GarrettCom®

Industrial Networking at Its Best™

Magnum 6KQE

Managed Edge Switch

Hardware

Installation and User Guide

Magnum™ 6KQE
Managed Edge Switch

Hardware
Installation and User Guide

Part #: 84-00182Z (Rev. A)

Trademarks

GarrettCom is a registered trademark and **Magnum, Dymec, DynaStar, Personal Switch, Link-Loss-Learn, S-Ring, Convenient Switch** and **Converter Switch** are trademarks of GarrettCom, Inc.

Ethernet is a trademark of Xerox Corporation

NEBS is a trademark of Telcordia Technologies

UL is a registered trademark of Underwriters Laboratories

Important: The Magnum 6KQE Managed Edge Switch contains no user serviceable parts. Attempted service by unauthorized personnel shall render all warranties null and void. If problems are experienced with Magnum 6KQE Switch products, consult Section 6, Trouble Shooting.

Contacting GarrettCom, Inc

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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 Réglement 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 10A 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 02/09: Initial Release

1.0 SPECIFICATIONS

1.1 Technical Specifications

Performance

Filtering / Forwarding Rate:
Ethernet (10Mb): 14,880 pps
Fast Ethernet (100Mb): 148,800 pps
Gigabit Ethernet (1000Mb): 1,488,000 pps
Switching Processing Type: Store and Forward with IEEE 802.3x full-duplex flow -control, non-blocking
Data Rate: 10Mbps, 100Mbps and 1000Mbps
Address Table Capacity: 4K node, self-learning with address aging
Packet buffer size : 240KB for 10/100 and 120KB for 1000Mb
Latency: 5 µs + packet time (100 to 100Mbps)
15 µs + packet time (10 to 10 Mbps, and 10 to 100Mbps)
Throughput with 8 10/100 and 2Glink max.- 4.17M pps (Transmit)
Back plane- 2.66Gb/s per slot

Network Standards and Compliance, hardware

Ethernet V1.0/V2.0 IEEE 802.3: 10BASE-T,
IEEE 802.3u: 100Base-TX, 100BASE-FX
IEEE 802.3z: 1000BASE-X Ethernet (Auto-negotiation)
IEEE 802.3ab: 1000BASE-X Ethernet
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
IEEE 802.3af: Power over Ethernet

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)

Maximum Standard Gigabit Ethernet Segment Lengths:

1000BASE-T (CAT5e or higher is recommended) - 100m (328 ft)
1000BASE-SX, full-duplex, multi-mode (62.5µm cable) - 220m

1000BASE-SX, full-duplex, multi-mode (50µm cable) - 550m
1000BASE-LX, full-duplex, multi-mode (50, 62.5µm cable) - 550m
1000BASE-LX, full-duplex, single-mode (9µm cable) - 5km
1000BASE-ZX, full duplex, single-mode (9µm cable) - >70km

Fiber Multi-mode connector types supported:

Fiber Port, MTRJ-type (plug-in): SFF Fiber multi-mode 100BASE-FX
Fiber Port, LC-type (plug-in): SFF Fiber multi-mode 100BASE-FX
Fiber Port, 1000BASE-SX, SFP modules

Fiber Single-mode connector types:

Fiber Port, LC-type Fiber SFF single-mode, 100BASE-FX
Fiber Port, 1000BASE-LX, SFP modules

LEDs: Per Port (one set at the port, one set on swivel top on right side)
(see section 5.1.1 and 5.1.2 for detailed LED configurations)

Operating Environment

Ambient Temperature:
-40° to 140° F (-40° to 60°C) for UL60950 and Component Parts rating
-40° to 195° F (-40° to 85°C) for IEC 60068 Type Test short term rating
Storage Temperature: -60°to 210°F (-50°to 100°C)
Ambient Relative Humidity: 5% to 95% (non-condensing)
Altitude: -200 to 13,000 ft. (-60 to 4000m)
Conformal Coating (humidity protection) optional: Request quote

Alarm Relay Contacts

One NC indicating internal power, one NC software controllable

Packaging

Enclosure: High strength extruded aluminum
Dimensions: 6.85 in. H x 7.5 in. W x 2.0 in. D
17.4 cm H x 19.1 cm W x 5.08 cm D
Cooling method: Convection, fully-enclosed ribbed-surface aluminum case used as a sink, designed for vertical mounting, no fans
Weight: 3 lbs. (1.3 kg)

Management Console connector

Serial DB-9, see details at sec. 3.6

DC Power Supply (Internal, floating ground design)

12VDC Power Input nominal (range 8 to 18VDC)
24VDC Power Input nominal (range 18 to 36VDC)
-48VDC Power Input nominal (range 36 to 60VDC)
125VDC Power Input nominal (range 88 to 150VDC)
250VDC Power Input nominal (range 160 to 300VDC)
Std. Terminal Block : " -, GND, + "

AC Power Supply (Internal)

AC Power Connector: IEC-type, male recessed
100-240VAC Power Input, 47 to 63 Hz (auto-ranging)

Power Consumption:

20 watts Max. (for a fully loaded fiber model with 2Gb)
15 watts Max. (for 8 port copper and 100Mb fiber model)

Dual DC Power Input (Optional)

A Dual-Source option is available for the 12VDC, 24VDC, –48VDC, and 125VDC and 250VDC 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 "

6KQE Mounting:

Vertical mounting normal. Suitable for wall or DIN-Rail mounting (**6KQE**)

Agency Approvals and Standards Compliance:

UL listed (UL60950), cUL, CE, Emissions meet FCC Part 15 Class A
NEBS Level 3 and ETSI Compliant
IEEE 1613 Class 2 Environmental Standard for Electric Power Substations
See also **Note for Power Substations** in Section 3.2.1, 3.6.1, and 5.1.3
IEC 61850 EMC and Operating Conditions Class C for Power Substations
NEMA TS-2 and TEES for DC-powered and PoE-powered traffic control equipment
Class1 Division 2 and ATEX for hazardous locations, pending

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

See the Configuration Guide on the GCI web site at
http://www.garrettcom.com/techsupport/insertion_guides/6kqecg.pdf
for configurations and options..

Email **info@GarrettCom.com** for additional information.

1.2 Ordering Information

MODEL **DESCRIPTION**

Magnum 6KQE-24VDC: Magnum 6KQE Managed Edge Switch, base unit with four 10/100 copper ports. Up to 3 100Mb fiber ports or up to four more 10/100 copper ports (or combinations) may also be configured, and up to 2 Gb ports are optional. Heavy duty metal case, IP53 for environmental protection, no fans.

For licensed managed networks software (MNS-6K, RS-Ring and S-Ring) including GUIs for ease-of-use and industry-leading security features, see separate data sheets.

Magnum 6KQE-12VDC: Same as 6KQE-24VDC except the power input is 12VDC

Magnum 6KQE-48VDC: Same as 6KQE-24VDC except the power input is -48VDC

Magnum 6KQEP-48VDC: PoE, same as 6KQE-48VDC except the four 10/100 ports are PoE-enabled, data pairs

Magnum 6KQE-125VDC: Same as 6KQE-24VDC except the power input is 125VDC

Magnum 6KQE-250VDC: Same as 6KQE-24VDC except the power input is 250VDC

Magnum 6KQE-AC: Same as 6KQE-24VDC except the power input is AC 100 to 240VAC, 47 to 63 Hz

Please use this URL: for the complete Configuration Guide for the Magnum 6KQE.
http://www.garrettcom.com/techsupport/insertion_guides/6kqecg.pdf

Configuration Options:

Each Magnum 6KQE base unit may be configured with a choice of 2 modular slots.

Following modules can be configured in Slot C only
(Slot C is 10/100 RJ-45 or 100Mb Fiber only)

Magnum 6KQE (Slot C) Port Modules:

6KQE4-RJ45 adds four 10/100 copper ports
6KQE4-1MMRJ adds three 10/100 copper and one MM 100Mb MTRJ fiber ports
6KQE4-2MMRJ adds two 10/100 copper and two MM 100Mb MTRJ fiber ports
6KQE4-3MMRJ adds one 10/100 copper and three MM 100Mb MTRJ fiber ports
6KQE4-1MLC adds three 10/100 copper and one MM 100Mb LC fiber ports
6KQE4-2MLC adds two 10/100 copper and two MM 100Mb LC fiber ports
6KQE4-3MLC adds one 10/100 copper and three MM 100Mb LC fiber ports
6KQE4-1SLC adds three 10/100 copper and one SM 20Km 100Mb LC fiber ports
6KQE4-2SLC adds two 10/100 copper and two SM 20Km 100Mb LC fiber ports
6KQE4-3SLC adds one 10/100 copper and three SM 20Km 100Mb LC fiber ports
6KQF-1SLCL adds three 10/100 copper and one SM 40Km 100Mb LC fiber ports
6KQF-2SLCL adds two 10/100 copper and two SM 40Km 100Mb LC fiber ports
6KQF-3SLCL adds one 10/100 copper and three SM 40Km 100Mb LC fiber ports

MM= Multi-mode fiber SM= Single-mode fiber

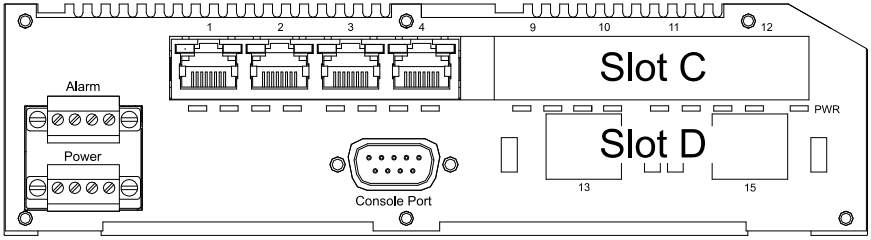
Following modules can be configured in Slot D only (Slot D is Gigabit Fiber only)

Magnum 6KQE (Slot D) Port Modules:

6KQE-2GCU	adds two auto-negotiating 10/100/1000Mb copper ports
6KQE-1GCU	adds one auto-negotiating 10/100/1000Mb copper port
6KQE-2GSFP	adds two SFP pluggable open transceiver ports for user selectable SFP Gb transceivers in each
6KQE-1GSFP	adds one SFP pluggable open transceiver port for user selectable SFP Gb transceiver

Gigabit (1000Mb) SFP (Small Form Pluggable) Transceiver option (6KQE)

SFP-SX	Gb SFP transceiver, 1000Mb-SX, 850nm wavelength, 550m
SFP-ESX	Gb SFP transceiver, 1000Mb, 1310nm wavelength, 2Km
SFP-LX10	Gb SFP transceiver, 1000Mb-LX, 1310nm wavelength, 10Km
SFP-LX25	Gb SFP transceiver, 1000Mb-LX, 1310nm wavelength, 25Km
SFP-ZX40	Gb SFP transceiver, 1000Mb-ZX, 1550nm wavelength, 40Km
SFP-ZX70	Gb SFP transceiver, 1000Mb-ZX, 1550nm wavelength, 70Km



MNS-6K License- MNS-6K managed software is pre-loaded from the factory.

S-RING Key: S-Ring and RS-Ring Redundancy Manager licensed software for redundant ring management. One S-Ring or RS-Ring key is for licensed use one 6K-managed self healing Ring.

CONSOLE CBL: Console attachment cable. Serial null modem (aka X-modem) cable with DB-9 connectors.

CONSOLE USB: Same as above, but with USB connector

DIN-RAIL-6KQ: Din-Rail mount for a secure vertical mount, with screws for 6KQE

Dual-SRC: Two separate power inputs (12/24/48, 125 or 250VDC)

KQ-CABLE-BKT: Metal bracket for 6KQE, used for cable strain relief, for vertical mount

CONFORM05 CRM: Conformal coating, heavy duty silicone at 5 mil thickness, for interior PCBs, PS and modules (for moisture protection)

CONFORM14 CRM: Conformal coating, heavy duty silicone at 14 mil thickness, for interior PCBs, PS and modules (for oil and gas industry)

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 6KQE Managed Edge Switch, base unit
(configured with user-selected port module options installed)

2 Set of two metal vertical mounting brackets, with screws to the case

1 6KQE Installation and User Guide (this manual)

Remove the items from the shipping container. Be sure to keep the shipping container should you need to re-ship the unit at a later date.

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

2.2 Product Description - Magnum 6KQE Managed Edge Switch

Magnum™ 6KQE Managed Edge Switches provide configurability in an entry-level industrial-grade package. The high performance 6KQE base unit comes with four 10/100 copper ports (which may be either regular or PoE). Up to 3 100Mb fiber ports or up to four more 10/100 copper ports or combinations, may also be configured. In addition, one or two Gb ports may be configured as 10/100/1000 copper or SFP fiber in any 6KQE base unit.

Magnum 6KQE comes with the best-of-breed MNS-6K managed networks software. (MNS-6K-SECURE optional) See the Managed Networks Software (MNS-6K) datasheet for more information at http://www.garrettcom.com/techsupport/software/datasheets/mns6kds.pdf

Magnum 6KQEs are ideal for building a switched, hardened Ethernet network infrastructure, connecting edge devices such as PLCs and IEDs with upstream switches or routers. Designed for use in industrial applications such as factory floors and control cabinets, industrial video surveillance systems with PoE, power utility substations, tariffed carrier field facilities, or transportation and oil and gas, the rugged Magnum 6KQE handles stressful workloads (mixes of bursty data traffic and priority streaming traffic) as well as harsh environmental conditions.

Advanced thermal design techniques with ribbed–surface Aluminum cases for maximum heat dissipation and a sealed case design enables the unit to operate in harsh Industrial grade environments efficiently. Heavy duty Ethernet Switch jobs are readily accommodated with an extended temperature rating of -40˚C to 60˚C by the UL Component Parts method, or -40˚C to 85˚C by the IEC 60068 Type-Test method. With options such as several popular DC power input types, AC power and DIN-Rail mounting, the hardened Magnum 6KQE is a “multi-purpose” Industrial Ethernet Switch.

The 6KQE managed switches also provides a PoE option via power –inside PoE base unit (6KQEP-48VDC) on Slot A and allows the users to utilize up to 4-ports of PoE to support 802.3af Powered devices. See details for PoE base unit in sec 5.2. The Power Sourcing Equipment (PSE) is fully compatible with Powered Devices (PD)(e.g wireless access points, IP phones) that comply with the IEEE 802.3af PoE standard. The PoE switch ports have an auto-sensing algorithm, so that they provide power only to 802.3af, PoE end devices. PoE **is managed by a multi-stage handshake to protect equipment from damage and to manage power budgets** .The PoE ports will discontinue supplying power when the PoE powered devices are disconnected. This feature supports the 802.3af PoE PSE standard for over-current protection, under-current detection, and fault protection.

High performance features include non-blocking unicast traffic speed on all ports and 802.1p QoS Traffic Prioritization. Magnum 6KQE switches are "plug-and-play" and are designed for use in connecting edge devices such as PLCs, IEDs and PoE video cameras with upstream switches and routers where a mix of bursty data traffic and priority streaming traffic for video surveillance and cell-tower applications are present.

Magnum 6KQE Managed Edge Switches have heavy-duty aluminum cases and are readily available with standard Industrial grade 24VDC power. Alternative internal DC power options are available. Internal AC power and DC power input types may be 12V, 24V, 48V, 125V, 250V and dual source DC input is optional on the 6KQE.

Alarm Relay contacts provided on each Magnum 6KQE Switch monitor the hardware and software through traps, providing a record of any losses of power signals and other user- defined software events. See Section 3.5 for details.

2.2.1 Packet Prioritization, 802.1p QOS

Quality of Service means providing consistent predictable data delivery to users from datagram paths that go all across a network. As a LAN device, the Magnum 6KQE can do its part to prevent any QOS degradation while it is handling Ethernet traffic through its ports and buffers.

The Magnum 6KQE switching hardware supports the IEEE 802.1p standard and fulfills its role in support of QOS, giving packet processing priority to priority tagged packets according to the 802.1p standard. In addition to hardware support for QOS, the MNS software (R2) supports two priority queues that can be shared across the eight levels of defined packet priorities for application-specific priority control by the user through software configuration settings.

2.2.2 Frame Buffering and Flow Control

Magnum 6KQE's 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 which 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.

When the Magnum 6KQE 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 it packets to cause "flow control". This tells the sending devices to temporarily stop sending traffic, which allows the traffic to catch-up 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 the Magnum 6KQE 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.

2.3 Managed Network Software for Magnum 6KQE

Magnum 6KQE comes with licensed MNS-6K Rel v4.1.4 software or MNS-6K-SECURE Rel v14.1.4, which allow the user to configure the Magnum 6KQE as a Managed Switch and implements security features and other software enabled features.

(NOTE: Magnum 6KQE managed switch will work with MNS-6K Rel v4.1.4 firmware or higher version only, or MNS-6K-SECURE v14.1.4 firmware or higher version only. Using any earlier MNS-6K versions will not support the 6KQE hardware)

For additional information about MNS-6K, see the Magnum MNS-6K **Software User guide** in pdf format, a separate document normally accessible via your web-browser, at ftp://ftp.garrettcom.com/

or FTP client program at ftp.GarrettCom.com using

user : m6kuser

password : m6kuser

All MNS-6K software information, and the documentation related to MNS-6K and MNS-6K-SECURE software, can be accessed at GarrettCom's FTP site.

Alternatively, for the latest documentation and information, or needed GarrettCom's MIBs for SNMP, visit **www.GarrettCom.com/techsupport/index.htm#software** and look for the Magnum MNS-6K info.

For interactive training software which shows basic and advanced info about the Magnum MNS-6K management software and for a useful tool for first time users, visit **Magnum MNS-6K Operator Training**.

You may also email: info@GarrettCom.com for further information.

2.4 Features and Benefits

- **Managed switching for high performance Ethernet LANs**
  Magnum 6KQE Switches provide unicast non-blocking (all ports can run at full speed at once) performance with standard Managed Network Software. They are typically used in LAN traffic centers with up to 8 100Mb +2 Gigabit ports for backbone connections, where managed network services are desired.

- **Switching services includes 802.1p QoS packet prioritization**
  The Magnum 6KQE switching hardware supports QoS, giving packet processing priority to priority tagged packets according to the IEEE 802.1p standard. For port- and application-specific priorities of data, the QoS software may be configured.

- **Fiber Ports Built-In**
  Magnum 6KQE Managed Edge Switches are designed to naturally include fiber ports, and support mixes of multi-mode, single-mode, 100Mb and 1000Mb speed; full-and half-duplex; classic Small Form Factor (SFF) and Small Form Pluggable (SFP) fiber connectors. RJ-45 10/100 ports can also be configured in the mix of port types.

- **Relay Contacts for monitoring internal power and user-defined software events**
  Two Alarm Relay contacts monitor basic operations. One is for hardware, and will signal loss of power internally. The other is software controlled and will signal user-defined software events such as a security violation or an S-Ring fault condition.

- **Vertical mounting for efficient convection cooling, no fans, extended temperature**
  Mounting brackets for vertical mounting are included. DIN-Rail mounting hardware is optional. Ethernet signal and power cables attach at the bottom. Two sets of status LEDs are included, one set viewable at the port connector and one set viewable from the front.

- **All types of power input, 12, 24, 48, 125, 250VDC and AC**
  The 6KQE can be configured with the user's choice of DC power supplies: 12V and 24V for factory floor, 48V for tariffed carrier field facilities and for PoE-powered applications such as IP video surveillance, and 125V or 250V for substations. An internal AC power supply may also be chosen, universal AC for use worldwide.

- **Heavy-duty design for Industrial Ethernet and extended temperature operation**
  Fiber ports take more power than copper ports, but the Magnum 6KQE design provides for this with heavy-duty components. The ambient temperature dual-rating is 60`C per UL methods, and 95°C per IEC type test methods.

- **MNS-6K licensed Management Software**
  Managed Networks Software (MNS) basic version, combined with a Magnum 6K-Series Switch, provides power and efficiency in a managed Ethernet platform. A full range of industry-standard software functions in the MNS-6K software product enables the versatile Magnum 6K Switches to perform efficiently in a wide range of managed LAN applications, including redundant topologies.

- **MNS-6K-SECURE (optional, for extra security)**
  Magnum MNS-6K-SECURE software is designed for those customers demanding extra security in their networks. MNS-6K-SECURE is an optional item--licensed per switch. All of the features in regular MNS-6K are included, plus extra security.

- **S-Ring and Link Loss Learn for economical high availability using ring topology**
  S-Ring combined with the Link-Loss-Learn feature provides reliable fast recovery of a fault in an economical ring topology combining unmanaged and managed switches.

- **RSTP-2004 for rings and meshes, fastest fault recovery, interoperability**
  RSTP-2004 provides reliable fast recovery from a fault in a redundant LAN, which may include Magnum switches and routers as well as other vendors industry-standard-RSTP products. Redundant topologies may include rings, dual-rings, and complex meshes.

2.5 Applications

Magnum 6KQE Edge Switches offer high performance, modularity and availability. They provide the flexibility of 100Mbps fiber and copper ports as well as single or dual Gigabit (1000Mb) ports, with industry-standard LAN management software. Magnum 6KQE Switches are easily used in a variety of applications including client/server computing, secure VLAN- performance upgrades to departmental networks, and stream traffic for VOIP and audio/video applications. They can also be used in a much diversified combination of mixed media in Industrial floor applications. The performance characteristics of the 6KQE Switches enable them to inter-connect a series of subnets (one subnet per 6KQE Switch port) in a LAN traffic center. The subnet connections may be via fiber or twisted pair cabling, 100Mbps or 10 Mbps speed, and full-or half-duplex.

The mixed-media modular capability is ideal for industrial applications where existing Ethernet LAN network cabling must be accommodated. The fiber-built-in media capability is ideal for integrating future-proof fiber cabling into the LAN structure.

Example 1: Magnum 6KQE Switch for an 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 6KQE Managed switch for any Industrial factory-floor, traffic control, transportation system, or power utility application. The several MNS-6K software operated features qualifies this managed switch to operate and perform securely and reliably in all critical applications. The addition of *S-Ring* and the *Link-Loss-Learn* software features allow this Managed switch to provide a very secure highly available redundant network capability in any ring topology network.

The Managed 6KQE's modularity along with the MNS-6K management software features remarkably handle industrial environments (i.e. where the factory floors are networked with Ethernet based mixed-media LANs equipped with PLCs, computers for taking readings and data from Machines, Client/ Server databases, etc. and sending these important data to the central office data warehouses) very securely and reliably. The DIN-Rail Mounting options on the Magnum 6KQE allow the factory floor's industrial user to mount the 6KQE securely anywhere on their Network setup.

The option of setting the ports at 10 or 100Mb on copper and 100Mb on fiber media provide widespread options to the users to mix and match their legacy and advance network needs. The modularity of the 6KQE Managed Edge Switches make them an attractive choice for use in applications with LAN connections to an organization's multiple site offices and factory- floors. The different locations can be easily connected together with the Fiber ports supported by the Magnum 6KQE Switch. A main NT-server in a secure area protected from earthquake or fire hazards can be connected to the full duplex Gigabit Fiber port.

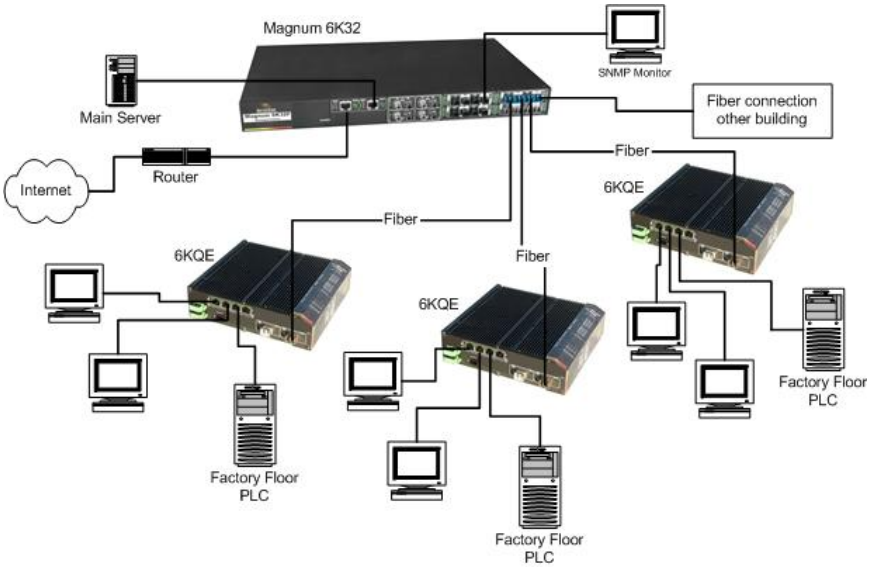


Fig 2.5a The industrial factory floor application with Magnum 6KQE

Extended temperature ratings and a variety of options for AC/DC power supplies qualify this managed 6KQE switch for use in non-temperature controlled networks and many other temperature sensitive critical Industrial applications where above normal room temperatures occur while the network is in operation. Full-duplex future proof fiber media can easily connect long distance subnets and provide a stable secure network to all applications. The SNMP management capability of the Magnum 6KQE Switch helps create a database of all the network subnets to easily manage the network.

Example 2: A managed network is needed to provide a redundant ring topology for maximum redundancy. In a network where any faulty cable, cable disconnection or power failure can bring the whole thing down, a ring switch can be reconfigured and up and running in milliseconds. The ring topology of the network consists of high speed LAN segments supported by 100Mbps full-duplex future-proof fiber media to provide a secure long distance LAN connection. The entire network is sharing a higher bandwidth Gigabit-enabled data-mining server for the vital database located in a separate secured building. The copper ports are required for multiple subnets inside the power plant to check the status of other Ethernet units. The entire spread network will be manageable to provide easy, detectable, uninterrupted support through a viewable SNMP monitor.

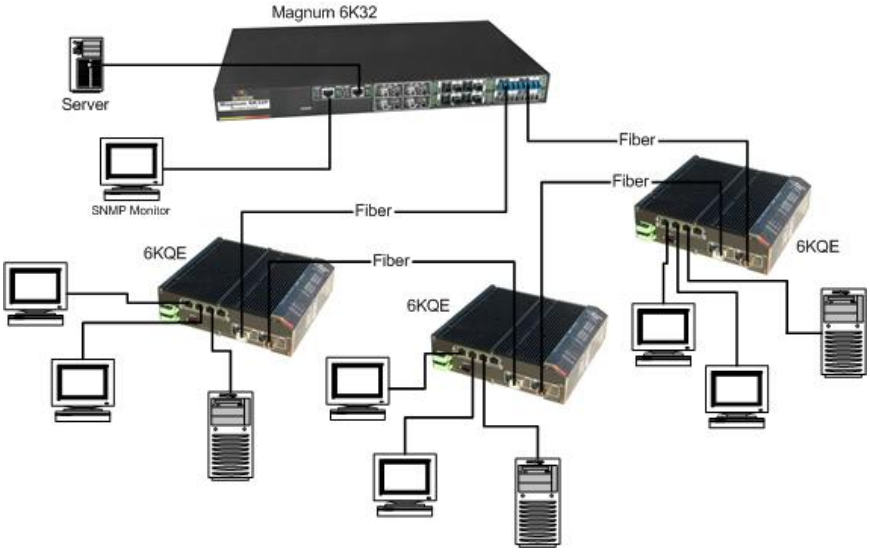


Fig 2.5b Magnum 6KQE equipped with S-Ring in redundant ring solution

The Magnum 6KQE Managed Edge Switch equipped with a mix of copper and fiber ports provides an economical and seamless solution to many requirements. The user-configurable Magnum 6KQE provides an extra boost to the network requirements by providing copper/fiber media along with the higher bandwidth support of 10/100 and 1000Mb. The user can utilize the SNMP feature equipped with VLAN, RMON, STP and

other standard managed LAN features to provide a secure and stable network.

The 6KQE Managed Fiber with S-ring and Link-Loss-Learn features easily fulfill the redundant requirement with a secure and fast reconfiguration time for cable breakup when set up in a ring topology. The Gigabit port option boosts the bandwidth for high speed to support the peak traffic and minimize congestion.

Example 3: In another application in an industrial environment, a 12 port Nebs compliant, 24VDC managed switch is required to meet the fiber and copper connections to cover the wider area of video CCTV. The switch must be SNMP enabled and managed to easily monitor the whole setup.

The Magnum managed edge switch easily qualifies for this requirement with the various features and modularity it has. Loaded with MNS-6K management software, the edge switch provides a very effective and economical solution for the video -vignette environment.

The security features (e.g. port-security, VLANs, SNMPv3, secure telnet, etc.) also boost the Magnum managed switches to provide a very effective and reliable solution. The modularity feature to support both copper and fiber at either 10/100/1000Mb speeds easily meets the various speeds of legacy and future broadband requirements.

In a fast growing secure video environment, the 6KQE is a reliable and secure solution. The modular design of the Magnum 6KQE, provides a wide range of copper/fiber options to meet requirements. The Gigabit uplink for storage or broadband uplink allows the telecom user a very effective solution to store their sensitive data securely.

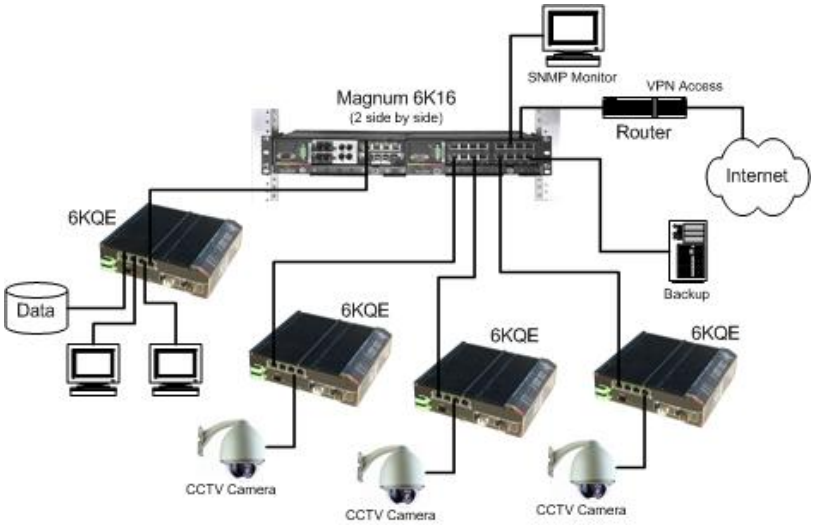


Fig 2.5c Magnum 6KQE deployed in a video security CCTV application for monitoring and securing the premises

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^{0}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 6KQE Switches, as well as connection of the various Ethernet media types.

3.1 Locating Magnum 6KQE Switches

For vertical panel mounting and wall mounting, see Section 3.3

For vertical DIN-Rail mounting, see Section 3.3.1

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

.

The rugged metal case of the Magnum 6KQE 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 6KQE 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.

3.2 Connecting Ethernet Media

The Magnum 6KQE Switches are specifically designed to support standard Ethernet media types within a single Switch unit. This is accomplished by using a two popular Fiber Connectors which can be individually selected and configured. (See Section 5.1 for a description of the Modules)

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

Media	IEEE Standard	Connector
Twisted Pair (CAT 3 or 5)	10BASE-T	RJ-45
Twisted Pair (CAT 5)	100BASE-TX	RJ-45
Twisted pair (CAT5E or CAT6)	1000BASE-T	RJ-45
Fiber (Multi-mode)	100BASE-FX	MTRJ, LC
Fiber (Single-mode)	100BASE-FX	LC
Fiber (Multi-mode)	1000BASE-SX	LC (SFP)
Fiber (Multi-mode, Single-mode)	1000BASE-LX	LC (SFP)
Fiber (Single-mode)	1000BASE-ZX	LC (SFP)

See http://www.garrettcom.com/techsupport/power_budget.pdf for Power budget calculations, to find fiber cable distance information.

3.2.1 Connecting Twisted Pair (CAT3, CAT5, UTP or STP)

The RJ-45 ports of the Magnum 6KQE can be connected to the following two media types: 100BASE-TX and 10BASE-T. CAT 5 cables should be used when making 100BASE-TX connections. When the ports are used as 10BASE-T ports, CAT 3 may be used. In either case, the maximum distance for unshielded twisted pair cabling is 100 meters (328 ft).

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

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

1. Using standard twisted pair media, insert either end of the cable with an RJ-45 plug into the RJ-45 connector of the port. Note that, even though the connector is shielded, either unshielded or shielded cables and wiring may be used.
2. Connect the other end of the cable to the corresponding device
3. Use the LINK LED to ensure proper connectivity by noting that the LED will be illuminated when the unit is powered and proper connection is established.

NOTE: for Power Substations: In support of the IEEE 1613 Class 2 standard, GCI advises that, for substation applications, the RJ-45 ports are intended for connectivity to other communication equipment such as routers or telecommunication multiplexers installed in close proximity (i.e., less than 2 meters or 6.5ft) to the 6KQE. It is not recommended to use these ports in substation applications to interface to field devices across distances which could produce high (greater than 2500V) levels of ground potential rise (GPR) during line-to-ground fault conditions. The 6KQE passes the 1613specifications for zero packet loss with fiber ports & with RJ-45 ports used as indicated here.

3.2.2 Connecting Twisted Pair (CAT5e or better, UTP or STP)

The RJ-45 Gigabit ports of the Magnum 6KQE can be connected to the media types, 1000BASE-T or CAT 5E or better 100-ohm UTP or shielded twisted pair (STP) balanced cable. The CAT 5E or better 100-ohm UTP or shielded twisted pair (STP) balanced cable is recommended to use when making 1000BASE-TX connections. In either case, the max distance for unshielded twisted pair cabling is 100 meters (328 ft).

The following procedure describes how to connect a 1000BASE-T twisted pair segment to the RJ-45 port. The procedure is the same for both unshielded and shielded twisted pair cables.

1. 1000BASE-T connections require that all four pairs or wires be connected. Insert either end of the cable with an RJ-45 plug into the RJ-45 connector of the port. Note that, even though the connector is shielded, either unshielded or shielded cables and wiring may be used.
2. Connect the other end of the cable to the corresponding device
3. Use the LINK LED to ensure proper connectivity by noting that the LED will be illuminated when the unit is powered and proper connection is established

3.2.3 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 70km with the single-mode LC.

3.2.4 Gigabit SFP (Small Form-factor Pluggable) Transceivers

The small form-factor pluggable (SFP) is a compact optical transceiver used in optical communications for both telecommunication and data communications applications. Due to its compact, hot pluggable characteristics, SFPs are becoming a very popular choice for various applications. The small-chassis Magnum 6KQE is designed for industry-standard Gb-SFPs for user selection of the SFP gigabit media type as desired.

All SFPs used in Magnum 6KQEs are compliant with the industry standard Multi-Source Agreement (MSA) ensuring compatibility with a wide range of networking kit.

(see Section 1.2 for the SFP's available for the 6KQE)

Note: It is highly recommended to remove the fiber cable first before removing the SFP transceiver for any reason. Not removing the fiber cable first can damage the fiber cable, cable connector or optical interfaces. It is advised not to remove and insert a SFP transceiver frequently as this may shorten its useful life.

Note: Always use an ESD wrist strap while handling the SFP transceivers since the SFP modules are static sensitive devices.

Note: The copper 1000BASE-T SFP transceiver port supports 1000Mb only. It is recommended to use a straight-through RJ-45(4-twisted pair) connection while connecting to any Server/workstation. While connecting with any Switch/repeater or other device, it is recommended to use Crossover RJ-45 (4-twisted pair) category 5 or higher cabling. The maximum length supported on copper 1000BASE-T is 100m (328 ft.).

3.2.5 Connecting Fiber Optic Cable to SFP Transceivers

1. Before connecting the fiber optic cable, remove the protective dust caps from the tips of the connectors on the PM. 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. Find the Transmit (TX) and Receive (RX) markings on the SFP transceiver to verify the top side of it. Some of the transceiver marks arrow sign for up.

4. Position the SFP transceiver correctly before insertion, and then insert the SFP transceiver carefully, until the transceiver connector snap into the place in the socket connector.

5. Connect the Transmit (TX) port on the Magnum PM to the Receive (RX) port of the remote device. Connect the Receive (RX) port on the PM to the Transmit (TX) port of the remote device.

The LINK LED on the front of the PM will illuminate and turn Green, when a proper connection has been established at both ends (and when power is ON in the unit). If LINK is not lit or OFF after cable connection, the normal cause is improper cable polarity. Swap the fiber cables at the PM connector and also check the connectivity on the target device to remedy this situation.

Reconfigure or reboot both of the devices if required.

If connected properly, you can check via (MNS-6K) software for verifying the validity of SFP Gigabit ports.

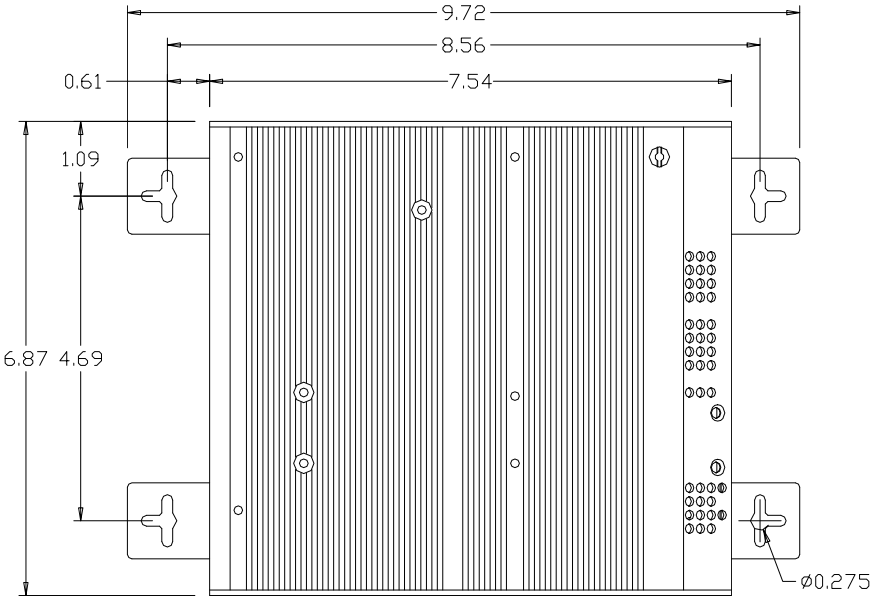
3.3 Mounting Dimensions for 6KQE with metal brackets

Each Mangum 6KQE is supplied with metal mounting brackets and screws to mount the unit securely on a panel or wall. It is recommended to mount the 6KQE vertically, as shown on following page, 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 6KQE unit out from the panel or wall behind it, creating a rear space of about ¼ inch or 1cm. This allows air circulation and cooling of the rear part of the case.

For best cooling of the 6KQE, attach the metal brackets to metal (rather than wood or plastic). Attaching to metal helps conduct heat away from the 6KQE through the metal brackets and into the metal support structure.

Since the 6KQE has special internal thermal techniques (patent pending) to move the heat generated by the electronic components inside into the case, the case may be quite warm to the touch during normal operation.



The unit is mounted using the brackets as shown in the illustration above. The spacing for the mounting screws into the supporting wall or panel is a rectangle 21.74 x 11.91 cm (8.56 x 4.69 inches) center-to-center.

3.3.1 DIN-Rail Mounting the Magnum 6KQE

The Magnum 6KQE 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 6KQE requires one DIN-Rail bracket for secure mounting. This may be ordered as Model # DIN-RAIL-6KQ. See a 6KQE viewed from the side, at the rear, with model DIN-RAIL-6KQ in place on the unit.

The DIN Rail bracket is mounted on one of three available positions at the rear of the 6KQE unit. Eight threaded holes are provided on the rear of 6KQE for DIN-Rail mounting purposes. The required four screws are included with the DIN-Rail bracket, and are no.4-40 X 5/16 PHIL. PAN Head.

To install the 6KQE with the DIN-Rail bracket installed, hold the 6KQE in the side

vertical position with the bottom out, and with the top moved in toward the DIN-Rail. Position the DIN bracket over the top of the DIN-Rail. Then, snap the bracket into holding position by moving the bottom of the 6KQE inwards to a vertical position. The DIN-Rail bracket is heavy duty, and will hold the 6KQE securely in position, even with cabling attached to the unit.

To release the 6KQE from the DIN-Rail mounting, press the top of the DIN-Rail bracket slide DOWN to release the 6KQE so that it can be dismounted by pulling the bottom out. Once the bottom of the 6KQE is rotated out, the DIN-Rail bracket is not engaged and the 6KQE can be moved up and out, free of the DIN-Rail mounting.

The DIN-Rail mounting bracket is optional and needs to be ordered as separate items, e.g Model # DIN-RAIL-6KQ

3.4 Powering the Magnum 6KQE Managed Edge Switch

The DC internal power supply supports installation environments where the DC voltage is from 10 to 300 volts depending on the model selected. The power consumption will range from about 15 up to 20 watts, depending on the port quantity and types in the configuration.. 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 6KQE Switches to special high-availability communications and/or heavy industrial-grade applications, including:

* 12VDC, -48VDC, 24VDC, 125VDC and 250VDC with single DC input,
* 12VDC, -48VDC, 24VDC, 125VDC and 250VDC with dual-source DC input
* AC input with internal power supply

(see Section 1.2, for Ordering Information)

3.5 Alarm Contacts for monitoring internal power, and Software Traps

The Alarm Contacts feature, standard on Magnum 6KQE's, provides two Form C Normally Closed (NC) contacts to which the user can attach two sets of status monitoring wires at the green terminal block. When this option is present, the terminal block for Alarm Contacts is part of the Power Input panel in the 6KQE case. The DC power input connection is in the same panel.

The first NC Alarm Contact (top position, switch vertically mounted) is a "Software Alarm", operated by user settings in the MNS-6K software. The user can disable the Software Alarm feature with a software configuration command if desired. When the Software Alarm is enabled, the Form C Normally Closed (NC) contact is held close during normal software operation. A user-defined software malfunction, such as an SNMP Trap or a Software Security violation or an S-Ring Fault, causes the contact to open and thus triggers an alarm in the user's monitoring system

The second NC Alarm Contact is held closed when there is power on the main board inside of the Switch. This provides a "Hardware Alarm" because the NC contacts will open when internal power is lost, either from an external power down condition or by the failure of the power supply inside of the Magnum Switch.

Useful info. about Alarm contacts:

1. There are four terminal blocks (1,2,3,4) provided next to the DC power supply
2. The left two pins (1,2) are hardware operated
3. The right two pins (3,4) are software operated
4. These are both NC (normally closed) relays
5. The switch's software operation needs to be enabled and set to get the Alarm traps. For detailed information about the Software Alarm and software control of SNMP alarm traps, please reference the Magnum MNS-6K Software User Manual.

The Alarm Contacts are on the front left area (next to the DC power source) of the Magnum 6KQE unit and are green in color as shown in the picture.

Fig 3.5a Alarm Contacts:
(1,2) are hardware operated
(3,4) are software operated

3.6 Connecting the Console Terminal to Magnum 6KQE

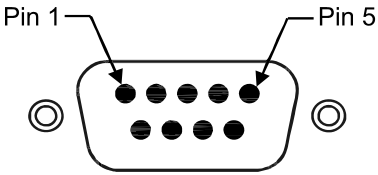
Use a (DB-9) "null modem" cable to connect the Magnum 6KQE Console Port (the RS-232 port on the 6KQE Switch) to your PC, so that your PC becomes the 6KQE Console Terminal.

Note: The DB-9 cable is not included with the 6KQE package.

Note: For a detailed description of Managed Network Software (MNS-6K) and Magnum 6KQE Switch configuration for Network Management, please refer to Magnum 6K Software Manual available on GarrettCom's FTP site.

Also available on GCI website at:
http://www.garrettcom.com/techsupport/sw_downloads.htm

3.6.1 RS-232 (DB-9) Console port (Serial port) pin assignments



DB-9 (Console port connector)

Pin	Signal	Description
1	DCD	Data Carrier detect (not used)
2	RXD	Receive Data (input)
3	TXD	Transmit Data (output)
4	open	not used
5	GND	Signal Ground
6	open	not used
7	RTS	Request to Send
8	CTS	Clear to Send
9	open	not used

The above provided information enables a managed station (a PC or Console terminal) to connect directly to the switch using a straight through cable.

Note: To use the Console port to configure the managed switch, a serial (Null-modem) female to female cable is required to communicate properly. The Null-Modem (DB-9) cable is optional and can be ordered from the factory, along with the unit as-
CONSOLE CBL for serial port
CONSOLE USB for USB port

NOTE for Power Substations: *In support of the IEEE 1613 Class 2 standard, GCI advises that, for substation applications, the serial (DB-9) console ports are intended for temporary connectivity to other equipment such as PCs. Since the console port connection is temporary, it is excluded from IEEE 1613 packet-loss testing per the 1613 standard-defined test procedure.*

4.0 OPERATION

This chapter describes the functions and operation of the Magnum 6KQE Switch.

4.1 Switching Functionality

A Magnum 6KQE provides switched connectivity at Ethernet wire-speed among all of its ports. The Magnum 6KQE supports10/100Mbs for copper media and 100Mb separate traffic domains for fiber ports to maximize bandwidth utilization and network performance. All ports can communicate to all other ports in a Magnum 6KQE, but local traffic on a port will not consume any of the bandwidth on any other port.

The Magnum 6KQE units are plug-and-play devices. There is no software configuring necessary to be done for basic operation at installation or for maintenance. The only hardware configuration settings are user options for an UP-LINK Switch (resides inside the unit) on the 6KQE4-RJ-45. There is an optional Half / Full duplex mode and 10Mbps or 100Mbps selection for the switched ports which must be configured through MNS software per unit as per the requirement. The internal functions of both are described below.

Filtering and Forwarding

Each time a packet arrives on one of the switched ports, the decision is taken to either filter or to forward the packet. Packets whose source and destination addresses are on the same port segment will be filtered, constraining them to that one port and relieving the rest of the network from having to process 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 un-interrupted operation of the network (such as occasional multi-cast packets) is forwarded to all ports.

The Magnum 6KQE Switches operate in the store-and-forward switching mode, which eliminates bad packets and enables peak performance to be achieved when there is heavy traffic on the network.

Address Learning

All Magnum 6KQE units have address table capacities of 4K node addresses suitable for use in larger networks. They are self-learning, so as nodes are added, removed or moved from one segment to another, the 6KQE Switch automatically keeps up with node locations.

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

4.2 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 10Mb Hub, media converter) or fixed mode at 10Mb or 100Mb Half/Full Duplex(managed switch) or not. No cross-over cable is required while using the 6KQE's copper port to other devices. Operation is according to the IEEE 802.3u standard.

The Managed 6KQE's Fast Ethernet copper ports can be set for either fixed 100Mb speed or for 10/100 F/H N-way auto-negotiation per the IEEE802.3u standard. The selection is made via MNS software. The factory default setting is for auto-negotiation. At 10Mb or 100Mb-fixed speed, the user may select half- or full-duplex mode by MNS Software for each RJ-45 port separately. For detail information **See Section 2.3 of this manual for information to access the "6K-MNS Software user guide"**

One frequently-used application for the Managed Magnum 6KQE Switch copper ports is to connect one of them using a fiber media converter to another Switch in the network backbone, or to some other remote 100Mb device. In this case, it is desirable to operate the fiber link at 100Mb speed, and at either half- or full duplex mode depending on the capabilities of the remote device. Standard commercially available Fast Ethernet media converters mostly do not support auto-negotiation properly, and require that the switched port to which they are connected be at the 100Mb fixed speed. Attachments to a 10/100 auto-negotiation port typically will not work properly. The 6KQE Switch's RJ-45 ports handle this situation by configuring the ports as per desired through MNS software port settings and can check the port status of each port after the change.

When Magnum 6KQE RJ-45 copper ports are set for auto-negotiation and are connected to another auto-negotiating device, there are 4 different speed and F/H modes possible depending on what the other device supports. These are: (1) 100Mb full-duplex, (2) 100Mb half-duplex, (3) 10 Mb full-duplex and (4) 10 Mb half-duplex.
The auto-negotiation logic will attempt to operate in descending order and will normally arrive at the highest order mode that both devices can support at that time. (Since auto-negotiation is potentially an externally controlled process, the original "highest order mode" result can change at any time depending on network changes that may occur). If the device at the other end is not an auto-negotiating device, the 6KQE's RJ-45 ports will try to detect its idle signal to determine 10 or 100 speed, and will default to half-duplex at that speed per the IEEE standard.

General information -

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

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

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

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

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

When operating in 100Mb half-duplex mode, cable distances and hop-counts may be limited within that collision domain. The Path Delay Value (PDV) bit-times must account for all devices and cable lengths within that domain. For Magnum 6KQE Fast Ethernet switched ports operating at 100Mb half-duplex, the bit time delay is 50BT.

4.3 Flow-control, IEEE 802.3x standard

Magnum 6KQE Switches incorporate a flow-control mechanism for Full-Duplex mode. The purpose of flow-control is to reduce the risk of data loss if a long burst of activity causes the switch to save frames until its buffer memory is full. This is most likely to occur when data is moving from a 100Mb port to a 10 Mb port and the 10Mb port is unable to keep up. It can also occur when multiple 100Mb ports are attempting to transmit to one 100Mb port, and in other protracted heavy traffic situations.

Magnum 6KQE Switches implement the 802.3x flow control (non-blocking) on Full-Duplex ports, which provides for a "PAUSE" packet to be transmitted to the sender when the packet buffer is nearly filled and there is danger of lost packets. The transmitting device is commanded to stop transmitting into the 6KQE Switch port for sufficient time to let the Switch reduce the buffer space used. When the available free-buffer queue increases, the Switch will send a "RESUME" packet to tell the transmitter to start sending the packets. Of course, the transmitting device must also support the 802.3x flow control standard in order to communicate properly during normal operation.

Note: When in Half-Duplex mode, the 6KQE Switch implements a back-pressure algorithm on 10/100 Mb ports for flow control. That is, the switch prevents frames from entering the device by forcing a collision indication on the half-duplex ports that are receiving. This temporary "collision" delay allows the available buffer space to improve as the switch catches up with the traffic flow.

4.4 Power Budget Calculations for 6KQE Modules with Fiber Media

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

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

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

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

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

where the "Cable Loss" for 62.5/125 and 50/125μm (M.m) is 2.8 dB/km,
and the "Cable Loss" for 100/140 (Multi-mode) is 3.3 dB/km,
and the "Cable Loss" for 9/125 (Single-mode) is 0.5 dB/km
and the "Cable Loss" for 9/125 (Single-mode) is 0.4 dB/km (LX25)
and the "Cable Loss" for 9/125 (Single-mode) is 0.25 dB/km (ZX40)
and the "Cable Loss" for 9/125 (Single-mode) is 0.2 dB/km (ZX70)

See http://www.garrettcom.com/techsupport/power_budget.pdf for more information on Power budget calculations

5.0 Magnum 6KQE Managed Edge Switch Port Modules

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

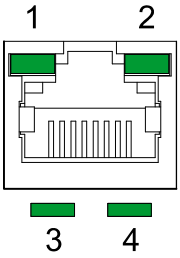
5.1 6KQE Modules

An important feature of the Magnum 6KQE is the use of Port Modules for flexible mixed-media connectivity to RJ-45 copper and various fiber media. The first four ports (1,2,3 & 4) of the Magnum 6KQE Switches are fixed RJ-45 copper ports with dual-speed 10/100Mbps auto-negotiating capability. Additionally the switch can accept up to two Port Modules to provide the user with up to 6 additional ports (10 total) providing a wide selection of Ethernet copper and fiber media connections with 10, 100 and 1000Mbps capability and up to 70km.

Note: The 6KQE Port modules are not identical to the port modules used in other 6K products such as the 6K25e and 6K16V. For information about other 6K products, please see the applicable manual. For a list of 6KQE Port Modules, refer to Section 1.2

Each 6KQE Port Module (PM) is individually described in the following sections.

5.1.1 6KQE Module LED designations



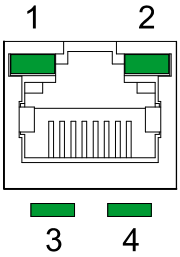
RJ45 (Standard)

1= ON (100Mb), OFF (10Mb)

2= ON (Link)

3= ON (Full Duplex), OFF (Half Duplex)

4= BLINKING (Activity)



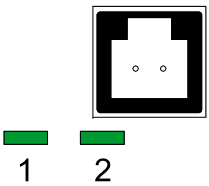
RJ45 (PoE)

1= ON (100Mb), OFF (10Mb)

2= ON (Link), BLINKING (Link/Activity)

3= ON (Full Duplex), OFF (Half Duplex)

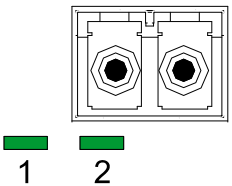
4= ON (PoE device detected)



MTRJ (Fiber)

1= ON (Link)

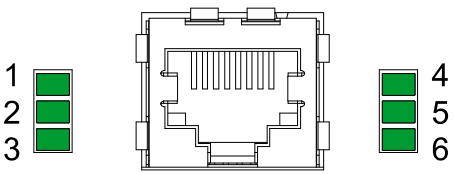
2= BLINKING (Activity)



LC (Fiber)

1= ON (Link)

2= BLINKING (Activity)



Gigabit (Copper / Fiber)

1= ON (Full Dx), OFF (Half Dx)

2= ON (Link)

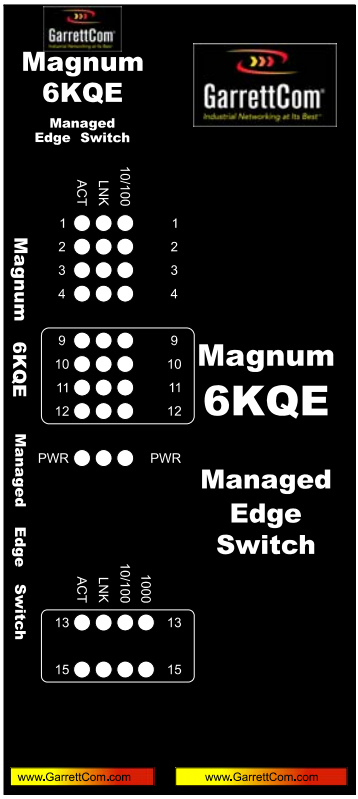
3= BLINKING (Activity)

4= ON (1000Mb) Not used for Fiber

5= ON (100Mb) Not used for Fiber

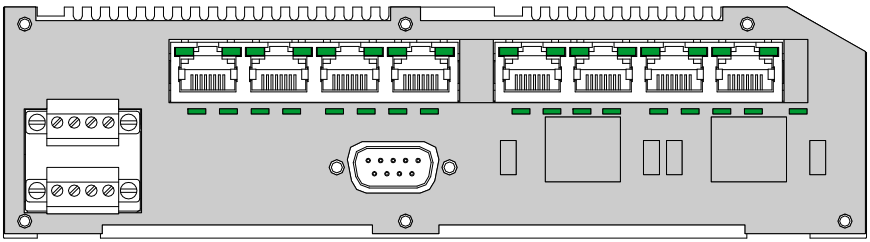
6= ON (10Mb) Not used for Fiber

5.1.2 6KQE Base Unit LED designations



6KQE Base Unit – Top label

5.1.3 6KQE4-RJ45, 4 x 10/100Mb RJ45 (Slot C)



The 6KQE4-RJ45 4-port Copper module provides four 10/100Mb switched RJ-45 ports. The 10/100Mb switched ports normally (as a default setting) are independently N-way auto-negotiating and auto-crossover (MDIX) for operation at 10 or 100Mb speed in full- or half-duplex mode. (i.e., each independently selects a mode and speed to match the device at the other end of the twisted pair cable).

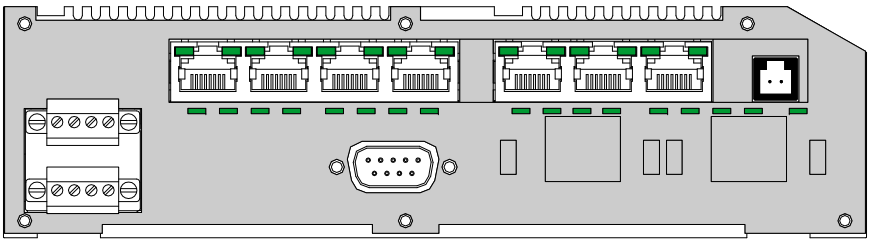
(for auto-negotiation and MDIX details, see Section 4.2 in the 6KQE User Guide).

On the model 6KQE4-RJ45 module, there are four LEDs for each port, two integrated into the connector, and two below the connector. The LK (Link) LED indicates "ready for operation" on that port when lit. The blinking ACT (Activity) LED indicates receiving Activity on that port when lit. The 10/100 LED indicates operation at 100Mb speed when ON and at 10 Mb speed when OFF (when auto-negotiation is not disabled). The FDX/HDX LED is ON to indicate full-duplex operation and OFF to indicate the half-duplex mode. A twisted pair cable must be connected into an RJ-45 port and the Link (LK) indicator for that port must be ON (indicating there is a powered-up device at the other end of the cable) in order for a LK LED to provide valid indications of operating conditions on that port.

Using the 6K (MNS-6K or MNS-6K-SECURE) management software, the user may disable auto-negotiation and fix the desired operation of each RJ-45 port. The user may select 10Mb or 100Mb speed and full- or half-duplex mode per-port as per user requirements. (See Magnum MNS-6K Software Manual for additional info)

NOTE: for Power Substations: *In support of the IEEE 1613 Class 2 standard, GCI advises that, for substation applications, the RJ-45 ports are intended for connectivity to other communication equipment such as routers or telecommunication multiplexers installed in close proximity (i.e., less than 2 meters or 6.5ft) to the 6KQE. It is not recommended to use these ports in substation applications to interface to field devices across distances which could produce high (greater than 2500V) levels of ground potential rise (GPR) during line-to-ground fault conditions. The 6KQE passes the 1613specifications for zero packet loss with fiber ports and with RJ-45 ports used as indicated here.*

5.1.4 6KQE4-1MMRJ, 1 x MTRJ / 3 x RJ45 (Slot C)



The 6KQE4-1MMRJ 4-port Fiber / Copper module provides one 100Mb Multimode MTRJ Fiber port and three 10/100Mb switched RJ-45 ports.

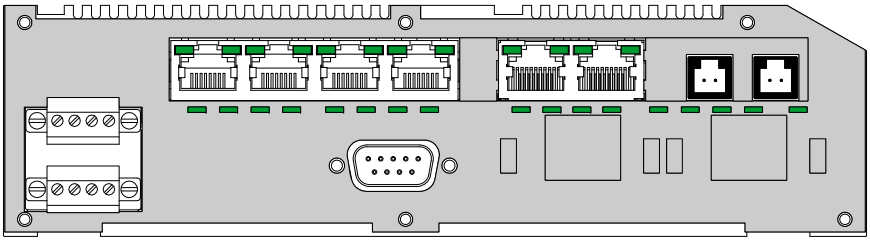
The 6KQE4-1MMRJ fiber port is a Small Form Factor (SFF) MTRJ Multimode connector. The MTRJ's small size and ease of connection make it a good choice for 100Mbps "fiber-to-the-desktop" Ethernet connectivity. When installed in a Magnum 6KQE Series Switch, it supports fiber optic cable distances up to the IEEE-

standard 100Mbps distance limits, i.e., typically 2km at full-duplex and 412m at half-duplex.

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

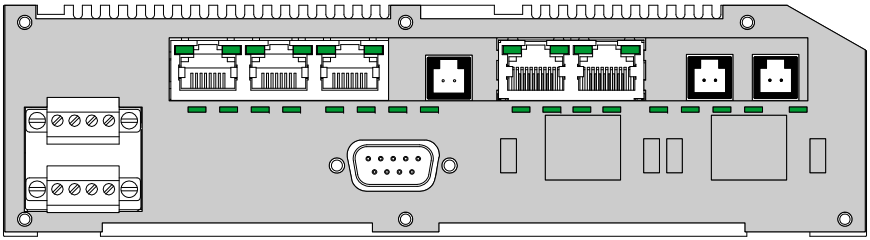
The 6KQE4-1MMRJ copper ports support Ethernet twisted pair segments of any standard length. It is equipped with a three-port RJ-45 connector, and offers 10/100 full / half-duplex auto-negotiating capability on each port. The RJ-45 connector is shielded to minimize emissions and will allow both unshielded twisted pair (UTP) and shielded twisted pair (STP) cable connections. When installed in a Magnum 6KQE Series Managed Switch, the copper ports support the standard distance of 100m on each port.

5.1.5 6KQE4-2MMRJ, 2 x MTRJ / 2 x RJ45 (Slot C)



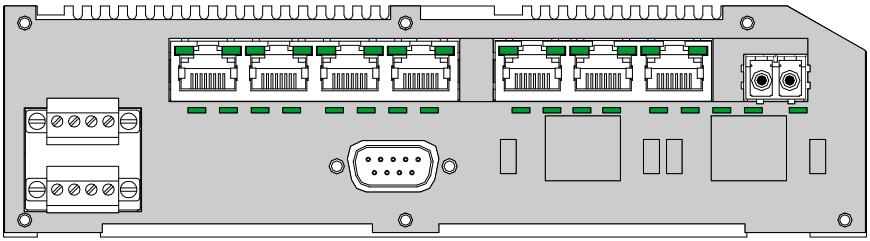
The 6KQE4-2MMRJ 4-port Fiber / Copper module provides two 100Mb Multimode MTRJ Fiber ports and two 10/100Mb switched RJ-45 ports. (see also Section 5.1.4 for additional information)

5.1.6 6KQE4-3MMRJ, 3 x MTRJ / 1 x RJ45 (Slot A, Slot C)



The 6KQE4-3MMRJ 4-port Fiber / Copper module provides three 100Mb Multimode MTRJ Fiber ports and one 10/100Mb switched RJ-45 port. This module option occupies parts of Slot “A” and Slot “C”. (see also Section 5.1.4 for information)

5.1.7 6KQE4-1MLC, 1 x LC / 3 x RJ45 (Slot C)



The 6KQE4-1MLC 4-port Fiber / Copper module provides one 100Mb Multimode LC Fiber port and three 10/100Mb switched RJ-45 ports.

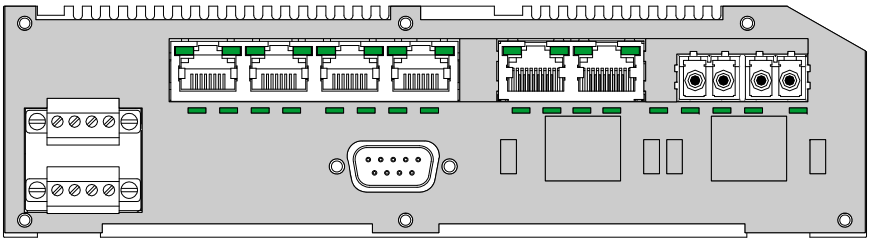
The 6KQE4-1MLC fiber port is a Small Form Factor (SFF) LC Multimode connector used primarily in 100Mbps fiber-to-the-desktop links. When installed in a Magnum 6KQE Series Switch, it supports fiber optic cable distances up to the IEEE-standard 100Mbps distance limits, i.e., typically 2km at full-duplex and 412m at half-duplex.

The compact size of the LC Connector reduces the size of wiring panels in wiring closets while providing the advantage of "future-proof" fiber optic technology.

The cable end is a "plug-in" connector with both fiber strands terminated in one housing that cannot be improperly inserted. Each port has an Activity (ACT) LED indicating packets being received and a Link (LK) LED indicating proper connectivity with the remote device when lit.

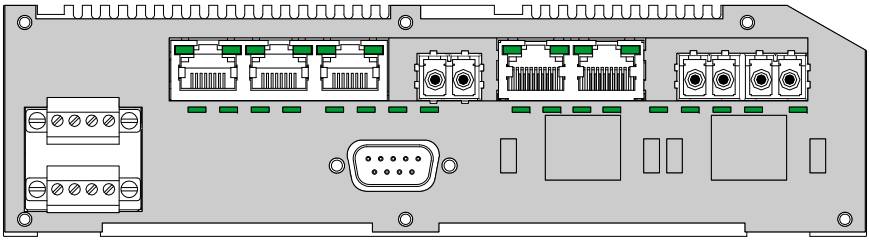
The 6KQE4-1MLC copper ports support Ethernet twisted pair segments of any standard length. It is equipped with a three-port RJ-45 connector, and offers 10/100 full / half-duplex auto-negotiating capability on each port. The RJ-45 connector is shielded to minimize emissions and will allow both unshielded twisted pair (UTP) and shielded twisted pair (STP) cable connections. When installed in a Magnum 6KQE Series Managed Switch, the copper ports support the standard distance of 100m on each port.

5.1.8 6KQE4-2MLC, 2 x LC / 2 x RJ45 (Slot C)



The 6KQE4-2MLC 4-port Fiber / Copper module provides two 100Mb Multimode LC Fiber ports and two 10/100Mb switched RJ-45 ports. (see Section 5.1.7 for more information)

5.1.9 6KQE4-3MLC, 3 x LC / 1 x RJ45 (Slot A, Slot C)



The 6KQE4-3MLC 4-port Fiber / Copper module provides three 100Mb Multimode LC Fiber ports and one 10/100Mb switched RJ-45 ports. This module option occupies parts of Slot "A" and Slot "C". (see Section 5.1.7 for more information)

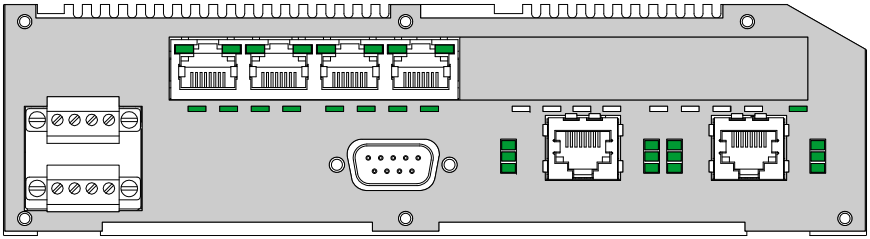
5.1.10 6KQE4-xSLC, LC Singlemode (20km) / RJ45 Module

The 6KQE4-xSLC 4-port Fiber / Copper modules provide 100Mb Singlemode LC Fiber ports, supporting distances up to 20km , and 10/100Mb switched RJ45 ports. These modules provide the same functions as the Multimode versions (see Sections 5.1.7 thru 5.1.9 for more detail and panel configurations).

5.1.11 6KQF-xSLCL, LC Singlemode (40km) / RJ45 Module

The 6KQF-xSLCL 4-port Fiber / Copper modules provide 100Mb Singlemode LC Fiber ports, supporting distances up to 40km , and 10/100Mb switched RJ45 ports. These modules provide the same functions as the Multimode versions (see Sections 5.1.7 thru 5.1.9 for more detail and panel configurations).

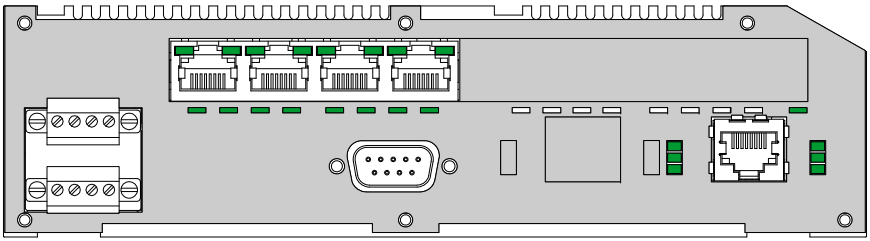
5.1.12 6KQE-2GCU, 1GCU (Gigabit RJ45 Copper ports) (Slot D)



The 6KQE-2GCU 2-port Copper Gigabit module provides two fixed 10/100/1000Mb RJ-45 ports.

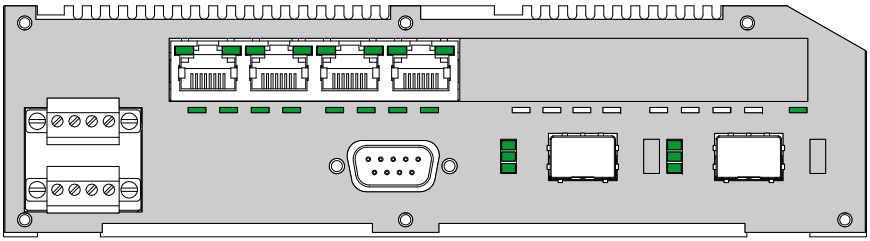
The Magnum 6KQE offers a Gigabit option with multiple choices of Copper 10/100/1000Mbps or Gigabit SFP Fiber transceivers for the modular slot. Up to two Gigabit ports (maximum) can be configured in Slot D only.

There are six LEDs provided for each Gigabit port. Each Copper Gigabit port has LEDs that indicate FH (Full or Half Duplex), LK (Link), ACT (Activity) and 10/100/1000Mbps speed (set to AUTO by default).



The 6KQE-1GCU 1-port Copper Gigabit module provides one fixed 10/100/1000Mb RJ-45 port.

5.1.13 6KQE-2GSFP, 1GSFP (Gigabit SFP Fiber ports) (Slot D)

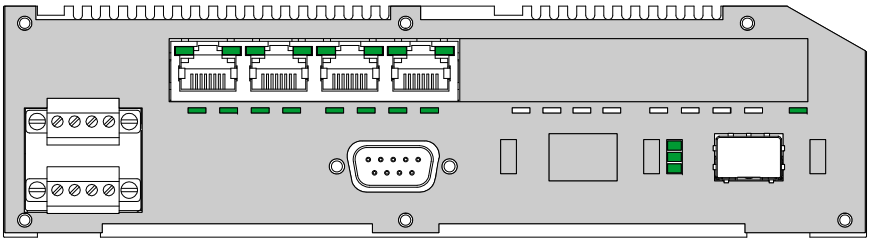


The 6KQE-2GSFP 2-port Fiber Gigabit module provides two SFP open transceiver locations that can operate at 10/100/1000Mbps speeds. Transceivers are

available with both multi-mode 850nm (550m), 1310nm (3km), single-mode 1310nm (10km and 25km) and single-mode 1550nm (40km and 70km) fiber options.
(see page 5 of this manual for part numbers)

The 1000Mb Gigabit SFP fiber-port modules on the Magnum 6KQE are normally set (factory default) to operate at AUTO mode for best fiber distance and performance.

LEDs are configured the same as the copper gigabit option. (see Section 5.1.12 above)



The 6KQE-1GSFP 1-port Fiber Gigabit module provides one SFP open transceiver location that can operate at 10/100/1000Mbps speeds.

5.2 6KQEP-48VDC, Base Unit w/PoE Power-pass-through

The 6KQE is available with the option of having PoE capabilities on the four fixed RJ45 ports in the base unit (ports 1, 2, 3 and 4).

The PoE (Power-over-Ethernet) RJ-45 ports are similar to regular RJ-45 ports, except they have the capability of providing power on each port to power up attached PD devices, per the IEEE802.3af PoE standard. The power-pass-through PoE ports are dependent upon the -48VDC input power to supply the PD power for these RJ-45 (10/100) ports. Each port supplies up to 15watts to power attached PoE PD devices.

The LEDs on the PoE ports are slightly different compared to regular (non-PoE) RJ-45 ports. When the PoE port is in use, the PoE LED is ON when connected properly to an IEEE 803.af compliant PD device on that port. When non-PoE devices are connected, the PoE LED is OFF. Operation of Ethernet data traffic is not affected by PoE. LINK and ACTIVITY LEDS are combined on the PoE modules into one LED that is marked as LINK/ACT.

PoE LEDs Summary

- For PoE devices, each RJ-45 PoE port supports only 802.3af complaint devices. The PoE LED is ON when the attached PD is drawing power from the port. The power is supplied on the data pairs, per IEEE802.3af PoE standard.
- For non-PoE devices connected, the PoE port will act as a normal RJ-45 port and the PoE LED is OFF. No power is sent out from the port.
- The PoE ports in Magnum 6K's with 48VDC power input act as a pass-through, so the 48VDC power input source to the Magnum 6KQE must be strong enough to provide power to the 6K switch and to all 4-RJ-45 ports with PD devices connected (up to 15 watts per PoE port).

- In the case where the 48VDC power in not internally connected to the POE port pins and no power is coming to the PoE ports for some reason, all the PoE port LEDs are ON simultaneously to indicate a trouble condition. The ports will still operate properly for data traffic to non-PoE devices.

6.0 TROUBLESHOOTING

All Magnum Ethernet products are designed to provide reliability and consistently high performance in all network environments. The installation of a Magnum 6KQE Switch is a straight forward procedure. The operation is also straightforward and is discussed in Section 4.0 of this 6KQE User Guide.

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 6KQE Switch is not performing as expected, do not attempt to repair the unit; instead contact your supplier for assistance or contact GarrettCom Customer Support.

6.1 Before Calling for Assistance

1. If difficulty is encountered when installing or operating the unit, refer back to the Installation Section of the applicable chapter of this manual. Also check to make sure that the various components of the network are interoperable.
2. Check the cables and connectors to ensure that they have been properly connected and the cables/wires have not been crimped or in some way impaired during installation. (About 90% of network downtime can be attributed to wiring and connector problems.)
3. Make sure that DC power is properly attached to each Magnum 6KQE Switch unit. Use the PWR LEDs to verify each unit is receiving power.
4. If the problem is isolated to a network device other than the Magnum 6KQE Switch product, 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 6KQE Switch and its associated cables are functioning properly.
5. If the problem continues after completing Step 4 above, contact your supplier of the Magnum 6KQE Switch unit or if unknown, contact GarrettCom, Inc. by fax, phone or email (*support@garrettcom.com*) for assistance.

6.2 When Calling for Assistance

Please be prepared to provide the following information.

1. A complete description of the problem, including the following points:
   a. The nature and duration of the problem;
   b. Situations when the problem occurs;
   c. The components involved in the problem;
   d. Any particular application that, when used, appears to create the problem;

2. An accurate list of GarrettCom product model(s) involved, with serial number(s). Include the date(s) that you purchased the products from your supplier.
3. It is useful to include other network equipment models and related hardware, including personal computers, workstations, terminals and printers; plus, the various network media types being used.
4. A record of changes that have been made to your network configuration prior to the occurrence of the problem. Any changes to system administration procedures should all be noted in this record.

6.3 Return Material Authorization (RMA) Procedure

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

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

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

No Problem Found.

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

6.4 Shipping and Packaging Information

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

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

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

2. Clearly mark the Return Material Authorization (RMA) number on the outside of the shipping container.
3. GarrettCom is not responsible for your return shipping charges.
4. Ship the package to:

GarrettCom, Inc.

47823 Westinghouse Dr.

Fremont, CA 94539

Attn.: Customer Service

APPENDIX A: WARRANTY INFORMATION

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

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

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

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

APPENDIX B : DC Power Input

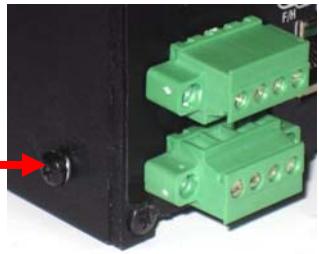
B1.0 Specifications for Magnum 6KQE Switches, DC Power at 12, 24, –48, 125 and 250VDC Power input

Each Magnum Model 6KQE Managed Switch requires DC power input, at 12, 24, 48, 125 and 250VDC nominal. The wide range of DC power input types qualifies this product for use in 12, 24, 48, 125 and 250VDC applications in different industries.

DC Power Terminals: "+", "**–**" are internally floating so that user may ground either

GND: ground wire connection to the 6KQE chassis screw

Fig B1.0 Location of chassis ground



Power Consumption:

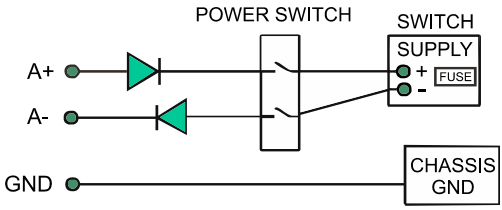
20 watts typical (for a fully loaded fiber model with 2Gb)
15 watts typical (for 8 ports, copper and 100Mb fiber)

12VDC Power Input nominal (range 8 to 18VDC)
24VDC Power Input nominal (range 18 to 36VDC)
-48VDC Power Input nominal (range 36 to 60VDC)
125VDC Power Input nominal (range 88 to 150VDC)
250VDC Power Input nominal (range 160 to 300VDC)

Standard 6KQE DC Power Input Terminal Block : " -, GND, + "

See also Section 1.0, Technical Specifications, for the 6KQE base unit

B2.0 12, 24, –48, 125 and 250VDC POWER, THEORY OF OPERATION



The 12, 24, -48VDC, 125 and 250VDC 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 6KQE Switches are easily installed in a variety of applications where 12, 24, -48VDC, 125 and 250VDC 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 24V and 125VDC options are particularly useful in the industrial environment, where it is common for facilities to operate on 24VDC or 125VDC power. The 125VDC options are mainly used in power utilities, such as electrical substations, electrical generating plants, etc. The 24VDC applications are mainly in heavy duty industrial automation such as factory floor, process plants, HVAC, military equipment, etc.

B4.0 6KQE, 12, 24, –48, 125 and 250VDC INSTALLATION

This section describes the proper connection of the 12, 24, –48, 125 and 250VDC leads to the DC power terminal block on the Magnum 6KQE Switch. The DC terminal block on the Magnum 6KQE Managed Switch is located on the left front of the unit and is 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.

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 6KQE 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, 24VDC, 125VD or 250VDC products, 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 6KQE Switches with the optional -48VDC, 12VDC, 24VDC, 125VDC or 250VDC 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: Internal DC Dual-Source Power Input Option

C1.0 SPECIFICATIONS - FOR MAGNUM 6KQE EDGE 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 8-18 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

Power Supply (Internal, 125VDC Dual-Source, model # Dual-Src-125V)

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 88 - 150 VDC

Power Supply (Internal, 250VDC Dual-Source, model # Dual-Src-250V)

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 160 - 300 VDC

With the exception of the dual DC input power connections and the power supply, all specifications and configuration options for the Magnum 6KQE -48VDC, 12VDC, 24VDC, 125VDC and 250VDC models with this Dual-Source option are identical to those listed in the ***Magnum 6KQE Edge Switches Installation and User Guide***, including Appendix B "Internal DC Power Supply Option"

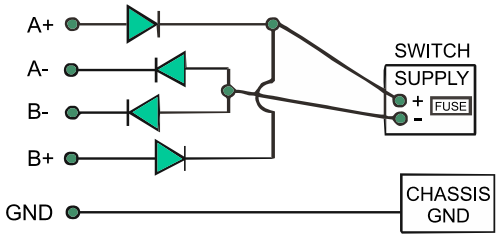
C2.0 MAGNUM 6KQE, with DC Dual-Source option

The 6KQE-Switch models with the internal -48VDC, 12VDC, 24VDC, 125VDC and 250VDC Dual-Source power supply are designed for installations where a battery plant is the power source, and where two separate power sources are utilized in order to increase operational uptime and to simplify maintenance.

The functionality of the Magnum 6KQE Switch -48VDC, 12VDC, 24VDC, 125VDC and 250VDC Dual-Source Option units are identical to the AC-powered models. Refer to the main sections of this ***Installation and User Guide*** for a detailed description of the Magnum 6KQE Switches.

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.

Figure C5.0: DC Dual-Source, wiring connections with Dual-Source option.

Dual Source Terminal block

C5.0 INSTALLATION

This section describes the proper connection of the -48VDC, 12VDC, 24VDC, 125VDC and 250VDC dual source leads to the power terminal block on the Magnum 6KQE Switch (shown in Figure above)

The terminal block is located on the left front of the unit next to the Alarm terminal block and is equipped with four (4) screw-down lead posts. 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). The Dual Source terminal block for the 12, 24, 48, 125 and 250VDC are the same.

Note: The GND should be hooked up first. The 6KQE 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 "+".

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

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 6KQE-48VDC**
Dual-Src-48V

See the Configuration Guide on the GCI web site at
http://www.garrettcom.com/techsupport/insertion_guides/6kqecg.pdf
for additional information.