

Managed Fiber Switch

August 2003
LE2425A



Front view



Rear view

Black Box[®]

Managed Fiber Switches

Installation and User Guide

Trademarks

UL is a registered trademark of Underwriters Laboratories

Important: The LE2425A Managed Fiber Switches contain no user-serviceable parts. Attempted service by unauthorized personnel shall render any and all warranties null and void. If problems are experienced with an LE2425A, consult Section 6, Troubleshooting, of this User Guide.

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P/N 84-01051 (Rev A 08/03)

FCC STATEMENT

**FEDERAL COMMUNICATIONS COMMISSION
AND
CANADIAN DEPARTMENT OF COMMUNICATIONS
RADIO FREQUENCY INTERFERENCE STATEMENTS**

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

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

This digital apparatus does not exceed the Class A limits for radio noise emission from digital apparatus set out in the Radio Interference Regulation of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de classe A prescrites dans le Règlement sur le brouillage radioélectrique publié par le ministère des Communications du Canada.

**NORMAS OFICIALES MEXICANAS (NOM)
ELECTRICAL SAFETY STATEMENT**

INSTRUCCIONES DE SEGURIDAD

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá de lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquear la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.
10. El equipo eléctrico debe ser situado fuera del alcance de las fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.
11. El aparato eléctrico deberá ser conectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.
12. Precaución debe ser tomada de tal manera que la tierra física y la polarización del equipo no sea eliminada.
13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.
14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.
15. En caso de existir, una antena externa deberá ser localizada lejos de las líneas de energía.
16. El cable de corriente deberá ser desconectado del equipo cuando el equipo no sea usado por un largo periodo de tiempo.
17. Cuidado debe ser tomado de tal manera que objetos líquidos no sean derramados sobre la cubierta u orificios de ventilación.
18. Servicio por personal calificado deberá ser provisto cuando:
 - A: El cable de poder o el contacto ha sido dañado; u
 - B: Objetos han caído o líquido ha sido derramado dentro del aparato; o
 - C: El aparato ha sido expuesto a la lluvia; o
 - D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o
 - E: El aparato ha sido tirado o su cubierta ha sido dañada.

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Revisions

08/03 : Initial Release of the user manual

1.0 SPECIFICATIONS**1.1 Technical Specifications****Performance**

Filtering / Forwarding Rate:

Ethernet: 14,880 pps

Fast Ethernet: 148,800 pps

Gigabit Ethernet: 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 μ s + packet time (100 to 100Mbps)

15 μ s + packet time (10 to 10 Mbps, and 10 to 100Mbps)

Network Standards and Compliance, hardware

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

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

IEEE 802.3z: 1000BASE-X Ethernet

IEEE 802.3ab: 1000BASE-X Ethernet

IEEE 802.1p: Priority protocol

IEEE 802.3x: Flow Control

Maximum 10 Mbps Ethernet Segment Lengths

Unshielded twisted pair - 100 m (328 ft)

Shielded twisted pair - 150 m (492 ft)

10BASE-FL multi-mode fiber optic - 2 km (6,562 ft)

10BASE-FL single-mode fiber optic - 10 km (32,810 ft)

Maximum Standard Fast Ethernet Segment Lengths:

10BASE-T (CAT 3, 4, 5 UTP) - 100 m (328 ft)

100BASE-TX (CAT 5 UTP) - 100 m (328 ft)

Shielded twisted pair - 150 m (492 ft)

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

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

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

100BASE-FX, full-duplex, single-mode - 20.0 km (66K ft)

100BASE-FX, full-duplex, Long Reach - 40.0 km (122K ft)

Maximum Standard Gigabit Ethernet Segment Lengths:

1000BASE-T (CAT5E or higher is recommended) - 100 m (328 ft)

1000BASE-SX, full-duplex, multi-mode(62.5 μ m cable) - 220m

1000BASE-SX, full-duplex, multi-mode(50 μ m cable) - 550m

1000BASE-LX, full-duplex, single-mode(62.5 μ m cable) -5Km

Fiber Multi-mode connector types supported:

Fiber Port, ST-type (twist-lock):Fiber multi-mode, 10Mb 10BASE-FL

Fiber Port, MTRJ-type (plug-in):SFF Fiber multi-mode100BASE-FX

Fiber Port, SC-type (snap-in):Fiber optic multi-mode, 100BASE-FX

Fiber Port, ST-type (twist-lock): Fiber optic m.-mode, 100BASE-FX

Fiber Port, 1000BASE-FX, GBIC modules

Fiber Single-mode connector types:

Fiber Port, SC-type: Fiber optic single-mode, 100BASE-FX
Fiber Port, LC-type: Fiber SFF single-mode, 100BASE-FX
Fiber Port, 1000BASE-FX, GBIC modules

LEDs: Per Port

LK: Steady ON when media link is operational

ACT: ON with receiver port activity

FDX/HDX: ON = Full-Duplex Mode

OFF = Half-Duplex Mode

100/10: ON = 100Mbps speed

OFF = 10 Mbps

Operating Environment

Ambient Temperature: 25° to 130° F (-5° to 55°C)

Storage Temperature: -40° to 185°F (-40° to 85°C)

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

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

Conformal Coating option: Request quote

Packaging

Enclosure: Rugged High strength metal. Suitable for stand-alone or rack-mounting

Dimensions: 1.70in. H x 17.0in. W x 9.0in. D

4.32cm H x 43.2cm W x 22.9cm D

Cooling method: Fan cooled, 3@ 7 cfm ea.

Management Console connector

DB-9 for RS-232 “ null-modem “ cable (sometimes called an Xmodem cable)

Power Supply (Internal)

AC Power Connector: IEC-type, male recessed at rear of chassis, with adjacent manual ON-OFF switch (on AC models only)

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

Input Frequency: 47 to 63 Hz (auto-ranging)

Power Consumption: 55 watts typical

60 watts max (for a fully loaded fiber model)

35 watts for a fully-loaded copper only model

DC Power Supply (Options)

-48VDC Power Input Voltage : -36 to -70 VDC

24VDC Power Input Voltage : 20 to 36VDC

125VDC Power Input Voltage : 88 to 150VDC

Std. Terminal Block : “ -, GND, + ”

Power Consumption: same as for AC models, see above

For DC internal power supplies at -48VDC, 24VDC and 125VDC, including Dual Source options (for continuity of operation when either of the DC input sources are interrupted), see Appendices B and C.

Per-port jumpers and switches

The copper daughter board has an internal switch on the port module for selecting MDI-MDIX crossover on port # 1.

Other port-specific user settings (such as FDX or HDX, copper 10/100 speed) can be fixed using software commands.

Agency Approvals

UL listed (UL80950), cUL, CE

Emissions meet FCC Part 15 Class A

Optional: ETSI and NEBS L3 Certified

Warranty: Three years, return to factory

Made in USA

NEBS Tested and Certified at Level 3 by an Independent Testing Laboratory.

1.2 Ordering Information

Managed Fiber Switch

<u>MODEL</u>	<u>DESCRIPTION</u>
	Managed fiber Switch (LE2425A): Black Box Managed fiber switch, base unit. May be configured with a selection of 10/100/1000LE2425A fiber and copper port connector types, 25 total ports max. Wire speed filtering and forwarding across all ports, 802.3x flow control, 802.1p priority packet processing, self-learning 4K-node address table, large 240KB packet buffers for 10/100 and 120KB for 1000Mb. Plug-and-play switching services, Two sets of LEDs (both rear and front) provide duplicate status data for viewing from either side, internal auto-ranging AC power supply, 19" rack-mounting brackets. For licensed managed networks software, see MNS-BB materials.
Black Box Managed fiber switch-48VDC:	Same as LE2425A except the power input is -48VDC
Black Box Managed fiber switch-24VDC:	Same as LE2425A except the power input is 24VDC
Black Box Managed fiber switch-125VDC:	Same as LE2425A except the power input is 125VDC
Configuration Options:	
Each Black Box Managed fiber switch base unit has four port module slots. The first three (A,B,C) may be one of the modules below, one (slot D) may only be a Gigabit module. Select up to four port modules per base unit.	
Black Box Managed fiber switch Port Modules	
LE2426C	"2+2" 100Mb Fiber module, w/ four 100Mb 2km FX SC connectors
LE2427C	"2+2" 10Mb Fiber module, w/ four 10Mb 2km FL ST connectors
LE2428C	TP Module, w/eight 10/100Mbps auto-negotiating RJ-45 ports
LE2429C	"4+2" module, w/four RJ-45 ports and two 2km mm FX ST's
LE2430C	"4+2" module, w/four RJ-45 ports and two 2km mm FX SC's
LE2431C	"4+2" module, w/four RJ-45 ports and two 20km Sgl.m FX SC's
LE2436C	SFF Fiber module, w/eight 100Mb mm FX MTRJ connectors
LE2437C	SFF Fiber module, w/eight 100Mbps sgl-m FX LC connectors
LE2435C	Blank cover for one (A,B,or C) module slot opening in a Black Box Managed fiber switch chassis
LE2432C	One port D-slot Gigabit module, uses one LE2425A slot and provides one GBIC open transceiver port for a user selectable GBIC connector module
LE2433C	One port A, B, C -slot Gigabit module, uses one LE2425A slot and provides one GBIC open transceiver port for a user selectable GBIC connector module
LE2434C	GBIC transceiver module for use in LE2432C or LE2433C, one SX port with mm SC fiber connector

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 Black Box Managed fiber switch LE2425C, base unit
(configured with user-selected port module options)
- 1 AC Power Cord (U.S. and other 115 VAC only)
- 1 Set of metal “Ears” for 19” rack mounting
- 1 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 - (LE2425A)

The *NEBS* Level 3 certified, LE2425A Managed Fiber Switch boosts the performance of large Ethernet LANs, typically serving as a “backbone” switch. It has the flexibility to handle a mix of both fiber and twisted-pair switched ports along with Gigabit backbone port options. The Managed Fiber switch withstands extremes of temperatures and humidity, is encased in a rugged chassis, and is adaptable to nearly any power station. It’s an ideal switch for demanding industrial, telecomm, or municipal installations such as telecomm central offices (CO), traffic control systems, water-treatment plants, or manufacturing plants.

The LE2425A Managed fiber switch has up to 25 ports capacity, all of which may be configured as fiber ports, but still offers a space-saving rack-mount chassis that is only 1U (1.70in. or 4.32cm) high. The “mixed-media” capability allows user selection of all popular flavors of fiber port connectors and modes, including even 10Mb fiber along with Gigabit ports. It also allows a mix of 10/100Mb RJ-45 (copper) ports and a fiber Gigabit port in the same unit. This flexibility is achieved via a family of LE2425A port modules for copper and fiber-built-in (emphasizing Small Form Factor fiber for high fiber port density), 6-port modules for fiber and RJ-45 combinations, and 1Gb port module selections using GBICs. These modules can be factory configured in a base chassis unit (or may be changed in the field by trained technicians) to adapt the unit to the user’s application and Ethernet cabling requirements. Even evolving mixed-media requirements for 10Mb and 100Mb fiber and copper as well as Gigabit ports can be handled by the Black Box Managed fiber switch product.

The packaging and power-input options target the Black Box Managed fiber switch at heavy-duty applications. The chassis mounting rack style may be “regular” (with the ports and LEDs in the front and the power input and management console connector in the rear) or “Reverse” (with the ports and LEDs and the power-input and the management console connector all in the rear and a duplicate set of LEDs in the front). Rack widths accommodated include standard 19” RETMA, ETSI, and 23” Telco. Input power may be AC, or –48VDC for Telco environments, or 24VDC for Industrial applications.

Designed for use in network traffic centers, the LE2425A Managed fiber switches are easy to install and use. Addresses of attached nodes are automatically learned, maintained and aged out, adapting the switching services to network changes. LEDs provide status information on each port. The LE2425A fiber switch provides high

performance plug-and-play hardware operation, 802.1p packet prioritization in hardware, and industry-standard managed networks software functionality, all in convenient 1U rack-mount packages.

2.2.1 Black Box Managed fiber switch (LE2425A)

The Black Box Managed fiber switch is a 19” rack-mountable Ethernet Switch with three eight-port slots (A, B, and C) and one GB-only slot (D) for configuration flexibility. Slots A, B and C may be configured with any of a large selection of fiber and copper port types and combinations of types, typically eight ports per module, but sometimes 6 or 4 ports or even one GB port. Slot D may be configured with a GB module that accepts GBICs. The port types configurable using the 4 slots allows the LE2425A to efficiently serve a large variety of applications, especially using fiber media. The Black Box Managed fiber switch port modules are normally factory installed, but may be changed or added in the field. (See Section 5)



Figure 2.2.1a: Black Box LE2425A’s Rear view



Figure 2.2.1a: Black Box LE2425A’s front view,

Status LEDs are part of each port module and are viewable when connecting the Ethernet media. A “regular” rack-mount LE2425A is shown in Figure 2.2.1a. On “Reverse” rack-mount models, there is a duplicate set of LEDs on the other (front) side for normal status viewing from that direction. Of course, with management, the port status data is also available in software.

2.2.2 Eight-port SFF fiber modules (LE2436C, LE2437C), 100Mb fiber

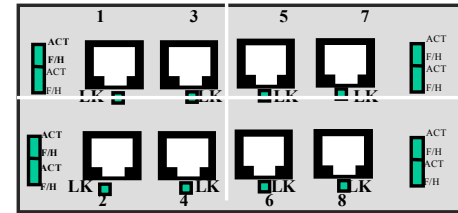
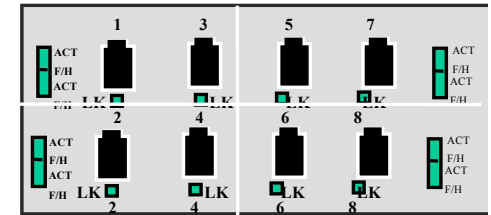


Fig.2.2.2 :
SFF Fiber Port Modules,
8-port
LE2436C (to the left) and
LE2437C (below)

In an eight-port SFF (Small Form Factor) fiber port module, all of the fiber ports are of the same speed (100Mb), but mode and connector type can vary in each 4-port half of the module.



Models available with Small Form Factor (SFF) are multi-mode MTRJ or LC-type connectors, and single-mode LC-type connectors.

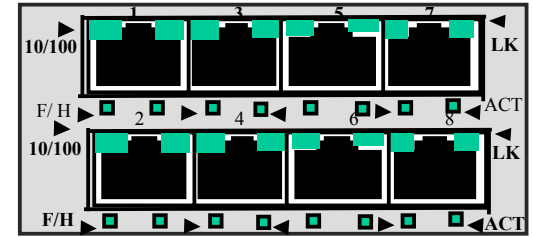
The 100Mb fiber eight-port modules for the Black Box Managed fiber switch’s normally are set (factory default) to operate in full-duplex mode for best fiber distance and performance. Using the LE2425A’s MNS-BB software, the user may select full- or half-duplex mode per-port through set-up of the software (See Black Box Managed fiber switch MNS-BB Software Manual) for the flexibility to adapt to any FDX or HDX type of Fast Ethernet devices).

There are three LED’s per fiber port. The Link (LK) LED indicates “ready for operation” on that port when lit, the F/H LED indicates operation in full-duplex mode when ON (half-duplex when OFF), and the blinking ACT LED indicates receiving Activity on the port. A fiber cable must be connected into a SFF 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.

2.2.3 Eight-Port Copper Module, LE2428C

The LE2425A's 8-port

Copper port module, model LE2428C, provides eight 10/100Mb switched RJ-45 ports. The 10/100Mb switched ports normally (as a default setting) are independently N-way auto-negotiating 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. (See Section 4.3 for auto-negotiation details)

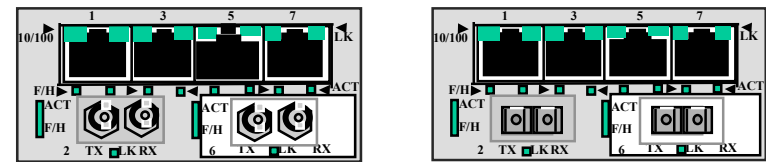


On the model LE2428C module, there are four LEDs for each port, two in the connector and two separate. The LK (Link) LED indicates “ready for operation” on that port when lit. The blinking ACT (Activity) LED indicates receiving Activity on that port when lit. The 10/100 LED indicates operation at 100Mb 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 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 LE2425A's MNS-BB software, the user may disable auto-negotiation and fix the desired operation of each RJ-45 port. MNS-BB Software set-up may select 10Mb or 100Mb speed and full- or half-duplex mode per-port as per user requirement. (See Black Box Managed fiber switch MNS-BB Software Manual for details info.)

2.2.4 Six-Port “4 + 2” Combo Modules, 4@ 10/100 RJ-45 and 2@ 100Mb fiber

The combo six-port modules (LE2429C) are combinations of copper and fiber media, available as four 10/100 switched RJ-45 copper ports and two 100Mb switched

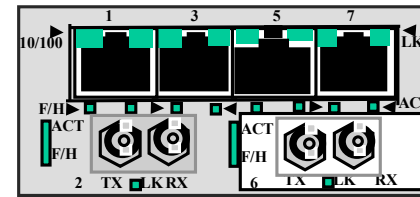


4@ RJ-45 + 2@ 100 Mb SC

multi-mode fiber ST, SC or single mode SC or Long Reach SC ports. For ports numbering, ports 1,3,5,7 are copper, ports 2 and 6 are fiber, ports 4 and 8 are not present.

The four RJ-45 ports operate just like the 8-port copper module, and the two fiber ports operate at 100Mbps full-duplex (default). User mode control per port through the MNS-BB software is also the same.

On LE2425A's "4+2" Combo modules, there are four LED's for each RJ-45 port, which indicate status the same as described for the LE2428C in Section 2.2.3 above. The fiber port's LEDs indicate status the same way as described for the SFF fiber modules in Section 2.2.2 above. Color-coding on the panel of the module shows which LEDs belong to which port.



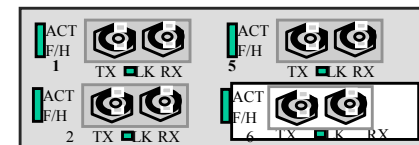
The LE2425A's Combo six-port modules are also available with 4@ MTRJ 100Mb mm SFF fiber and 2@10Mb fiber mm ST ports, and with 4@ RJ45

4@ RJ-45 + 2@ 10 Mb

ST

10/100 copper and 2@10Mb fiber mm ST ports. The operation of the SFF fiber and the RJ-45 half of the module is as described for those port types above. For detailed information about 10Mb mm ST fiber half of the module, please check section 2.2.5.

2.2.5 Four-Port 10 Mb mm Fiber ST Modules



The 4-port @10Mb ST fiber modules operate the same as the 8@100Mb ST fiber modules except for the 10Mb speed. For ports numbering, ports 1, 2, 5, 6 are present, ports 3, 4, 7, 8 are not present. The default setup on the 10Mb fiber module is half-duplex, which allows the Black Box Managed fiber switch to connect to any 10Mb hub or media converter or almost any other device with a 10Mb fiber Ethernet port. User mode control per port through the MNS-BB software is the same as the other LE2425A modules. The fiber ports support fiber cabling distances according to the 10BASE-FL standard, i.e., 2km distance for multi-mode fiber. (Single-mode for up to 10Km distance may be available as a special order configuration).

2.2.6 Gigabit (1000Mbps) port modules

The Black Box Managed fiber switch can be configured for Gigabit speed. While up to all four slots may be Gigabit, normally it is configured in slot D (the GB-only slot) and Slot C if a 2nd GB port is desired. The Gigabit port option comes as LE2432C (for slot D, the narrow slot) and LE2433C (for slots C or B or A).



The LE2425A Modules provide a GBIC opening for insertion of industry-standard GBICs to provide GB media flexibility. GBIC models are available for both multi-mode and single-mode fiber connections, and for GB copper as well, with new models appearing often.

The 1000Mb Gigabit fiber-port modules on the Black Box Managed fiber switch are normally set (factory default) to operate in full-duplex mode for best fiber distance and performance. The 1000Mbps SC fiber-optic module on the Gigabit -SX and Gigabit-LX transceivers are compatible with the IEEE 802.3z Gigabit standards.

There are two LEDs mounted on each Gigabit port module. The Gigabit fiber port is fixed at 1000Mbps speed full-duplex mode at all times and has LEDs that indicate LK (Link status) and ACT (receiving activity) on that port when lit.

2.2.7 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 Black Box Managed fiber switch can do its part to prevent any QOS degradation while it is handling Ethernet traffic through its ports and buffers.

The Black Box LE2425A, Managed fiber 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-BB 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.

2.2.8 Frame Buffering and Flow Control

Black Box LE2425A fiber switches 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 Black Box LE2425A Switch detects that its free buffer queue space is low, the Switch sends industry standard (full-duplex only) PAUSE packets out to the devices sending packets to cause "flow control". This tells the sending devices to temporarily stop sending traffic, which allows a traffic catch-up to occur without dropping packets. Then, normal packet buffering and processing resumes. This flow-control sequence occurs in a small fraction of a second and is transparent to an observer. Another feature implemented in LE2425A Managed fiber 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.

2.2.9 Managed Network Software (MNS-BB-BB) for Black Box LE2425A

Black Box Managed LE2425A's come with licensed MNS-BB software, which allow to configure the Managed Switch and other Software enabled features. For additional information about MNS-BB, see the Black Box Managed fiber switch MNS-BB Software User Guide, a separate document.

2.3 Features and Benefits

■ Managed switching for high performance Ethernet LANs

Black Box Managed LE2425A Switches provide non-blocking (all ports can run at full speed at once) performance with standard Managed Networks Software (MNS-BB-BB) included. They are typically used in LAN traffic centers with 16 to 24 100Mb ports and one or 2 Gigabit ports for backbone connections, where managed network services are desired.

■ Switching services includes 802.1p QoS packet prioritization

The Managed LE2425A Switch hardware supports QoS, giving packet processing priority to priority tagged packets according to the IEEE 802.1p standard. For port- and application-specific priorities, the QoS software may be configured by the user.

■ Features Fiber-Built-In

Managed LE2425A Switches are designed to naturally include fiber ports, and support mixes of multi-mode and single-mode; 10 Mb, 100Mb and 1000Mb speed; full- and half-duplex; classic Small Form Factor (SFF) and GBIC fiber connectors. RJ-45 10/100 ports can also be configured in the mix of port types.

■ Modular design for port flexibility, in a 1U space-saving rack-mount package

The 1U LE2425A switch chassis has 4 slots for port configurations. Family of 4, 6 or 8 port modules allow the user to select the desired mix of port types & speeds. The port modules are normally factory installed and tested, but may be changed in the field.

■ Rack-mounting may be standard or “reverse”, 19 inch or ETSI or 23” Telco

The standard rack mounting provides Ethernet ports and status LEDs in front, service connections (power input and management console) in the rear. “Reverse” rack mounting provides status LEDs in front and all cabling connections in the rear. Standard 19’ rack mount brackets are included, with ETSI and 23” Telco optional.

■ Standard AC power input, -48VDC or 24VDC or 125VDC input is optional

Standard AC power input is IEC plug, auto-ranging for worldwide use. For special applications, models with -48VDC or 24VDC or 125VDC are available. Dual Source DC input can also be selected and configured on the DC power input models.

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

Fiber ports take more power than copper ports, but the LE2425A design provides for this with heavy-duty components. The ambient temperature can be up to 55°C.

■ NEBS and ETSI tested and certified

The LE2425A has been tested and certified for NEBS and ETSI. Request test reports.

■ MNS-BB licensed Network Management Software included, S-Ring optional

Release 2.3 (summer '03) includes SNMP Switch Management with secure access control, RMON, CLI, Port Security; Port Mirroring; Port Settings Control; Telnet, TFTP, FTP support, Spanning Tree Protocol, multi-level QoS, Port- and tag-based VLANs, GVRP, IGMP Snooping, SNMPc GUI support; Event Log; SNTP client for time-of-day; BootP and DHCP client for IP configuring, and password security.

2.4 Applications

Black Box Managed Fiber Switches offer high performance and modularity. They provide the flexibility of 100Mbps fiber and copper ports as well as Gigabit ports, with industry-standard LAN management software. Black Box LE2425A Switches are easily used in a variety of applications including MANs (metropolitan area networks) client/server computing, secure VLAN- performance upgrades to departmental networks, and LAN traffic centers require GB backbone services. The performance characteristic of the LE2425A Switches enables them to inter-connect a series of subnets (one subnet perLE2425A 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 mode.

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

Example 1 : Black Box Managed fiber Switch for a VLAN application

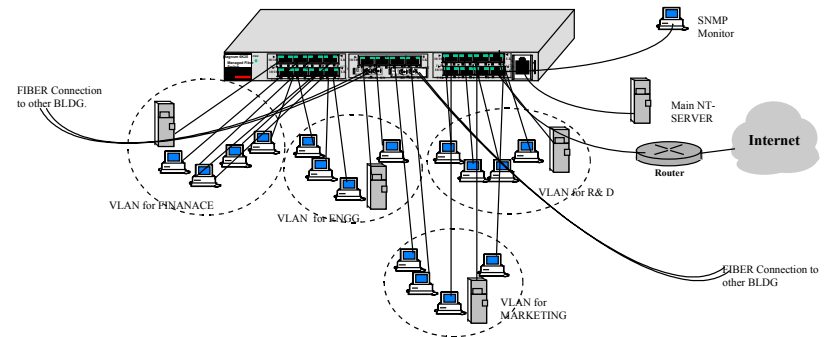
Equipped with lots of useful features, the Black Box Managed fiber switch Managed switch is able to handle a VLAN application and provide a security and performance in an Ethernet network center. A secure VLAN-enabled network is simply an administratively configured broadcast domain. The network administrator determines which ports and nodes are in which broadcast domains by setting membership profiles for each of them. The Black Box Managed fiber switch's VLAN capability can be developed in several types of Virtual LANs, such as Port-based VLANs, MAC-based VLANs or Tag-based VLANs.

In an office environment where departments such as Finance, Engineering, R&D, and Marketing need to keep a secure LAN, theLE2425A's VLAN feature will prevent traffic cross-over among domains, and thus from keep sensitive data and information controlled. The Managed Black Box Managed fiber switch equipped with VLANs capability is ideal for any application where a secure VLAN to multiple departments is needed.

The modularity of theLE2425A Managed Fiber Switch makes it an attractive choice for use in applications with LAN connections to an organization's multiple site offices. The different offices can be easily connected together with the Fiber ports supported by the Black Box Managed fiber 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.

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 Black Box Managed fiber Switch helps create a database of all the network subnets to easily manage the network.

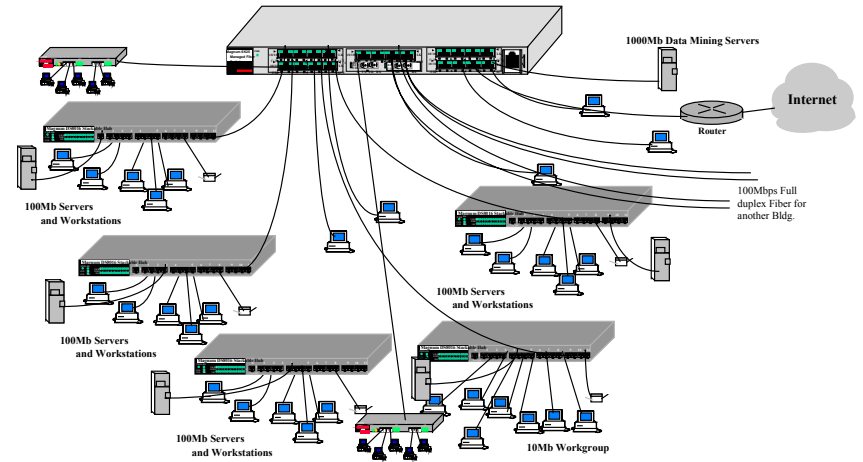


Example 2. In another application, a managed switch is needed to provide an Ethernet backbone for a diversified network with multiple subnets. The back bone consists of high speed LAN segments supported by 100Mbps full-duplex future-proof fiber media to provide secure long distance LAN connections. The 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 building. The entire spread network will be manageable to provide easy, detectable, uninterrupted support through a viewable SNMP monitor.

The Black Box Managed fiber switch Managed Fiber Switch equipped with the mix of copper and fiber ports provides an economical and seamless solution to the requirements. The user-configurable Black Box Managed fiber switch 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, Sntp and other standard managed LAN features to provide a secure and stable network.

The LE2425A Managed Fiber Switch with mixed-media flexibility allows the users more than one configuration alternative. The user has an advantage by fulfilling the present requirements as well as benefiting from the multiple choices of modules to

support future expansion as the network evolves. The Gigabit port option boosts the bandwidth for high speed to support the peak traffic and minimize congestion.



3.0 Installation

This section describes installation of the Black Box Managed Fiber Switches, as well as connection of the various Ethernet media types.

Safety Precautions:

Before installing the equipment, it is necessary to take the following precautions:

If the equipment is mounted in an enclosed or multiple rack assembly, the environmental temperature around the equipment must be less than or equal to 50° C.

If the equipment is mounted in an enclosed or multiple rack assembly, adequate air flow must be maintained for proper and safe operation.

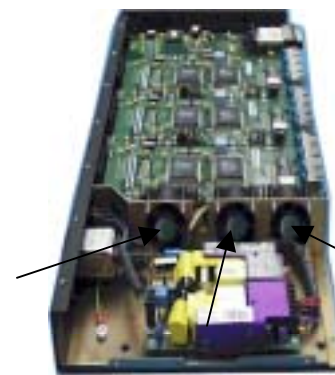
If the equipment is mounted in an enclosed or multiple rack system, placement of the equipment must not overload or load unevenly the rack system.

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.

If the equipment is mounted in an enclosed or multiple rack assembly, verify that the equipment has a reliable and uncompromised earthing path.

3.1 Locating Black Box Managed LE2425A Switch

The location of a Black Box LE2425A fiber Switch is dependent on the physical layout of the network. Typically the Switch is placed in a central wiring location where groups of network devices need to be connected in order to communicate with each other. These Switches are typically rack mounted in a wiring closet (see Section 3.3.2 below), but because they have rubber feet they can also be installed on a shelf or table top unit. The compact size allows it to be easily placed in an office or lab area, and it can also be either shelf or wall-mounted (see Section 3.3.1 below).



Locate an AC receptacle that is within six feet (2 meters) of the intended Black Box Managed fiber switch site. The rugged metal case of the Black Box Managed fiber switch will normally protect it from accidental damage in a lab or workplace setting. Maintain an open view of the front to visually monitor the status LEDs. Keep an open area around the unit so that cooling can occur from the small fan on the left side, while the unit is in operation. See figure below.

Figure 3.1: Location of the Black Box LE2425A fiber switch's cooling fans

3.2 Connecting Ethernet Media

The Black Box LE2425A fiber Switches are specifically designed to support all standard Ethernet media types within a single Switch unit. This is accomplished by using a family of different port Modules which can be individually selected and configured per-port. See Section 2.4 for a description of the PMs.

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

<u>IEEE Standard</u>	<u>Media Type</u>	<u>Max. Distance</u>	<u>Port Module</u>
<u>Fiber:</u>			
1000BASE-FX	mm ¹ Fiber	220m (ft)	LE2434C
	sgl.m ² Fiber	5Km	LE24XX
100BASE-FX	mm ¹ Fiber	2.0km (6,562 ft)	LE2429C, LE2430C
	sgl.m ² Fiber	18.0km (95K ft)	LE2431C, LE24XX
small form factor	mm ¹ Fiber	2.0km (6,562 ft)	LE2436C, LE2437C
small form factor	sgl.m ¹ Fiber	15 km	LE24XXX
<u>Copper:</u>			
10BASE-T and 100BASE-TX twisted pair		100m (328 ft)	LE2428C

¹ mm = multi-mode

² sgl.m = single-mode

3.2.1 Connecting Fiber Optic ST-type, “twist-lock”

The following procedure applies to installations using a PM with ST-type fiber connectors. This procedure applies to ports using a LE2425A module, MST-type port.

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. Connect the Transmit (TX) port (light colored post) on the LE2425A’s PM to the Receive (RX) port of the remote device. Begin with the color-coded strand of the cable for this first TX-to-RX connection.
4. Connect the Receive (RX) port (dark colored post on the PM) to the Transmit (TX) port of the remote device. Use the non-color coded fiber strand for this.
5. The LINK LED on the front of the PM will illuminate when a proper connection has been established at both ends (and when power is ON in the unit). If LINK is not lit after cable connection, the normal cause is improper cable polarity. Swap the fiber cables at the PM connector to remedy this situation.

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

The following procedure applies to installations using a PM with SC-type fiber connectors, i.e., using LE2430C, LE2431C single-mode.

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

3.2.3 Connecting Single-Mode Fiber Optic

When using single-mode fiber cable, be sure to use single-mode fiber port connectors. Single-mode fiber cable has a smaller diameter than multi-mode fiber cable (9/125 microns for single-mode, 50/125 or 62.5/125 microns for multi-mode where xx/xx are the diameters of the core and the core plus the cladding respectively). Single-mode fiber allows full bandwidth at longer distances, and may be used to connect 10 Mb nodes up to 10 Km apart, or 18Km with the LE2431C.

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

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

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

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

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

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

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

3.2.5 Connecting Twisted Pair (CAT5E or better, Unshielded or Shielded)

The RJ-45 Gigabit ports of the Black Box Managed fiber switch 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 maximum distance for unshielded twisted pair cabling is 100 meters (328 ft).

<u>Media</u>	<u>IEEE Standard</u>	<u>Connector</u>
Twisted Pair (CAT 5E)	1000BASE-T	RJ-45

NOTE : *It is recommended that high quality CAT. 5E cables (which work for both 100 Mb and 1000Mb) be used whenever possible in order to provide flexibility in a mixed-speed network.*

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

3.3 Table-Top or Shelf Mounting

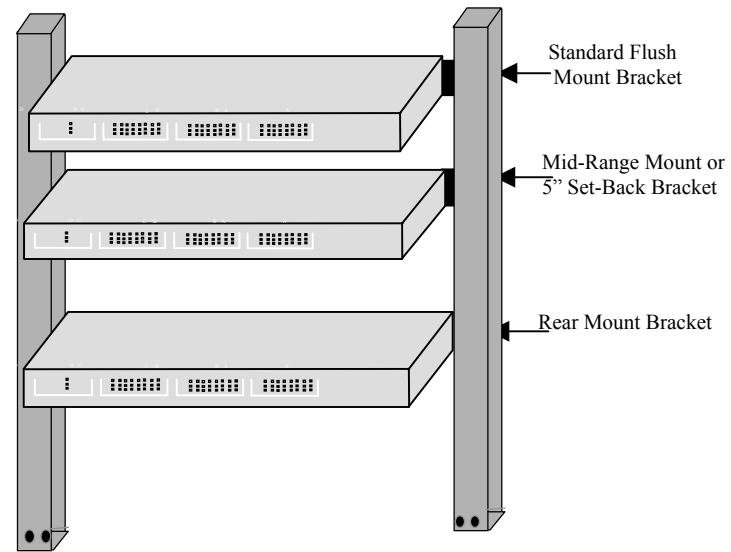
The Black Box Managed fiber Switches can be easily mounted on a table-top or any suitable horizontal surface, and has four rubber feet to provide stability without scratching finished surfaces.

3.3.1 Rack-mounting (for 19” RETMA racks), Black Box Managed LE2425A switches

Installation of a Black Box Managed Fiber Switch in a 19” rack is a simple procedure. The units are 1U (1.70”) high. When properly installed, the front-mounted LED status indicators should be in plain view and easy to read. Rack-mount installation requires special 19” rack-mounted brackets and screws (included with each Black Box LE2425A fiber switch unit). These brackets attach to the front sides of the Switch (regular package, i.e., not the Reverse version), which is then typically fastened into a standard 19” RETMA rack as shown here.

The 23” brackets and the ETSI (European metric, approx. 21”) brackets are also available (optional) for rack-mounting of Black Box LE2425ASwitches. These brackets are popular in the Telco industry where they are a standard for Central Office rack-mounting purposes. The 23” and the ETSI brackets are mainly used for larger equipment assemblies in rack-mounting frames where the rack-mount equipment is typically accessed in operation from both sides.

The bracket mounting holes in the sides of the Black Box LE24254A fiber switch permits it to be mounted in various ways. The same holes fit all three types (19", ETSI, 23") of brackets. The mounting for the 23" is illustrated in Figure 3.3.1 below. The brackets may be attached flush with the front, or attached in the center for a set-back mounting which may reduce cabling torque.



3.4 Powering the LE2425A Managed Fiber Switch

The Black Box Managed LE2425A Switches incorporate an internal universal power supply and have a recessed male IEC connector for the AC power cord at the left-rear. A manual power ON-OFF switch is adjacent. A six-foot 115 VAC 60 Hz standard power cord is supplied with each unit shipped within the United States and Canada.

The auto-ranging power supply supports installation environments where the AC voltage is from 90 to 260 volts with a power input frequency between 47 and 63 Hz. The 25-port units will consume over 20 watts of power typically. When connecting the Ethernet cabling, there is no need to power down the unit. Individual segments can be connected or disconnected without concern for AC power-related problems or damage to the unit.

Power supply options are available to suit the LE2425A Switches to special high-availability communications and/or heavy industrial-grade applications, including:

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

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

3.5 LE2425A Port Module Installation

The Black Box Managed LE2425A Switches are normally received from the factory with all required PM modules installed. There may be situations where cards need to be added or replaced. In cases where additional cards are needed, the faceplate for an available front-mounted slot must be removed. The following procedure describes this operation.

3.5.1 Preparation for Installing and Removing PMs

STOP!!!

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

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

Step 1. Make sure the PM Card package has all necessary accessories to install it properly. Each PM Card package except the Gigabit, for field installation contains (Daughterboard (Bigger) and Granddaughter board (smaller), three 5/8 stand offs for Granddaughter board, six #4-40 Pan-Head screws along with Front panel face plate package. The Front panel faceplate package includes 3 retainer brackets and six #2-56 flat head screws.

NOTE: *Every PM Card package comes with their matching Daughter and Granddaughter board. The copper PM card should not work properly if mixed with other Fiber combo PM card packages. Always install the PM module separately one by one to avoid the mixing.*

Step 2. Remove Chassis Cover

The Black LE2425A switch chassis are combined with top and bottom parts and assembled together with the help of 22 Philips-head screws. There are 7 screws located on the front-bottom and rear-top of the unit and four screws each on the sides. Remove these screws. Once these are removed, the top cover is easily lifted off the

chassis base. When the chassis top cover has been removed, the interior of the unit is exposed.

Figure 3.5.1a: Removing Chassis Cover

Caution: Be careful not to disturb the power supply.

Looking down into the LE2425A switch unit, notice that there are individual PM installation spaces and female latch(white) connectors provided on the main board along with four stand-off's for each PM card position. (See Figure 3.5.1b).



Figure 3.5.1b: LE2425A Managed fiber switch, Top view without chassis cover

Step 3. Remove front panel face plate retaining screws

There are four PM slots (A, B, C and D) located on the front of the chassis cover. Looking into the vertical placed Chassis cover of the unit, there are three brackets with retaining screws (#256 flat head) which hold each PM Face plate card slot securely. These six screws shown in the picture below are used to secure a PM face plate in position, but unscrew only four of the screws as shown in Fig. below. These screws are also used to secure the individual PM cards screen plate which can be subjected to significant forces from the attached cables. (See Figure 3.5.1c)

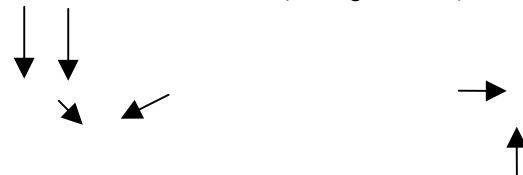


Figure 3.5.1c: Top View – PM retaining screws hold Face Plate

3.5.2 Installing PM Cards in the LE2425A Managed fiber switch

Up to four front-mounted PM cards may be installed in one Black Box LE2425A Switch unit. Follow these steps to install a PM.

Step 1. Remove top chassis cover. See procedure in Section 3.5.1 above.

Step 2. Place Granddaughter board (as shown in fig. 3.5.2a and 3.5.2b) on the chassis built in stand off (female) provided at the front of the LE2425A Main Board and screw down tightly with the three 7/16 stand-off (male) on the top of the Granddaughter board. The 7/16 stand off has been used to place the daughter board on the top of the granddaughter board and latch it securely.



Fig 3.5.2a Granddaughter Board shown separately



Fig 3.5.2b Granddaughter Board placed in slot A and secured with three 7/16 stand-off's

Step 3. The figure here illustrates the basic layout of an individual PM card. Each PM card fits into the space provided on the main board.



Fig. 3.5.2c Daughter Board, top view of version for 4 copper 10/100 ports

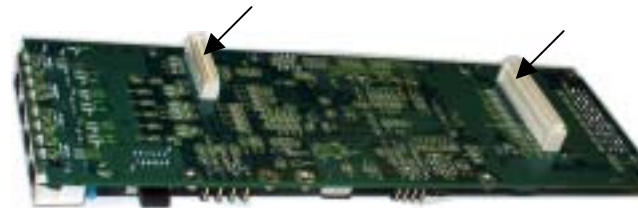


Fig 3.5.2d Daughter Board shown upside down with

two male latch connectors

- Step 4.** Hold the daughter board with both hands at the end and align the two cream color latching connectors (male) placed at the bottom of the daughter board with the other female connector placed on the Granddaughter and main board. As shown below in Fig. 3.5.2e



Fig. 3.5.2e LE2425A's PM daughter board aligned with the bottom female connector for the installation

- Step 5.** Once the latching connectors are aligned properly and the mounting holes are aligned with stand offs then press slowly and firmly with two fingers (as shown below in Fig. 3.5.2f) on the top of the latching connectors until the connectors latched up securely.

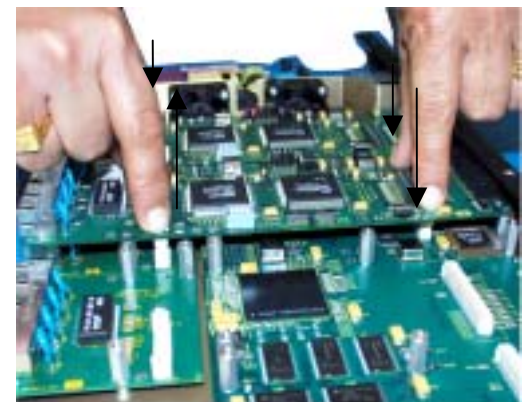


Figure 3.5.2f: Securely latching up PM

Cards into a Black Box LE2425A switch

NOTE: *All PM slots need not be filled in order for the Black Box LE2425A switch unit to be operational. When leaving PM slots empty, always use a face plate (LE2435C) to cover the slot opening in the front panel. This will maintain proper cooling air flow, safety, and operation as required by FCC, CE, and other regulations.*

Step 6. Now screw down the daughter board with 6 #440 screws, so that it holds the daughter board securely. The figure below shows the top view of PM card after successfully installing the PM cards inside the Black Box Managed fiber switch.



Fig. 3.5.2g Top View : PM Module installed inside a LE2425A

Step 7. Once the installation of granddaughter and daughter modules is done, the front panel screen plates need to be placed on the front of the chassis cover to complete the installation process for that port module. The front panel screen plate comes along with the package of port module separately along with 3 brackets and 6 #256 flat head screws. The brackets and screws have been installed inside of the top cover as shown in Fig. 3.5.2h.



Fig. 3.5.2h Inside view of chassis cover (from the rear), showing the front panel screen plates installed inside the chassis cover using brackets and screws

Step 8. Once all PM cards have been installed (including faceplates for empty slots), the chassis cover should be replaced. Make sure the chassis cover is aligned properly before securing the enclosure.

3.5.3 Removing PM Cards

To properly remove a PM card from the LE2425A Managed Fiber Switch, follow the 3 steps below.

Step 1. Remove chassis cover See procedures in Section 3.5.1 above.

Caution: Be sure the power cord is unplugged.

Step 2. Remove retaining screws placed on top for the PM and Face Plate

On the top of the daughter module there are six retaining screws for each PM card. These screws are used to secure a PM card in position (see Figure 3.5.3a). Remove the three standoffs holding the Granddaughter board with the chassis. The screen faceplate screws out from the inside front of the chassis cover by loosening the 4 screws and bracket while holding it down firmly.

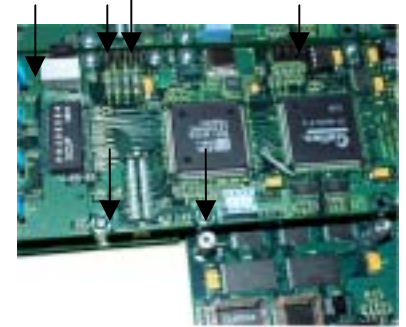


Figure 3.5.3a: Top View - 6 retaining screws shown by arrows

Step 3. Remove PM Card

Carefully and gently pull out the daughter board from the latching connectors, using both hands, gripping the board near the latch-up connectors as shown in Fig. 3.5.3b. If the now empty slot is to remain unused, be sure to install a PM-BLNK face plate cover.



Figure 3.5.3b: Removing a PM

Card

If another PM card is replacing the one that has been removed, follow the steps as described for installing a PM card discussed in Section 3.5.1.

3.6 Connecting the Console Terminal to Black Box Managed fiber switch (Management)

Use a DB-9 “null modem” cable to connect the LE2425A’s Console Port (the RS-232 port on the LE2425A Switch) to the your PC, so that your PC becomes the LE2425A’s Console Terminal.

Note: The DB-9 cable does not include with the LE2425A unit package.



Rear View of Black Box Managed fiber switch, (Typical Console Port is on the rear of LE2425A Models)

Note: For detail description of Managed Network Software (MNS-BB) and Black Box Managed fiber Switch configuration for Network Management, please refer to Black Box Managed fiber switch Software.

4.0 OPERATION

This chapter describes the functions and operation of the Black Box Managed fiber Switch.

4.1 Switching Functionality

A Black Box Managed LE2425A switch provides switched connectivity at Ethernet wire-speed among all of its ports. The Black Box Managed LE2425A switch supports 10/100Mbps for copper media and 10 or 100Mb separate traffic domains for fiber ports to maximize bandwidth utilization and network performance. All ports can communicate to all other ports in a Black Box Managed fiber switch, but local traffic on a port will not consume any of the bandwidth on any other port.

Black Box Managed LE2425A switch 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 LE2428C module. Optional Half / Full duplex mode and 10 or 100Mbps selection for the switched ports must be configured through MNS-BB 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 operation of the network (such as occasional multi-cast packets) are forwarded to all ports.

The Black Box Managed LE2425A 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 Black Box Managed LE2425A switch 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 LE2425A Switch automatically keeps up with node locations.

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

4.2 Status LEDs

For all Black Box Managed LE2425A switch models :

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

4.3 Up=link Manual Switches set as (=) , for RJ-45 port only

The module has a manual Up-link switch, located on the inside of the board next to the 10/100Mb (LE2428C) port # 1 which it controls. It enables the port's cable to be cascaded (X) to a 10/100Mb repeater or switching hub in the network. The Up-link Switch position is configured as (=) position by default from the factory settings on all the RJ-45 ports, either used for all copper module or combo module.

4.4 Auto-negotiation, for Fast Ethernet copper ports

The Managed LE2425A switch 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-BB software. The factory default setting is for auto-negotiation. At 100Mb-fixed speed, the user may select half- or full-duplex mode by MNS-BB Software for each RJ-45 port separately. For detail information see Section 8 (Optimizing Port usage) of Black Box Managed fiber switch Software user guide (MNS-BB).

One frequently-used application for the Managed LE2425A Switch copper ports is to connect one of them using a fiber media converter to another Switch in the network backbone, or to some other remote 100Mb device. In this case, it is desirable to operate the fiber link at 100Mb speed, and at either half- or full duplex mode depending on the capabilities of the remote device. Standard commercially available Fast Ethernet media converters mostly do not support auto-negotiation properly, and require that the switched port to which they are connected be at 100Mb fixed speed. Attachment to 10/100 auto-negotiation ports typically will not work properly. TheLE2425A Switch's RJ-45 ports handle this situation by configuring the ports as per desire through MNS-BB software port settings and can check the port status of each port after the change.

When Black Box Managed LE2425A switch 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 LE2425A’s RJ-45 ports will try to detect its idle signal to determine 10 or 100 speed, and will default to half-duplex at that speed per the IEEE standard.

General information -

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

- the devices at both ends of the cable are capable of operation at either 10 Mb or 100Mb speed and/or in full- or half-duplex mode, and can send/receive auto-negotiation pulses, and . . .
- 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 up. These are exceptions to the “negotiate at LINK – enabled” rule above, but may be occasionally encountered.***

When operating in 100Mb half-duplex mode, cable distances and hop-counts may be limited within that collision domain. The Path Delay Value (PDV) bit-times must account for all devices and cable lengths within that domain. For Black Box LE2425A Fast Ethernet switched ports operating at 100Mb half-duplex, the bit time delay is 50BT.

4.5 Flow-control, IEEE 802.3x standard

Black Box Managed LE2425A 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.

Black Box Managed LE24254A 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 LE2425A 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 LE2425A 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.

4.6 Power Budget Calculations for LE2425A Switch PM’s with Fiber Media

Receiver Sensitivity and Transmitter Power are the parameters necessary to compute the power budget. To calculate the power budget of different fiber media installations using LE2425A’s products, the following equations should be used:

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

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

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

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

where the “Cable Loss” for 62.5/125 and 50/125 μm (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 (LXSC25)

and the “Cable Loss” for 9/125 (Single-mode) is 0.25 dB/km

(LXSC40)

and the “Cable Loss” for 9/125 (Single-mode) is 0.2 dB/km (LXSC70)

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

Fiber Port Module	Speed, Std.	Mode	Std. km fdx (hdx)	Wave - length nm	Cable Size μm	X'mitr Output P _T , dB	R'cvr Sens. P _R , dB	Worst OPB, dB	Worst* distance Km, fdx	typical OPB, dB	typical* distance Km, fdx
F10ST	10Mb FL	Multi-Mode	2 (2)	850	62.5/125	-15.0	-31	14	5	17	6
					100/140	-9.5	-31	19.5	5.9	23.5	7
					50/125	-19.5	-31	19.5	3.4	13.5	4.8
PM-MST, MSC	100Mb FX	Multi-mode	2 (0.4)	1300	62.5/125	-20	-31	9.0	2.5	14	5
					50/125	-23.5	-31	5.5	2.0	12	4
PM-SSC	100Mb FX	Single-mode	18+ (0.4)	1300	9/125	-15	-31	14	28	17.5	35
PM-SSCL	100Mb FX	Single-mode	40 (0.4)	1300	9/125	-5	-34	29	58	32.5	65
PM-MTRJ	100Mb FX	Multi-mode	2 (0.4)	1300	62.5/125	-20	-31	9.0	3.0	15.8	5.5
					50/125	-23.5	-31	5.5	2.0	12.2	4.0
PM-MLC	100Mb FX	Multi-mode	2 (0.4)	1300	62.5/125	-19	-31	12	4	16	5.7
PM-SLC	100Mb FX	Single-Mode	15+ (0.4)	1310	9/125	-15	-28	11	22	-	-
GBIC-SXSC	1000Mb	Multi-mode	0.55	1300	62.5/125 50/125	-9.5	-17	5.5	2	12.5	4
GBIC-LXSC10	1000Mb	Single-mode	10	1300	9/125	-9.5	-20	8.5	17	10.5	21
GBIC-LXSC25	1000Mb	Single-mode	25	1550	9/125	-4.0	-21	15	37.5	<i>17.5</i>	<i>43</i>
GBIC-LXSC40	1000Mb	Single-mode	40	1550	9/125	-4.0	-21	15	60	<i>17.5</i>	<i>70</i>
GBIC-LXSC70	1000Mb	Single-mode	70	1550	9/125	-3.0	-23	18	90	<i>20.5</i>	<i>102</i>

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

- The 100Mb fiber segment must operate in full-duplex (FDX) mode, i.e. the full-duplex (factory default) setting for 100Mbps fiber ports must be used, and
- The worst-case OPB of the fiber link must be greater than the fiber cable’s passive Attenuation.

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

5.0 Introduction – LE2425A’s Managed Fiber Switch Port Modules

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

5.1 Inspecting the Package and Product

This section applies only to PMs shipped as separate items, i.e., LE2425A’s PMs are not factory installed in a Black Box’s LE2425A PM slot.

Examine the shipping container for obvious damage prior to installing a LE2425A’s PM; notify the carrier of any damage you believe occurred during shipment or delivery. Inspect the contents of this package for any signs of damage and ensure that the items listed below are included.

This package should contain:

1 or more LE2425A’s PMs

Installation instructions, with illustrations

Remove the LE2425A PM(s) from the shipping container. Be sure to keep the shipping container should you need to ship any of the PMs separately at a later date. In the event there are items missing or damaged, contact your supplier. If you need to return the unit, use the original shipping container if possible. Refer to Chapter 5 for specific return procedures.

5.2 PM Module Description

An important feature of the Black Box Managed fiber switch is the use of Port Modules for flexible mixed-media connectivity to RJ-45 and fiber media. Since the Black Box LE2425A Switches have dual-speed capability for copper ports, the 6 or 8-port interfaces are designed to support all standard Ethernet media types at 10 or 100Mps speed. Each LE2425A PM provides six or eight ports for connecting Ethernet segments with its individual connector type and media.

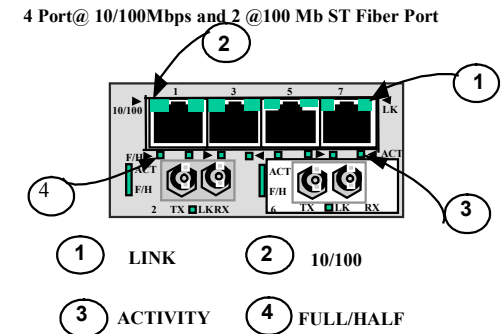
For a list of LE2425A’s Port Module types, refer to Section 1.2

Each LE2425A PM is individually described in the following sections.

NOTE: The port #1 on the RJ-45 ports on all the modules, either all RJ-45 ports or used for COMBO module is set as (=) other user ports, by factory default.

5.2.1 LE2429C, 4@10/100Mbps RJ-45 and 2@100Mb multi-mode FX-ST “twist lock” Combo Module

The LE2429C is a combo 6 port module of RJ-45’s at 10/100Mbps and fiber optic ports at 100MB. The Combo module is equipped with dual-mode ST-type connectors and dual speed copper ports. The ST-connector functions as a fiber optic transceiver to support 100BASE-FX network segments. When installed in a LE2425A Managed Fiber Switch, the copper port supports the standard distance 100m on each port and the fiber port supports fiber optic cable distances up 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, a Link (LK) LED that indicates proper connectivity with the remote device when lit, and FDX/HDX LED to indicate full-duplex mode when lit (or half-duplex when off). The 10/100 LED indicates the speed, if the LED is ON 100Mbps if it is OFF 10Mbps.

5.2.1a XXXXXX 4@10/100Mbps RJ-45 and 2@10Mb multi-mode FX-ST “twist lock” Combo Module

The XXXXXX is a six port combo module that looks similar to the 100Mb combo module with the exception of 10Mb speed at the ST fiber module. The ST-connector functions as a fiber optic transceiver to support 10BASE-FX network segments. When installed in a LE2425A Managed Fiber Switch, the copper port supports the standard distance 100m on each port and the fiber port supports fiber optic cable distances up the IEEE-standard 10Mbps distance limits, i.e., typically 2km at full-duplex and half-duplex.

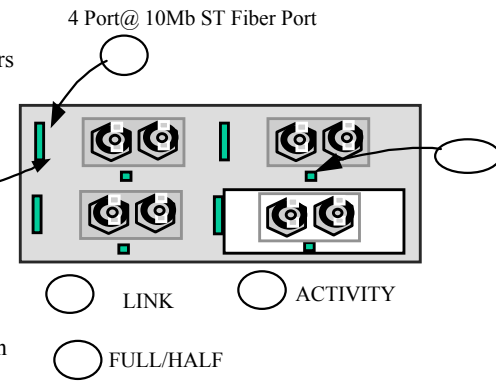
Each port has an Activity (ACT) LED indicating packets being received, a Link (LK) LED that indicates proper connectivity with the remote device when lit, and FDX/HDX LED to indicate full-duplex mode when lit (or half-duplex when off). The 10/100 LED indicates the speed, if the LED is ON, 100Mbps if it is OFF, 10Mbps.

5.2.1b LE2427C, 4@10Mb multi-mode FX-ST “twist lock” Module

The LE2427C is a 10Mb

multi-mode fiber module with 4 ST-Fiber ports. All four fiber ports are ST connectors and configured as 10Mb Half-duplex by default. The 10Mb ST-fiber ports allow the user to connect their legacy 10Mb network to the LE2425A switch.

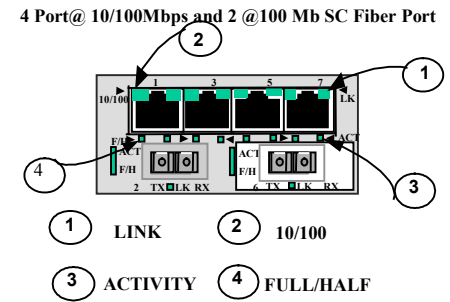
They also provide a convenient way for the half duplex hub to connect to the switch through 10Mb fiber ports. It supports distances according to the 10Base-FL standard i.e, 2Km distance for multi-mode fiber. (Single-mode for 10Km distance may be available as a special order).



Each port has an Activity (ACT) LED indicating packets being received, a Link (LK) LED indicating proper connectivity with the remote device when lit, and FDX/HDX LED indicating full-duplex mode when lit (or half-duplex if off).

5.2.2. LE2426C 4@10/100Mbps RJ-45 and 2@100Mb multi-mode FX-SC “snap-in” Fiber connector

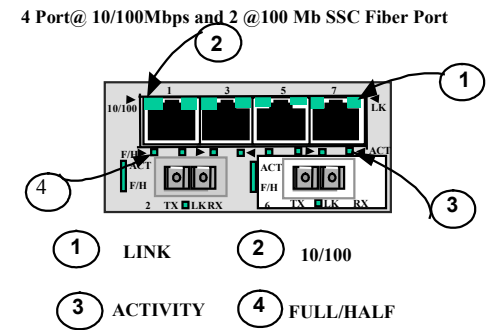
The LE2426C’s is also a Combo 6 Port module equipped with 4 10/100Mb RJ-45 ports along with 2 multi-mode 100Mbps fiber optic transceivers all in one module. This is similar to the LE2427C. It has the same LEDs indicating port activity (ACT), Link (LK), and FDX / HDX and 10/100 operation, and the same face-plate lettering.



While the functionality of these two modules is essentially the same, the LE2426C is equipped with an SC-type "snap-in" connector instead of an ST-type.

5.2.3 LE2431C 4@ 10/100Mbps RJ-45 Ports and 2@100Mbps single-mode FX-SC-type, “snap-in” connector

The LE2431C is also a Combo module equipped with 4 dual speed copper ports and 2 Single-mode SC-type connectors. It provides an advantage through combining copper and Fiber functions in one module of the LE2425A Switch supporting four Copper and two single-mode fiber network segments.



The LE2431C, when installed in a Black Box LE2425A Switch operates on copper at the 100m distance. The Fiber is single-mode and cable lengths can be as much as 25+ Km (see Power Budget, Section 4.5)

Each port has an Activity (ACT) LED indicating packets being received, a Link (LK) LED that indicates proper connectivity with the remote device when lit, and a FDX/HDX LED to indicate full-duplex mode when lit (or half-duplex when off). The 10/100 LED indicates 100Mbps speed when lit and 10Mbps speed when off. To distinguish the single-mode LE2430C from the multi-mode LE2431C , the label “Sgl. M.” is at the top of the faceplate of the LE2431C .

5.2.8 (special model) @ 10/100 Mb copper port and 2@100Mbps single-mode FX-SC-type, “snap-in” connector

The (special model) is also a Combo module equipped with 4 dual speed copper ports and 2 Single-mode (Long Reach) SC-type connectors. It provides a combination of copper and Fiber functions in one module to the LE2425A Switches, supporting four Copper and two single-mode (Long-Reach) fiber network segments.

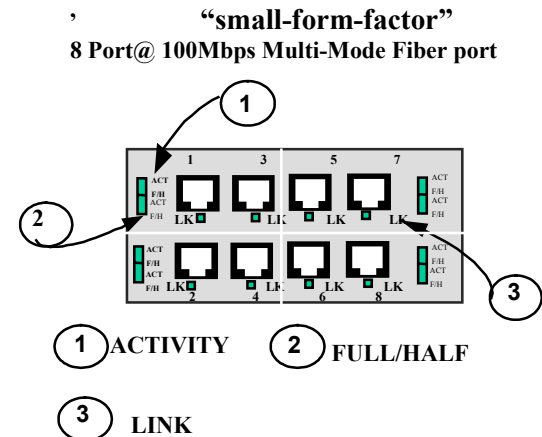
The (special model), when installed in a LE2425A Managed Switch has copper supporting the 100m distance and Fiber supporting single-mode fiber cable lengths of as much as 40+ Km (see Power Budget, Section 4.5)

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

FDX/HDX LED indicating full-duplex mode when lit (or half-duplex when off). The 10/100 LED indicates the speed for the copper port, which is 100Mbps when the LED is ON and 10 Mb when the LED is OFF.

5.2.5 LE2436C , 8 @100Mb multi-mode FX , MTRJ Small-Form-factor

LE2436C is a multi-mode fiber optic 8-port module equipped with a small-form-factor MTRJ-type connector. It looks almost like an RJ-45 port, but it is black in color. The 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 Black Box LE2425A Switch, it supports fiber optic cable distances up the IEEE-standard 100Mbps distance limits, i.e., typically 2km at full-duplex and 412m at half-duplex.



The functionality of this 100BASE-FX multi-mode 8 Port module is essentially the same as the ST and SC-types. It has the same LEDs per port indicating port activity (ACT), Link (LK), and FDX or HDX operation.

5.2.5a (special model), 4 @100Mb multi-mode FX , MTRJ Small-Form-Factor and 4@ 10Mb Multi-mode ST-Fiber port

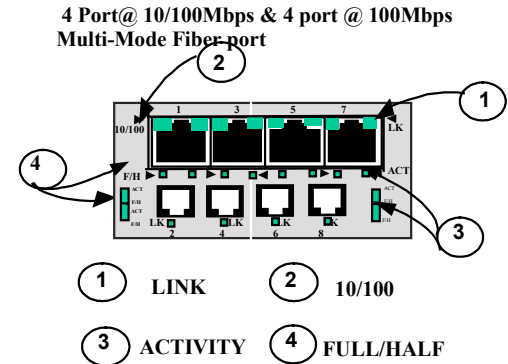
The (special model) is a combo module with two different kinds of fiber flavor with two different speeds. The top four ports of MTRJ Small form factor fiber support at 100Mb full-duplex, whereas the bottom two ports multi-mode ST-Fiber support 10Mb half-duplex. This combo module provides more flexibility to the user to connect their legacy 10Mb fiber as well as 100Mb to the LE2425A Switch.

When installed in a Black Box LE2425A Switch, the 100Mb MTRJ connector 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 10Mb Multi-mode ST-Fiber connector supports the standard fiber optic distance limit of 2Km at Full and Half-duplex both.

The functionality of this 100BASE-FX multi-mode 4 port module is essentially the same as the ST and SC-types. It has the same LEDs per port indicating port activity (ACT), Link (LK), and FDX or HDX operation

5.2.6 (special model), 4@ 10/100Mbps RJ-45 and 4@100Mb m-mode FX , MTRJ Small-Form-Factor

The (special model) Module is a combo module with copper and fiber (Small Form Factor) MTRJ type ports. The small size of MTRJ connectors give an advantage of placing more ports on one module. The XXXXX is equipped with 4 10/100 RJ-45 ports and 4 MTRJ fiber ports.



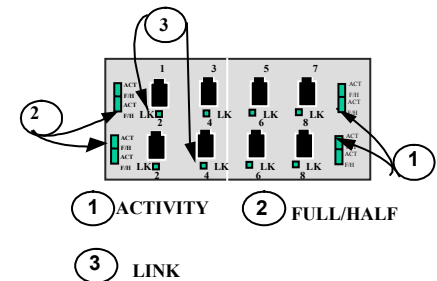
When installed in a Black Box Managed fiber Switch, it supports the standard distances as mentioned on 5.2.3. and the LEDs also act similarly.

5.2.7 LE2437C, 8 ports @ 100Mbps single-mode LC connector Small-Form Factor

LE2437C is a eight-port single-mode fiber LC connector “small-form-factor” used primarily in 100Mbps fiber-to-the-desktop links.

When installed in a Black Box LE2425A Switch, it supports fiber optic cable distances up to the IEEE-standard 100Mbps distance limits, i.e., typically 15km at full-duplex and 412m at half-duplex.

8-Port@ 100Mbps multi-mode LC fiber port



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, a Link (LK) LED indicating proper connectivity with

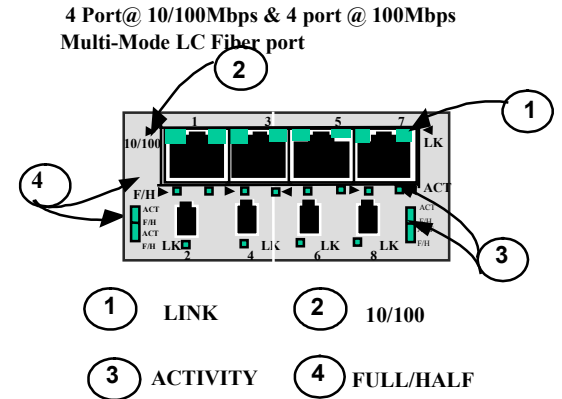
the remote device when lit, and a FDX/HDX LED indicating full-duplex mode when lit (or half-duplex when off).

5.2.8 (special model), Combo 4@ 100Mbps multi-mode -LC small-form factor and 4@ 10/100 Mbps RJ-45 Connector

The (special model) Module is a combo module with a combination of copper and Fiber (Small Form Factor)

LC type ports. The small size of LC connectors give an advantage of having more ports on one module. The XXXX is equipped with 4 10/100 RJ-45 ports and 4 LC (Small form factor) multi-mode fiber ports.

When installed in a Black Box Managed LE2425A Switch, it supports the standard distances as per mentioned on 5.2.8. and the LEDs also acts similarly as mentioned above.

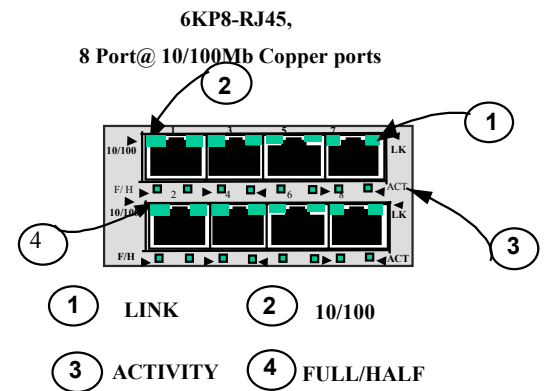


5.2.9 LE2428C (Twisted Pair), 10/100Mb 8-Port

The LE2428C module supports Ethernet twisted pair segments of any standard length. It is equipped with an eight-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. The LE2428C module is equipped with a Media Dependent Interface-Crossover (MDI-X) switch to allow for one cascaded connection. This feature eliminates the need for a special twisted pair

crossover cable when connecting to a hub or another switch.



The switch is configured as (=) position by default settings from the factory, the left-most RJ-45 port is used for segments going to workstations and other user node device connections as other ports of the module. For cascaded and up-link connections (i.e.: a connection to another hub or switch typically), the uplink switch should be in the OUT (X) position.

Each port has an Activity (ACT) LED indicating packets being received, a Link (LK) LED that indicates proper connectivity with the remote device when lit, a FDX/HDX LED to indicate full-duplex mode when lit (or half-duplex when off), and a “10/100” LED indicating 100Mb when lit (or 10 Mbps when off).

Important Note: For the LE2428C Crossover Switch-Inside is set for (=) by default from the factory for the Port # 1 and act similar as other user port.

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

5.2.10 LE2434C Gigabit fiber(1000Mb) Transceiver , multi-mode SC Connector

The LE2434C is a multi-mode Gigabit fiber Transceiver equipped with SC type connectors that can be easily snapped in and out. The Gigabit fiber ports are most popular as server-to-switch and switch-to-switch applications. It supports cable distances up to the IEEE 802.3z standard 1000Mbps distance limits, i.e., 220m minimum at full duplex.



The GBIC transceiver is fastened using snap-in clips. Insert the transceiver (take care to insert it the right way up, arrows on top) until it clicks in place. When removing the transceiver, press the clips on either side of the transceiver at the same time and pull the transceiver out.

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.

5.2.12 LE2435C (Blank Cover)

The LE2435C is a blank face plate or cover plate that must be installed in any empty LE2425A's PM slot to maintain proper cooling air flow, safety, etc.

Two screws underneath the front panel hold the LE2435C in place.



NOTE: For ordering the (special model) modules, please call Black Box (724-746-5500) to get the special part no.

6.0 TROUBLESHOOTING

If problems should develop during installation or operation, follow the suggestions below prior to calling Technical Support for help. If you are unsure of any procedure described in this chapter, or if the LE2425A is not operating as expected, do not attempt to repair or alter the unit. Contact Black Box for assistance.

6.1 Before Calling for Assistance

1. If you have difficulty installing or operating the LE2425A Managed Modular Switches, refer to **Chapters 3 and 4**. Make sure that the various other components of the network are working.
2. Check the cables and connectors to make sure that they have been properly connected and the cables/wires have not been crimped or in some way impaired during installation.
3. Check that the AC power cord is plugged into a functioning electrical outlet. Make sure that the AC power cord is properly plugged into the Modular Switches. Use the PWR LED to verify that the unit is receiving proper power.
4. If the problem is isolated to a network device other than the LE2425A Managed Fiber Switch, replace the problem device with a known good device. Verify whether or not the problem is corrected. If it is not, go to step 5. If the problem is corrected, the Managed LE2425A Switches and its associated cables will function properly.
5. If the problem still exists, contact Black Box.

6.2 When Calling for Assistance

If you determine that your LE2425A Managed Fiber Switch is malfunctioning, do not attempt to alter or repair the unit. It contains no user-serviceable parts. Contact Black Box at (724) 746-5500.

Before you do, make a record of the history of the problem. Black Box will be able to provide more efficient and accurate assistance if you have a complete description, including:

- the nature and duration of the problem.
- when the problem occurs.
- the components involved in the problem.
- any particular application that, when used, appears to create the problem or make it worse.

6.3 Shipping and Packaging Information

If you need to transport or ship your LE2425A Managed Switch:

- Package it carefully. We recommend that you use the original container.
- If you are shipping the LE2425A Managed Switch for repair, make sure you include everything that was in the original package. Before you ship, contact Black Box to get a Return Materials Authorization (RMA) number.

Ship the package to:

Black Box Corporation

1000 Park Drive

Lawrence, PA 15055

Phone: (724) 746-5500

Fax: (724) 746-0746

APPENDIX B : Internal DC Power Supply Options**B1.0 SPECIFICATIONS FOR LE2425A MANAGED FIBER SWITCHES, DC****POWER****Power Supply (Internal -48VDC Option)**

DC Power Connector: 3 terminals: “-“, “GND”, “+”

Input Voltage: 36 - 70 VDC

Power Consumption: Same as for AC models (see Section 1.1)

Power Supply (Internal 24 VDC Option) Industrial Applications

DC Power Connector: 3 terminals: “-“, “GND”, “+”

Input Voltage: 20 - 36 VDC

Power Consumption: Same as for AC models (see Section 1.1)

Power Supply (Internal 125 VDC Option) Industrial Applications

DC Power Connector: 3 terminals: “-“, “GND”, “+”

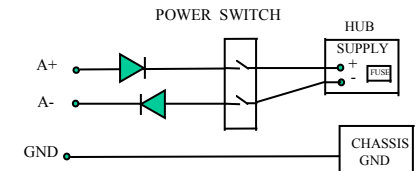
Input Voltage: 88 - 150 VDC

Power Consumption: Same as for AC models (see Section 1.1)

With the exception of the power supply, all specifications and functions of LE2425A Switch -48VDC, 24VDC and 125VDC models are identical to those listed in the main manual.

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

The -48VDC, 24VDC and 125VDC power options are designed using diodes inside on each DC power input line behind the two external power connection terminals, so that the power from an external source can only flow into the 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.



The manual power “On-Off” Switch (optional) is used for powering the unit on and off when it is placed into or taken out of service.

B3.0 APPLICATIONS FOR DC POWERED SWITCHES

Black Box Managed LE2425A Switches are easily installed in a variety of applications where -48VDC, 24VDC and 125VDC power is used as the primary power source. The -48VDC, 24VDC and 125VDC power configuration provides an Ethernet networking solution utilizing a special power supply in a managed Fiber Switch.

The -48VDC solution is particularly useful in the telecommunication industry, where it is common for facilities to operate on -48VDC power. Such companies include

regular and wireless telephone service providers, Internet Service Providers (ISPs) and other communication companies. In addition, many high availability equipment services, such as broadcasters, publishers, newspaper operations, brokerage firms and other facilities often use a battery backup system to maintain operations in the event of a power failure. It is also frequently used for computer system backup, management and operations monitoring equipment.

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

B4.0 INSTALLATION

This section describes the installation of the -48 VDC, 24VDC and 125VDC power source leads to the -48 VDC, 24VDC and 125VDC power terminal block on the LE2425A fiber switches. (see figure at right).

In this picture, the -48VDC terminal block on the LE2425A Managed fiber switch is located on the rear of the unit and is equipped with three (3) screw-down lead posts. It is similar for 24VDC and

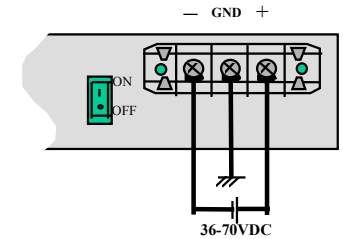


Figure B4.0: -48VDC Terminal Block on LE2425A switch-48VDC
125VDC options on Black Box Managed LE2425A switch. The leads are identified as negative (-), positive (+), and chassis ground (GND).

The actual connection procedure is very straightforward. Simply connect the leads to the LE2425A’s unit, beginning with ground. Ensure that each lead is securely tightened.

Note: The GND should be hooked up first. The LE2425A unit has a floating ground, so the user may elect to Ground either + or - terminal to suit the customer’s use.

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

An ON-OFF manual switch is optional for DC power. This can be used to cut off power connections and as a RESET for the LE2425A Managed Switch.

B4.1 UL Requirements for DC-powered units

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

2. *Minimum 14AWG cable for connection to a earthing wiring.*
3. *Use only with Listed 10 A circuit breaker provided in building installation.*
4. *“Complies with FDA radiation performance standards, 21 CFR subchapter J.” or equivalent.*
5. *Fastening torque of the lugs on the terminal block: 9 inch-pound max.*
6. *Centralized DC Power Source cable securement, use at least four cable ties to secure the cable to the rack at least 4 inches apart, with the first one located within 6 inches of the terminal block.*

B5.0 OPERATION

Operation of Black Box LE2425A Switches with the optional -48VDC, 24VDC and 125VDC power supply is identical to that of the standard AC-powered models.

B6.0 ORDERING INFORMATION

To order the optional -48VDC power supply factory installed, add a suffix of “-48VDC” after the product’s standard model # Example: **LE2425A-48VDC**.

Similarly to order the optional 24VDC or 125VDC industrial specific power supply factory installed, add a suffix of “24VDC” or “125VDC” after the product’s standard model #. Example: LE2425A- 24VDC, LE2425A-125VDC.

B7.0 TROUBLESHOOTING

Please refer to Section 6.0 for troubleshooting

APPENDIX C: Internal DC Dual-Source Power Option

C1.0 SPECIFICATIONS - FOR BLACK BOX LE2425A MANAGED SWITCH

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

DC Power Connector: First Source: “A+”, “A-“, 2nd Source “B-“, “B+”
 GND: Terminal for “earth” or ground wire connection to the hub chassis
 Input: Two separate sources, each at 36 - 70 VDC

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

DC Power Connector: First Source: “A+”, “A-“, 2nd Source “B-“, “B+”
 GND: Terminal for “earth” or ground wire connection to the hub chassis
 Input: Two separate sources, each at 20 - 36 VDC

Power Supply (Internal, 125VDC Dual-Source, model # Dual-Src-24V)

DC Power Connector: First Source: “A+”, “A-“, 2nd Source “B-“, “B+”
 GND: Terminal for “earth” or ground wire connection to the hub chassis
 Input: Two separate sources, each at 88 - 150 VDC

With the exception of the dual DC input power connections and the power supply, all specifications and configuration options for the LE2425A switch -48VDC, 24VDC and 125VDC models with this Dual-Source option are identical to those listed in the *LE2425A Managed Fiber Switches Installation and User Guide*, including Appendix B “Internal DC Power Supply Option”

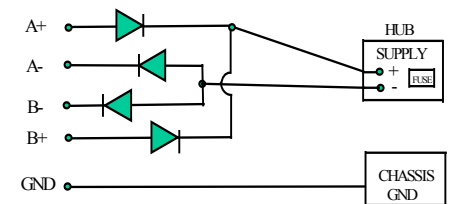
C2.0 BLACK BOX MANAGED FIBER SWITCH, with -48VDC, 24VDC and 125VDC Dual-Source option

The LE2425A-Switch models with the internal -48VDC, 24VDC and 125VDC Dual-Source power supply are designed for installations where a battery plant is the power source, and where two separate power sources are utilized in order to increase operational uptime and to simplify maintenance.

The functionality of the Black Box Managed LE2425A Managed switch-48VDC, 24VDC and 125VDC Dual-Source Option units is identical to the standard AC-powered models. Refer to the main sections of this *Installation and User Guide* for a detailed description of the LE2425A 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

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

C5.0 INSTALLATION

This section describes the proper connection of the -48VDC, 24VDC and 125VDC dual source leads to the -48VDC, 24VDC 7 125VDC power terminal block on the LE2425A's Switch (shown in Figure)

The -48VDC terminal block on the LE2425A Managed Switch, as shown in Fig C5.0 is located on the right rear of the unit and is equipped with five (5) screw-down lead posts. If it is the reverse model it is located on the left rear. The primary terminals are identified as positive (A+), negative (A-), and the secondary power terminals as

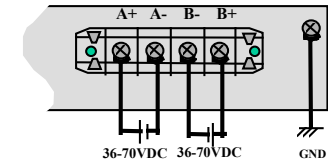


Figure C5.0: -48VDC Dual-Source, wiring connections to the External Terminal

Block on a LE2425A's 48VDC with Dual-Source option

negative (B-), positive(B+). The chassis “earth” or ground (GND) is a threaded post with a #6 nut. The Dual Source terminal block for the 24VDC and 125VDC are similar.

Note: The GND should be hooked up first. The LE2425A unit has a floating ground, so the user may elect to Ground either + or = terminal to suit the customer's use.

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

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

The 24VDC & 125VDC terminal block on Black Box Managed LE2425A switch's is similar to that described in the -48VDC information above.

C5.1 UL Requirements

The following must be adhered to in order to conform to UL requirements:

1. *Minimum 18 AWG cable for connection to a Centralized DC power source.*
2. *Minimum 14 AWG cable for connection to earthing wiring.*
3. *Use only with Listed 10 A circuit breaker provided in building installation.*
4. *“Complies with FDA radiation performance standards, 21 CFR subchapter J.” or equivalent.*
5. *Fastening torque of the lugs on the terminal block: 9 inch pound max.*
6. *Centralized DC Power Source cable securement, use at least four cable ties to secure the cable to the rack at least 4 inches apart with the first one located within 6 inches of the terminal block.*

C6.0 ORDERING INFORMATION

To order the optional Dual-Source -48VDC power supply factory installed, order “Dual-Src48V” as a separate line item following the product model.

Example: **LE2425A-48VDC**

Dual-Src-48V for the regular DS model with no ON-OFF switch
or **Dual-Src48V-SWITCH** with the ON-OFF manual switch.

Similarly, order the “Dual –source 24VDC” or “Dual-source 125VDC” as a separate line item following the product model.

Example: **LE2425A-24VDC** or **LE2425A-125VDC**

Dual-Src24V for regular models with no ON-OFF switch
Or **Dual-Src125V-Switch** for models with the ON-OFF switch

C7.0 OPERATION

Operation of the Dual-Source LE2425A’s -48VDC, 24VDC and 125VDC Switch models are identical to that of the standard models.