

## Networking and Datacom Design and Sourcing Guide



Ethernet Switches Media Converters Ethernet Extenders Device Servers USB Connectivity Interface Converters Modems Wireless

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## The Networking and Datacom Design and Sourc Your source for networking and datacom solutions in industrial and

This guide presents educational resources and the solutions you need to build and upgrade your network. Throughout this guide, you'll find applications and tutorials to help you solve networking and datacom challenges.

Whether you want to connect equipment in harsh industrial environments, extend your office network, add users in remote offices, even set up security and surveillance cameras and equipment, the experts at Black Box can help.

As always, we're here 24/7 to answer your questions and to help you plan your network. Tell us what you want to do and our application engineers will find the right solution for you.



- Industrial solutions for every type of network and datacom application including:
  - -Security -Factory automation -Traffic control -Oil, gas, and mining
- Building automation
  Military bases
- One of the largest selections of industrial switches anywhere.
- Need advice? Ask our application engineers.



#### NETWORKING APPLICATIONS AND TUTORIALS

- Security and surveillance: pages 6–7
- Factory automation: pages 8–9
- Building automation: pages 10–11
- Managed vs. unmanaged switches: page 17
- Alpha-Ring technology: page 20

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- Why use IP for security: page 63
- Extend networks over existing facilities: page 73
- Terminal servers explained: page 83

## ing Guide: commercial environments.



#### **COMMERCIAL NETWORKING**

- Choose from multiple solutions to extend your network. •
- Enterprise-wide to small-business network solutions. •
- Add failover redundancy with managed switches. .
- Bring fiber to the desktop with miniature media converters. .
- Add VoIP phones, wireless access points, and cameras with PoE devices.
- Extend your LAN over existing twisted-pair with Ethernet extenders.

#### **Industrial Networking**

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## Networking Guide

## Networking Icons Explained

#### By Black Box Engineering

Throughout this guide, you'll see icons at the top of product pages that will give you a quick way to determine the general features and specifications of the switch, converter, extender, or other network solution.

The icons graphically illustrate management features, Power over Ethernet capabilities, Alpha-Ring protocol, mounting, power, connectors, and temperature ranges.





Icons

#### Managed

Supports SNMP via embedded agents and has a command line interface (CLI) that can be accessed via serial console, Telnet, and Secure Shell. Switches can often be configured and managed as groups.



#### Web Smart

Offers access to switch management features such as port monitoring, link aggregation, and VPN through a simple Web interface via an embedded Web browser.



#### PoE

Enables low-level (15.4 watts) power delivery over twisted-pair Ethernet cable to PoE-enabled devices such as IP telephones, wireless access points, Web cameras, and audio speakers.



#### PoE+

Supplies up to 25 watts to larger, more power-hungry devices. Backwards compatible with PoE.



#### Alpha-Ring

A proprietary protocol designed to provide a faster network recovery time after a failure than standard STP. Devices can be organized in a ring arrangement.



#### DIN Rail

An industry-standard metal rail, usually installed inside an electrical enclosure, which serves as a mount for small electrical devices, saving space.



#### Panel mount

Indicates a device that can be mounted in an opening in a cabinet, panel, etc.



Desktop Device generally sits on a desk or other flat surface.



Operating temperature range is -40° to +75° C.



Industrial environments present much harsher conditions than are found in typical office environments. They not only often have extremes of temperatures, humidity, dirt, and corrosive materials, they may also contain devices such as motors and mechanical switches, which cause a large amount of electromagnetic interference (EMI).

The challenge with industrial controls as well as with other electronic devices intended for use in these environments is to have them function reliably in spite of adverse conditions. This may mean using a device that's built to withstand harsh conditions, protecting the device in a specialized cabinet, or both.

#### Extended temperature range

Many industrial devices are installed outdoors in unventilated sealed enclosures, which freeze in the winter and heat to extremely high temperatures in the summer. They and their power supplies are expected to perform over a wide temperature range. Typically they're rated so you can select one appropriate to your environment. Temperature tolerances from -25 to +60° C (-13 to +140° F) are common and you can even find devices rated for extremes of -40 to +75° C (-40 to +167° F).

Because industrial components are sealed against contaminants and also because they're often installed inside enclosures, they rely on air convection rather than fans for cooling.

#### Resistance to moisture and contaminants

Moisture is the enemy of electronic components, and industrial devices are often subject to water in all its forms, from high humidity and condensation to drips and splashes. Industrial devices are also often subject to dirt, dust, oil, salt spray, and chemicals when they're installed outdoors or indoors in an environment such as a factory floor.

For these reasons, industrial components are usually housed in hardened metal cases that are sealed against contaminants, including particulates such as airborne dust, as well as moisture, and sometimes chemicals.

One way to protect industrial devices from their environment is with an enclosure designed to seal out contaminants such as dust and moisture. These enclosures are usually NEMA rated to describe the amount of protection they provide. For more on NEMA enclosures, see **page 40**.

#### **Power supplies**

The power supplied to industrial sites can vary tremendously. AC power varies anywhere from 60 VAC to 960 VAC, and often only DC power is supplied, with 24 VDC or 48 VDC being common.

Industrial power may be three-phase power, which is used for power transmission across power grids and is favored for large motors and heavy loads at industrial sites. It's also frequently "dirty" power, subject to noise, voltage fluctuations, and spikes. This inconsistent power is hard on the electronic components in industrial devices and can cause equipment damage or data loss.

Because of this variability, industrial control devices are either sold entirely separately from their power supply or are available with a choice of power supplies. Unlike ordinary networking devices, industrial controls require you to choose the correct power supply for both device and application.

Industrial power supplies must be matched to both the type of power input they'll be receiving from the power grid and the power output they'll be expected to provide to the industrial control device.

#### EMI protection

Industrial areas are also prone to electromagnetic interference (EMI) and radio-frequency interference (RFI). Interference and noise from EMI/RFI creates unwanted signals that may interfere with network performance.

Devices for industrial applications are usually built to withstand higher EMI than those intended for office or data center use. Chassis are usually shielded, and EMI signals can be absorbed by using capacitor-based circuits or through special coatings as well.

#### Mounting

Components for office or data center use are usually either freestanding or mounted on 19" rails in a cabinet or rack. Industrial devices, on the other hand, are usually panel mounted by bolting them to a flat surface, or they may be DIN rail mounted.

DIN rail is an industry-standard metal rail that is used both wallmounted or rackmounted. Industrial devices mount directly on the rail or may come with separate DIN rail brackets.

## Networking Solutions Solutions



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Industrial Ketworking Solutions





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Applications Industrial

## Security and Surveillance

## Keeping an eye on things.

Protect your property and assets, and ensure the safety of employees, with a security and surveillance system. Whether you have one building or a large campus, implementing a security network might be easier than you think especially if you don't have to run all new cabling.

In this campus scenario, the security surveillance system combines new and existing technologies and cabling.

A. The operations center houses the data center and security command center.

**B.** When first built, the guard station had an analog phone, which was connected to the operations center via twisted-pair cabling. As technology evolved, new security requirements mandated that the guard station include a PC, security camera, and an IP phone. To achieve this, the company could have trenched a new fiber cable to the guard station for IP connectivity, but opted instead for a much faster and much more economical route. They decided to deploy a pair of LB300 Series Ethernet Extenders (page 29) over the existing twisted-pair cabling.

The basement of the operations center building houses the company's security center. The company wanted to mount IP security cameras on the roof of the building. Because the cameras would be more than 300 feet from the security center, the company decided to run fiber to the cameras. To convert the fiber to copper CAT6 cable and to power the cameras, the company installed LEH1000 Series Hardened PoE Switches (pages 18–19).

 $\ensuremath{\mathsf{C}}.$  Fiber cable was trenched to connect the operations center to the company's second building.

**D.** The company recently upgraded its parking lot security cameras from analog to digital. The old analog cameras were connected via coax cable.

To provide IP connectivity to the new digital cameras over the existing coax cable and to eliminate costly fiber trenching and disruption, the company used the multidrop Industrial LB532 Series Ethernet Extenders (page 29).

E. While upgrading its rooftop security cameras, the company also added a security camera to the electrical/generator building. As there was no IP connection between the buildings, the company decided to use a pair of LWE200 Series 5-GHz Wireless Ethernet Extenders with PoE (pages 30-31), to connect the cameras.

#### Analog cameras vs. IP cameras.

An analog camera is a traditional CCTV camera. It sends video over coax or UTP cable to a digital video recorder (DVR). While analog cameras perform well, they are limited to resolutions of the NTSC/PAL standards of  $720 \times 575$  pixels or 0.4 megapixel. Analog camera resolutions range from 420 to 700, which at the high end can produce sharp images.

IP cameras are digital cameras. One of the biggest advantages of IP cameras is their resolution that can range from 1.3 megapixels to 5 megapixels



Higher

Cost

Lower

Applications

Industrial

## **Factory Automation**

The challenge of mixed technologies in an industrial environment.

There is a new industrial revolution. It's combining advancements in machines and controls with advancements in computing and communications. The new manufacturing environment is going to be smarter and increase a manufacturer's competitive edge. Today's technology is being applied in ways not even thought of 10 years ago to solve problems and increase industrial productivity.

That's where the challenge of mixing new and existing technologies in an industrial environment comes in. Black Box can be your trusted advisor in helping you make the transition. Call our pre-sales engineers, and we can help you design a solution for your specific application.

#### Why fiber?

Fiber optic cable is often the preferred cable choice in industrial environments because it can cover very long distances and offers immunity to electrical interference.

Fiber doesn't have the 100-meter distance limitation of twisted pair copper, so it can support distances from 300 meters to 40 kilometers, or more, depending on the style of cable, wavelength, and network.

Fiber also provides extremely reliable data transmission. It's completely immune to many environmental factors that affect copper cable. The fiber is made of glass, which is an insulator, so no electric current can flow through. It is not affected by electromagnetic interference and radio-frequency interference (EMI/RFI), crosstalk, impedance problems, or other external factors. You can run fiber next to industrial equipment without worry.

#### A ring topology for redundancy.

Although Ethernet is usually thought of as having a star topology, it's possible to build an Ethernet network as a ring. This is often used in applications where it may be difficult to run fiber in a star formation from a central switch, such as in industrial or even traffic signal applications. A ring topology has the advantage of providing a redundant pathway if a link goes down.

In the scenario above, **Multimode Fiber Cable** (page 41) is used to connect computer numeric controlled (CNC) machines to **Hardened Managed Ethernet Switches** (LEH900 Series) (pages 18–19) in an Ethernet network. The switches are set up in an Alpha-Ring protocol for maximum uptime and reliability with a failover time of less than 30-ms, which is virtually instantaneous. If one part of the ring fails, traffic will automatically reverse direction. For more information on Alpha-Rings, see **page 20**.

#### Machine vision.

Machine vision is an image-based automated inspection technology that is now an indispensable tool in manufacturing to increase quality and profitability.

Machine vision technology incorporates cameras, PCs, software, and other hardware to automatically take pictures and inspect materials as they pass along an assembly line.

USB 3.0 greatly enhances machine vision systems. Because of the 5-Gbps throughput of USB 3.0—ten times more than USB 2.0—



## Applications

- A. RS-232 Line Drivers
- **B. CATx Cable**
- C. Hardened Managed Ethernet Switches
- D. Multimode Fiber Cable
- E. CNC Workstations
- F. USB 3.0 Extenders
- G. USB 3.0 Machine Vision Inspection

D

it eliminates problems of stability and low latency for image transmission and camera control. USB 3.0 enables the transmission of higher-resolution, higher-frame video with no loss of quality.

In the scenario above, the USB 3.0 Ultimate Fiber Extender, (page 36), is used to connect the assembly line and manager desk to a USB vision machine camera, lights, and related reject hardware.

#### Industrial serial connections.

B

Industrial control is a designation for the devices that interface with machinery such as packaging machines, generators, lathes, and even scales. Although most of today's IT runs on Ethernet, industrial devices often use an RS-232, RS-485, or RS-422 serial interface.

RS-232 transmits data at speeds up to 115 kbps and over distances up to 50 feet, although higher distances can be achieved by using low-capacitance cable. Both sync and async binary data transmission fall under RS-232. Although the original RS-232 connector is DB25, DB9 and RJ-45 connectors are now more common. Also, industrial devices often use a terminal block instead of a connector for the RS-232 interface. RS-232 is somewhat restricted as an industrial interface because of its restricted range and because it only supports point-to-point links.

In this scenario, **RS-232 Line Drivers** (ME800A-R4) (blackbox.com) are being used to drive data from the scale over CATx cable to a manager's workstation PC.

Industrial

## **Building Automation**

## Control multiple systems from one central location.

Industrial switches, media converters, and wireless Ethernet extenders enable one person to oversee the HVAC systems of several buildings in a large apartment complex.

A community of apartment buildings is spread out over a five-acre campus. Each has its own boiler room in the basement to house its heating, ventilation, and air-conditioning (HVAC) equipment. The housing complex, while large, only employs one facilities worker to look after the heating and cooling system.

During an update of the HVAC system, the contractor wanted to make it possible for the entire system to be controlled from one central location. Hardened switches, media converters, and wireless Ethernet extenders were part of the solution.

#### Hardened Switches and media converters in the boiler rooms.

Unlike the Ethernet switches in a wiring closet or computer center, Ethernet switches in harsh environments have to endure dirt, humidity, and temperature fluctuations.

In this building automation application, Heavy-Duty Edge Switches (LBH240 series, **pp. 14-15**) are used in the boiler rooms. They're robust and easy to set up, and they're available with a vast array of interface, power, and durability options. They can operate in temperatures of -40° to +75° C. They are mounted near the building's HVAC equipment, so they were placed in a NEMA cabinet that protects them from dirt, water, and grease.

Copper cable runs from the switches to the boilers, hot water tanks, HVAC, and other equipment, but fiber needs to run to the roof of each building because of the long distance and also because of the potential for EMI interference from elevators, lighting, and other building infrastructure, so industrial Gigabit Ethernet media converters (LGC320A-R2, **p. 24**) are used.

#### Wireless Ethernet extenders on the rooftop.

More hardened media converters convert the fiber backbone back to copper on each rooftop, where it's run to Wireless Point-to-Point Ethernet Extenders (LWE100A-KIT, **pp. 30-31**), a quick way to extend an Ethernet link between buildings. Because they're wireless, there's no hassle or expense of laying cable.

Each Ethernet Extender is mounted on a pole on the roof of each building, creating a "hub and spoke" arrangement, with the "hub" residing on the roof of the building where the HVAC is controlled. The configuration is simple, as the extenders are pre-configured to work with each other. Their tough, waterproof enclosures make them ideal for outdoor use.

#### Total control from one central location.

The new network provides visibility into all four buildings, enabling the facilities worker to monitor and control the entire HVAC system via IP. Temperature and NEMA ratings explained.

The converters operate in extreme temperatures, but will be placed in a NEMA-rated enclosure. In this Guide, switches are rated as standard (0 to 40° C), hardened (-25 to +60° C), and extreme (-40 to +75° C). Industrial

Applications



The National Electrical Manufacturers' Association (NEMA) issues guidelines and ratings for an enclosure's level of protection against contaminants that might come in contact with its enclosed equipment.

NEMA 3 enclosures, designed for both indoor and outdoor use, provide protection against falling dirt, windblown dust, rain, sleet, and snow, as well as ice formation. The NEMA 3R rating is identical to NEMA 3 except that it doesn't specify protection against windblown dust. NEMA 4 and 4X enclosures, also designed for indoor and outdoor use, protect against windblown dust and rain, splashing and hose-directed water, and ice formation. NEMA 4X goes further than NEMA 4, specifying that the enclosure will also protect against corrosion caused by the elements.

NEMA 12 enclosures are constructed for indoor use only and are designed to provide protection against falling dirt, circulating dust, lint, fibers, and dripping or splashing noncorrosive liquids. Protection against oil and coolant seepage is also a prerequisite for NEMA 12 designation.



## Fast Ethernet Unmanaged Switches with Fiber Uplinks

DIN RAIL	RACKMOUNT	DESKTOP	POWER	STANDARD	HARDENED	EXTREME
	I	1	External AC			

#### LBH100 Series, LBH110 Series (10/100 Media Converter Switches)



Media Converter Switches feature LEDs on two sides so you can view network status at a glance no matter which way the unit is mounted.

- Provide one 10-Mbps (LBH110 series) or 100-Mbps (LBH100 series) fiber port and two 10/100-Mbps UTP switch ports.
- Tough enough to withstand any environment—whether it's the wiring closet, the factory floor, or even the desert.
- Function as both a media converter and a switch.
- Copper ports are autosensing for speed and duplex, and feature MDI/MDI-X.
- Support VLAN tagging and Spanning Tree passthrough.
- Choose from standard, hardened, and extreme models depending on the environment.
- Mount on DIN rails with optional brackets, or you can rackmount up to 16 units in the optional trays.

#### Product Selection Guide

Switch Series	Ports	Temperature Options	Fiber Mode Option	Fiber Connector Options	Power Options
LBH100 Series	(2) 10/100 (RJ-45) (1) 100 Mbps (Fiber)	Standard (0° to 40° C) Hardened (-25° to 60° C) Extreme ( -40° to 75° C)	Single-Mode Multimode	SC, MT-RJ, ST, LC	100–240 VAC 12, 24, 48 VDC
LBH110 Series	(2) 10/100 (RJ-45) (1) 10 Mbps (Fiber)	Standard (0° to 40° C) Hardened (-25° to 60° C) Extreme ( -40° to 75° C)	Single-Mode Multimode	ST	12, 24, 48 VDC

Use Standard Media Converter Switches in clean, temperature-controlled areas of 0 to +40° C, such as offices and closets.

Hardened Media Converter Switches suit -25 to +60° C operation in dusty or dirty environments. Their sealed cases are a heat sink, so no internal airflow is needed for cooling, and they resist contaminants such as dust, dirt, and moisture.

For harsher environments of -40 to +75° C, choose **Extreme Media Converter Switches**. These rugged units are for outdoor use (they only require protection from water) and feature a sealed case, which uses its own metal shell as a heat sink.

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DC-powered Hardened and Extreme units have internal screw terminals for connecting DC power in addition to the AC power jack. You can use them simultaneously with both your DC power supply and an AC power adapter (sold separately) to provide redundant power input.

You can also order a Powered Rackmount Tray (LH1505P-RACK, LH1505P-RACK-2-9-V), available with one or two common AC adapters that output 9 VDC to 16 Media Converter Switches.

#### 10/100 Media Converter Switches

Standard		
Multimode 115-VAC ST		LBH100A-ST
Single-Mode 115-VAC SC		LBH100A-SSC
Hardened Multimode 110–240-VAC S	ST	LBH100A-H-ST
Extreme		
Multimode 110–240-VAC S	ST	LBH100A-P-ST
Multimode 24-VDC SC with DIN-Rail Bracket	LBH'	100A-PD-ST-24

These are some of the most popular switches in these series. To see all the products in these series, go to **blackbox.com** and enter LBH100\* or LBH110\* in the search box.

LANs, WANs, and Beyond: blackbox.com/networking.

## S BLACK BOX

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## Fast Ethernet Unmanaged Switches



#### Mix and match standard, hardened, and extreme LBH600 Series Switches (Heavy-Duty Edge) in one installation.

Unlike the Ethernet switches in your wiring closet or computer center, the Ethernet switches at the edges of your network have to put up with the bumps, the dirt, the dampness, and the temperature fluctuations that happen out in the real world. This is where LBH600 Series Switches from Black Box come in.

These tough 6-port Ethernet switches enable you to expand your network even into harsh areas such as factory floors or the outdoors. They're robust, they're easy to set up, and they're available with a vast array of interface, power, and durability options.

#### Built tough.

These switches come in a sturdy steel case that withstands heavy use. Plus, they're available in three temperature options (standard, hardened, and extreme) to adapt to nearly any environment. Because all three types work together seamlessly, you can use inexpensive standard switches in protected office environments and choose the more robust hardened or extreme switches for harsh locations at your network's edge. To see more switch options, turn the page or go to **blackbox.com**.

LBH600 Series (Hardened Heavy	-Duty Edge Switches), (6) UTP Ports
100–240 VAC	LBH600A-H
12-VDC	LBH600A-H-12
24-VDC	LBH600A-H-24
DIN-Rail	LBH600A-HD-24
48-VDC	LBH600A-H-48
These and some of the most second	a subtable of the state of the

These are some of the most popular switches in this series. To see all the products in this series, go to blackbox.com and enter LBH600\* in the search box.





**Ethernet Switches** 

Ethernet Switches Industrial



### Fast Ethernet Unmanaged Switches with Fiber Uplinks and PoE



LBH120 Series (Hardened Mini Industrial) LBH150 Series (Heavy-Duty Edge) LBH240 Series (Heavy-Duty Edge) LPH240 Series (PoE PSE) LP004A (Extreme 4-Port PoE)

#### LBH120 Series

- Unmanaged switches for taking your Ethernet network into harsh environments—without taking up much-needed space.
- Industrial-strength case. Complies with IEC standards for electromagnetic compatibility (EMC) in industrial environments.
- Full wire-speed forwarding rates.
- Fiber optic models offer interference-free connections plus extended distances—as far as 75 kilometers (46.6 mi.).

Use these unmanaged switches to switch 10BASE-T/100BASE-TX traffic or 10BASE-T/100BASE-TX and 100BASE-FX traffic in factory or other industrial areas.

With a slim design, the LBH120 series (Hardened Mini Industrial) switches suit harsh environments where you're constrained by space. They can be installed easily on a DIN rail (a mounting kit is included). Simplifying matters further, they feature Auto MDI/MDI-X on their copper ports, autonegotiate for speed, and autodetect full- or half-duplex mode.

In addition to their compliance with the IEC 61000-Part 6-2 Generic standard for electromagnetic compatibility (EMC), the LBH120 series switches comply with IEC 60068-2-6 Fc vibration resistance and IEC 60068-2-27 Ea shock standards.

They support 2048 MAC addresses, feature a 384 KB buffer memory and broadcast storm filtering, and provide full wire-speed forwarding rates.

#### LBH150 Series, LBH240 Series

• Four or five 10/100 UTP ports plus one or two 100-Mbps fiber ports.

LP004A

- RJ-45 ports support autonegotiation, so you can easily attach any 10- or 100-Mbps device.
- Two sets of LEDs enable you to see status information from the front, top, or side.
- Panel or DIN-rail mount.
- Support VLAN tagging and Spanning Tree passthrough.
- Convection cooled, sealed against dust and dirt.

Unlike the Ethernet switches in your wiring closet or computer center, the Ethernet switches at the edges of your network have to put up with the bumps, the dirt, the dampness, and the temperature fluctuations that happen out in the real world. This is where Heavy-Duty Edge Switches from Black Box come in.

These tough, 6-port Ethernet switches enable you to expand your network even into such harsh areas as factory floors or the outdoors.

#### Product Selection Guide

Switch Series	Ports	Temperature Options	Fiber Mode Options	Fiber Connector Options	Power Options	PoE		
LBH120 Series (Hardened Mini Industrial Switches)	(4) 10/100 (RJ-45) (1) 100 Mbps (Fiber)	Hardened (-25° to 60° C)	Multimode 20 km Single-mode 40 km Single-mode 75 km	SC ST	12–48 VDC (All models)	_		
LBH150 Series (Heavy-Duty Edge Switches)	(5) 10/100 (RJ-45) (1) 100 Mbps (Fiber)	Standard (0° to 40° C) (LBH150A-S*) Hardened (-25° to 60° C) (LBH150A-H*) Extreme ( -40° to 75° C) (LBH150A-P*)	Single-mode Multimode	SC ST MT-RJ LC	100–240 VAC 12 VDC 24 VDC 48 VDC	—		
LBH240 Series (Heavy-Duty Edge Switches)	(4) 10/100 (RJ-45) (2) 100 Mbps (Fiber)	Standard (0° to 40° C) (LBH240A-S*) Hardened (-25° to 60° C) (LBH240A-H*) Extreme ( -40° to 75° C) (LBH240A-P*)	Single-mode Multimode	SC ST MT-RJ LC	100–240 VAC 12 VDC 24 VDC 48 VDC	—		
LPH240 Series (PoE PSE Switches)	(4) 10/100 Mbps Total (2) 100 Mbps (Fiber)	Hardened (-25° to 60° C) (LPH240A-H*) Extreme ( -40° to 75° C) (LPH240A-P*)	Single-mode Multimode	SC ST	100–240 VAC 48 VDC	PoE 802.3af		
LP004A (PoE Switch)	(4) 10/100 Mbps Total	Extreme (-40° to 75° C)	_	—	48 VDC	PoE 802.3af		

To see all the products in a particular series, go to **blackbox.com** and search for the appropriate SKU (including the asterisk) for that category, as listed in the chart above.



**BLACK BOX** 









They're robust, they're easy to set up, and they're available with a vast array of interface, power, and durability options. They're everything you're looking for in an industrial edge switch.

#### Built tough.

All LBH150 and LBH240 series switches come in a sturdy steel case that withstands heavy use. Plus, they're available in three versions to adapt to nearly any environment. Because all three types work together seamlessly, you can use inexpensive Standard Heavy-Duty Edge Switches in protected office environments and choose the more robust Hardened or Extreme Heavy-Duty Edge Switches for harsh locations at your network's edge.

#### LP004A

- Tough, unmanaged switch works as power source equipment (PSE), providing power across UTP cable to up to four attached PoE devices.
- Heavy-duty, premium-grade extended temperature components. IP40-rated steel case is designed to keep out dust, dirt, moisture, smoke, and insects.
- For use in industrial and sheltered outdoor environments.
- Connect wireless access points, readers, cameras, sensors, and other PoE equipment at the edge of your 10BASE-T or 100BASE-TX network.
- Autonegotiating, full-/half-duplex ports with Auto MDI/ MDI-X.

Use this heavy-duty Power over Ethernet switch to provide power across UTP cable to wireless access points, ID badge readers, security cameras, sensors, and other PoE equipment at the edge of your 10BASE-T or 100BASE-TX network.

#### LPH240 Series

- Features four 10-/100-Mbps RJ-45 ports plus two fiber ports, five 10-/100-Mbps RJ-45 ports plus one fiber port, or six 10-/100-Mbps RJ-45 ports.
- Four RJ-45 ports support 802.3af PoE.
- Extends the network up to 2 kilometers (1.2 mi.) over multimode fiber or up to 20 kilometers (12.4 mi.) over single-mode fiber.
- Extended temperature range of -25 to +60° C. -48-VDC terminal-block power input.
- Includes Link-Loss-Learn (LLL) for self-healing LAN structures.

LPH240 series (Hardened PoE PSE) switches from Black Box power remote PoE devices such as security cameras and wireless access pointseven in industrial or factory environments where temperature is an issue. Rugged metal cases serve as a heat sink to dissipate heat, giving these hardened switches a temperature range of -25 to +60° C. Plus, the cases are sealed to resist contaminants such as dust, dirt, moisture, smoke, and insects.

LBH120 Series (Hardened Mini Industrial Switches)	
(5) 10-/100-Mbps Copper	LBH120A-H
5-Port (4-to-1); (4) 10-/100-Mbps Copper + (1) 100-Mbps Fiber, Multimode, ST	LBH120A-H-ST
LBH150 Series (Heavy-Duty Edge Switches) Extreme, (5) 10/100 Copper + (1) Fiber Ports, Multimode, 100–240-VAC, ST	LBH150A-P-ST
LBH240 Series (Heavy-Duty Edge Switches) Hardened, (4) 10/100 Copper + (2) Fiber Ports, Multimode, 100–240-VAC, ST	LBH240A-H-ST
4-Port Power over Ethernet Switch	LP004A
LPH240 Series (PoE PSE Switches) Hardened, (6) 10/100 RJ-45 Ports, AC-Powered	LPH240A-H

To see all the products in this series, go to **blackbox.com** and enter LBH120\*, LBH150\*, LBH240\*, LPH240\*, or LP004A in the search box.



LBH240A-H-SC









### Gigabit Ethernet Unmanaged Switches with Fiber Uplinks



#### LBH2001 Series

(Hardened and Extreme Media Converter Switches) LGH008A (Hardened Gigabit Edge Switch)



LBH2001 Series (Hardened and Extreme Media Converter Switches)

- Includes two 10-/100-/1000-Mbps copper switch ports and one 1000-Mbps fiber multimode port.
- Converts 1000BASE-T to 1000BASE-SX multimode or LC single-mode fiber.
- Withstands temperatures as low as -40° C and as high as +75° C, depending on model.

Featuring two 10-/100-/1000-Mbps copper switch ports and one 1000-Mbps fiber port, these switches reliably connect segments in harsh environments, particularly at the network edge, as well as connections in wiring closet and office areas.

Because these switches transfer Ethernet packets at Gigabit speeds over fiber, you can ensure secure and interference-free extensions for your datasensitive, bandwidth-intensive applications. LGH008A

LGH008A (Hardened Gigabit Edge Switch)

- Rated for operating temperatures of -10° to +70° C.
- Eight 10-/100-/1000-Mbps ports are autosensing for speed and duplex.
- Dual DC power inputs for redundant power.
- DIN-rail mount.
- IP50 rated steel housing.
- Plug-and-play convenience.

The Hardened Gigabit Edge Switch brings eight Gigabit Ethernet ports to harsh industrial environments with temperatures ranging from -10° to +70° C. Its rugged steel enclosure mounts on standard DIN rails. Dual DC power inputs enable redundant power provisioning. Ethernet ports are autosensing 10/100/1000 Mbps with Auto MDI/MDI-X on all ports.

Note: This switch does not include a power supply. See **blackbox.com** for compatible power supplies.

#### Product Selection Guide

Switch Series	Ports	Temperature Options	Fiber Mode Option	Power Options†
LBH2001 Series (Hardened and Extreme Media Converter Switches)	(2) 10/100/1000 RJ-45 (1) 1000 Mbps ( Fiber)	Hardened (-25° to 60° C) (LBH2001A-H*) Extreme ( -40° to 75° C) (LBH2001A-P*)	SC Multimode LC Single-Mode	100–240 VAC 12 VDC; 24 VDC; 48 VDC
LGH008A (Hardened Gigabit Edge Switch)	(8) 10/100/1000 RJ-45	-10° to 70° C	_	9–48 VDC via (2) 5-Pin Terminal Blocks†

To see all the products in a particular series, go to **blackbox.com** and search for the appropriate SKU (including the asterisk) for that category, as listed in the chart above. † Power adapters (PS012, PS003A) are not included.

LBH2001 Series (Hardened Media Converter Switch	es)		
Multimode SC	LBH2001A-H-SC	Multimode SC	LBH2001A-P-SC
Single-Mode LC	LBH2001A-H-LX	Hardened Gigabit Edge Switch, 8-Port	LGH008A

These are some of the most popular switches in the LBH2001 series. To see all the products in this series, go to **blackbox.com** and enter LBH2001\* in the search box. For pricing details, call **724-746-5500**.



**BLACK BOX** 

Industrial

Ethernet Switches

# The benefits of using managed switches.

Managed and unmanaged switches both have their purposes in a network. Here's a quick look at the advantages of using managed switches.

#### Minimizing network downtime.

A major advantage of managed switches is the failover redundancy they add to your network, helping to achieve less network downtime. Recent studies exploring IT downtime found that that the average business loses \$159,331 per year through downtime and data recovery. It's estimated that businesses' ability to generate revenue is reduced by 29%.

Managed switches can help companies avoid these problems by allowing for failover links in the network. Protocols, like an Alpha-Ring topology, that achieve a 30 millisecond or less failover time after a network link is broken help minimize downtime and help enable a more convenient network infrastructure with reduced cable costs. Standardized protocols like Rapid Spanning Tree (RSTP), Multiple Spanning Tree (MSTP), and Spanning Tree Protocol (STP) allow for failover links and interoperability over multiple vendor switches.

In addition, features like the Link Aggregation Control Protocol (LACP) enable the user to add more bandwidth for high flow-rate applications without changing the cable type on the switch. These features of managed switches, operating alone or in combination, can create a low-downtime, low-latency network.

#### Cutting operational expenses.

Another area in which the managed switch can assist in lowering IT costs is in operational expenses. This can be accomplished because managed switches enable you to remotely access and monitor your network, removing the need to keep staff onsite 24/7 at remote locations just to monitor network health.

Management communications tools like Telnet, RS-232, a Web browser, or SNMP (Simple Network Management Protocol) enable you to get an

update on the status of your network. And they give you the ability to access and control your device remotely in order to make changes or troubleshoot issues. Managed switches feature advanced network diagnostic tools such as Port Mirroring and Remote Network Monitoring (RMON) that give you a visual breakdown of network traffic per port, as well as the ability to troubleshoot and bench test network equipment/ devices.

#### Increased security.

Finally, managed switches can help increase your network security. With features such as 802.1X Port-Based Network Access Control (PNAC) and PoE (Power over Ethernet) port control, you can control switch port access for each network user individually. For example, you can set a static 24 MAC address to be associated with each port and deny access to all other MAC addresses. A managed switch enables the creation of Access Control Lists (ACLs), which can control the specific network traffic of users by using simple "allow" and "deny" statements.

In addition, managed switches let you view the MAC address table to see what devices and users have accessed your device. This way, you can take steps to prevent unauthorized access.

Black Box Explains: The difference between managed, unmanaged, and Web-smart switches (**page 59**).

#### A Summary of the Benefits of Managed vs. Unmanaged Switches

Managed	Unmanaged
Help minimize network downtime	Typically cost less
Lower operational expenses	Easier setup, "plug in and go" installation
Increased security	Ideal for small and medium networks
Save, restore, or duplicate network and switch configurations	
Ideal for advanced network setups	
Ideal for networks that span several locations	

Related





**Ethernet Switches** 

Industrial

### Fast Ethernet Managed Switches with Fiber Uplinks and PoE



LEH900 Series (Hardened Managed Ethernet) LEH1000 Series (Hardened Managed Ethernet with PoE) LEH1100 Series (Hardened Managed Ethernet with PoE+)

- Increase network reliability and add redundancy in harsh environments.
- Operate in extreme temperatures.
- Support Alpha-Ring, STP, and link aggregation for redundancy and resiliency.
- Some switches support PoE (802.3af) or PoE+ (802.3at) operation.
- Offer less than a 30-ms recovery time, link failover, and redundant power inputs.
- Meet numerous harsh/industrial standards, including NEMA TS1/2 for traffic control, and EN6100-6-2 and -6-4 for industrial environments, including railway applications.

LEH1104A-4MMSC

Designed for rugged environments, the LEH900, LEH1000, and LEH1100 Series (Hardened Managed Ethernet Switches) give you the high reliability you need. Use these managed switches to configure, control, and monitor remote equipment in the worst environments.

#### Maximize uptime.

Advanced management features will help you minimize network downtime by enabling you to remotely diagnose and manage network problems. You'll lower operational expenses, too, by eliminating the need to send IT technicians on site to troubleshoot and access network equipment.

The switches are fully manageable through a Web interface, SNMP, or command-line interface (CLI). You can control the bandwidth utilization on each port individually as well as set up Quality of Service (QoS) priority queuing for critical applications.

The switches support port-based VLAN and IEEE 802.1Q VLAN tagging, MAC-based trunking, IP-multicast IGMP snooping, rapid spanning tree for redundancy, and port mirroring. Plus, they also have 802.1x port-based authentication for security.

#### Network flexibility with multiple protocol options.

The switches give you maximum network flexibility with two methods for maintaining network resiliency: Spanning Tree Protocol (STP/RSTP) and Alpha-Ring protocol. The switches can also help you maximize network uptime by enabling failover links with a 30 millisecond or less failover.

With STP, you can set up redundant links to provide automatic backup paths if an active link fails. It also avoids the creation of bridge "loops" that cause broadcast storms.



Watch the Hardened Managed Switches Video





Watch the Hardened Managed Ethernet Switches Video



LEH1008A-2GSFP

LEH908A

In addition, you can also seamlessly incorporate the Alpha-Ring into existing STP networks for greater redundancy.

Expand bandwidth with Link Aggregation Control Protocol (LACP 802.3ad) by combining links and providing another method of network redundancy.

#### These switches can take the heat (and cold).

Encased in an IP30-rated metal case, the switches withstand extreme temperatures ranging from -40° to +75° C. You can use them in a multitude of environments from factory floors to transportation applications. The switches comply with multiple environmental standards.

Use them for:

- Security and surveillance applications, particularly with video cameras and access control.
- Military applications, especially in ships and other vehicles.
- Factory automation applications for controlling machinery.
- Oil and gas fields for remote equipment monitoring and control.
- Building automation for controlling HVAC and lighting systems.

#### Multiple switch choices.

The switches feature redundant power inputs and include a DIN-rail mount. The panel and rack mounting kits and power supplies (MDR-40-12, MDR-40-24, SDR-240-48) are sold separately. The switches also include a serial cable (DB9 M/F) for the console connection.

Switches with copper/fiber ports, as well as PoE and PoE+ switches are available. All models offer full wire-speed forwarding rates, autonegotiatation for network speeds, and Auto-MDI/MDI-X, eliminating the need for crossover cables on the copper ports.



#### **Product Selection Guide**

Switch Series	Ports	Temperature	Fiber Mode	Power	PoE
LEH908A (Hardened Managed Ethernet Switch)	(8) 10-/100-Mbps RJ-45	-40° to 75° C	All Copper (RJ-45)	12-32 VDC	_
LEH900 Series (Hardened Managed Ethernet Switches)	(6) 10-/100-Mbps RJ-45; (2) 100- or 1000-Mbps Fiber or SFP	-40° to 75° C	Multimode SC Multimode ST 1000-Mbps SFP Port 100-Mbps SFP Port	12–32 VDC	_
LEH1000 Series (Hardened Managed Ethernet Switches with PoE)	(8) 10-/100-Mbps RJ-45; (2) 100- or 1000-Mbps Fiber or SFP	-40° to 75° C	Multimode SC Multimode ST 1000-Mbps SFP 100-Mbps SFP	47–57 VDC	PoE
LEH1100 Series (Hardened Managed Ethernet Switches with PoE+)	(4) 10-/100-Mbps RJ-45 (2) SFP or (4) 100-Mbps Fiber	-40° to 75° C	Multimode SC Multimode ST 1000-Mbps SFP Port 100-Mbps SFP Port	47–57 VDC	PoE+

LEH900 Series (Hardened Managed Ethernet Switches)					
(8) 10/100-Mbps	LEH908A				
(6) 10/100-Mbps, (2) GE SFP	LEH906A-2GSFP				
LEH1000 Series (Hardened Managed Ethernet Switches, PoE)					
LET 1000 Series (Hardeneu Manageu Ethernet 3	Switches, POE)				
(8) 10/100-Mbps PoE	LEH1008A				

CATx

 LEH1100 Series (Hardened Managed Ethernet Switches, PoE+)

 (4) 10/100-Mbps PoE+, (4) 100-Mbps MM ST
 LEH1104A-4MMST

 (4) 10/100-Mbps PoE+, (2) GE SFP
 LEH1104A-2GSFP

These are some of the most popular switches in these series. To see all the products in these series, go to **blackbox.com** and enter LEH900\*, LBH100\*, or LEH110\*in the search box.

Media Converters

CATx

For more information on Alpha-Ring protocol, see page 20.

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LANs, WANs, and Beyond: blackbox.com/networking.



Ethernet Switches Industrial



## **Keep Network Traffic Flowing.**

## Spanning Tree and Alpha-Ring

As computer networks have become mission-critical assets for most, if not all, businesses, keeping the network up and running has assumed a crucial importance. Just as there are different types of traffic that run over a computer network, there are different solutions to keeping that traffic flowing, each with its own pros and cons.



#### Spanning Tree Protocol (STP)

The Spanning Tree Protocol (standardized as IEEE 802.1d) specifies a network design with redundant links to provide automatic backup paths if an active link fails. STP also avoids the creation of bridge loops that cause broadcast storms. Without STP, Ethernet switches with redundant links have no standardized way to keep from looping data over and over again to the other switches in the network, eventually disabling the network's ability to pass data.

The idea behind a Spanning Tree topology is to enable switches to automatically discover a subset of the network topology that is loop-free, i.e., a tree. With STP turned on, the switches will perform the spanning tree algorithm when they are first connected, as well as any time there is a topology change, and automatically communicate with each other in a loop-free mode. Then, should a failure of one of the active links occur, STP unblocks the redundant links to enable the network to continue transmitting traffic.

#### The Alpha-Ring Protocol

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The Alpha-Ring protocol is a proprietary protocol designed to provide a faster network recovery time after a failure than standard STP. As the name suggests, Alpha-Ring enables the switches to be organized in a ring arrangement. During normal operation, the backup path for the Alpha-Ring is blocked, and data follows the other links around the ring.

If, however, one of the active links fails, the Alpha-Ring protocol unblocks the backup path to enable data to keep flowing. Typical failover for Alpha-Ring protocol is less than 30 milliseconds.

In addition, unlike STP, Alpha-Ring does not operate using any bandwidth-consuming packets to check the ring status. The ring port connections are monitored by each switch individually without the need for test packets to be generated and transmitted around the ring.

#### **Ethernet Ring Protocols**

Although Ethernet is usually thought of as having a star or bus topology, it's also possible to build an Ethernet network as a ring. This configuration has the advantage of providing a redundant pathway if a link goes down. A ring topology is often used in applications such as traffic signals and surveillance where long distances may make it difficult to run links in a star formation from a central switch and where downtime must be limited.

#### Generally speaking, ring architectures have these advantages:

1. They have fast failover times, typically sub-50ms.

2. They require a decreased number of ports. Fewer ports are needed to provide the same amount of resiliency as centralized switched networks with redundant paths. This results in decreased initial investment and lower ongoing maintenance costs.

3. They are scalable and enable a step-by-step network rollout. More switches can be added to the ring incrementally. The full traffic does not need to traverse a main/distribution switch.

4. They use bandwidth efficiently; dedicated paths are not required.

5. They simplify configuration. Predefined paths between the switches that are connected to the ring are not needed.

NOTE: The LEH Series Hardened Managed Ethernet Switches on pages 18-19 use the Alpha-Ring protocol for redundancy.

## Industrial

## Ethernet Switches

## **Power Supplies**



- Compact DIN-rail mount power supplies are perfect for tight spaces.
- Use to power industrial devices such as Hardened Managed Ethernet Switches, Heavy Duty Edge Switches, and Media Converter Switches.
- DIN-rail power supplies have an extended operating temperature range of -25 to +70° C.
- The external, autosensing 100–240 Power Adapters (PS002A, PS003A) come with power cords. For country-specific power cords, contact our FREE Tech Support.
- The PS003A has stripped ends power output
- Many options available. Contact Tech Support at 724-746-5500 for help choosing the correct power supply for your application.



#### **Product Selection Guide**

Power Supply	Туре	Operating Temperature	Output Voltage	Connector Type	Max. Output Current (Amps)	Power (Watts)
MDR-10-12	DIN-Rail	-20 to +70° C	12 VDC	Terminal Block	0.8	10
MDR-40-12	DIN-Rail	-20 to +70° C	12 VDC	Terminal Block	3.3	40
MDR-60-12	DIN-Rail	-20 to +70° C	12 VDC	Terminal Block	5	60
SDR-120-12	DIN-Rail	-25 to +70° C	12 VDC	Terminal Block	10	120
PSD100-R2	External	-20 to +70° C	12 VDC	Terminal Block	1.7	20
PS002A	External	-40 to +75° C	12 VDC	3-Pin DIN	3	36
PS003A	External	-40 to +75° C	12 VDC	Flying Leads	3	36
MDR-10-24	DIN-Rail	-20 to +70° C	24 VDC	Terminal Block	0.4	10
MDR-40-24	DIN-Rail	-20 to +70° C	24 VDC	Terminal Block	1.7	40
MDR-60-24	DIN-Rail	-20 to +70° C	24 VDC	Terminal Block	2.5	60
SDR-120-24	DIN-Rail	-25 to +70° C	24 VDC	Terminal Block	5	120
PSD012	External	-20 to +60° C	24 VDC	Terminal Block	1.5	36
MDR-40-48	External	-20 to +70° C	48 VDC	Terminal Block	0.8	40
SDR-120-48	DIN-Rail	-20 to +70° C	48 VDC	Terminal Block	2.5	120
PSD014	External	-10 to +60° C	48 VDC	Terminal Block	1.6	75

PS002A

### SFP and SFP+ Transceivers



- Small Form-Factor Pluggable (SFP) Optical Transceivers enable you to adapt an SFP slot to a 100-Mbps or Gigabit fiber interface.
- Extended diagnostics.
- -40 to +85° C operating temperature.

SFP, 155-Mbps Fiber with Extended Diagnostics	150404
850-nm Multimode, LC, 2 km	LFP401
1310-nm Multimode, LC, 2 km	LFP402
1310-nm Single-Mode, LC, 30 km	LFP403
1310-nm Single-Mode, Plus, 60 km, LC	LFP404
SFP, 1250-Mbps Fiber with Extended Diagnostics	
850-nm Multimode, LC, 550 m	LFP411
1310-nm Multimode, LC, 2 km	LFP412
1310-nm Single-Mode, LC, 10 km	LFP413
1310-nm Single-Mode, LC, 30 km	LFP414
SFP with SerDes Interface,	
1.25 Gbps, Copper, 1000BASE-T, Extended Diagnostics	LFP415
SFP with SGMII Interface, 1.25 Gbps, Copper,	
10/100/1000BASE-T, Extended Diagnostics	LFP416
10GBASE-SR SFP+ with Extended Diagnostics,	
850-nm Multimode, LC, 300 m	LSP421
10GBASE-LR SFP+ with Extended Diagnostics	
1310-nm Single-Mode, LC, 10 km	LSP422
For full features and specs, go to <b>blackbox.com</b> .	
For pricing details, call <b>724-746-5500</b> .	

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#### Fast Ethernet Managed Switches with Fiber Uplinks



#### LEH800 Series (Hardened Managed Ethernet Switches)

- Hardened managed switches operate in very hot and very cold conditions—even outdoors in sheltered locations.
- Available in copper-only and copper and fiber optic port configurations, including Gigibit-speed switches.
- Have bandwidth rate control and support IEEE 802.1p Quality of Service (QoS) for four priority queues.
- Support network redundancy, offering a recovery time of <30 ms and automatic link failover, as well as redundant power inputs.
- Manageable through an RS-232 console, Telnet, SNMP, RMON, a Web browser, or TFTP.
- Per-port programmable MAC address locking, up to 24 static secure MAC addresses per port, and MAC-based trunking.

Designed for rugged environments, the LEH800 Series (Hardened Managed Ethernet Switches) provide reliable switching in industrial areas.

Encased in IP30 rated metal cases, they withstand temperatures ranging from -40° to +75° C. They're great for factory floors and traffic-signal applications (the switches comply with the IEC 61000-6-2 EMC Generic standard for immunity in industrial environments, IEC 60068-2 testing for vibration resistance and shock, as well as NEMA TS 1 and TS 2 environmental requirements for traffic-control equipment).

Fully manageable through SNMP, a Web browser, Telnet, or a console port, the switches are designed to integrate mixed-speed copper-only segments or 10-/100-Mbps copper networks with fiber backbones. You can control the maximum bandwidth on each port individually, as well as set up Quality of Service (QoS) priority queuing for critical applications.

#### **Product Selection Guide**

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Switch Series	Ports	Temperature Options	Fiber Mode Option	Power Options
LEH808 Series	(8) 10/100 (RJ-45) (2) 100 or 1000 Mbps (Fiber)	-40° to 75° C	Multimode SC 2 km Multimode ST 2 km Single-mode SC 20 km Single-mode ST 20 km Multimode SC 550 m Single-mode SC 20 km Single-mode SC 10 km	12 to 32 VDC
LEH812 Series	(12) 10/100 (RJ-45) (2) 100 or 1000 Mbps (Fiber)	-40° to 75° C	Multimode SC 2 km Multimode ST 2 km Single-mode SC 20 km Single-mode ST 20 km Multimode SC 550 m Single-mode SC 20 km	12 to 32 VDC
LEH813 Series	(13) 10/100 (RJ-45) (1) 100 Mbps (Fiber)	-40° to 75° C	Multimode ST 2 km Single-mode SC 20 km Single-mode ST 20 km	12 to 32 VDC



LEH808-1G

A majority of the switches support a Gigabit Ethernet uplink port or two. All models offer full wire-speed forwarding rates, autonegotiate for network speed, and feature Auto-MDI/MDI-X, eliminating the need for crossover cables on the copper ports.

What's more, the LEH800 Series switches support port-based VLAN and IEEE 802.1Q VLAN tagging, MAC-based trunking, IP-multicast IGMP snooping (V1, V2, and V3), rapid spanning tree for redundancy, and port mirroring. Plus, they also boast 802.1x port-based authentication for network security.

Mount the compact switches on a DIN rail, on a panel, or in a rack. The switches come with redundant power inputs (terminal block and DC jack).

LEH800 Series (Hardened Managed Ethernet Switches)					
8-Port 10/100BASE-TX + 2-Port 100BASE-FX SC Multimode					
LE	H808-2MMSC				
8-Port 10/100BASE-TX + 2-Port 100BASE-FX ST Multimode					
L	EH808-2MMST				
12-Port 10/100BASE-TX + 2-Port 100BASE-FX ST Multimode					
L	EH812-2MMST				
12-Port 10/100BASE-TX + 2-Port 100BASE-FX SC Multimode					
LE	EH812-2MMSC				
13-Port 10/100BASE-TX + 1-Port 100BASE-FX ST Multimode					
L	EH813-1MMST				

These are some of the most popular switches in this series. To see all the products in this series, go to **blackbox.com** and enter LEH808\*, LEH812\*, or LEH813\* in the search box.

### Fast Ethernet Modular Managed Switches with Fiber Uplinks



#### LE2325 Series (Managed Field Switches)

- Ideal for industrial networking in harsh environments.
- IP53-rated protection. Advanced thermal chassis works as a heat sink and features a ribbed surface for heat dissipation.
- Great for building a switched, hardened Ethernet infrastructure to connect edge devices.
- Features four 10/100 copper ports plus three slots for adding copper and fiber modules (for a maximum of 16 total ports).
- Power over Ethernet (PoE) options available.
- Handles traffic that comes in bursts and prioritize streaming traffic.
- Includes mounting brackets and management software.
- Supports SNMP management plus secure browser-based access.





Use the LE2325 Series Switches (Modular Managed Field Switches) to build a switched, hardened Ethernet infrastructure to connect edge devices, such as PLCs and IEDs, with upstream switches or routers.

Ideal for industrial networking in factory, engineering/process control, utility, or video surveillance applications, the switches feature a high-strength, extruded aluminum chassis that works as a heat sink and features a ribbed surface for heat dissipation—no need for fans. Even better, the switches' sealed case provides high EMI/RFI noise immunity.

They also boast IP53-rated environmental protection and meet IEC 61850 and IEEE 1613 Environmental Standards for Electric Power Substations, are NEBS Level 3 and ETSI compliant, and are NEMA TS 2 rated for outdoor use.

Start with a LE2325 Series Switch with (4) 10-/100-Mbps Copper Ports (fixed RJ-45 ports in chassis Slot A) or, for networks where you need Power over Ethernet for 802.3af devices on switched ports, choose a switch with (4) 10-/100-Mbps Copper PoE Ports and -48-VDC Power Input. Contact Tech Support at **724-746-5500** for help building the perfect switch.

#### Managed Field Switch Chassis with (4) Fixed RJ-45 Ports

(4) 10-/100-Mbps Copper Ports	
24-VDC Power Input	LE2325A-24VDC
-48-VDC Power Input	LE2325A-48VDC
125-VDC Power Input	LE2325A-125VDC
250-VDC Power Input	LE2325A-250VDC
(4) 10-/100-Mbps Copper Ports with PoE -48-VDC Power Input	LE2325A-POE48DC
anaged Field Switch Port Module	
(4) 10-/100-Mbps Copper Ports	LE2326C
(4) 100-Mbps Multimode Fiber 1 C	LE2337C

These are some of the most popular switches in this series. To see all the products in this series, go to **blackbox.com** and enter LE232\* in the search box.



M



## Fast Ethernet and Gigabit Ethernet Media Converters



LIC020, LGC320 Series (Industrial MultiPower Media Converters)

- Powers up one of five ways: with AC or DC power, via a PC's USB port, using power over Ethernet (PoE), or via an optional PowerTray.
- Converts 10-/100- or 10-/100-/1000-Mbps copper to duplex 100-Mbps or 1000-Mbps fiber.
- Copper ports are autonegotiating for speed.
- Extended temperature range when used with DC power: -25 to +70° C.
- Includes clips for mounting on DIN rails.

These ultra-compact, plug-and-play converters offer multiple power options, including support for the IEEE 802.3af Power over Ethernet (PoE) standard. Plus, the Industrial MultiPower Media Converter is designed for use in harsh industrial environments.

For extra versatility, you can power the Industrial MultiPower Media Converters multiple ways—via the external AC power supply included with each converter; using 5–50-VDC terminal block power; through 802.3af Power over Ethernet (PoE); through the optional USB Power Adapter Cable (LHC021A) that plugs into a PC's USB port; or through an optional rackmount PowerTray (LHC018A-AC-R2).

You can even use multiple power options at the same time to provide maximum redundancy and ensure that your mission-critical applications remain up and running. For instance, you can connect a converter to power sourcing equipment (PSE) for PoE while also using AC adapter power, DC terminal block power, and USB bus power. Then, if any one of these power sources fails, the other sources will continue to supply power to the converter seamlessly.

You can also connect a PSE switch to an uninterruptible power supply to ensure that the switch and each connected media converter always have power.

The converters come with DIN clips, so you can attach them to a DIN rail. When installing multiple Industrial MultiPower Media Converters on a DIN rail, use one DC input source, then cascade from one DC block to the next until you reach the maximum current available.

#### **Product Selection Guide**

Part Number	Copper Speed	Fiber Speed	Fiber Type	Connector	Distance	PoE	Power
LIC022A-R2	10-/100-Mbps	100-Mbps	1300-nm Multimode	ST	2 km		
LIC023A-R2	10-/100-Mbps	100-Mbps	1300-nm Multimode	SC	2 km		
LIC024A-R2	10-/100-Mbps	100-Mbps	1310-nm Single-Mode	ST	40 km	202 2af Da C DD	AC or DC power supply; USB port;
LIC025A-R2	10-/100-Mbps	100-Mbps	1310-nm Single-Mode	SC	40 km	802.3dl POE PD	PoE; PowerTray chassis
LGC320A-R2	10-/100-/1000-Mbps	1000-Mbps	850-nm Multimode	SC	300 m		
LGC321A-R2	10-/100-/1000-Mbps	1000-Mbps	1310-nm Single-Mode	SC	10 km		

LIC026A-R2 front and rear views (blackbox.com)

For full features and specs, go to blackbox.com. For pricing details, call 724-746-5500.





Industrial Media Converters

Bottom View: LGC5310A

## Gigabit Ethernet Media Converters with PoE/PoE+



#### LGC5300 Series (Industrial Gigabit Ethernet Media Converters)

- Provide power to remote PoE/PoE+ devices such as security cameras, wireless access points, and more.
- Withstand extreme temperatures of -40° to +65° or +75° C (depending on model).
- Convert 10/100/1000BASE-T copper to 1000BASE-X fiber.
- Support IEEE 802.3af PoE or IEEE 802.3at PoE+ standards.
- Acts as power sourcing equipment (PSE) on the copper side to power PoE devices.
- Models have either a multimode, single-mode, or SFP port.
- Models with SFP ports can be customized to the interface of your choice.
- UTP ports are autosensing with Auto MDI/MDI-X.
- Compatible with legacy pre-IEEE standard powered devices.

Use these tough media converters to extend your network over fiber. They convert 10/100/1000BASE-T UTP to 1000BASE-X fiber and provide PoE/PoE+ to remote equipment. Because they are Power Sourcing Equipment (PSE), they can link faraway PoE/PoE+ devices via your standard Ethernet cable.

The converters operate in extreme temperatures of -40° to +65° or +75° C (depending on model) and are ideal for powering PDs such as security cameras, wireless access points, building access devices, and automation equipment in harsh environments. They are especially useful at powering devices in hard-to-reach locations with limited access to AC power outlets, such as ceilings, closets, even the factory floor. The cost of running electrical power to each device is eliminated by sending power over the Ethernet cable.

The LGC5300 series supports PoE (IEEE 802.3af) and provides up to 15.4W of power per UTP port. The LGC5310 series supports PoE+ (IEEE





802.3at) and provides up to 25.5W per port for more demanding devices such as video conferencing equipment, PTZ (pan-tilt-zoom) cameras, and 802.11n wireless access points.

The models with SFP ports enable easy adaptability to different fiber types, multimode or single-mode, even Gigabit copper, depending on the SFP transceiver you use.

Other features include link modes, which can propagate link faults from fiber to copper and copper to fiber. A PoE power reset function disables the power output in the case of a link failure on the receiving end. This gives the powered device two seconds to re-initialize.

These compact media converters can be tabletop mounted, wall mounted, or DIN-rail mounted using an optional DIN-rail mounting kit. They can also be mounted on a 1U 19" rackmount shelf.

Switch Series	Copper Speed	Fiber Speed	Fiber Type	Connector	Distance	PoE	Temperature	Power
LGC5300A		1000 Mbps	—	SFP	—			
LGC5301A		1000 Mbps	850-nm Multimode	SC	550 meters (1804 ft.)	802.3af PoE PSE	-40° to 65° C (-40° to 149° F)	
LGC5302A	10-/100-	1000 Mbps	1310-nm Single-Mode	SC	12 km (7.5 mi.)		(	DC torminal block
LGC5310A	/1000-Mbps	1000 Mbps	—	SFP	—			DC terminal block
LGC5311A		1000 Mbps	850-nm Multimode	SC	550 meters (1804 ft.)	802.3at PoE+ PSE	-40° to 75° C (-40° to 167° F)	
LGC5312A		1000 Mbps	1310-nm Multimode	SC	12 km (7.5 mi.)			

Product Selection Guide

For full features and specs, go to blackbox.com. For pricing details, call 724-746-5500.



## **Gigabit Ethernet Network Interface Device**



#### LGC340A

- Functions as a switch, a media converter, and a mode converter.
- Features two 10-/100-/1000-Mbps copper Ethernet ports plus two 100-/1000-Mbps SFP ports.
- Use as a switch, a media converter, and a mode converter.
- If a link goes down, 1+1 uplink protection provides failover in under 50 milliseconds.
- Powered through AC, DC, or USB.
- Extended temperature range of -20° to +70° C.
- Supports 155-Mbps and 1250-Mbps SFPs.
- Jumbo frame support up to 10,240 bytes.
- DIN rail mount (sold separately).

#### Use multiple ways.

The Media Converter Network Interface Device is a carrier-class DIN rail switch that has the versatility to handle many applications at the edge of your network. Two autosensing 10-/100-/1000-Mbps copper ports plus two autosensing 100-/1000-Mbps SFP slots in an intelligent switch enable you to use the Media Converter Network Interface Device for managed fiber termination, fiber drop and insert, fiber repeater, fiber mode conversion, and dual independent copper-to-fiber media conversion with automatic failover.

#### Copper and/or fiber switch.

You can use the device as a copper/fiber or all copper switch. The versatility is in the SFP slots. As a copper/fiber switch, you can have two 10-/100-/1000-Mbps copper ports and two autosensing 100-/1000-Mbps fiber SFP ports. But the SFPs also support 10-/100-/1000-Mbps copper operation. So if you insert two copper SFPs, you will have an entirely copper switch. Talk about versatility.

#### Double-duty media conversion.

The device gives you media conversion flexibility for distance extension. You can install it as a dual copper/fiber media converter then use it as two independent converters.



## Double-duty mode conversion with redundant 1+1 protection.

You can deploy this switch as a 4-port device with fiber redundancy. It gives you two different mode conversions to choose from: 1+1 Non-Revertive and 1+1 Revertive. Both relate to how the box responds if a primary link fails. In Non-Revertive mode, the box will continue to use the backup fiber link after the failure on the primary link has been fixed. In Revertive mode, the box will revert to the primary link.

#### Hardened for the edge of your network.

The switch is designed for industrial use and has an temperature range of  $-20^{\circ}$  to  $+70^{\circ}$  C plus power options for AC, DC, and USB power.

#### Fully manageable.

The switch is fully manageable and supports active and passive IEEE 802.3ah OAM on all ports, as well as DHCP and SNMP. The switch can also be managed through the RS-232 console port.

LGC340A

#### Media Converter Network Interface Device

(2) 10-/100-/1000-Mbps Copper to (2) SFP Copper/Fiber

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

## **SFP Transceivers**

SFP and SFP+ are terms for a type of transceiver that plugs into a special port on a switch or other network device to convert the port to a copper or fiber interface. These compact transceivers replace the older, bulkier GBIC interface. Although these devices are available in copper, their most common use is to add fiber ports. Fiber options include multimode and single-mode fiber in a variety of wavelengths covering distances of up to 120 kilometers (about 75 miles), as well as WDM fiber, which uses two separate wavelengths to both send and receive data on a single fiber strand.

SFPs support speeds up to 4.25 Gbps and are generally used for Fast Ethernet or Gigabit Ethernet applications. The expanded SFP standard, SFP+, supports speeds of 10 Gbps or higher over fiber.

Because these compact transceivers are hot-swappable, there's no

need to shut down a switch to swap out a module—it's easy to change interfaces on the fly for upgrades and maintenance.

Another characteristic shared by this group of transceivers is that they're OSI Layer 1 devices—they're transparent to data and do not examine or alter data in any way. Although they're primarily used with Ethernet, they're also compatible with uncommon or legacy standards such as Fibre Channel, ATM, SONET, or Token Ring.

Formats for SFP, SFP+, and XFP transceivers have been standardized by multisource agreements (MSAs) between manufacturers, so physical dimensions, connectors, and signaling are consistent and interchangeable. Be aware though that some major manufacturers, notably Cisco, sell network devices with slots that lock out transceivers from other vendors.

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#### **Ethernet Extender Selection Guide**

Extender	Max. Distance (km)	Media Type	Speed (Mbps @ 300 m)	Temperature	PoE	Power	Ethernet Ports
LBPS301A (Hardened), page 27	1.9	vDSL (RJ-11)	50	-40° to 75° C	PoE+ (30 w)	24-48 VDC	1
LBPS304A (Hardened), page 27	1.9	vDSL (RJ-11)	50	-40° to 75° C	PoE+ (69.1 w)	24–48 VDC	4
LB308A (Hardened), page 29	1.9	vDSL (RJ-11)	50	-40° to 75° C	—	24 VDC	8
LB304A (Hardened), page 27	2	vDSL (RJ-11)	50	-40° to 75° C	—	24-48 VDC	4
LB303A (Hardened), page 27	2	vDSL (RJ-11)	50	-40° to 75° C	—	12–30 VDC	1
LBPS310A-KIT (Hardened), page 28	2	vDSL (RJ-11)	100	-40° to 75° C	—	46-57 VDC	1
LBM303A (Hardened), Web	2	vDSL (RJ-11)	50	-40° to 75° C	—	12–30 VDC	1
LR0020A-KIT-R2 (SDSL), Web	6	SDSL (RJ-45)	2.3	-40° to 70° C	—	100–125 VAC	1
LB532A-R/L/M (DeeSel.1 Industrial), page 29	6	G-SHDSL (RJ-45)	5.7	-40° to 85° C	_	100–240 VAC	2
LWE100A (Wireless Point-to-Point), page 31	10	Wireless	40	-30° to 82° C	_	100–240 VAC	1
LWE200A (Wireless Point-to-Point), page 31	24	Wireless	300	-40° to 70° C	_	120 VAC	1
LBNC300A (Hardened), page 27	3	BNC	70	-26° to 60° C	—	100–240 VAC	1



PoE	DIN RAIL	PANEL MOUNT	RACKMOUNT	DESKTOP	POWER	HARDENED	EXTREME
۶			Į		External AC		

#### LB300 Series (Hardened Ethernet Extenders over vDSL) LBNC300A (LinkGain Ethernet Extender over Coax) LBPS300 Series (Hardened VDSL Ethernet Extenders with PoE+)

#### LB300 Series

- Provides an easy way to extend the reach of your Ethernet network and add ports, even in harsh conditions.
- Extends 10- or 100-Mbps Ethernet up to 1.2 miles (2 km) over voice-grade copper.
- Hardened for use at an extended temperature range of -40° to +75° C.
- Uses symmetrical vDSL for speeds of up to 100 Mbps.
- Ethernet ports are Auto MDI/MDI-X and autosensing for speed and duplex.

#### LBNC300A

- Extends 10-/100-Mbps Ethernet over existing coax cabling.
- Use in pairs to extend point-topoint up to 1.6 miles (2.6 km) at 1 Mbps.
- Or transmit at 75-Mbps through 85-Mbps speeds up to 656 feet (200 m).
- Take advantage of existing coax to break the 327-foot (100-m) copper-Ethernet barrier.



LB303A

LBNC300A

#### LBPS300 Series

- Extends 10BASE-T/100BASE-TX Ethernet across ordinary voicegrade copper wire.
- Ideal for last-mile applications.
- Supports an extreme temperature range of -40° to +75° C.
- Acts as a Power over Ethernet PSE providing 802.3at compliant power to a PoE device.
- Supports 50 Mbps for distances up to 984 feet (300 m) and 1 Mbps for distances of up to 6232 feet (1900 m).



LBPS304A



These are some of the most popular switches in these series. To see all the products in these series, go to blackbox.com and enter LB30\* or LBPS30\* in the search box.



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**Extenders** Industrial

## Fast Ethernet Unmanaged Extender with Power Over Line



#### LBPS310A-KIT (Hardened PoL PoE Ethernet Extender Kit)

- Provides 802.3at PoE over one pair of voice-grade UTP.
- Power PoE PD devices, such as IP cameras and wireless access points, in the worst conditions.
- Extends Power over Ethernet up to 1.2 kilometers and Ethernet up to 2.2 kilometers.
- Hardened for industrial use with a tough aluminum case and an extended temperature range of -40 to 75° C.
- Autosensing, autonegotiating 10-/100-Mbps Ethernet port with Auto MDI/MDI-X.
- Powered through a 48-VDC terminal block or a 48-VDC jack. Order power supplies separately (SDR-120-48).
- Supports DIN rail, panel, and rackmount installations.

The Hardened PoL PoE Ethernet Extender Kit connects and powers PoE devices such as security cameras over one pair of ordinary voice-grade UTP cable. It saves on installation costs by enabling you to use wire you may already have installed.

#### Speed, distance, and power.

This extender delivers the goods with up to 100-Mbps performance at up to 300 meters (984 feet). Plus, even at a distance of almost three football fields, it powers 802.3at PoE devices with a full 30 watts, so high-powered devices like PTZ cameras can get the power they require. At longer distances, speed and power go down, of course, but you can still get full power by using a separate power supply with the remote unit (see the chart to the right).

#### Built tough for rough environments.

The extender is hardened for industrial use with a tough aluminum case that keeps out dust and debris. It features an extended temperature range of -40 to +167° F. The extender mounts on standard DIN rails and accepts standard 48-VDC power via terminal block. For redundant power, the terminal block has a second power input or you can use the 48-VDC power jack.

The kit includes a local and a remote unit.





#### Distance/Speed/Power with Power over Link (PoL) Enabled:

Distance	Data Rate	PoE Output
300 m (984 ft.)	100 Mbps	30 watts
400 m (1312 ft.)	90 Mbps	15.4 watts
600 m (1968 ft.)	60 Mbps	14 watts
800 m (2624 ft.)	45 Mbps	9.5 watts
1 km (3280 ft.)	35 Mbps	7 watts
1.2 km (3937 ft.)	20 Mbps	5 watts

NOTE: The LBPS310A-KIT does not come with a power supply. Order the DIN Rail Power Supply, 120 Watts, 48 VDC (SDR-120-48) separately.

#### Distance/Speed/Power with Power over Link (PoL) Disabled:

Distance	Data Rate	PoE Output
1.4 km (0.8 mi. )	15 Mbps	30 watts
1.6 km (1 mi.)	10 Mbps	30 watts
1.8 km (1.1 mi.)	3 Mbps	30 watts
Up to 2.2 km (Up to 1.4 mi.)	1 Mbps	30 watts

(Power supply on remote unit.)

#### Hardened PoL PoE Ethernet Extender Kit LBPS310A-KIT

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.



### Fast Ethernet Managed Extenders with Multidrop Capabilities



#### LB532A Series (DeeSel.1 Industrial Ethernet Extenders, G-SHDSL)

- Extends industrial 10/100BASE-TX Ethernet connections at speeds up to 5.7 Mbps.
- Use to connect industrial Ethernet devices and remote LANs up to 6.9 km apart.
- Use as a repeater in multi-drop applications.
- Tough—meets IP40 specs and withstands temperatures of -40° to 85° C.
- Includes a built-in, four-port, autosensing 10-/100-BASE-TX switch.

Make connections at speeds up to 5.7 Mbps and across distances ranging from 1.2 to 6.9 km (1.7 to 4.3 mi.). An auto-rate feature senses the ideal speed/distance configuration and ensures that you achieve the highest possible speed on each connection.

This rugged extender can withstand temperature extremes of -40° to 85° C so you can use it to connect Ethernet-enabled industrial devices such as cameras, security equipment, etc.

The multi-drop unit can be used as a repeater between the local and remote units.

The remote extender features a built-in,

four-port, autosensing 10-/100BASE-TX Ethernet switch so you can connect four additional devices. A built-in auto-MDIX means you can use either straight-through or crossover cable.

Plug-and-play means that you'll be up and running in seconds. The auto-MDIX also detects the polarity of the cable on each port and automatically configures the signaling to match.



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DeeSel.1 Industrial Ethern	let Extenders
G.SHDSL	
Multi-Drop Unit	LB532A-M
Local Unit	LB532A-L
Remote Unit	LB532A-R

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

## Fast Ethernet Managed Extender with Local Switching



#### LB308A (10/100BASE-TX Hardened Ethernet Extender Switch)

- This hardened Ethernet switch provides flexibility with eight 10/100BASE-TX ports, plus two VDSL extender ports.
- VDSL ports provide a full-duplex, 50-Mbps link over up to 1900 m (6232 feet) of voice-grade copper wire.
- Supports IP multicast filtering through IGMP snooping.
- Complies with NEMA TS 1 and TS 2 environmental requirements for traffic control equipment.

This 10BASE-T/100BASE-TX Hardened Ethernet Extender Switch uses vDSL to provide an easy, inexpensive way to extend the reach of your Ethernet network over ordinary voicegrade copper wire. Use the switch in harsh environments and extended temperature ranges. Because you use your existing copper infrastructure, you save on cabling costs. Plus it has an internal switch and eight Ethernet ports, so you can use it to easily add remote ports at the edge of your network. This switch is easy to set up. Just plug an extender switch into each end of your copper wire and use simple DIP switches to set one unit as local (CO) and the other as remote (CP).

The switch is transparent to upper level protocols such as TCP/IP, and there's never any software to install. Plus, the RJ-45 port autosenses speed and duplex, and it features MDI/MDI-X, so your Ethernet is virtually foolproof.



NOTE: Must be used in pairs with another LB308A.

10/100BASE-TX Hardened Ethernet		
Extender Switch		
8-Port	1	

LB308A

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.





## Wireless Ethernet Extenders, 5-GHz



**LWE200 Series** 

Wireless Ethernet Extender (LWE200A-KIT)

- Rugged, high-speed extenders for line-of-sight wireless connections.
- High-speed 300-Mbps transmissions handle HD video from security cameras.
- Set up point-to-point connections up to 24 km (15 mi.) apart.
- Point-to-multipoint connections can go up to 8 km (5 mi.).
- Combines directional and omnidirectional antennas for better throughput.
- AES 128-bit encryption secures data.
- Weatherproof NEMA enclosure can withstand the harshest conditions.
- Power over Ethernet means you don't have to install power lines.

When you need secure, robust wireless data transmissions, these are the extenders to choose. Because they operate at 5-Ghz and 300-Mbps, they easily transmit high-definition video from security and surveillance cameras at the edge of your network.

These types of networks are ideal for connecting security checkpoints, monitoring industrial equipment, even powering remote workstations.

#### One-to-one or one-to-many.

The directional antennas in the kit are designed for line-of-sight, point-to-point

connections up to 24 kilometers (15 miles) apart. The access point and the subscriber unit in the kit are configured to work together.

For point-to-multipoint connections, use the separate access point and multiple subscriber units for distances up to five miles away. (You can't mix and match the components of the kit with the individual access point and subscriber units due to the power differences.)

#### Maximum transmission power.

The point-to-point kit gives you maximum transmission power. The 23-dBi directional antennas in the kit give you 40 watts EIRP.

The maximum legal radiated power is four watts EIRP for the individual subscriber unit and one watt EIRP for the individual access point. The subscriber unit has a 23-dBi directional antenna and the access point has a 6-dBi omnidirectional antenna.

The extenders utilize MIMO technology to achieve these very high data rates through a combination of spacial streams and highlevel OFDM modulation.

#### Use anywhere.

These extenders come in a NEMA-rated, weatherproof aluminum enclosure so they can be

## Wireless Ethernet Extender, 2.4-GHz



#### LWE100A-KIT

- Get affordable, point-to-point wireless Ethernet extension up to 10 km (6.2 mi.).
- Extenders are pre-synchronized to work with each other.
- Tough waterproof enclosure for outdoor use.
- Features 802.11n wireless for fast throughput— up to 40 Mbps at up to 5 km (3.1 mi.).
- Features an 8-dBi internal antenna or can used with an external antenna.
- Powered through the Ethernet cable—no outdoor power outlet needed.
- 10-/100-Mbps Ethernet port with MDI/MDI-X.

The Wireless Point-to-Point Ethernet Extender Kit gives you a quick way to extend an Ethernet link between buildings. Get a 40-Mbps wireless link up to 5 km (3 mi.) away—enough bandwidth to support several workstations. At lower speeds go further—about 6.2 km (10 mi.).

The kit comes with two wireless extender units synchronized to work together. Mount each on a building within line-of-sight of each other. The extenders are waterproof, weatherproof, and compact.

What's more, the extenders don't require a nearby power outlet because they receive their power through the Ethernet cable.



Point-to-point application





used in the worst environments. A rubber gasket seals and protects the connector port from the weather.

Use these extenders in any number of wireless extension applications. Because of their very high data throughput, they can easily transmit highdefinition video from security cameras. They are also useful for transmitting data in industrial settings, campus environments, medical complexes—anywhere you need robust and secure wireless transmission.

Your data is safe, too. The extenders use AES 128-bit encryption.

#### PoE.

These extenders receive their power through the Ethernet cable via a 18-VDC power injector (included). You don't have to worry about running a power line or placing them near a power outlet.

They are also easy to use. A built-in browser interface provides easy reconfiguration and monitoring.

# Wireless Ethernet Extenders5-GHz, 300-MbpsKit (One pair of radios)Access PointLWE200A-APSubscriberLWE200A-S

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

The extenders offer easy setup. An LED indicates when they are properly aligned.

Use the kit in any number of wireless extension applications. Quickly and economically extend your network's reach to areas such as guard stations or utility buildings, or any site where it's not cost effective to run cable for just one or two workstations.

For data security, the extenders use 64-/ 128-/152-bit WEP encryption, WPA/WPA2 and pre-shared key WPA-PSK/WPA2-PSK protocols, as well as IEEE standard 802.1X authentication.

The kit includes two extender units, two PoE power injectors with two power cords, and two pole-mounting rings.



#### Wireless Point-to-Point Ethernet Extender Kit 2.4-GHz

LWE100A-KIT

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

NOTE: Lightning protection is required for safe installation. For more information, contact Tech Support.

LANs, WANs, and Beyond: blackbox.com/networking.





#### Industrial RS-232↔485 DIN Rail MM Fiber Driver (MED100A)

- Enable any two async serial devices to communicate half- or full-duplex over two multimode ST<sup>®</sup> fibers at distances up to 4 km (2.5 mi.).
- RS-232 signals are supported up to 115.2 kbps; RS-422 or RS-485 signals are supported up to 460.8 kbps.
- Different standards can be mixed and matched to allow RS-232 devices to connect to your RS-422 or RS-485 system.
- Replaces converters and isolators when you connect remote equipment.
- Can be set on repeater mode to create a multi-drop master/slave configuration, enabling one serial device to talk to multiple slave devices around a fiber ring.

- Operates from -40 to +85° C.
- Serial connections are on a terminal block.
- Powered by 10 to 30 VDC Power Supply (sold separately).

#### Industrial RS-232↔RS-422/485 DIN Rail MM Fiber Driver (MED101A) Has all the features of the MED100A plus:

- Three-way isolation, 2000-V input/output.
- Modbus ASCII or RTU compatible.
- Automatic Send Data Control eliminates the need for driver software.
- Removable terminal blocks.
- Power is +10 to -48 VDC (±20%) or from optional DIN Rail 12-VDC Power Supply (sold separately).

#### Industrial RS-232↔RS-422/485 DIN Rail SM Fiber Driver (MED102A)

Has all the features of the previous Drivers plus/or:

- Extends communications up to 15 km (9 mi.).
- Supports serial data rates to 115.2 kbps.
- Provides connections between asychronous full- or half-duplex serial equipment over duplex single-mode fiber.
- Power is +10 to -48 VDC (±20%) or from optional DIN Rail 12-VDC Power Supply (sold separately).

FREE, Live, 24/7 Tech Support Talk with an expert at **724-746-5500** or go to **blackbox.com/go/TS**.



#### Industrial DIN Rail Fiber Drivers

RS-232/485 to Multimode ST	MED100A
RS-232/422/485 to Multimode ST	MED101A
RS-232/422/485 to Single-Mode SC	MED102A

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

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- Optical isolation protects your devices from transient surges and ground loops on your data line.
- Operate in harsh environments, withstanding temperatures of -40° to +85° C.
- Feature 10-48-VDC operation.
- Modbus ASCII or RTU compatible.
- Automatic Send Data Control eliminates the need for driver software.

- Adds 1219.2 m (4000 ft.) and another 32 nodes to an RS-485 data circuit. Configure one side as RS-422 and the other side as RS-485 to enable a 4-wire RS-422 device to communicate with a 2-wire RS-485 device.
- Connectors: (2) 5-position terminal blocks
- Power: +10 to -48 VDC (±20%) or from optional DIN Rail 12-VDC Power Supply (PSD100).
- Isolates the TD, RD, RTS, and CTS channels.
- Connectors: (1) DB9 M, (1) DB9 F
- Power: +10 to -48 VDC (±20%) or from • optional DIN Rail 12-VDC Power Supply (PSD100).

Industrial DIN Rail Repeaters	
RS-422/485	ICD107A
RS-232	ICD108A

For full features and specs, go to blackbox.com. For pricing details, call 724-746-5500.

## **DIN Rail**

DIN rail is an industry-standard metal rail, usually installed inside an electrical enclosure, which serves as a mount for small electrical devices specially designed for use with DIN rails. These devices snap right onto the rails, sometimes requiring a set screw, and are then wired together.

Many different devices are available for mounting on DIN rails: terminal blocks, interface converters, media converter switches, repeaters, surge protectors, PLCs, fuses, or power supplies, just to name a few.

DIN rails are a space-saving way to accommodate components. Because DIN rail devices are so easy to install, replace, maintain, and inspect, this is an exceptionally convenient system that has become very popular, especially in industrial environments.

A standard DIN rail is 35 mm wide with raised-lip edges, its dimensions outlined by the Deutsche Institut für Normung, a German standardization body. Rails are generally available in aluminum or steel and may be cut for installation. Depending on the requirements of the mounted components, the rail may need to be grounded.



### Wireless Serial Transceivers



#### MDR290 Series (Wireless 900-MHz RS-232 Serial Transceivers)

- Eliminates cable connections. Controls serial devices wirelessly.
- For mobile, temporary, or fixed installations—point-to-point or multipoint.
- Set up outdoor, clear-line-of-sight links up to 32.1 km (20 miles).
- Indoor links can go up to 457.2 m (1500 ft.).
- Operates in the license-free 900-MHz band using Frequency-Hopping Spread Spectrum (FHSS) technology.
- Transmits around corners and through walls.
- FHSS provides reliable 115.2-kbps communications.
- Supports RS-232 2-wire, half-duplex communications.
- Plug-and-play design.

## A typical point-to-multipoint application using five MDR292A units linking one server to four clients.



MANAGED	PANEL MOUNT	POW	ER	DB9	EXTREME
-		External AC	DC		

#### Industrial Modem RF115 (MDR100A-R4)

- Makes wireless line-of-sight connections up to 32.1 km (20 mi.).
- Transmits RS-232 up to 96.5 km (60 mi.) with two repeaters.
- Use two modems to communicate point to point or contact multiple remote devices in a polled multipoint setting.
- Transmits uncompressed data at speeds up to 115 kbps, half-duplex.
- Frequency-Hopping Spread Spectrum (FHSS) technology sends data error-free via radio waves.
- Heavy-gauge steel and extended-temperature components ensure industrial operation.
- Modem attaches to a DIN rail or a flat panel and has built-in surge protection.
- Includes one modem and one power supply.



Set up secure wireless links for serial control with our Serial Transceivers.

Wireless 900-MHz Serial Transceivers, RS-232	
(1) Client/Server Unit	MDR292
(2) Client Server Units (Kit)	MDR293A-KI

These are just some of our most popular Wireless Serial Transceivers. To see all the products in this series, go to **blackbox.com** and enter MDR29\* (900-MHz) or MDR24\* (2.4-GHz) in the search box. For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500** 



The MDR100A-R4 has a fixed-whip antenna but can also be used with an optional RF antenna.

#### Industrial Modem RF115

#### MDR100A-R4

For an RS-485 plug-in, go to **blackbox.com** and enter MD3310-R2 in the search box. For additional antennas, enter MDR15\* in the search box. For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.


## Hardened Serial Device Servers



#### LES420 Series, LES431A

- Enables you to monitor a serial industrial device over an Ethernet LAN/WAN.
- Configure, troubleshoot, upgrade firmware, and more.
- UL<sup>®</sup> Listed for use in Class 1 Division 2 hazardous areas.
- NEMA TS-2 rated for use in transportation applications.
- Rugged design for operation in a wide temperature range.
- Includes easy-to-use configuration software.
- Built-in Web server for browser-based management.
- Boasts high throughput with low latency.

#### 1-, 2-, 3-Port Servers

- Provide easy remote monitoring and control of one, two, or four RS-232, -422, or -485 devices over 10-/100-Mbps Ethernet.
- Use to easily integrate one, two, or four serial devices into your Ethernet network.

#### 1-Port Modbus Server

- Provides a gateway between Modbus® TCP and Modbus ASCII or RTU devices.
- Enables older PLCs and similar devices to talk to newer TCP sensors and meters.







LES422A

Hardened Serial Device Servers	
1-Port	LES421A
2-Port	LES422A
4-Port	LES424A
1-Port Modbus	LES431A

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

## Serial Converters with/without Opto-Isolation



#### **ICD100 Series**

#### RS-232 422/485 Converters (ICD100A, ICD105A)

- Converts half- or full-duplex RS-232 signals to optically isolated and balanced full-duplex RS-422 or 2-wire half- or 4-wire full-duplex RS-485.
- Switch-selectable data rates between 2400 bps and 19.2 kbps.
- Extends communications up to 1219.2 meters (4000 feet).
- The ICD100A has opto-isolation, the ICD105A does not.

#### RS-232 Current Loop (ICD101A)

- Has one 20-mA transmit loop and one 20-mA receive loop.
- Both signals feature 1000-VDC opto-isolation to protect against surges and ground loops.
- Both loops can be set as active or passive. When set to active, an isolated 20-mA current is supplied to each loop.
- Top speed of 19.2 kbps.

#### RS-422/RS-485, RS-232 Repeaters (ICD102A-ICD103A)

- The RS-422/RS-485 model acts as a repeater, isolator, extender, and converter. It features switch-selectable data rates between 2400 bps and 115.2 kbps.
- The RS-232 model isolates the TD, RD, RTS, and CTS channels. All four channels support speeds up to 115.2 kbps.



ICD100A

#### Serial Converters Selection Guide

Converter	With Opto-Isolation	Without Opto-Isolation
RS-232↔RS-422/RS485	ICD100A	ICD105A
RS-232↔Current Loop	ICD101A	—
RS-422/485 Repeater	ICD102A	ICD107A, blackbox.com
RS-232 Repeater	ICD103A	ICD108A, blackbox.com
RS-422/485 to Fiber Driver	MED100A, p. 32	MED101A, p. 32
USB 2.0↔(2) RS-232	—	ICD111A, p. 38

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.







## USB 3.0 Extender



- Extends USB 3.0 signals up 100 meters (330 ft.) over multimode fiber cable.
- Transfers at 5-Gbps speeds—ten times faster than USB 2.0.
- Link to two USB 3.0 security and industrial cameras, external storage drives, and other high-bandwidth USB devices.
- Uses secure and isolated fiber for extensions.
- Works with AIA USB3 Vision<sup>™</sup> devices.
- Features locking power and USB ports for secure plug-ins.
- Receiver supplies 900 mA of current to the remote USB devices.
- Includes the Extreme USB<sup>®</sup> suite of features:
  - Transparent USB extension.
  - Plug and play. No drivers to install on your computer.
  - Works with Windows®, Mac® OS X®, and Linux® systems.

CH C

Extend USB signals as far as 100 meters (330 ft.) to two remote USB 3.0 devices using secure, interference-free fiber cabling.

The USB 3.0 Ultimate Fiber Extender uses multimode fiber optic cabling to extend device signals to remote areas of your factory, office, or security monitoring application.

Compatible with the USB 3.0 or "SuperSpeed USB" standard, the extender boasts speeds up to 5 Gbps, about ten times that of USB 2.0. This way, you can extend your USB bus connections to newer USB 3.0 devices that use higher bandwidths and require bidirectional asynchronous, full-duplex data transfer. Plus, it supplies more power than USB 2.0 to the remote devices.

With the higher data-transfer rate and power, the extender is ideal for connecting industrial USB 3.0 machine vision cameras, particularly those with high power sensors. It's also great for post-production video editing and broadcast applications with USB 3.0 peripherals and external USB CD/DVD drives in different rooms.

The extender offers reliable operation with all USB 3.0 devices, including USB hubs. The local

unit draws its power from the USB bus and the two-port remote unit receives its power from the included AC adapter. The remote unit supplies 900 mA power for each USB port.

The extender includes a local unit, a remote unit, a USB 3.0 cable, and a power supply. The units also have two LC connectors.

#### USB 3.0 Ultimate Fiber Extender IC502A

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.



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# **Machine Vision**

# 100% assembly line inspection

Machine vision technology—the image-based automatic inspection process—has matured greatly and is now becoming an indispensable tool in manufacturing to increase quality *and* profitability. USB 3.0, with its 5-Gbps throughput and ability to send power and data over the same line, has greatly contributed to this growth.



#### What is machine vision?

Machine vision is a system often used in assembly line applications that incorporates cameras, computers, software, and other hardware to automatically take pictures and inspect materials.

Machine vision uses a small industrial camera and lights mounted near an assembly line to take pictures of product as it passes. The images are then analyzed by software to determine if various aspects of the product meet acceptable specifications. For instance, if a label is misplaced, the bottle will be rejected. All of this is done at incredibly high speeds fractions of a second.

Years ago, machine vision systems were very expensive, costing hundreds of thousands of dollars. But in the last 15 years or so, advances in technology have brought the cost of machine vision down, making it a practical solution for 100 percent quality control. And the cost for implementing machine vision keeps decreasing as technological capabilities increase.

Machine vision is now an indispensable tool for quality assurance, sorting, and material handling in every industry, including electronics,

food processing, pharmaceuticals, packaging, automotive, etc. It is an economical way to make sure sub-spec product is rejected. Machine vision can be used to inspect for geometry, placement, packaging, labeling, seal integrity, finish, color, pattern, bar code, and almost any other parameter you can think of.

**Operator Interface** 

#### USB 3.0 and machine vision

USB 3.0 brings a number of advantages to machine vision systems. Because of its 5-Gbps throughput, ten times more than USB 2.0, it eliminates problems of stability and low latency for image transmission and camera control. USB 3.0 enables the transmission of higher-resolution, higher-frame rate video with no loss of quality.

USB 3.0 also sends data and power on the same line. This is enough to power a camera without worrying about a separate power supply or power line.

In addition, compared to older systems, USB 3.0 is plug-and-play, making it easy to swap out cameras and other hardware, such as USB 3.0 extenders, hubs, and other devices.





## **USB** Industrial Hubs



ICI104A Series, IC200



- Connect USB devices in industrial settings—without worrying about disconnects or ESD.
- High-retention ports keep USB cables tightly connected.
- Provides up to 15 kV ESD (electrostatic discharge) protection.
- Some models offer isolation from ground loops.
- Rated for extreme temperatures of -40° to +80° F.
- Meets multiple industrial certifications and approvals.



These industrial hubs are a great choice for factory, utility, engineering, and even healthcare applications. Considerably more rugged than ordinary, office-grade USB hubs, these are designed to connect USB peripherals in areas with lots of electromagnetic interference (EMI).

The hubs are also designed to prevent ESD (electrostatic discharge) from damaging connected USB devices—which makes them ideal for use near electronically noisy motor controls, and equipment with large electrical loads.

Because the hubs have high-retention ports, standard USB cables are a lot less likely to shake loose—even in environments with lots of equipment vibration. (Disconnecting them requires up to 3.2 pounds of force.)

#### Product Selection Guide

Product Code	USB 2.0	Ports	Speed	Usage
ICI104A	1	4 Port Hub + 1 Power Charging Port	Up to 480 Mbps	Light Industrial
ICI200A	1	4	Up to 480 Mbps	
ICI202A	1	4 with Isolation	Up to 480 Mbps	Listed for Class 1
ICI207A	1	7	Up to 480 Mbps	Division 2 Hazardous Areas
ICI208A	1	7 with Isolation	Up to 480 Mbps	

For full features and specs, go to blackbox.com. For pricing details, call 724-746-5500.

## USB↔RS-232 Converters



- Connect your USB 2.0 computer to RS-232 industrial equipment.
  - Add one or two COM ports.
  - Perfect for point-of-sale, medical, SCADA, and factory-automation applications.
  - Provide 3000-VDC optical isolation between ports.
  - Provide 15-kV ESD surge protection against spikes and ground loops.
  - All use RS-232 handshaking.
  - Powered from the USB interface.
- Mount to a DIN rail.
- Include 1-meter (3.2-ft.) USB cable.

#### **Product Selection Guide**

Product Code	USB 2.0	Ports	Speeds
ICD111A	1	RS-232 + (2) DB9	USB: 12 Mbps; RS-232: Up to 460.8 kbps

For full features and specs, go to blackbox.com. For pricing details, call 724-746-5500.

ICD111A



### Industrial Modems



#### MD1980A (9600 FP Modem)

- A tough modem for super-fast polling times in large, multidrop applications.
- Designed for industrial or outdoor use with temperature ranges from -40 to +85° C.
- Operates 4-wire full-duplex or 2-wire half-duplex over a voice leased line.
- Flash poll speeds of 4800 or 9600 bps.
- Provides heavy-duty surge protection.
- Adaptive equalizer with DSP technology.
- Auto RTS enables multidrops for devices with 3-wire data interfaces and no RTS control signal.

#### Modem 202



#### Modem 202

- Supports the Bell 202 leased-line standard.
- Use it as a modem or in pairs as line drivers for links up to 32 km (20 miles) long over your own twisted-pair lines.
- Supports voice-band Frequency-Shift Keying (FSK) simplex or half-duplex operation at up to 1200 bps on two wires or full-duplex up to 1200 bps on four wires over nonswitched leased lines.

Modem 202	
For full features and specs, go to <b>blackbox.com</b> .	
For pricing details, call 724-746-5500.	

MD845A-R2



#### 9600 FP Modem, Standalone AC

MD1980A

For full features and specs, go to blackbox.com. For pricing details, call 724-746-5500.

#### Modem 202T



MD1970A

#### Modem 202T

- The reliable modem for polling equipment.
- Supports the Bell 202T modem standard.
- Operates point-to-point or multipoint, for polled systems, full- or half-duplex, 2- or 4-wire.
- Works on copper lines that don't meet conventional specifications.
- Circuitry prevents carrier-detect and data errors over noisy lines.
- Anti-streaming capability.

Modem	202T

Standalone AC	MD1970A
Standalone DC	MD1970A-DC

For full features and specs, go to blackbox.com. For pricing details, call 724-746-5500.

## Need a custom cable or adapter for an industrial application?

Tell us what you want and we'll build it. Whether you need an octopus cable, special wiring, or different connectors, call Black Box. Or go online and design your own on our configurator page.

### Call 724-746-5500 or visit blackbox.com/go/Configurators.





## **NEMA Enclosures**



RMW5110AC-R2

#### ClimateCab Series, NEMA 12

- No cooling available? Use a self-contained ClimateCab<sup>™</sup>.
- Air conditioners or fans keep equipment cool. • NEMA 12 rated for protection against dirt,
- dust, lint, debris, and splashing liquids. • Choose from multiple cabinet styles including standalone, wallmount, and PC cabinets.
- See them at blackbox.com/go/ClimateCab.



RMN600A-R2

#### NEMA 12 Wallmount Cabinets

- These tough enclosures are built to keep components safe.
- Choose from 12U, 19U, and 26U models.
- Fully welded steel construction with M6 rails.
- Double hinged design enables access to the front and back of your equipment.
- Front and back sections lock independently.
- To see all three models, go to blackbox.com and search for RMN6\*.

NEMA RATE



RMN400A

#### DataSafe NEMA Outdoor Cabinet, NEMA 3, 3R, 4, 4X, 12

- Insulate your mounted equipment from harsh conditions indoors and out.
- Ideal for mounting equipment in industrial areas
- Built to withstand windblown rain and dust as well as extremes in temperatures.
- Mounts on a rooftop or in a tower telecomm setting.



#### Wireless Wallmount Cabinet, NEMA 4X

- Shelter equipment without shuttering the signals of wireless devices.
- NEMA 4X construction protects Wi-Fi equipment indoors or out-use it on walls, floors, and rooftops.
- Fiberglass construction enables Wi-Fi and WLAN signals to pass through unimpeded.



#### NEMA 4 Rated Fiber Optic Wallmount Enclosure

- Protect your fiber terminations in damp environments
- NEMA 4 rated for use in damp environments, basements, and below-ground floors prone to water leakage and seeping.
- This is just one in an entire line of fiber enclosures. Search for Fiber Enclosures at blackbox.com.



#### NEMA 4X Equipment Cabinet

- Secures wireless access points without interfering with the wireless signal.
- Perfect for securing access points in difficult environments—indoors or out.
- Constructed of molded fiberglass polyester that doesn't interfere with wireless signals.

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Wireless Wallmount Cabinet NEMA 4X	RM100A
Rackmount Fiber Panel NEMA 4	JPM4001A-R2
Equipment Cabinet NEMA 4X	RM900A

For full features and specs, go to **blackbox.com**. For pricing details, call 724-746-5500.





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Introduction Commercial

# **Commercial Switches**

# Choosing the right switch for the job.

Black Box can help you choose the right switch for your application, whether it's a Layer 3 switch for the data center, a Layer 2 access switch for your telecom closets, or a compact, desktop switch for a conference room. We can even advise you on what switches to use for specialty applications, such as video over IP.

#### LAN Access Switches

These switches are the workhorses of your network. Whether you have a small remote office and need only a few switches or are on a large-campus-size LAN that requires many switches, you'll find the right one here. By choosing the right switch, you can more efficiently manage data, voice, video, even PoE applications; improve network operations; and enhance the user experience.

Black Box offers a wide ranges of switches that meet the needs of enterprise networks, data centers, and smaller organizations across every industry and sector. When choosing a switch, consider how the switch will be used in your network and what your network needs are now and for at least the next five years. Look for a switch that gives you resiliency, scalability, and flexibility for a strong, communications environment.

In addition, most Black Box LAN access switches integrate Quality of Service (QoS) to ensure your network supports multiservice traffic, a higher backplane capability, low-latency, and other applications that coexist with data such as multimedia and PoE. Black Box also offers a number of Eco switches that minimize power consumption.

See Black Box commercial switches on pages 50, 53-59. For industrial switches, see pages 12-23.

As always, if you need advice on choosing the right switch, call Black Box Tech Support at 724-746-5500.

#### **Desktop Switches**

Sometimes you need smaller, compact, desktop switches that can you can deploy almost anywhere: in conference rooms for visitors, at trade shows, in retail establishments for PoS connections and kiosks, in test labs, for temporary workgroups, and more. Typically, they are simple, unmanaged, plug-and-play switches. Black Box desktop switches include:

• 4-8 ports

• 10-/100-/1000-Mbps or 10-/100-Mbps speeds

See these switches on pages 51-52.



Gigabit Layer 3 Stackable Switch with 10-GbE Uplinks, page 59



Gigabit Ethernet Managed Layer 2 SFP Fiber Switch with 10-GbE Uplink, page 57



Gigabit Ethernet Managed Layer 2 Switches with PoE, Eco, page 55



Gigabit Ethernet Unmanaged Layer 2 Switches with PoE, page 52

#### Product Selection Guide

	Ports	Unmanaged			Managed			
	FE or GE	Copper	FO Uplinks	10 Gig SFP+	Copper	FO Uplinks	10 Gig SFP+	
Rackmount	48	—	—	—	1	1	1	
	24	1	✓	—	1	1	1	
	16	1	✓	—	1	1	—	
Desktop	4–8	1	<ul> <li>Image: A second s</li></ul>	_	1	1	_	



Fast Ethernet Unmanaged Desktop Switches, page 51

# Layer 2, 3, and 4 Switches

With the rapid development of computer networks over the last decade, high-end switching has become one of the most important functions of a network for moving data efficiently and quickly from one place to another.

Here's how a switch works: As data passes through the switch, it examines addressing information attached to each data packet. From this information, the switch determines the packet's destination on the network. It then creates a virtual link to the destination and sends the packet there.

The efficiency and speed of a switch depends on its algorithms, its switching fabric, and its processor. Its complexity is determined by the layer at which the switch operates in the OSI (Open Systems Interconnection) Reference Model.

OSI is a layered network design framework that establishes a standard so that devices from different vendors work together. Network addresses are based on this OSI Model and are hierarchical. The more details that are included, the more specific the address becomes and the easier it is to find.

The Layer at which the switch operates is determined by how much addressing detail the switch reads as data passes through.

Switches can also be considered MAC- or IP-level. A MAC-level switch operates in Layer 2 of the OSI Model and can also operate in a combination of Layers 2 and 3. IP-level switches operate in Layer 3, Layer 4, or a combination of the two.

#### Layer 2 Switches (The Data-Link Layer)

Layer 2 switches operate using the data link (MAC) layer addresses. Link-layer, hardware, or MAC-layer addresses identify individual devices. Most hardware devices are permanently assigned this number during the manufacturing process.

Switches operating at Layer 2 are very fast because they're just sorting MAC addresses, but they do not look at the Layer 3 portion of the packet to learn anything more.

#### Layer 3 Switches (The Network Layer)

Layer 3 switches use network or IP addresses that identify locations on the network. A location can be a LAN workstation, a location in a computer's memory, or even a different packet of data traveling through a network.

Switches operating at Layer 3 take more time examining packets than Layer 2 devices and incorporate routing functions to actively calculate the best way to send a packet to its destination.

#### Layer 4 Switches (The Transport Layer)

Layer 4 of the OSI Model coordinates communications between systems. Layer 4 switches are capable of identifying which application protocols (HTTP, SNTP, FTP, and so forth) are included with each packet, and they use this information to hand off the packet to the appropriate higher-layer software. Layer 4 switches make packet-forwarding decisions based not only on the MAC address and IP address, but also on the application to which a packet belongs.

Because Layer 4 devices enable you to establish priorities for network traffic based on application, you can assign a high priority to packets belonging to vital in-house applications, such as e-mail and video conferencing, with different forwarding rules for low-priority packets such as generic HTTP-based Internet traffic.

Layer 4 switches also provide an effective wire-speed security shield for your network because any company- or industry-specific protocols can be confined to only authorized switched ports or users. This security feature is often reinforced with traffic filtering and forwarding features.

#### Speed vs. Capability

As the layers increase in switches, so does the CPU power and processing time (latency) of the switch. The trade-off for more control and capabilities in a higher layer switch is less speed and increased power consumption. Lower layer switches are faster and use less processing power. Choosing a switch that matches your network needs creates maximum networking efficiency.

	OSI Layer 2	OSI Layer 3	OSI Layer 4
	Sort packets by MAC address	Sort packets by MAC address	Sort packets by MAC address
	<ul> <li>More than two ports—usually four or more</li> </ul>	<ul> <li>Route packets by IP address</li> </ul>	<ul> <li>Route packets by IP address</li> </ul>
	<ul> <li>May support multiple network speeds and</li> </ul>	<ul> <li>More than two ports—usually four or more</li> </ul>	<ul> <li>Prioritize packets by application</li> </ul>
tchoc	have autosensing ports	<ul> <li>May support multiple network speeds and</li> </ul>	• More than two ports—usually four or more
luies	Ports may be the same media type or may	have autosensing ports	<ul> <li>May support multiple network speeds and</li> </ul>
	be mixed media (copper and fiber)	<ul> <li>Ports may be the same media type or</li> </ul>	have autosensing ports
	<ul> <li>Fast and easy to configure</li> </ul>	may be mixed media (copper and fiber)	<ul> <li>Ports may be the same media type or may</li> </ul>

• Ports may be the same media type or may be mixed (copper and fiber)

Related

Swi

Industrial Switches: pages 12–23 Media Converters: pages 62–71 Industrial Media Converters: pages 24–26 Extenders: pages 72–79 Industrial Extenders: pages 27–34

FREE, Live, 24/7 Tech Support: Talk with an expert at **724-746-5500** or go to **blackbox.com/go/TS**.







## Video over IP Commercial

# **How to Implement Multicasting**

While IP multicasting has many benefits, it also presents challenges. Multicasting delivers identical data to multiple receivers simultaneously, without transmitting multiple copies. So, when multicast data enter a subnet, the natural reaction of the switches is to send the multicast data to all their ports. This is referred to as multicast flooding and means that all the ports in that subnet (or at least their network interfaces) are required to process that multicast data even if they are not "seeing" this data. This can cause more data to travel across the network and slow or overrun the network infrastructure. IGMP (Internet Group Management Protocol) offers a solution to this issue.



The Black Box MediaCento<sup>™</sup> IPX extends HDMI video over any IP network to as many as 250 distant screens—or to video walls. You can run the Black Box MediaCento IPX in unicast (one transmitter to one receiver) or multicast (one transmitter to many receivers) mode applications. The unit can also support a video wall, using multicast mode to output a single source video to a matrix of screens, so that you can project your HD content on a larger scale with one image divided over multiple video screens.

For MediaCento IPX multicasting applications, it's very important to choose the right Ethernet switch, one that can handle the requirements to multicast data in your network without flooding your IP infrastructure.

The recommended Black Box Ethernet switches for this application are the LGB Series of switches.

You will need Ethernet switches with these minimum features:

- Gigabit (1000-Mbps) or faster Ethernet ports
- Support for IGMP v2 (or v3) snooping

• Support for Jumbo frames (packets) up to 9216-byte size and you must enable Jumbo frames when configuring the switches

• High bandwidth connections between switches, preferably multi-Gigabit speed and or multiple slower links using Link Aggregation Control Protocol (LACP)

You should also:

• Look specifically for switches that perform their most difficult tasks (for example, IGMP Snooping) using multiple dedicated processors—that is, the tasks are carried out in custom ASIC hardware rather than software routines on a general processor.

• Check the maximum number of concurrent "snoopable groups" each switch can handle and make sure that they meet





- B. Gigabit Web Smart Switch, 16-Port
- C. HDMI Cable
- D. Ethernet Cable (CAT6)





or exceed the number of MediaCento IPX transmitters that you will use to create multicast groups.

• Check the throughput speeds of the switch. Make sure that each port is full-duplex (that is, provides bidirectional communications) and that the up- and downstream data speeds for each port are 1 Gigabit per second (Gbps).

• Where possible, use the same switch manufacturer throughout a single subnet and, also if possible, the same model of switch— this will simplify configuration and lessen the chances of compatibility issues.

• When choosing Layer 3 switches for the network, at least one must be capable of operating as an IGMP requester.

Black Box recommends these switches for IP multicasting: LGB6000 series (page 59), LGB1100 series (page 54), and LGB5000 series (page 58).

FREE, Live, 24/7 Tech Support Talk with an expert at **724-746-5500** or go to **blackbox.com**/go/TS.



# Museum

# Flexible multicasting over a LAN.

For the best user experience, choose the right network infrastructure when deploying HD video-over-IP networks.

For example, in a science museum, interactive touchscreens and high-definition video graphics displays are vital to an exhibit's success. In these type of KVM extension applications where you want to distribute HD video across a network without any loss of quality and without slowing down the network, you need to understand what type of switches to use with your KVM extenders.

ServSwitch<sup>™</sup> Agility by Black Box enables you to deliver perfect video, audio, and USB connections across your LAN. With Agility and network switches that support IP multicasting, you can share HD content with as many receivers as you want.

Point-to-point connections typically use unicast connections. However, to support a large number of simultaneous receivers, IP multicast is a more efficient delivery protocol. Multicast uses network infrastructure efficiently by requiring the sender to transmit to a large number of receivers. After the sender transmits, the network nodes take care of replicating the packet to reach multiple receivers as necessary. Multicast also scales to a large receiver population by not requiring the sender to have prior knowledge of who or how many receivers there are for a given multicast. IGMP (Internet Group Management Protocol) is the IP mechanism that enables switches and routers to perform multicasting. IGMP was developed to help prevent network flooding by requiring individual hosts to opt into multicasts. It also provides a mechanism for switches and routers to determine whether any hosts located within their subnet want to receive a multicast.

In order to do IGMP snooping, Layer 2 switches must be enabled to do something beyond typical Ethernet switching: They now must be able to decipher data packets at Layer 3 to read the logical addressing and multicast instructions. This requires considerably more processing power than their normal "day job" of reading physical MAC addresses at Layer 2.



Implementing IGMP snooping on a switch with a slow processor can cause severe performance problems when data is transmitted at high rates and/or there are multiple IGMP groups to be monitored. If a switch cannot keep pace, it will cause backlogs where large numbers of data packets are arbitrarily discarded and/or it will resort to sending all multicasts to all ports, causing multicast flooding. Either way, this results in slow video updates and a poor user experience.

In recent years, the number of Layer 2 switches that support IGMP snooping has increased, but there is a wide variance in performance. For this reason, it's important to choose the right Ethernet switch for the job.

Therefore, for multicasting, use high-performance Layer 2 or Layer 3 Switches, such as the LGB5028A on **page 58**. Without the IGMP support, your network devices will be receiving so many multicasting packets, they will not be able to communicate with other devices. Plus, this switch gives you the bandwidth control needed to send video over a LAN.

In this illustration, the Gigabit Layer 2 Managed Switches (A) are connected the ServSwitch Agility (ACR1000 Series) transmitters in the data center (B). This is to enable the efficient transmission of video over the museum's IP network.

These transmitters then extend high-definition video to the appropriate receivers in the museum exhibit, including dual-head monitors (C) and touchscreens (D). Additionally, video and data are easily multicast to receiver units that are LCD display walls and monitors (E). Users can interact with any of the displays in this exhibit using touchscreen DVI monitors.

Learn more by reading the Black Box Explains on page 57: Multicasting video over a LAN: Use the right switch.

Series Name	Picture	Speed	Ports	PoE	Management	10G	All SFP	Layer 3
LBS000 Series LB016A LPB300 Series, page 51		100- Mbps	5–16	J	_	_	_	_
LGB304A LGB400 Series LGB4005A LPB1205A and LPB1300 Series, page 52		1000- Mbps	4–24	J	_	_	_	_
LPB700 Series, page 53		100- Mbps	8–24	s	Web Smart	_	_	—
LGB708A, LGB1100 and LGB2100 Series, page 54		1000- Mbps	8–48	_	Managed	_	_	_
LPBG700 and LPB2800 Series, page 55		1000- Mbps	8–48	J	Managed	_	_	_
LGB5120 Series, page 57		1000- Mbps	24–28	_	Managed	J	J	_
LGB5000 Series, page 58		1000- Mbps	28, 52	_	Managed	J	_	_
LGB6000 Series, page 59		1000- Mbps	24, 48	_	Managed	s	_	V

## Fast Ethernet Unmanaged Switches



#### LBS000 Series (USB-Powered 10/100 Switches) LB016A (Pure Networking 10/100 Ethernet Switch)



#### LBS000 Series

- Quickly build a small network or add ports to an existing network.
- 10-/100-Mbps ports are autosensing for speed and duplex.
- Can be powered through a PC's USB port so there's no need to find a spare outlet. Or use the included AC power supply.
- Auto MDI/MDI-X.

#### **Product Selection Guide**



#### LB016A

- Designed specifically for small- to medium-sized workgroups.
- 10-/100-Mbps ports are autosensing for speed and duplex.
- Auto MDI/MDI-X.
- Easy setup.
- Universal power supply.

Model	10/100 Ports	Form Factor	Power
LBS005A (USB-Powered 10/100 Switch)	5	Ultra-Compact	USB or AC
LBS008A (USB-Powered 10/100 Switch)	8	Ultra-Compact	USB or AC
LB016A (Pure Networking 10/100 Switch)	16	Desktop	100–240 VAC

For full features and specs, go to blackbox.com. For pricing details, call 724-746-5500

## Fast Ethernet Unmanaged Switches with PoE+



#### LPB300 Series (PoE+ Fast Ethernet Unmanaged Switches)

 Add VoIP phones, wireless access points, security cameras, and other PoE devices to your existing 10/100 Ethernet network.

- IEEE 802.3at compliant with 30 watts of power per port.
- Powers devices directly through your LAN cables.
- Eliminate the need to install power outlets.
- Automatically detects PoE devices.
- Provides 10/100 auto-detection and half-/full-duplex operation.



- Supports Auto MDI/MDI-X on all ports.
- Every port supports simultaneous 200-Mbps rates in full-duplex mode for smooth operations.
- Transmit over CATx UTP and STP cable.

#### **Product Selection Guide**

Model	10/100 Ports	Form Factor	Power	PoE
LPB308A	8	Rackmount	100–240 VAC (120 W)	PoE+
LPB316A	16	Rackmount	100–240 VAC (408 W)	PoE+

For full features and specs, go to blackbox.com. For pricing details, call 724-746-5500.

LANs, WANs, and Beyond: blackbox.com/networking.

## Gigabit Unmanaged 10/100/1000 Ethernet Switches



#### LGB304A, LGB400 Series, LGB4005A

- The LGB304A can be powered through the PC's USB port, so there's no need to find a spare outlet.
- LGB4005A, with five autosensing 10-/100-/1000-Mbps ports, is ideal for small networks.
- The LGB400 series has 8, 16, or 24 autosensing 10-/100-/1000-Mbps ports.
- Easy plug-and-play operation.
- Autonegotiation makes your job easy: every port automatically senses the mode/speed of connected devices.
- Auto MDI/MDI-X on each port. No need for crossover cables.



#### **Product Selection Guide**

Model	10/100/1000 Ports	Form Factor	Power
LGB304A	4 RJ-45	Desktop	USB/115 VAC
LGB4005A	5 RJ-45	Desktop	100–240 VAC
LGB408A	8 RJ-45	Desktop	100–240 VAC
LGB416A	16 RJ-45	Rackmount	100–240 VAC
LGB424A	24 RJ-45	Rackmount	100–240 VAC

These are some of the most popular Gigabit Switches. To see all Gigabit Switches, go to **blackbox.com**. For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

## Gigabit Unmanaged Ethernet Switches with PoE



#### LPB1205A, LPB1300 Series

- Add up to eight VoIP phones, wireless access points, security cameras, terminals, and other PoE devices to your existing 10/100/1000 Ethernet network.
- IEEE 802.3af or 802.3at compliant.
- LPB1205A features four PoE ports and one uplink port. Each PoE port provides 15.4 watts of power.
- LPB1300 series features five or eight shielded PoE ports that provide 30 watts of power per port.



- Automatically detect PoE devices.
- All ports support 10-/100-/1000-Mbps Ethernet with auto-detection for speed and duplex.

#### **Product Selection Guide**

Model	10/100/1000 Ports	Form Factor	Power	PoE
LPB1205A	5	Desktop	100–240 VAC (60 W)	PoE (802.3af)
LPB1305A	5	Desktop	100–240 VAC (200 W)	PoE+ (802.3at)
LPB1308A	8	Desktop	100–240 VAC (200 W)	PoE+ (802.3at)

These are some of the most popular Gigabit Switches. To see all Gigabit Switches, go to **blackbox.com**. For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

## Fast Ethernet Web Smart Switches with PoE



#### LPB708A, LPB716A, LPB724A (10/100 PSE Web Smart Switches)

LPB716A



PoE IP Phones

PoE IP Security Cameras

Support for 802.1p QoS with up to four queues.802.1Q VLAN supports two groups.

Inject power into Ethernet cable for PoE.

• Use a Web browser to configure and manage the switch.

• 24-port model has two dual-media ports that can be used as SFP ports.

• Auto-MDI/MDI-X on all copper ports.

#### **Product Selection Guide**

Model	10/100 Ports	SFP Ports	Form Factor	PoE	Power
LPB708A	8	—	Desktop	PoE	100–240 VAC (130 W)
LPB716A	16	—	Rackmount	PoE	100–240 VAC (260 W)
LPB724A	24	2	Rackmount	PoE	100–240 VAC (390 W)

For full features and specs, go to blackbox.com. For pricing details, call 724-746-5500.

# Expanding your small network.

By Keith Ross, Director, Networking Products —Add an Ethernet switch —

Because most home and small-office networks are now Internet connected, they're generally built around a router such as the Pure Networking<sup>™</sup> Wireless Router. These all-in-one network devices integrate routing with wireless and two to four Ethernet switch ports. To add more Ethernet ports to the tiny network created by the router, just connect an Ethernet switch to one of the router's LAN ports using a CAT5 or higher cable.

The switch you choose should support the same network speed as the router—100-Mbps Fast Ethernet is the most common choice for small networks. Older switches may not support MDI/MDI-X autocrossover; in this case, you'll need a straight-pinned cable if you're using a switch uplink port, or a cross-pinned cable if using a switch LAN port. Most of today's small Ethernet switches, however, automatically sense and adapt to network speed and cable pinning, making them almost foolproof—just plug them in to add more ports.



## **Gigabit Ethernet Managed Switches**



#### LGB708A (Gigabit Web Smart Switch)

 Features eight autosensing, autonegotiating 10-/100-/1000-Mbps ports; two are dual-media ports, which may be used as Gigabit Ethernet UTP or SFP ports.

I GB2124A

- Accepts two 1250-Mbps SFPs.
- Configure and manage the switch through your Web browser.
- Password-protected access.



#### LGB2100 Series (Gigabit Web Smart Switches)

- Includes dual-media UTP/SFP ports for fiber Gigabit Ethernet uplinks with an SFP Optical Transceiver.
- Web smart features provide easier manageability, security, QoS, and performance.
- Provides enhanced QoS support for real-time applications.
- Fanless to reduce noise, moving parts, and the chance for failure.
- Port mirroring enables you to isolate network errors.
- 802.3az Energy-Efficient Ethernet saves on power costs.
- Reduces power consumption by turning off ports not in use.

#### LGB1100 Series (Gigabit Managed Switches)

- Set up versatile high-speed switching with Gigabit SFP uplinks using these energy-efficient L2+ switches.
- LGB1126A has (20) 10/100/1000 Gigabit UTP ports, plus (4) dual-media UTP/SFP and (2) SFP ports that support 100/1000 Gigabit fiber speeds.
- LGB1148A provides (44) 10/100/1000 Gigabit UTP ports, plus (4) dual-media 100/1000 Gigabit UTP/SFP ports.
- Web-based management with full SNMP support.
- Configurable QoS parameters for prioritizing traffic.
- Bundle ports using 802.3ad LACP aggregation.
- IGMP for limiting bandwidth-heavy multicast traffic.
- Ideal for video streaming, VoIP, and Wi-Fi client applications.



LGB1126A

These switches feature fixed ports plus SFP slots for additional connectivity as well as the management and security you need for your SMB or entry-level enterprise network. Plus, you can switch packets efficiently for real-time applications.

The dual-media ports can be used either as a normal UTP Ethernet port or adapted to 100- or 1000-Mbps fiber through the use of an SFP.

Ideal for mixed-speed and legacy-integration environments, the switches enable you to connect twisted-pair Ethernet, Fast Ethernet, and Gigabit Ethernet segments to devices on other ports or to a fiber optic backbone plugged into the switches' SFP slots.

#### **Product Selection Guide**

Model	10/100/1000 UTP Ports	Dual Media SFP Ports	SFP Ports	Management	Form Factor
LGB708A (Gigabit Web Smart Switch)	6	2	_	Web Smart	Rackmount
LGB2118A (Gigabit Web Smart Switch)	16	2	—	Web Smart	Rackmount
LGB2124A (Gigabit Web Smart Switch)	20	4	—	Web Smart	Rackmount
LGB1126A (Gigabit Managed Switch)	20	4	2	Managed	Rackmount
LGB1148A (Gigabit Managed Switch)	44	4	_	Managed	Rackmount

For full features and specs, go to blackbox.com. For pricing details, call 724-746-5500.

## Gigabit Ethernet Managed Switches with PoE



#### LPBG700 Series (Gigabit PoE Web Smart Switches)

- Feature 16 or 24 autosensing, autonegotiating 10-/100-/1000-Mbps ports; four are dual-media ports, which may be used as Gigabit Ethernet UTP or SFP ports.
- Accept 1250-Mbps SFPs.
- Use a Web browser to configure and manage the switch.
- Inject power into Ethernet cable for PoE devices such as wireless access points and security cameras.
- Auto MDI/MDI-X on all copper ports.
- Include IEEE 802.1Q VLAN tagging and 802.1p QoS.
- Support Jumbo Frames and IGMP.



#### LPB2800 Series (Gigabit PoE+ Managed Switches, Eco)

- These high-speed managed switches provide up to 380 watts of power, depending on model, to wireless APs, IP cameras, VoIP phones, and more.
- Have 8, 20, or 44 10/100/1000BASE-T UTP ports plus 2 or 4 dual-media UTP/SFP ports. LPB2826A also has (2) SFP ports.
- Power 802.3af PoE or high-powered 802.3at PoE+devices through
- the data line.
- Full SNMP management plus Web-based management.
- Support for VLAN and QoS.
- 802.3az Energy-Efficient Ethernet saves on power costs.
- Enterprise-class security.

The LPB2800 Series (Gigabit Ethernet Managed Switches) add high-speed ports—including dual-media ports—while offering the management and security features your enterprise network needs.

The switches are fully managed, supporting SNMP version 1, 2c, and 3. The embedded RMON software agents support RMON groups 1 (history), 2 (statistics), 3 (alarms), and 9 (events).

The integral Web server enables Web-based management via Web browser. This GUI interface enables switch configuration, system dashboard, maintenance, and monitoring.

The wide range of management and support features also includes dual image, port mirroring, LLDP, sFlow<sup>®</sup>, UPnP<sup>®</sup>, IPv6, SSH, RADIUS, DHCP Client/DHCPv6 Client, SNTP, cable diagnostics, ping, syslog, and Telnet client with SSH security.



Top: LPBG2810A; middle: LPBG2826A; bottom: LPBG2848A

Support for up to four simultaneous VLANs enables you to segment traffic with port-based, 802.1Q tag-based, or MAC-based VLANs. VoIP traffic is automatically assigned to a voice-specific VLAN to maintain quality. 802.1p Layer 2 quality of service (QoS) enables prioritization of time-sensitive applications such as VoIP and video.

You get enterprise-class security features, too. 802.1X port-based network access control authenticates devices connecting to your network. The switch also supports SNMPv3 cryptographic security, SSH, and SSL. Plus, you can set up a guest VLAN that enables visitors to access the Internet without also giving them access to the corporate network.

#### **Product Selection Guide**

Model	10/100/1000 UTP Ports	Dual Media SFP Ports	SFP Ports	Form Factor	PoE	Power
LPBG716A (Gigabit PoE Web Smart Switch)	12	4	—	Rackmount	PoE	100–240 VAC (260 W)
LPBG724A (Gigabit PoE Web Smart Switch)	20	4	—	Rackmount	PoE	100–240 VAC (390 W)
LPB2810A (Gigabit PoE+ Managed Switch)	8	2	—	Desktop	PoE+	100–240 VAC (130 W)
LPB2826A (Gigabit PoE+ Managed Switch)	20	4	2	Rackmount	PoE+	100–240 VAC (370 W)
LPB2848A (Gigabit PoE+ Managed Switch)	44	4	—	Rackmount	PoE+	100–240 VAC (380 W)

For full features and specs, go to blackbox.com. For pricing details, call 724-746-5500.

LANs, WANs, and Beyond: blackbox.com/networking.

# Multicasting video over a LAN: Use the right switch.



In video extension applications where you want to distribute HD video across a network, you need to understand how it works and what kind of networking equipment to use with your extenders.

## Unicasting vs. multicasting, and why an unmanaged Layer 2 switch isn't sufficient.

Unicasting is sending data from one network device to another (point to point); in a typical unicast network, unmanaged Layer 2 switches easily support these types of communications. But multicasting is transmitting data from one network device to multiple users. When multicasting with unmanaged Layer 2 switches, all attached devices receive the packets, whether they want them or not. Because a multicast header does NOT have a destination IP address, an unmanaged network switch (a Layer 2 switch without supported capabilities) will not know what to do with it. So the switch sends the packet out to every network port on all attached devices. When the client or network interface card (NIC) receives the packet, it analyzes it and discards it if not wanted.

# The solution: a Layer 2 switch with IGMPv2 or IGMPv3 and packet forwarding.

Multicasting with Layer 2 IGMP-capable switches is much more efficient than with unmanaged Layer 2 switches because it identifies the multicast packet and sends it only to the intended receivers. An unmanaged switch sends the multicast packets to every device and, if there are many sources, the network will slow down because of all the traffic. And, without IGMPv2 or IGMPv3 snooping support, the switch can handle only a few devices sending multicasting packets.

Layer 2 switches with IGMP support, however, "know" who wants to receive the multicast packet and who doesn't. When a receiving device wants to tap into a multicasting stream, it responds to the multicast broadcast with an IGMP report, the equivalent of saying, "I want to connect to this stream." The report is only sent in the first cycle, initializing the connection between the stream and receiving device. If the device was previously connected to the stream, it sends a grafting request for removing the temporary block on the unicast routing table. The switch can then send the multicast packets to newly connected members of the multicast group. Then, when a device no longer wants to receive the multicast packets, it sends a pruning request to the IGMP-supported switch, which temporarily removes the device from the multicast group and stream.

Therefore, for multicasting, use routers or Layer 2 switches that support the IGMP protocol. Without this support, your network devices will be receiving so many multicasting packets, they will not be able to communicate with other devices using different protocols, such as FTP. Plus, a feature-rich, IGMP-supported Layer 2 switch gives you the bandwidth control needed to send video from multiple sources over a LAN.

## Gigabit Ethernet Managed L2 SFP Fiber Switches



#### LGB5120 Series

- Add SFPs when you need to expand your network for maximum flexib ility and scalability.
- Super versatility. Add a 10-Gbps fiber link when you expand your 100/1000-Mbps copper/fiber network.
- Provides superior manageability, security, QoS, and performance.
- Bundle multiple ports for higher bandwidth with Link Aggregate Control Protocol aggregation.
- Supports guest VLAN, voice VLAN, and port-, tag-, and protocol-based VLANs.
- Programmable QoS classification and prioritization.
- Robust security with VLAN capabilities.
- Supports AC and DC dual-power inputs.

These copper/fiber L2 switches give you the flexibility to select a variety of ranges with SFP transceivers. The switches' intelligent features enable you to improve the availability of your critical business applications, protect your sensitive information, and optimize network bandwidth to deliver information and applications more effectively.

#### Advanced management functions.

These next generation L2 switches support advanced security management capabilities and network features. You'll get extensive management capabilities, greater bandwidth control, and QoS for switching in VoIP and other real-time, high-performance applications. The switches support IPv6/IPv4. They also support s-Flow, giving you better network visibility and performance optimization.

#### Pack up the trunk.

To provide more bandwidth to a specific application or segment, combine ports using the switches' 802.3ad Link Aggregate Control Protocol (LACP) capabilities. With this bandwidth aggregation feature, the combined ports create a multilink trunk for load sharing.

#### High-level service.

The switches offer extensive Quality of Service support including prioritization, classification, scheduling, rate limitations, and more.

#### Safe and secure.

Your network is safe with these switches. They have a 32K MAC table and offer MAC address filtering and VLAN capabilities so you can segregate networks.

#### Multiple management options.

Monitor, configure, and control the switch via the Web interface. The LGB5128A can also be managed through Ethernet using CLI or the serial port.

#### Green.

These switches feature IEEE 802.3az energy-efficient Ethernet, which scales down power consumption during periods of low data activity. This feature adds energy savings of up to 50%.

#### SFPs.

For the SFP slots, order SFP modules, such as the 850-nm Multimode Gigabit SFP Module (LFP411) and 1310-nm Single-mode Gigabit SFP Module (LFP412). For information on SFP module compatibility, contact our FREE Tech Support. See **page 21** for more information about SFPs.



#### **Product Selection Guide**

Model	Dual Media SFP Ports	SFP Ports	SFP+ Ports	Form Factor
LGB5124A	4	20	—	Rackmount
LGB5128A	4	20	4	Rackmount

For full features and specs, please go to **blackbox.com**. For pricing details, call **724-746-5500**.

## Gigabit Ethernet Managed Switches with 10-GbE Uplinks



#### LGB5000 Series



LGB5052A: top: front view; bottom: rear view

- Provides (20) or (44) 10/100/1000BASE-T UTP ports, (4) dual-media UTP/SFP ports, and (4) SFP+ ports that support speeds up to 10 Gbps.
- Full SNMP management plus Web-based management.
- Support for VLAN and QoS.
- Supports IEEE 802.1x port-based network access control.
- 802.3az Energy-Efficient Ethernet saves on power costs.

#### Versatile high-speed switching with 10-GbE uplinks.

The LGB5000 Series Gigabit Ethernet Managed Switches add 28 or 52 high-speed ports—including four 10-GBE SFP+ ports—while offering the management and security features your enterprise network needs.

These capable Layer 2 switches offer 20 or 44 autosensing 10-/100-/ 1000-Mbps RJ-45 Ethernet ports. They also have four dual-media ports, each of which consists of an 10-/100-/1000-Mbps RJ-45 port plus an SFP port. These dual-media ports can be used either as a normal UTP Ethernet port or adapted to 100- or 1000-Mbps fiber through the use of an SFP. Additionally, the switches feature four SFP+ ports which support 1- or 10-Gbps uplinks through the use of SFP+ transceivers.

#### Fully manageable.

The switches are fully managed, supporting SNMP version 1, 2c, and 3. The embedded RMON software agents support RMON groups 1 (history), 2 (statistics), 3 (alarms), and 9 (events).

The integral Web server enables Web-based management via a Web browser. This GUI interface enables switch configuration, system dashboard, maintenance, and monitoring.

# The wide range of management and support features also includes dual image, port mirroring, LLDP, sFlow<sup>®</sup>, UPnP<sup>®</sup>, IPv6, SSH, RADIUS, DHCP Client/DHCPv6 Client, SNTP, cable diagnostics, ping, syslog, and Telnet client with SSH security.

#### Support for VLAN and QoS.

Support for up to four simultaneous VLANs enables you to segment traffic with port-based, 802.1Q tag-based, or MAC-based VLANs.

802.1p Layer 2 quality of service (QoS) enables prioritization of time-sensitive applications such as VoIP and video.

#### Secure.

You get enterprise-class security features, too. 802.1X port-based network access control authenticates devices connecting to your network. The switches also support SNMPv3 cryptographic security, SSH, and SSL. Plus, you can set up a guest VLAN that enables visitors to access the Internet without also giving them access to the corporate network.

#### Go green.

The LGB5000 Series features IEEE 802.3az energy-efficient Ethernet, which scales down power consumption during periods of low data activity. This feature adds up to energy savings of up to 50%.

Cable length detection adjusts signal strength to the cable length, reducing power consumption on shorter cable runs.

#### **Product Selection Guide**

Model	10/100/1000 Ports	SFP Ports	SFP+ Ports
LGB5028A	20	4	4
LGB5052A	44	4	4

For full features and specs, go to blackbox.com. For pricing details, call 724-746-5500.

## Gigabit L3 Managed Stackable Switches with 10-GbE Uplinks



#### LGB6000 Series



Front views: top: LGB6026A; bottom: LGB6050A

- Full wire-speed L2 switching and L3 routing.
- Feature 24 or 48 autosensing, autonegotiating 10-/100-/1000-Mbps ports; four are dual-media ports, which may be used as Gigabit Ethernet UTP or SFP ports.
- Also feature two 10-Gbps slots that enable you to create high-speed fiber uplinks using an Uplink Module (LGB6001C) and an SFP+ transceiver.
- Stackable; a stack of up to eight switches can be managed as one unit with up to 320-Gbps throughput.
- Full range of enterprise features including 802.1p QoS, 802.1x access control, and support for 802.11q VLAN.
- Support for RIP, OSPF, PIM, DSCP, and ACLS.

#### Product Selection Guide

Model	10/100/1000 Ports	SFP Ports	SFP+ Ports	Form Factor
LGB6026A	24	4	2	Rackmount
LGB6050A	48	4	2	Rackmount

For full features and specs, go to blackbox.com. For pricing details, call 724-746-5500.

# The difference between unmanaged, managed, and Web smart switches.

#### By Jon Diegan, Product Engineer

With regard to management options, the three primary classes of switches are unmanaged, managed, and Web smart. Which you choose depends largely on the size of your network and how much control you need over that network.

Unmanaged switches are basic plug-and-play switches with no remote configuration, management, or monitoring options, although many can be locally monitored and configured via LED indicators and DIP switches. These inexpensive switches are typically used in small networks or to add temporary workgroups to larger networks.

Managed switches support Simple Network Management Protocol (SNMP) via embedded agents and have a command line interface (CLI) that can be accessed via serial console, Telnet, and Secure Shell. These switches can often be configured and managed as groups. More recent managed switches may also support a Web interface for management through a Web browser.

These high-end switches enable network managers to remotely access a wide range of capabilities including SNMP monitoring; enabling and disabling individual ports or port Auto MDI/MDI-X; port bandwidth and duplex control; IP address management; MAC address filtering; Spanning Tree; port mirroring to monitor network traffic; prioritization of ports for quality of service (QoS); VLAN settings; 802.1X network access control; IGMP snooping; and link aggregation or trunking.

Managed switches, with their extensive management capabilities, are at home in large enterprise networks where network administrators need to monitor and control a large number of network devices.

Web-smart switches—sometimes called smart switches or Webmanaged switches—have become a popular option for mid-sized networks that require management. They offer access to switch management features such as port monitoring, link aggregation, and VPN through a simple Web interface via an embedded Web browser. What these switches generally do not have is SNMP management capabilities or a CLI. Web-smart switches must usually be managed individually rather than in groups.

Although the management features found in a Web-smart switch are less extensive than those found in a fully managed switch, these switches are becoming smarter, with many now offering many of the features of a fully-managed switch.

## PoE Mid-Span

Commercial

## Managed and Unmanaged PoE Midspan Injectors



LPJ000 Series (Gigabit PoE and PoE+ Midspan Injectors)



 Use to power various VoIP phones, security system cameras, wireless network access points, Bluetooth<sup>®</sup> access points, and other PoE- or PoE+-compatible equipment.

- Avoids the cost and hassle of installing AC power at remote cameras or door scanners.
- Provides a minimum of 15.4 watts to every 802.3af port and a minimum of 25.5 watts to every 802.3at port.



Watch the Power over Ethernet Video

The LPJ000 Series (Gigabit PoE and PoE+ Mid-Span Injectors) adds power to Ethernet for powering PoE devices.

PoE (802.3af) injectors provide up to 15.4 watts of power to PoE devices; PoE+ (802.3at) injectors provide up to 25.5 watts per port to support more high-powered devices such as wireless access points, PTZ security cameras, IP phones containing streaming video displays, and LCDs. 802.3at injectors are backwards compatible with 802.3af devices.

The LPJ000 Series is easy to install—literally plug-and-play. They automatically detect whether a connected device is PoE compliant and only send power to PoE devices. 802.3at injectors perform a classification sequence, determining if connected devices require 802.3at-level power. All include overvoltage, overcurrent, and overtermperature overload and short circuit protection.

Managed multiport models feature a GUI and full SNMP management for easy integration into your managed network.

#### Selection Guide | PoE/PoE+ Gigabit Injectors

		PoE (802.3af)		PoE+ (8	02.3at)
Туре	Ports	Unmanaged	Managed	Unmanaged	Managed
Desktop	1	LPJ001A-F	—	LPJ001A-T	—
	8	LPJ008A-F	LPJ008A-FM	LPJ008A-T	LPJ008A-TM
Rackmount	16	LPJ016A-F	LPJ016A-FM	LPJ016A-T	LPJ016A-TM
	24	LPJ024A-F	LPJ024A-FM		_

These are some of the most popular injectors in this series. To see all the products in this series, go to blackbox.com and enter LPJO\* in the search box.

## Gigabit PoE+ Splitter



- Brings PoE power to non-PoE devices.
- Splits a PoE or PoE+ signal into separate power and data sources.
- Enables you to use PoE or PoE+ to power non-PoE devices.
- Supports Gigabit Ethernet as well as 802.3af PoE and 802.3at PoE+.
- Provides up to 12-VDC 1.7-amp power to a non-PoE device.
- Features autosensing, autonegotiating 10-/100-/1000-Mbps ports.

#### Gigabit PoE+ Splitter

LPS2001

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

### Fast Ethernet and Gigabit Ethernet PoE Repeaters



LPR110 LPR1100 Series



- Extend Ethernet and PoE up to 300 meters.
- Delivers IEEE 802.3af standard power, excellent for VoIP phone systems, remote access points, and IP cameras.
- Autosensing, autonegotiating 10-/100-Mbps or 10-/100-/1000-Mbps Ethernet ports.
- Auto MDI/MDI-X means you never need a crossover cable.
- Plug-and-play ease of use.

The 802.3af-compliant LPR Series PoE Repeaters enable you to extend PoE connections beyond the 100-meter limit to access faraway PoE devices.

The repeaters pass on both data and power, so they need no separate power supply. Add one repeater for an additional 100 meters (328 ft.) or daisychain two repeaters to extend the reach of your PoE an additional 200 meters (656 ft.) on top of the standard PoE distance of 100 meters (328 ft.) for a total reach of 300 meters (984 ft.) Because each repeater uses about 2.5 watts, we do not recommend daisychaining beyond two units.



Two repeaters daisychained support a PoE PD end device up to 6.49 watts. Installation is easy—just plug in the Ethernet cable and go.

The LPR1131 repeater provides one (1) 10/100/1000 PD input port, one (1) 10-/100-/1000-Mbps PSE output port, and a standard 3-port 10/100/1000 switch so you can connect other devices.

#### LPR Series (PoE Repeaters)

Fast Ethernet, PoE, (1) PD In, (1) PoE Out	LPR110
Gigabit PoE, (1) PD In, (1) PoE Out	LPR1101
Gigabit PoE, (1) PD In, (1) PoE Out, and (3) RJ-45 Ports	LPR1131

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

# Power over Ethernet (PoE)

#### What is PoE?

The seemingly universal network connection, twisted-pair Ethernet cable, has another role to play, providing electrical power to low-wattage electrical devices. Power over Ethernet (PoE) was ratified by the Institute of Electrical and Electronic Engineers (IEEE) in June 2000 as the 802.3af-2003 standard. It defines the specifications for low-level power delivery—roughly 13 watts at 48 VDC—over twisted-pair Ethernet cable to PoE-enabled devices such as IP telephones, wireless access points, Web cameras, and audio speakers.

The basic 802.3af standard was joined by the IEEE 802.3at PoE standard (also called PoE+ or PoE plus), ratified on September 11, 2009, which supplies up to 25 watts to larger, more power-hungry devices. 802.3at is backwards compatible with 802.3af.

#### How does PoE work?

Ethernet cable that meets CAT5 (or better) standards consists of four twisted pairs of cable, and PoE sends power over these pairs to PoEenabled devices. In one method, two wire pairs are used to transmit data, and the remaining two pairs are used for power. In the other method, power and data are sent over the same pair.

When the same pair is used for both power and data, the power and data transmissions don't interfere with each other. Because electricity and data function at opposite ends of the frequency spectrum, they can travel over the same cable. Electricity has a low frequency of 60 Hz or less, and data transmissions have frequencies that can range from 10 million to 100 million Hz.

#### Basic structure.

There are two types of devices involved in PoE configurations: Power Sourcing Equipment (PSE) and Powered Devices (PD).

PSEs, which include end-span and mid-span devices, provide power to PDs over the Ethernet cable. An end-span device is often a PoE-enabled network switch that's designed to supply power directly to the cable from each port.

Mid-span PoE injectors are PSE devices. They sit between non-PoE switches and power PD devices.

PDs are pieces of equipment like surveillance cameras, sensors, wireless access points, and any other devices that operate on PoE.

#### PoE benefits and applications.

- Use one set of twisted-pair wires for both data and low-wattage appliances.
- PoE works well for video surveillance with IP cameras, and powers Wi-Fi access points and VoIP phone systems.
- Save money by eliminating the need to run electrical wiring.
- Easily move an appliance with minimal disruption.
- If your LAN is protected from power failure by a UPS, the PoE devices connected to your LAN are also protected from power failure.

For more information about PoE, including a video, see the Resources section of **blackbox.com**.

### Selection Guide | Media Converters

Series Name		Form Factor	Speed	PoE / PoE +	BNC	SFP	SFP +
LMC400 Series LMC4000 Series, page 64		Micro Mini	10/100/1000- Mbps	_	_	V	_
LHC000 Series LHC5100 Series LMC000 Series LGC5100, page 65		Desktop	10/100/1000- Mbps	_	J	_	_
LMC11032A, page 66	ingunumun	Desktop	10 Gigabit	_	_	_	J
LPM600 Series LPS500A, LPD500A, <b>page 66</b>	Electronic Constantiant (Constantiant Constantiant Consta	Desktop	10/100/1000- Mbps	J	_	J	_
LGC5200 Series, page 67	A Communities and a communities of the communities	Desktop	10/100/1000- Mbps	J	_	J	_
LHC200 Series LGC200 Series, page 68	and a second sec	Desktop or Chassis	10/100/1000- Mbps	_	_	V	_
LHC000-R2 Series LGC000-R2 Series, page 69	C. C. A. Manual Ma Manual Manual Ma Manual Manual Ma Manual Manual Man	Miniature Desktop or Chassis	10/100/1000- Mbps	_	_	J	_
Flexpoint Series, page 70		Desktop or Chassis	10/100/1000- Mbps	_	J	J	_
LMC5000 Series LGC5000 Series, page 71		Modular Chassis	10/100/100- Mbps	_	J	1	_

Commercial Media Converters

# Why use IP for security?

Internet Protocol (IP) based video surveillance systems provide several benefits versus analog systems. Advantages include remote accessiblity, high image quality, event management, scalability, and cost effectiveness.

Power over Ethernet (PoE) sourcing equipment such as switches and media converters simplify installation of IP cameras by eliminating the need for AC power circuits at the camera location. Add a PoE media converter (page 67) and you have an easy way to power cameras and backhaul video traffic long distances over fiber.

Good quality images. Digital images don't lose quality in transmission. Simplified installation. Simply connect your security camera to the nearest network connection and assign an IP address.

Cabling. It's a lot easier to run one twisted-pair cable than to install electrical wiring. And it's much less expensive than an analog-based security system running over a coax cable.

Power options. PoE and PoE+ give you flexibility in terms of output power.



## Micro Mini Fast Ethernet and Gigabit Ethernet Media Converters



### LMC400 Series (Fast Ethernet) LMC4000 Series (Gigabit Ethernet)

- Bring fiber to the desktop conveniently and cost-effectively.
- Ultra compact, weighing only 2.5 ounces.
- Supports distances of up to 5 kilometers over multimode fiber or 30 kilometers over single-mode fiber.
- USB-powered for portability, or use them with the included power adapter.
- Models with SFP ports for 100-Mbps or 1000-Mbps Ethernet.

#### Product Selection Guide



Product Serie	Speed Options	Fiber Options	Distance Options	Connector Types	Power Options
LMC400 Serie (Fast Ethernet	s 10-/100-Mbps	Multimode	0.5 km (0.3 mi.)	ST	External
LMC4000 Serie (Gigabit Ethern	et) 10-/100-/1000-Mbps	Single-mode	12 km (7.5 mi.) 30 km (18.6 mi.)	SC SFP (LC)	USB

1

The LMC400 and LMC4000 Series Micro Mini Media Converters are ideal for bringing fiber to the desktop and for mobile applications where light weight, compact size, and low power requirements are critical.

These ultra-compact media converters are portable yet powerful. For extra versatility, they can be USB-powered, making it easy to provide fiber connectivity to locations where AC or DC power is unavailable, for instance, field-deployed fiber-to-the-laptop. For easy portability, the converters conveniently slip into a pocket or laptop carrying case.

The converters are plug-and-play with an RJ-45 port that autonegotiates for speed, duplex mode, and crossover functions for PCs with 10BASE-T, 100BASE-TX, and 1000BASE-T Ethernet.

Because they can be powered through a computer's USB 1.0 or 2.0 port, the converters are ideal for connections to fiber in areas where a spare power outlet may not be available. When plugged into a computer's USB port, the media converter shuts down automatically when you turn off the computer, which saves energy.

#### LMC400 Series (Micro Mini Media Converters, Fast Ethernet)

0-/100-/1000-Mbps Copper to 100-Mbps Duplex Fiber	
SFP	LMC400A
Multimode, 1310-nm, 5 km, ST	LMC401A
Single-Mode, 1310-nm, 30 km, ST	LMC403A

#### LMC4000 Series (Micro Mini Media Converters, Gigabit Ethernet )

10-/100-/1000-Mbps	Conner to	1000-Mbps Duplex Fiber
10710071000-10005	Copper to	1000-ivibps Duplex liber

LMC4000A
LMC4001A
LMC4003A

These are some of the most popular media converters. To see all the products in these series, go to **blackbox.com** and enter LMC40\* in the search box.

# Fiber NIC adapters vs. media converters.

You have two choices for making the connection from the fiber to a PC: a fiber network interface card (NIC)Ethernet adapter or a media converter like the Micro Mini Media Converter (**above**).

#### Fiber NIC Ethernet adapters:

- Powered from the PC—require no separate power provision.
- Require an open PCI or PCI-E slot in the PC.
- Can create driver issues that must be resolved.
- May be required in high-security installations that require a 100% fiber link to the desktop.

#### Media converters:

- No need to open the PC.
- Powered from an AC outlet or a PC's USB port.
- Don't require an open slot in the PC.
- Plug-and-play installation—totally transparent to data, so there are no driver problems; install in seconds.

## Fast Ethernet and Gigabit Ethernet Compact Media Converters with Internal Power Supplies



## LHC000 Series LHC5100 Series LGC5100 Series LMC000 Series





LGC5134A-R4



LMC001A-R5



Compact

1U size saves space.

#### Product Selection Guide

Product Series	Speed Options	Fiber Options	Distance Options	Connector Types	Power Options	
LGC5100	1000-Mbps					
LHC000 Series	100-Mbps	Multimode Single-Mode	Multimode Single-Mode	300 m (984 ft.) 2 km (1 2 mi )	ST	
LHC5100 Series	100-Mbps			Multimode Sinale-Mode	20 km (12.4 mi.)	SC
LMC000 Series	10-/100-Mbps		40 km (24.8 mi.) 80 km (49.7 mi.)	BNC		
LMC7000 Series	10-/100-Mbps					

- Simplified high-end copper-to-fiber conversion.
- Compact size means you can install them virtually anywhere.
- Depending on version(s) ordered: -Multimode models send data as far as 300 meters (984.2 ft.) or 2 kilometers (1.2 mi.).
  - -Single-mode models transmit data from 15 to 80 kilometers (9.3 to 49.7 mi.).
- Built-in universal power supply autosenses power for worldwide use.
- No crossover cable needed on the UTP side. Auto MDI/MDI-X detection figures out wiring type and adjusts to it automatically.
- LinkLoss<sup>™</sup> and FiberAlert<sup>™</sup> notify you of "silent failures" on the fiber side.

#### **Compact Media Converters**

1000BASE-TX to 1000BASE-SX, Multimode, 850-nm, 220 m, SC	LGC5134A-R4
100BASE-TX/100BASE-FX, Multimode, 1300-nm, 2 km, ST	LHC001A-R4
100BASE-TX/100BASE-BX, Single-Mode, Single-Strand, 1310 TX/1550 RX, 20 km, SC	LHC5129A-R3
10BASE-T to 10BASE-FL, 2 km, Multimode, 850-nm, SC	LMC002A-R5
10/100BASE-TX to 100BASE-SX, Multimode, 850-nm, 300 m, ST	LMC7001A-R4

These are some of the most popular converters in these series. To see all the products in these series, go to **blackbox.com** and enter LMC0\*, LHC0\*, LHC51\*, or LGC51\* in the search box.

## Commercial

## 10-Gigabit Ethernet Media Converters



#### LMC11000A Series (Dynamic Fiber Conversion System)



• XFPs available for 10GBASE-SR (short-range) multimode and 10GBASE-LR (long-range) single-mode fiber, and for 10GBASE-CX4 copper.

#### • Convert 10GBASE-T to fiber.

- Function as a copper-to-fiber converter, a fiber mode converter, and a fiber repeater.
- Protocol transparent for 10-Gigabit links.
- Great for telecoms and enterprises requiring both 10-Gbps mode conversion and fiber extension.
- Ideal for linking a switch via a 10-Gbps Ethernet link to a fiber backbone for extended distance.
- Also link 10-Gbps servers in two buildings over interference-free fiber.

• SFP+ transceivers available for 10GBASE-SR (short range) multimode and 10GBASE-LR (long-range) single-mode fiber.

#### Product Selection Guide

Switch Series	Speed	Connectors	Power
LMC11002A	10-Gigabit	(2) XFP slots	External
LMC11012A	10-Gigabit	(2) SFP+ slots	External
LMC11022A	10-Gigabit	(1) SFP+ slot, (1) XFP slot	External
LMC11032A	10-Gigabit	(1) SFP+ slot, (1) RJ-45	External
LMC11042A	10-Gigabit	(1) XFP slot, (1) RJ-45	External

## Fast Ethernet and Gigabit Ethernet Media Converters with PoE



#### LPM600, LPS500A LPD500A, LGC5200 Series

- Convert copper to fiber and power PoE devices.
- Convert 10-/100-Mbps copper to 100-Mbps fiber or 10-/100-/1000-Mbps copper to 1000-Mbps fiber.
- Connect to PoE switches, mid-span hubs, or other 802.3af power source equipment (PSE).
- MDI/MDI-X on all copper ports.
- Undercurrent and overcurrent detection and load sensing.



- Link-fault pass-through and far-end fault detection prevents data being sent across invalid links.
- Use PSE models to power a PoE device at the far end of the copper link.
- PD models work as powered devices that receive their power from PoE power source equipment.



LPD500A



LGC5210A

#### Product Selection Guide

Switch Series	Copper Speed	Fiber Speed	Fiber Type	Connector	Distance	PoE	Power
LPM600A	10-/100-Mbps	100BASE-FX	Multimode	SC	2 km (1.2 mi.)	802.3af PoE PSE	Internal Power
LPS500A-MM-LC	10-/100-/1000-Mbps	1000BASE-SX	Multimode	LC	220 m (722 ft.)	802.3af PoE PSE	Internal Power
LPS500A-SM-10K-LC	10-/100-/1000-Mbps	1000BASE-LX	Single-Mode	LC	10 km (6.2 mi.)	802.3af PoE PSE	Internal Power
LPD501A	10-/100-Mbps	100BASE-FX	Multimode	ST	2 km (1.2 mi.)	802.3af PoE PD	PoE or external power
LGC5210A	10-/100-/1000-Mbps	1000BASE-FX	_	SFP	_	802.3at PoE PSE	AC power supply, DC power jack, DC terminal block

These are some of the most popular converters in these series. To see all the products in these series, go to blackbox.com/go/PoEMC.

# Fast Ethernet and Gigabit Ethernet Media Converters with PoE/PoE+



### LGC5200 Series

- Connect with fiber and provide power to remote PoE devices.
- Features two 10-/100-/1000-Mbps copper ports.
- Models have either a multimode, single-mode, or SFP port.
- Models with SFP ports can be customized to the data rate and distance of your choice through the use of standard SFPs.
- UTP ports are autosensing with Auto MDI/MDI-X; one UTP port supports 802.11af PoE.
- Act as power sourcing equipment (PSE) on the copper side to power PoE devices.
- Feature an extended temperature range when used with DC terminal-block power.
- Rugged metal chassis.

**Product Selection Guide** 

These tough media converters are the ideal way to extend your network over fiber and also power a PoE device. Use them to link to faraway PoE devices such as IP security cameras, wireless access points, and VoIP phones.

The media converters feature two autosensing 10-/100-/1000-Mbps UTP ports. One UTP port supports 802.3af Power over Ethernet, enabling it to power a PoE PD device; the other is a straightforward Ethernet port, which can be used for network expansion. The fiber port can be either multimode, single-mode, or an SFP port that can be customized to virtually any interface—including multimode fiber, single-mode fiber, or Gigabit copper—through the use of a standard SFP.

The Gigabit PoE+ Media Converter can be powered three ways: from an AC power supply (LGC5210-PS, included), via the DC power jack, or via the DC terminal block. When used with DC power to the terminal block, the converter supports an extended operating temperature range of +32 to +158° F (0 to +70° C). The converters require only one power source to power both the converter and a PoE+ device; you can position the PoE+ device up to 100 meters (328 feet) away from the converter, enabling flexible placement of wireless APs and security cameras. A pair of input terminals and output terminals enables you to cascade DC power in a DIN rail installation (optional DIN Rail Clip [LXC-DR] is sold separately).

Switch Series	Copper Speed	Fiber Speed	Fiber Type	Connector	Distance	PoE	Power
LGC5200A		1000-Mbps	—	SFP	—	802.3af PoE PSE	
LGC5201A		1000-Mbps	850-nm Multimode	SC	550 meters (1804 ft.)	802.3af PoE PSE	
LGC5202A	10 /100 /1000	1000-Mbps	1310-nm Single-Mode	SC	15 km (9.3 mi.)	802.3af PoE PSE	AC power supply,
LGC5210A	Mbps	1000-Mbps	—	SFP	10 km (6.2 mi.)	802.3at PoE+ PSE	DC power jack,
LGC5211A		1000-Mbps	850-nm Multimode	SC	550 meters (1804 ft.)	802.3at PoE+ PSE	DC terminal block
LGC5212A		1000-Mbps	1310-nm Multimode	SC	15 km (9.3 mi.)	802.3at PoE+ PSE	

These are some of the most popular converters in this series. To see all the products in this series, go to blackbox.com/go/PoEMC.

## Fast Ethernet and Gigabit Ethernet Media Converters



### LHC200, LGC200 Series (Pure Networking Media Converters)

- Convert from copper to fiber.
- Simple plug-and-play installation.
- Use as a standalone media converter or in a convenient rackmount chassis.
- Diagnostic LEDs for troubleshooting.
- Link-fault passthrough alerts you to "silent failures" on the fiber side.
- UTP ports are autonegotiating for speed and duplex.
- Auto MDI/MDI-X on all copper ports.

Available in basic 10-/100- or 1000-Mbps models, these media converters can cover most of your network's media conversion requirements. There's even a rackmount chassis for enterprise network applications.

The 10/100 models extend your network up to 2 kilometers (1.2 miles) over multimode fiber or up to 20 kilometers (12.4 miles) over single-mode fiber.

Gigabit models extend your network 500 meters (1640 ft.) over multimode fiber or up to 15 kilometers (9.3 miles) over single-mode fiber.

The SFP Converter (LGC200A) features a Gigabit twisted-pair port plus a standard SFP slot, which enables you to customize the converter with an SFP to get the fiber interface of your choice. Through the use of SFPs, you can extend a network up to 30 kilometers (18.6 miles) over single-mode fiber. The converter accepts any standard 1250-Mbps SFP.





Pure Networking Media Converter Accessories	
14-Slot Rackmount Chassis	LHC200A-RACK
Redundant AC Power Supply for Chassis	LHC200A-RACK-PS

#### Selection Guide | Pure Networking Media Converters

	1	5			
Product Series	Copper	Fiber	Distance	Connector Types	Power Options
LHC201A	10-/100-Mbps	100-Mbps Multimode, 1310-nm	2 km (1.2 mi.)	SC	External
LHC202A	10-/100-Mbps	100-Mbps Single-Mode, 1310-nm	20 km (12.4 mi.)	SC	External
LGC201A	1000-Mbps	1000-Mbps Multimode, 850-nm	0.5 km (0.3 mi.)	SC	External
LGC202A	1000-Mbps	1000-Mbps Single-Mode, 1310-nm	15 km (9.3 mi.)	SC	External
LGC200A	1000-Mbps	SFP	0.5-30 km (0.3–18.6 mi.)	LC	External

These are some of the most popular switches in these series. To see all the products in these series, go to **blackbox.com** and enter LHC2\* or LGC2\* in the search box.

## Miniature Fast Ethernet and Gigabit Ethernet Media Converters

RACKMOUNT	DESKTOP	POWER	POWER
		External AC	USB

## LHC000, LGC000 Series (Multipower Miniature Media Converters)

- Connect Ethernet, Fast Ethernet, or Gigabit Ethernet copper ports to fiber optic cable.
- Compact size—measure just 1.8"H x 0.8"W x 3.4"D.
- Available in fiber optic duplex and single-strand fiber versions.
- 10/100 versions autonegotiate for speed and duplex.
- Use as standalone media converters or rackmount in the optional PowerTray.
- Powered by its universal AC power supply, a PC's USB port (LHC000 series only), or the optional rackmountable PowerTray.
- Auto MDI/MDI-X means you never need to worry about what kind of cable to use.

#### Simple connections.

Bring fiber to the desktop more conveniently and at a lower cost than installing fiber NICs with the economically priced Multipower Miniature Media Converters. Just connect a converter to your PC's copper port with a CAT5 cable (you can use unshielded or shielded CAT5 or higher), then connect a fiber cable to the converter's other side. Best of all, you can tuck these tiny converters unobtrusively behind your PC.

#### Flexible power options.

Power the converter one of three ways:

- Through its included AC power supply.
- Through the optional USB Power Adapter Cable (LHC021A), which plugs into a PC's USB port (LHC000 series only).
- Or through the optional rackmount PowerTray, which powers up to 18 converters in only 2U of rack space (rackmount ears are included).



#### Choose your model.

Choose from multimode and single-mode duplex fiber versions, and single-mode single-strand fiber versions.

For long-distance transmissions, order single-mode models. They support distances of 20 kilometers (12.4 mi.), 40 kilometers (24.8 mi.), or even 70 kilometers (43.4 mi.), depending on the model.

The 10-/100-/1000-Mbps versions also work as data rate converters, performing speed autonegotiation on the twisted-pair port.

We also offer an SFP-to-SFP mode converter model (LGC300A). It enables you to adapt the converter to the interfaces of your choice simply by adding SFPs. Use a pair of SFPs to convert any fiber type to any other fiber type, for instance. The mode converter version works with both Fast Ethernet and Gigabit Ethernet SFPs.

LHC018A-AC-R2
LHC021A

#### Selection Guide | Multipower Miniature Media Converters

Product Series	Copper	Fiber	Distance	Connector Types	Power Options
LHC013A-R2	10-/100-Mbps	100-Mbps Multimode 1300-nm	2 km (1.2 mi.)	ST	External
LHC015A-R2	10-/100-Mbps	100-Mbps Single-Mode, 1310-nm	40 km (24.8 mi.)	SC	External
LGC120A-R2	10-/100-/1000-Mbps	1000-Mbps Multimode, 850-nm	300 m (984 ft.)	SC	External
LGC121A-R2	10-/100-/1000-Mbps	1000-Mbps Single-Mode, 1310-nm	10 km (6.2 mi.)	SC	External

These are some of the most popular converters in these series. To see all the products in these series, go to blackbox.com/go/MC.

## Fast Ethernet and Gigabit Ethernet Multiservice Media Converters



### Flexpoint Modular Media Converters

- Work as standalone conversion devices or hot-swappable, chassisbased media converters.
- Easy installation—no software required.
- The FlexPoint Power Chassis holds up to 14 media converters and features single or dual hotswappable AC or DC power supplies.
- The chassis fits into a standard 19" rack to save space.

FlexPoint<sup>™</sup> Modular Media Converters from Black Box are versatile and cost-effective standalone media converters that you can upgrade to a chassis-based system. They provide the ultimate in flexibility and reliability for your expanding multimedia LAN.

FlexPoint offers a very wide range of converter options, including media converters for legacy media such as ThinNet and 10BASE-FL. Your choices include:

• ATM OC-3

• ATM OC-12

Single-mode to multimode fiber converters

Long-distance fiber converters

• 10/100 rate converters

- Ethernet
- Fast Ethernet
- Gigabit Ethernet
- UTP
- Single-mode fiber
- Multimode fiber
- ThinNet
- TI/EI line drivers • RS-232

The incredible variety and versatility of this system make it ideal for networks that are subject to constant upgrades and changes.

Tailor the system to your requirements. Get the media converters you need now and use them individually. Then, when your LAN grows, mount your media converters on the wall using the 5-Position Rackmounting Kit (LMC205), or use the media converters as modules in the Power Chassis. The Power Chassis holds 14 media converters and a Single or Dual AC or DC Power Supply.

SELACK BOX





The 14-slot chassis (LMC200) makes the FlexPoint system easy to expand.





Flexpoint Modular M	Aedia Converters
---------------------	------------------

10BASE-T/100BASE-TX/1000BASE-T to 100BASE-X/1000BASE-X, SFP	LMC1017A-SFP
10BASE-T/100BASE-TX/1000BASE-T to 1000BASE-LX, Single-Mode, ST, 12 km	LMC1017A-SMST
100BASE-TX to 100BASE-FX, 1300-nm Multimode, SC, 2 km Full-Duplex, 412 m Half-Duplex	LMC213A-MMSC-R2
10BASE-T/100BASE-TX to 100BASE-FX, Single-Mode, SC, 28 km	LMC100A-SMSC-R3
FlexPoint 14-Slot Power Chassis, Single AC Power Supply	LMC200

To see all the products in this series, go to **blackbox.com** and enter Flexpoint or the base SKU with an \* in the search box.

#### Product Selection Guide

Switches	Speed Options	Fiber Options	Distance Options		Protocols Supported	Power
Flexpoint Modular Media Converters	10-/100-/1000-Mbps	Multimode Single-mode	220 m 300 m 2 km 5 km 10 km	15 km 25 km 28 km 58 km 65 km	Ethernet (BNC, ST, SC, LC, RJ-45, SFP (LC) RS-232 (DB9, RJ-45)	External Power (AC, DC)
### Fast Ethernet and Gigabit Ethernet Multiservice Media Converters



### High-Density Media Converter System II

- Monitor and manage your network's copper-to-fiber converters from a central location.
- The included MIBs enable you to manage the system from any standard SNMP system or the included iView software.
- Many modules offer Layer 2 media conversion.
- Choose a rackmountable chassis for high-density applications.
- Hot-swappable modules.
- Redundant power supplies are available.





The Black Box<sup>®</sup> High-Density Media Converter System II offers fully manageable rackmount and desktop chassis. It enables you to monitor and manage the media converters in your large network from one location. The system is particularly well suited for network extension over fiber, offering a wide range of hot-swappable converter modules.

#### Chassis with Modular SNMP Management

These heavy-duty chassis are manageable through a separate SNMP Management Module (LMC5200A).

Choose from 1U, 6-slot chassis or 3U, 20-slot chassis. Each chassis has one additional slot for the SNMP module.

A built-in SNMP switch enables you to disable chassis management. Even with management turned off, the SNMP agent continues to communicate with installed modules.

Models with dual power supplies eliminate a point of failure.

#### **Unmanaged Chassis**

You can also choose from a 1- or 2-slot Unmanaged Chassis for desktop use. Although these chassis are unmanaged, modules within them can be accessed through a managed chassis in the same system.

All chassis feature redundant, 6.8-cfm-rated cooling fans to keep them from becoming overheated.

#### Layer 1 Modules

Layer 1 modules convert the incoming electrical signal from one cable type and then transmit it over another type. They bridge the gap between

two different Ethernet media types and are totally transparent to network operation, having no effect on data.

#### Layer 2 Modules

Use a pair of these modules at opposite ends of a link to increase your network reach. Unlike Layer 1 converters, which only convert one Ethernet media type to another, Layer 2 modules are true switches. They actively store, filter, and forward Ethernet packets like any other MAC-layer switch. Layer 2 media converters increase network efficiency and reduce network overhead, significantly increasing data throughput.

All modules include the LinkLoss<sup>™</sup> feature, which notifies you of "silent failures" on copper-to-fiber links.

High-Density Media Converter System II Layer 1 Module 10BASE-T/100BASE-TX to 10BASE-FL/ 100BASE-FX, Multimode, 1310-nm, 2km, SC	LMC5195C
Chassis, Managed, 6-Slot, Desktop/Rackmount	
AC Power	LMC5203A
Dual AC Power	LMC5204A
Dual DC Power	LMC5205A
Chassis, Unmanaged, 2-Slot Desktop, AC Power	LMC5201A

To see all the products in this series, go to **blackbox.com** and search for the High-Density Media Converter System II or the base SKU followed by an \*.

#### **Product Selection Guide**

Switch Series	Chassis Choices	Power	Speed Options	Protocols Supported
High-Density Media Converter System II LMC5000, LGC5000 Series	1 slot 2 slots 3 slots 6 slots 20 slots	AC DC Dual AC Dual DC	10-/100-/1000-Mbps	RJ-45 BNC ST SC T1/E1/J1 DS3/E3/STS-1 OC-12/SFP/VDSL2

Extenders Commercial

### Extenders Selection Guide

Series Name		Protocol	Distance (Max)	Media Type	Speed (300 m)	PoE
LB200A-R3, page 74		Ethernet	1.6 km	vDSL (RJ-45)	15 Mbps	_
LBPS01A-KIT, page 74		Ethernet	1.6 km	vDSL (RJ-11)	28 Mbps	J
LB300 LPB300, <b>page 75</b>	A CHINE	Ethernet	1.9 km	vDSL (RJ-11)	50 Mbps	V
LB500, page <b>76</b>		Ethernet	4 km	G-SHDSL (RJ-11)	4.6 Mbps	_
TE160, page 77	The second secon	POTS	2 km	Fiber	J	_
ME800A-R4, page 78		Serial	6.4 km	4-Wire	115,200 bps	_
ME890A, <b>page 79</b>		Serial	1 km	CATx	57.16 Kbps	_

# **Extend a LAN Over Existing Facilities**

# Extend Ethernet over twisted pair using xDSL technologies.

A company's growth and physical expansion doesn't have to be a nightmare for the IT department. In fact, LAN extension doesn't have to be expensive or difficult. Extenders make the job of connecting buildings on a campus over existing voice-grade twisted pair cabling at high speeds and long distances easy.



### xDSL, G.SHDSL, VDSL, and VDSL2

Parking Garage

**xDSL**, a term that encompasses the broad range of digital subscriber line (DSL) services, offers a low-cost, high-speed data transport option for both individuals and businesses, particularly in areas without access to cable Internet.

xDSL provides data transmission over copper lines using the existing twisted pair infrastructure in your building or on your campus. DSL technology is relatively inexpensive and reliable.

xDSL technologies can be used effectively in enterprise LAN applications. When interconnecting sites on a corporate campus, buildings and network devices often lie beyond the reach of a standard Ethernet segment. Now you can use existing twisted pair copper infrastructure to connect remote LANs across longer distances and at higher speeds than previously thought possible.

There are various forms of DSL technologies, all of which face distance issues. The quality of the signals goes down with increasing distance.

To provide more bandwidth to customers, telco providers kept pace by offering ever-faster xDSL variations (ADSL, HDSL, SDSL, etc.). Suppliers have kept pace likewise, with technologies to give network managers higher-speed ways to link networks over existing twisted pair infrastructure.

But as bandwidth-intensive requirements have increased, so has the need for technologies that support broadband wireline links for point-to-point Ethernet connectivity and at longer distances. SHDSL, also known as G.SHDSL (Single-Pair, High-Speed Digital Subscriber Line) transmits data at much higher speeds than older versions of DSL. Support of symmetrical data rates makes SHDSL a popular choice for businesses, private networks, and other services.

SHDSL combines ADSL and SDSL features for communications over two or four (multiplexed) copper wires. As a departure from older DSL services designed to provide higher downstream speeds, SHDSL specified higher upstream rates, too. For higher-bandwidth symmetric links, newer SHDSL devices for 4-wire applications support 10-Mbps rates at distances up to 1.3 miles (2 km). Equipment for 2-wire deployments can transmit up to 5.7 Mbps at the same distance.

VDSL (Very High Bitrate DSL) as a DSL service allows for downstream/upstream rates up to 52 Mbps/16 Mbps. Extenders for local networks boast 100-Mbps/60-Mbps speeds when communicating at distances up to 500 feet (152.4 m) over a single voice-grade twisted pair. Depending on the application, you can set VDSL to run symmetrically or asymmetrically.

VDSL2 (Very High Bitrate DSL 2) provides a higher bandwidth (up to 30 MHz) and higher symmetrical speeds than VDSL, enabling its use for data, video, and voice at longer distances. While VDSL2 supports upstream/downstream rates similar to VDSL, at longer distances, the speeds don't fall off as much as those transmitted with ordinary VDSL equipment.

### Extenders Commercial

#### Selection Guide

Product Series	Distance (Max.)	Management	Media	Speed (300 m)	PoE	Kit	Ethernet Ports
LGC5100, <b>p. 65</b>	1.6 km		vDSL (RJ-45)	15 Mbps	—	✓	1
LB200A-R3, below	1.6 km		vDSL (RJ-45)	15 Mbps	—	1	2
LBPS01A-KIT, <b>p. 74</b>	1.2 km	Upmapaged	vDSL (RJ-11)	28 Mbps	1	✓	1
LB300A-R3, <b>p. 75</b>	1.9 km	Unmanaged	vDSL (RJ-11)	50 Mbps	—	—	1
LBNC300A, <b>p. 75</b>	3 km		BNC	70 Mbps	—	—	1
LB510A-R2, <b>p. 76</b>	4 km		G.SHDSL (RJ-11)	4.6 Mbps	—	—	1
LB512A-KIT, <b>p. 76</b>	8 km		G.SHDSL (RJ-45)	5.7 Mbps	—	✓	4
LB522A-KIT, <b>p. 76</b>	10 km	Managod	G.SHDSL (RJ-45)	11.4 Mbps	—	✓	4
LB524A-KIT, <b>p. 76</b>	10 km	Manageu	G.SHDSL (RJ-45)	22.8 Mbps	—	✓	4
LB528A-KIT, <b>p. 76</b>	10 km		G.SHDSL (RJ-45)	45.6 Mbps	_	1	4

### Ethernet Extenders, Unmanaged, Standalone



### LB200A-R3



- The low-cost solution for campus network expansions and delivering last-mile Ethernet.
- Extends your Ethernet network 1.3 km (4250 ft.) at speeds up to 16.7 Mbps.
- Uses inexpensive 2-wire twisted-pair cable.
- Switch-selectable rates up to 16.7 Mbps.
- Two autosensing 10/100BASE-TX ports.
- Ideal for always-on Internet access, real-time bidirectional video streaming, and various multimedia applications.
- Sold in pairs—use one as a customer premise line driver and one as a central office line driver.

### Line Rates

Asymmetric					
Maximu	ım Speed				
Upstream	Downstream	Distance			
1.5 Mbps	9.4 Mbps	5500 ft. (1676 m)			
2.3 Mbps	16.7 Mbps	5000 ft. (1524 m)			
Symmetric					
Maximu	ım Speed				
Upstream	Downstream	Distance			
12.5 Mbps	12.5 Mbps	4000 ft. (1219 m)			
16.6 Mbps	16.7 Mbps	3300 ft. (1006 m)			

#### Ethernet Extenders, Data Only, 2-Pack Kit

#### LB200A-R3

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

### Ethernet Extenders, Unmanaged, Standalone with PoE



### LBPS01A-KIT

- Includes two extenders—one acts as PoE power source equipment (PSE); the other is a standard extender.
- Extends 10BASE-T/100BASE-TX Ethernet across ordinary voice-grade copper wire.
- Supports 100-Mbps downstream and 60-Mbps upstream for distances up to 500 feet (152 m).
- Supports distances of up to 4000 feet (1.2 km) at 28 Mbps.

#### VDSL PoE/PSE 10/100 Ethernet Extender Kit

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

SELACK BOX



### Ethernet Extenders, Unmanaged, Standalone and Chassis-Based



### LB300, LBNC300 Series (LinkGAIN Ethernet Extenders)





- Extend 10- or 100-Mbps Ethernet up to 2 km (1.2 miles) over voice-grade UTP or up to 2.6 km (1.6 miles) over coax.
- Point-to-point and plug-and-play.
- Use as a standalone or in a convenient rackmount chassis.
- Symmetrical vDSL for speeds of up to 100 Mbps.
- Ten speeds with easy-to-read speed indicator LEDs on top of the extender.
- Ethernet ports are Auto MDI/MDI-X and autosensing for speed and duplex.

10BASE-T/100BASE-TX Ethernet Extenders use vDSL to provide an easy, inexpensive way to extend the reach of your Ethernet network over ordinary voice-grade copper wire or coax cable.

Just plug an extender into each end of your copper wire and use simple DIP switches to set one unit as local (CO) and the other as remote (CP) there's never any software to install. Plus, the RJ-45 port autosenses speed and duplex and features MDI/MDI-X for easy cabling.

For larger installations, you can mount the extenders in a convenient 16-slot rackmount chassis. The chassis has ventilation holes plus a fan to keep the extenders cool. Media converters for Ethernet extension over multimode fiber are also available for this chassis, see **blackbox.com**.



The 16-Slot Chassis (LB300A-RACK) provides an easy way to rackmount extenders.

#### LB300A-R3

	Maximum Speed		
24-AWG Wire	Upstream	Downstream	
1900 m (1.2 mi.)	1 Mbps	1 Mbps	
1700 m (1.1 mi.)	3 Mbps	3 Mbps	
1600 m (1.0 mi.)	5 Mbps	5 Mbps	
1500 m (0.9 mi.)	10 Mbps	10 Mbps	
1400 m (0.8 mi.)	15 Mbps	15 Mbps	
1000 m (0.6 mi.)	20 Mbps	20 Mbps	
800 m (0.5 mi.)	25 Mbps	25 Mbps	
600 m (0.4 mi.)	30 Mbps	30 Mbps	

#### LBNC300A

	Maximum Speed		
RG-6 Coax	Upstream	Downstream	
2600 m (1.6 mi.)	5 Mbps	5 Mbps	
2400 m (1.5 mi.)	10 Mbps	10 Mbps	
2000 m (1.2 mi.)	16 Mbps	16 Mbps	
1800 m (1.1 mi.)	20 Mbps	20 Mbps	
1400 m (0.8 mi.)	43 Mbps	43 Mbps	
1000 m (0.6 mi.)	63 Mbps	63 Mbps	
600 m (0.4 mi.)	74 Mbps	74 Mbps	
200 m (0.1 mi.)	85 Mbps	85 Mbps	

LinkGAIN 10/100TX Ethernet Extenders, 2-Pack	
Over vDSL	LB300A-R3
Over Coax	LBNC300A
16-Slot Chassis, 19"	LB300A-RACK

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**. *NOTE: Must be used in pairs.* 

Extenders Commercial

### Managed Ethernet Extenders



### LB500 Series (10BASE-T/100BASE-TX G.SHDSL Extender/NTU) (DeeSL.1/DeeSL.2 Ethernet Extender Kits, G-SHDSL)



- Extend your Ethernet connections, and get the best combination of speed and distance available.
- Get cost-effective high-speed extension over your existing voice-grade twisted-pair cable.
- Four Ethernet ports enable you to make up to four 10-/100-Mbps connections easily.
- Built-in Auto MDI/MDI-X enables them to work with either a straight-through or crossover cable.
- An advanced auto-rate algorithm automatically determines the best possible baud rate for each connection and sets up the extender without the need for user interface.
- Plug-and-play. Just plug it in, power it on, and it's up and running.

The LB520 Series also:

- Supports QoS, CoS, and VLAN to ensure mission-critical network connections are of top quality with advanced traffic management features.
- Has a built-in console port to make setup a snap. And you can also use the embedded HTTP/SNMP agent to remotely manage the unit from anywhere in the world.

These extenders include a pair of auto-rate Ethernet extenders and use a standard twisted-pair connection, which simplifies your life and provides cost-effective network extension by enabling you to make the most of your pre-existing infrastructure.

Use these extenders to connect remote LANs across distances and at speeds previously unheard of. An auto-rate feature ensures that you achieve the highest possible speed on each connection.

The extenders autosense the data rate to provide reliable broadband connectivity with full-duplex symmetric rates. See the chart below for the maximum distances. For complete speed/distance charts, see **blackbox.com**.

### Product Selection Guide

Product Code	Interconnect	Speed (300 m)	Distance (max.)	Management	Media Type	Kit	Ethernet Ports
LB510A-R2	2-Wire	4.6 Mbps	4 km	Managed	G-SHDSL (RJ-11)	—	1
LB512A-KIT	2-Wire	5.7 Mbps	8 km	Managed	G-SHDSL (RJ-45)	1	4
LB522A-KIT	2-Wire	11.4 Mbps	10 km	Managed	G-SHDSL (RJ-45)	1	4
LB524A-KIT	4-Wire	22.8 Mbps	10 km	Managed	G-SHDSL (RJ-45)	1	4
LB528A-KIT	8-Wire	45.6 Mbps	10 km	Managed	G-SHDSL (RJ-45)	1	4

These are some of the most popular extenders in this series. To see all the extenders in this series, and for full features and specs, go to **blackbox.com** and enter LB5\* in the search bar. For pricing details, call **724-746-5500**.

### **POTS Line Extenders**



### **TE160A Series**





- Connects central office voice signals to distant "Plain Old Telephone" (POTS) equipment over fiber cables while using standard telephone signaling.
- Supports both FXS (connects to PBX) and FXO (connects to phone device).
- Digitizes voice calls and sends data at greater distances without degradation. Plus, no amplification is required.
- Ideal for areas with high interference.
- Choose from multimode or single-mode fiber operations.
- Includes audio transmission, caller ID, and automatic ringdown.

Sure, a lot of folks are moving to VoIP systems these days. But the fact is, many businesses still rely on an old analog phone system with a central PBX for trunking and switching voice calls. And what if you want to route calls from your proprietary circuit-switched system over secure, crystal-clear fiber cabling at farther distances? Then you need POTS 2-Wire to Fiber Converters.

Set up high-quality voice links without having to upgrade to a campuswide, IP-based PBX system with IP phones connected to a network. The converters do this by inexpensively connecting basic analog phone services from 2-wire FXS copper lines to optical wiring. Easily link Central Office devices to distant POTS equipment while gaining all the advantages and bandwidth of fiber. They're particularly great for areas where ground loops and EMI/RFI interference may be a problem.



FREE, Live, 24/7 Tech Support Talk with an expert at **724-746-5500** or go to **blackbox.com/go/TS**.



POTS 2-Wire to Fiber Converters	
FXS to Multimode ST	TE160A-R2
FXS to Single-Mode SC	TE164A-R2

These are some of the most popular converters in this series. To see all of the converters in this series, and for full features and specs, go to blackbox.com and enter TE16\* in the search bar. For pricing details, call **724-746-5500**.

### Serial Extender

DESKTOP	POWER	DB9
	EXTERNAL AC	(*****)

### ME800A-R4 (SHM-C Async)



- Easily connect RS-232 devices over ordinary copper wire.
- Ideal for point-of-sale applications.
- Transmits RS-232 up to 6.4 km (4 miles), at 9600 bps, over 4-wire connections.
- At a maximum speed of 115.2 kbps, you can go up to 1.2 km (4000 feet).
- Backwards compatible with the ME800A-R3.
- Must be used in pairs.

RS-232 is the most common serial interface in use today. This means you can use your SHM-C in RS-232 installations-industrial applications; security systems; UNIX®, DEC2, and HP® workstation connectivity; and more.

Choose our 4-Wire SHM-C Async to transmit data up to four miles (6.4 km). Run loopback tests or change DTE/DCE selection simply by pressing a front-panel button, without opening the case.

850-VDC optical isolation protects your data from electrical interference.

### Works with:

• CAT5 Unshielded 100-MHz Solid Bulk Cable (EYN717A-1000)

PC

- DB9 Serial Extension Cable, M/F (BC00200)
- DB9 Serial Extension Cable, M/M (BC00240-0006)

RS-232 Cable

- Serial AT Adapter, DB9 M to DB25 F (FA521A-R3)
- Serial AT Adapter, DB9 F to DB25 M (FA520A-R5)
- Short-Haul Modem–B (ME800A-R3, etc.)

Short-Haul Modem–C Async (SHM–C Async)	
4-Wire, Standalone	ME800A-R4

For full features and specs, go to blackbox.com. For pricing details, call 724-746-5500.

### What others are saying...

"My name is Api Weinert and I am a Fire Captain for the Laguna Beach Fire Department in Orange County, CA. I have spent about five hours on the phone trying to track down information on modems that we use as part of our fire station dispatch system. I have been speaking with service agents from around the U.S. and have built up a bit of frustration trying to track down the correct items.

This morning I had the pleasure of speaking with two individuals from your company, Susan and Ray. I wanted to express my sincere thanks to them for their assistance and absolute pleasurable demeanor. Ray in particular gave me more information in five minutes than five hours of previous interactions with other companies. I certainly hope that you recognize these employees for their outstanding customer service skills and knowledge of your products."

Api Weinert, Fire Captain, Laguna Beach Fire Department

### Commercial **Extenders**

### CATx DB9 Line Driver

DESKTOP	POWER	DB9
	EXTERNAL AC	(*****)

### ME890A-R2



- Control RS-232 equipment up to 1219 m (4000 feet) away.
- Run signals over inexpensive CAT5 cable and break the RS-232 distance limitation.
- Plug-and-play. The driver is a pure hardware solution providing real-time data transfer with no software conflicts.
- Ideal for a wide variety of applications:
- -Operate touch screens and presentations remotely.
- -Transfer data between computers.
- -Control console servers.



- Easy installation. The driver provides full-duplex transmission and hardware handshake signals. There's no need for setup or configuration.
- Data rates up to 250 kbps.
- Includes one local unit, one remote unit, and two power supplies.
- 1000-VDC isolation barrier.
- Has temperature range of 0 to +60° C.

#### CATx DB9 Line Driver

ME890A-R2

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

### How a line driver operates.

Line drivers can operate in any of four transmission modes: 4-wire full-duplex, 2-wire full-duplex, 4-wire half-duplex, and 2-wire half-duplex. In fact, most models support more than one type of operation. So how do you know which line driver to use in your application?

#### The deal with duplexing.

First you must decide if you need half- or full-duplex transmission. In half-duplex transmission, voice or data signals are transmitted in only one direction at a time, In full-duplex operation, voice or data signals are transmitted in both directions at the same time. In both scenarios, the communications path support the full data rate.

#### Two wires or not two wires? That is the question.

The second consideration you have is the type of twisted-pair cable you need to complete your data transmissions. Generally you need twisted-pair cable with either two or four wires. Often the type of cabling that's already installed in a building dictates what kind of a line driver you use.

For example, if two twisted pairs of UTP cabling are available, you can use a line driver that operates in 4-wire applications, such as the Short-Haul Modem-C Async. Otherwise, you might choose a line driver that works for 2-wire applications, such as the Short-Haul Modem-B 2W or the Async 2-Wire Short-Haul Modem.

If you have the capabilities to support both 2- and 4-wire operation in half- or full-duplex mode, we offer line drivers that support all four types of operation. Some line drivers, like the ME890A-R2 (**above**), have advanced features that use all eight wires.

As always, if you're still unsure which operational mode will work for your particular applications, consult our Technical Support experts and they'll help you make your decision.

### Serial Console Servers with Ethernet Uplinks



### LES1100, LES1200, LES1500 Series (Value Line, Advanced, Cisco Console Servers)

- Manage a range of serial console ports and devices from a single user interface.
- Manageable over your network—or even the Internet—using any standard Web browser.
- Support auto failover.
- Protect data traveling over a public network with Secure Shell (SSH) encryption, SSH tunneled serial bridging, SSH tunneling for TCP/UDP, IP packet filtering, and more.
- · Off-line data logging, on-line data buffering and logging, as well as port sniffing for multiple users per port.



LES1116A



### Value Line Console Servers

Black Box<sup>®</sup> Value Line Console Servers provide solid out-of-band serial console port control in a secure platform. Use them as gateways to remotely access servers and other network IT equipment for reliable 24/7 uptime.

The console servers feature secure serial bridging, encapsulating incoming raw serial data into IP packets and transporting it over a network to a remote location, where it's then represented as serial data.

Use the stable Linux® OS platform and preloaded Nagios® network monitoring software to centrally manage Linux, Windows®, Sun®, HP®, and IBM® servers. Value Line Console Servers come with SDT Connector, a free open-source SSH Java client. Use it to autoload your configurations to set up SSH tunnels.

In addition to remote in-band access through its 10BASE-T/100BASE-TX TCP/IP ports, Value Line Console Servers support out-of-band access via external dialup modem.

Advanced encryption keeps all connection communications secure—to protect against unauthorized access, the system enables you to restrict access by IP address, password, or account.

To help ensure maximum uptime, Value Line Console Servers proactively scan serial streams on console ports, searching for specific errors and phrases. The console server supports SNMP and SMTP alerts/traps for serial ports and hosts.

#### **Advanced Console Servers**

Console Server

Get all the features above, plus:

- Dual Ethernet connections with auto failover and bonding capabilities for high availability.
- Dual universal AC input for powering from two sources for backup power.
- Includes a built-in modem RJ-11 port for setting up out-of-band access, as well as a DB9 port for an external modem.
- Federal Information Processing Standard (FIPS) 140-2 validated module for enhanced security.
- USB ports plus a flash drive.

#### **Cisco Secure Server**

Get all the features above, plus:

- Cisco<sup>®</sup> compatible RJ-45 ports for quick installation
- Support for direct USB 2.0 connections to one • or two Cisco USB console ports.
- Manage embedded service processors. ٠

All of these servers work with the Virtual Central Management System Software (facing page).

Serial Console Servers					
Value Line, 48-Port	LES1148A				
Advanced, 8-Port	LES1208A-R2				
Advanced, Cisco Pinout, 8-Port	LES1508A				

To see all the products in these series, go to blackbox.com and enter LES11\*, LES12\*, or LES15\* in the search box.

Cellular Wireless

### Serial Console Servers with Ethernet and Wireless Uplinks



### LES1300, LES1400 Series (Advanced Cellular Console Servers)

- Advanced console port access that's fully redundant with dual Ethernet ports to ensure high availability.
- Integral GSM or CDMA modem enables you to access and manage remote serial devices over a cellular network.
- The modem enables you to reach serial devices even if they're not networked or if the network goes down.
- GSMand CDMA modems are compatible with most cellular networks.
- Federal Information Processing Standard (FIPS) 140-2 validated module for enhanced security.



For reliable console server management and access to remote data center equipment, choose an Advanced Cellular Console Server.

This platform provides secure serial console port control in a single box, whether you need 24/7 in-band or out-of-band access to your vital network-attached and serially attached devices in the data center.

#### Built-in modems + AC redundancy

Equipped with a built-in modem and dual 10/100 Ethernet ports, these servers give you multiple access paths, plus a redundant AC power supply for maximum uptime.

The modems accept a SIM card that links it to an account with a mobile carrier enabling the console server to communicate over the mobile network. To use the modem, you need a data plan and a SIM card from your telco provider.

#### Flash memory

The servers feature 16 GB of USB flash memory for local FTP/TFTP storage, which you can use for disaster recovery and storing device configurations and logs off-line.

#### IPSec High Availability VPN gateway

The servers include IPSec High Availability VPN gateway software, which enables you to set up console connections within a secure IPSec VPN network. If there's a network outage, the console server will automatically reconnect the VPN using a modem link or broadband failover route.

#### Cut power costs

You can also use these console servers to manage ports on PDUs and UPSs to cut power consumption and reduce utility bills. The console servers come with Network UPS Tools for UPS monitoring.

#### Efficient data transport

For efficient data transport, the servers feature secure serial bridging. This is useful if you need to connect to legacy serial devices running proprietary protocols over the Internet instead of an older, dedicated telecom channel.

Plus the console servers use the Linux OS platform, so there's no dealing with proprietary protocol issues when you want to customize it.

#### Other advanced features

LES1308A

- Secure out-of-band management.
- Robust advanced encryption. •
- Scanning serial stream and sending alerts.

Headquarters

Local

- Hotkey power on a PDU or an RPS.
- GNU bash shell script support.

#### Virtual Central Management System Software

Use with LES Series 1100, 1200, 1300, 1400, and 1500 Console Servers to manage large numbers of console servers.

Advanced Cellular Console Servers	
(8) RJ-45 Serial Ports, Dual Ethernet,	

and GSM Modem	LES1308A
(16) RJ-45 Serial Ports, Dual E and CDMA Modem	thernet, LES1416A
Virtual Central Management	
System Software,	
1000 Devices, 3 Years	LES-VCMS-1000-3Y

LES-VCMS-1000-3Y

To see all the products in this series, go to blackbox.com and enter LES13\* or LES14\*, in the search box.

### Serial Device Servers with Ethernet and Wireless Uplinks



### LES1200 Series (Remote Console Managers)

#### Virtual Central Management System Application



- Federal Information Processing Standard (FIPS) 140-2 validated module for enhanced security.
- 10/100 Ethernet WAN uplinks.
- Provide optional redundant backup paths via 802.11g wireless, dialup modem, or 3G cellular.
- Seamless automatic failover.
- Integral temperature sensors enable you to monitor conditions at the remote site.
- USB ports enable you to store logs and configurations on a flash drive.
- Advanced security uses LDAP, Radius, or TACACS+ authentication, yet maintains a local user list for out-of-band communications through modem or cellular links.

### LES1204A-3G-R2 Internet Internet Internet Internet Internet Internet Internet Internet Internet

# Remote Console Managers2-PortLES1202A3-Port with ModemLES1203A-M4-PortLES1204A4-Port with 3G CellularLES1204A-3G-R2

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

### Secure Site Managers



- Manage your routers or servers remotely.
- Provide in-band and out-of-band access to DB9 RS-232 serial ports on network equipment that has a serial console port.
- Include a built-in V.92 modem and a 10BASE-T/100BASE-TX port.
- Access serial ports over the network via SSH connections and simple menu-driven commands, or through a discrete TCP port connection to one of the unit's serial outputs.
- Full matrix capability enables you to connect any two ports.
- Two levels of security: one for the supervisor and one for the user.

Secure Site Managers	
8-Port	SW551A
16-Port	SW552A

### Serial Console Servers

### Common Serial Console Server Applications

Serial

PoS Device

Remote Console Manager in Serial Tunneling Configuration

Ethernet

Network



Remote Console Manager in PSTN Application

Ethernet

Remote Console Managers

(LES1202A), p. 82

PC

Serial



### **Console Servers**

Console servers give network administrators a single point-of-control for managing a wide range of IT devices from anywhere in the world. A console server is a device that provides serial ports for remote access to serial equipment, such as servers, routers, switches, firewalls, and other critical remote equipment. The remote equipment can be accessed over a serial link, such as a modem, or over a network.

Network managers can use console servers to access multiple serial ports in order to change configuration parameters, reboot equipment, connect users to restricted ports, and a variety of other functions.

Console servers are more advanced than terminal servers and usually have SSL and/or SSH security features. They also have serial communication capabilities such as SSHD and Telnet. Console servers also usually provide out-of-band management. This is useful when there is a failure of regular network communications network administrators can still access and restore communications at the remote site. Console servers are extremely useful for controlling equipment down the hall, at branch offices, and in remote offices around the world.

Console servers eliminate "truck rolls." These are expensive, time-consuming road trips to the remote site to do something as simple as rebooting a switch. In this respect, console servers give network administrators a great way to reduce operation expenses and to get the network up and running faster.

### Serial Converters



### IC100 Series (RS-232 to RS-422/485 or RS-422)



### RS-232↔RS-485/422 Converters Plus

- Transmit up to 1219.2 m (4000 feet) at speeds up to 115.2 kbps.
- Operate in multipoint applications; 2- or 4-wire operation, full- or half-duplex, async (data leads) only.
- Selectable RTS-CTS turnaround delay and loopback test feature.
- Feature a terminate/unterminate option.
- A jumper transmitter is always on or controlled by RTS.

#### RS-232↔RS-422 Converters

- Transmit up to 1219.2 m (4000 feet) at speeds up to 64 kbps.
- A jumper transmitter is always on or controlled by RTS.
- For 4-wire, full-duplex, point-to-point applications.
- Feature DIP switches instead of DIP shunts for easy setup.
- Async (data leads) only.

### IC1400 Series (RS-232 to RS-422)







How fast do you want to send data? Our top-selling converters give you two speed options.

If your PC has a 16550 UART chip, you can send data at 115.2 kbps with the RS-232↔RS-485/422 Converter Plus. It has a line bias feature that prevents it from receiving line noise as it sends or receives signals. The converter works in all popular 2- or 4-wire applications. It's also available with built-in opto-isolation.

The RS-232↔RS-422 Converter supports 64-kbps speeds and has a jumper transmitter that's always on or controlled by RTS.

Serial	<b>Bidirectional</b>	Interface	Converters
Julia	Diancetionar	miller fuce	CONVENCES

RS-232 to RS-485/422 Converters Plus, Standalone	
DB25 Female to Terminal Block	IC108A
With Opto-Isolation	IC109A-R3
RS-232 to RS-422 Converters, Data Leads Only	
Standalone, DB25 Female to Terminal Block	IC107A-R3
Rackmount Card	IC107C-R3
or full features and specs, go to <b>blackbox.com</b>	

For 1 For pricing details, call 724-746-5500.







Async Bidirectional	Interface Converters
RS_232 to RS_122	DR9 Female to Terminal Bl

RS-232 to RS-422, DB9 Female to Terminal Block	IC1473A-F
RS-232 to RS-422, DB9 Female to DB9 Female	IC1474A-F

- Convert unbalanced RS-232 signals to balanced RS-422 signals.
- The RS-232 side has a DB9 port configured as DCE.
- The RS-422 side has a terminal block (IC1473A-F) or a DB9 connector (IC1474A-F).
- RS-422 pin-outs on the ICI474A-F match an SMPTE video standardcompatible controlling device.
- If the peripheral operates on the RS-422 signal, use only one DB9 converter. But if the transmitting and receiving equipment only operates on RS-232, use two converters.
- Provides 115.2-kbps speed for distances up to 1219.2 m (4000 feet).

#### IC600 Series (RS-232 to RS-485 or RS-422)





232 | 422

### Async RS-232↔RS-485 Interface Converters

- Half- or full-duplex operation over two or four wires, point-to-point or multipoint.
- Distances up to 14.4 km (9 mi.).
- Async data rates up to 115.2 kbps.
- Operate with or without transmit "echo."

#### Async RS-232↔RS-422 Interface Converters

- Full-duplex data transmission over four wires.
- Distances up to 1219.2 m (4000 ft.).
- Async data rates up to 19.2 kbps.
- Connect directly to RS-232 equipment.
- Loop back all RS-232 handshaking signals.

### Async Bidirectional Interface Converters

RS-232≁	→RS-485, DB9 F to Terminal Block	IC620A-F
	DB9 Female to RJ-45	IC624A-F
RS-232≁	→RS-422, DB9 Female to RJ-45	IC631A-F
For full feat For pricing	ures and specs, go to <b>blackbox.com</b> . details, call <b>724-746-5500</b> .	

#### IC800 Series (RS-232 to RS-422/485)



- Converts RS-232 to 4-wire RS-422 or to 2- or 4-wire RS-485.
- Select RS-485 2-wire half-duplex or RS-485 4-wire full-duplex operation.
- Selectable RS-422 operation with transmit and receive always enabled.
- Automatic RS-485 driver control, so it works without any special programming for handshaking signals. Also enables transmitter from RS-232 TD signal and receiver when not transmitting.
- Built-in bridging switches for 2- or 4-wire operation with no external jumpers to set.





IC821A

- Set operating mode with four switches.
- No external power is required if two RS-232 output handshake lines are available.
- The model with Opto-Isolation features 2000-VAC isolation to guard against damaging ground loops.

Universal Bidirectional Converters	
RS-232↔RS-422/485	IC820A
RS-232↔RS-422/485 with Opto-Isolation	IC821A



### Selection Guide | USB Extenders

USB

Product Code		USB 1.1	USB 2.0	USB 3.0	Speeds	Remote Hub Ports	Distance Supported	Media Used	Applications
IC101A, page 90		1	_	_	Low Speed @ 1.5 Mbps High Speed @ 12 Mbps	1	85 m	CATx	<ul> <li>Interactive White Boards</li> <li>Keyboard &amp; Mouse Extension</li> </ul>
IC282A, blackbox.com		5		_	Low Speed @ 1.5 Mbps High Speed @ 12 Mbps	2	85 m	CATx	<ul><li>Digital Signage</li><li>Industrial Control</li></ul>
IC280A, blackbox.com		1	1	_	Up to 480 Mbps	1	100 m	CATx	<ul> <li>Keyboard &amp; Mouse Extension</li> <li>Digital Signage</li> <li>Industrial Control</li> </ul>
IC402A, page 88		1	1	_	Up to 480 Mbps	2	100 m	CATx	<ul> <li>Industrial Control</li> <li>Medical Device Community</li> <li>Web-Camera Security</li> <li>Access Control</li> </ul>
IC400A, page 88	vennetit intervet vennetit ven	1	1	_	Up to 480 Mbps	4	100 m	CATx	
IC404A, page 88		1	1	_	Up to 480 Mbps	4	500 m	Multimode Fiber	<ul> <li>Keyboard &amp; Mouse Extension</li> <li>Digital Signage</li> <li>Industrial Control</li> </ul>
IC406A, page 88		1	1	_	Up to 480 Mbps	4	10 km	Single-Mode Fiber	<ul> <li>Medical Device Community</li> <li>Web-Camera Security</li> <li>Access Control</li> </ul>
IC408A, page <b>89</b>		1	1		Up to 480 Mbps	4	100 m	LAN or Direct Connect	
IC502A, page 89		_	_	1	Up to 5 Gbps	2	100 m over OM3 Multimode	Multimode Fiber LC	<ul> <li>Machine Vision</li> <li>USB 3.0 Vision Specification</li> <li>Mass Storage</li> <li>Large File Transfer</li> </ul>

Note: Page numbers refer to the product series and not necessarily the specific products pictured here. For more information, go to **blackbox.com**. Note: USB 2.0 specification includes USB 1.1 compatibility.

USB

### Selection Guide | USB Hubs

	Product Code		USB 1.1	USB 2.0	USB 3.0	Ports	Speeds
	IC204A, page 90	Transa a seconda	1	1	_	4 Port Hub + 1 Power Charging Port	
	IC148A, page 90	Marine Marine Marine Marine	J	1	_	7	Up to 480 Mbps
	IC640A, page 90		1	1	_	10	
	IC159A, page 90	100 1 0 1000 1000 1000 1000 1000 1000	1	1	1	4	Up to 5 Gbps
	ICI104A, pages 38, ,91	And the second s	1	1	_	4	Up to 480 Mbps for Light Industrial
	ICI200A, pages 38, 91		1	1	_	4	
Industrial Grade	ICI202A, pages 38, 91		1	1	_	4 with Isolation	Up to 480 Mbps, UL <sup>®</sup> Listed for Class 1
	ICI207A, pages 38, 91		1	1	_	7	Division 2 Hazardous Areas -40 to +80 °C (-40 to 176 °F)
	ICI208A, pages 38, 91		s	s	_	7 with Isolation	

Note: Page numbers refer to the product series and not necessarily the specific products pictured here. For more information, go to **blackbox.com**. Note: USB 2.0 specification includes USB 1.1 compatibility.

### **USB** Extenders

MANAGED	POWER
-	
	External AC

### IC400 Series (USB Ultimate Extenders)

- Extends both USB 2.0 and USB 1.1 up to 100 meters over UTP, 500 meters over multimode fiber, and 10 kilometers over single-mode fiber.
- Includes the Extreme USB<sup>®</sup> suite of features:
  - Transparent USB extension.
  - Plug and play. No drivers to install on your computer.
  - Works with Windows®, Mac® OS X®, and Linux® systems.

USB

 Ideal for a wide variety of USB devices including printers, scanners, hard drives, audio devices, touch screens, Web cams, and more.

Install your USB devices anywhere. You can also combine your USB Ultimate Extender with additional USB hubs to power up to 14 USB devices or three USB hubs with 11 USB devices.

Depending on the extender you choose, you'll get distances of up to 100 meters (328 ft.) over UTP, 500 meters (1640.4 ft.) over multimode fiber, or 10 kilometers (6.2 mi.) over single-mode fiber. The extenders support all major operating systems including Windows, Mac OS, and Linux. They're truly plug-and-play as they are ready to operate right out of the box. No new driver installation is required. The USB Ultimate Extenders work with all USB device types: control, interrupt, bulk, and isochronous at up to 480 Mbps. An AC power adapter at the remote unit provides standard 500 mA to each USB port.



USB Ultimate Extenders	
4-Port over UTP	IC400A
2-Port over UTP, with Remote Power	IC402A
4-Port over Multimode Fiber	IC404A
4-Port over Single-Mode Fiber	IC406A

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

See the Product Selection Guide on pages 86–87.

### A brief overview of USB

The Universal Serial Bus (USB) hardware (plug-and-play) standard makes connecting peripherals to your computer easy. **USB 1.1**, introduced in 1998, is the original USB standard. It has two data rates: 12 Mbps and 1.5 Mbps.

USB 2.0, or Hi-Speed USB 2.0, was released in 2000. It increased the peripheral-to-PC speed from 12 Mbps to 480 Mbps, or 40 times faster than USB 1.1. This increase in bandwidth enabled the use of peripherals requiring higher throughput, such as CD/DVD burners, scanners, digital cameras, and video equipment. It is backward-compatible with USB 1.1.

The newest USB standard, introduced in 2008, **USB 3.0** (or SuperSpeed USB), provides vast improvements over USB 2.0. It promises speeds up to 5 Gbps, nearly ten times that of USB 2.0.

**USB 3.0** has the flat USB Type A plug, but inside there is an extra set of connectors and the edge of the plug is blue instead of white. The Type B plug also looks different, with an extra set of connectors.

USB 3.0 adds a physical bus running in parallel with the existing 2.0 bus. USB 3.0 cable contains nine wires—four wire pairs plus a ground. It has two more data pairs than USB 2.0, which has one pair for data and one pair for power. The extra pairs enable USB 3.0 to support bidirectional async, full-duplex data transfer instead of USB 2.0's half-duplex polling method. USB 3.0 provides 50% more power than USB 2.0 (150 mA vs. 100 mA) to unconfigured devices and up to 80% more power (900 mA vs. 500 mA) to configured devices. Also, USB 3.0 conserves more power when compared to USB 2.0, which uses power when the cable isn't being used.

### Transmission rate: 3.0: 4.8 Gbps



1.1: 12 Mbps max.



1.1 and 2.0 Type A 1.1 and 2.0 Type B



Mini A

Tier/bus: 5

Cable length/node:

Devices/bus: 127

requiring higher speeds)

5 meters (3 meters for 3.0 devices



1.1 and 2.0 Mini B

3.0 Type A



3.0 Type B

USB

### IC502A (USB 3.0 Ultimate Fiber Extender)



- Extends USB 3.0 signals up 100 meters (330 ft.) over multimode fiber cable.
- Transfers at 5-Gbps speeds—ten times faster than USB 2.0.
- Link to two USB 3.0 security and industrial cameras, external DVD drives, and other high-bandwidth USB devices.
- Uses secure and isolated fiber for extensions.
- Features locking power and USB ports for secure plug-ins.
- Works with AIA USB3 Vision<sup>™</sup> devices.
- Receiver supplies 900 mA of current to the remote USB devices.
- Includes the Extreme USB® suite of features:
  - Transparent USB extension.
  - Plug and play. No drivers to install on your computer.
  - Works with Windows®, Mac® OS X®, and Linux® systems.

Extend USB signals as far as 100 meters (330 ft.) to two remote USB 3.0 devices using secure, interference-free fiber cabling.

The USB 3.0 Ultimate Fiber Extender uses multimode fiber optic cabling to extend device signals to remote areas of your factory, office, or security monitoring application.

Compatible with the USB 3.0 or "SuperSpeed USB" standard, the extender boasts speeds up to 5 Gbps, about ten times that of USB 2.0. This way, you can extend your USB bus connections to newer USB 3.0 devices that use higher bandwidths and require bidirectional asynchronous, full-duplex data transfer. Plus, it supplies more power than USB 2.0 to the remote devices.

With the higher data-transfer rate and power, the extender is ideal for connecting industrial USB 3.0 machine vision cameras, particularly those with high-power sensors. It's also great for post-production video editing and broadcast applications with USB 3.0 peripherals and external USB CD/DVD drives in different rooms.

The extender offers reliable operation with all USB 3.0 devices, including USB hubs. The local unit draws its power from the USB bus and the two-port remote unit receives its power from the included AC adapter. The remote unit supplies 900 mA power for each USB port.

#### USB 3.0 Ultimate Fiber Extender

IC502A

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

### IC408A (USB 2.0 Ultimate Network or Direct Connect Extender)

- Great for extending USB keyboard, interactive whiteboard, or storage device signals.
- Versatile—extend USB 2.0 and USB 1.1 over either an Ethernet LAN or a direct CATx cable connection.
- Transmits up to 100 meters (328 feet) over CATx or between network switches.
- Includes the Extreme USB® suite of features:
  - Transparent USB extension.
  - Plug and play. No drivers to install on your computer.
  - Works with Windows®, Mac® OS X®, and Linux® systems.

The IC408A uses inexpensive UTP cable you may already have installed in your building or your existing LAN architecture for easy, cost-effective USB extension. It's ideal for USB keyboard and mouse extension and sensor/data acquisition applications. Plus it's great for connecting to whiteboards in classrooms located beyond the maximum USB bus distance.

Or use the extender to bridge the gap between a computer CPU or server and USB flash drives, scanners, and printers in other rooms, as well as to connect USB monitoring cameras or USB touchscreens used for interactive digital signage.



4-Port USB 2.0 Ultimate Network or Direct Connect Extender IC408A





- Plug-and-play hubs for connecting up to 10 high-speed USB peripherals.
- Ideal for connecting scanners, digital cameras, removable drives, MP3 players, handheld PCs, and more.
- The USB 3.0 hub transfers files at 5 Gbps—ten times faster than USB 2.0—even when using multiple devices. It's fully backward compliant with USB 2.0.
- The USB 2.0 hubs transfer data up to 480 Mbps.
- Powered either from the USB bus (without a power adapter) or from the included adapter (recommended when connecting multiple USB devices).
- Hubs detect speed of connected USB devices automatically.
- The IC148A includes one USB mini Type B male to USB Type A male cable.
- The IC204A quickly recharges USB devices. Each port has a battery charging function (only one port can charge at a time).

### Hey, so what is USB 3.0?

USB 3.0 adds a physical bus running in parallel with the existing 2.0 bus. It contains nine wires, four pairs plus a ground. USB 2.0 only has one data pair and one power pair. USB 3.0 is backward compatible with USB 2.0. It looks different too. The inside is blue instead of white.





For more specs on these hubs, see pages 86–87.

Industrial USB hubs, pages 36–37.

### Product Selection Guide | USB Hubs

Product Code	USB 2.0	USB 3.0	Ports	Speeds
IC148A	1	—	7	Up to 480 Mbps
IC204A	1	—	4 Port Hub + 1 Power Charging Port	Up to 480 Mbps
IC640A	1	—	10	Up to 480 Mbps
IC159A	_	1	4	Up to 5 Gbps

For full features and specs, go to blackbox.com. For pricing details, call 724-746-5500.

### Get the CATx and custom cable you need—fast.

Use these handy, on-line tools to find the cables you want.

CATx Cable Selector—Quickly find the exact CAT5/5e/6/6A cable you want.

Custom Cable and Adapter Configurator—Design your custom cable or adapter on-line.

### Call 724-746-5500 or visit blackbox.com/go/Configurators.



USB

### **USB** Hubs

### **ICI Series**



- Connect USB devices in light industrial settings—without worrying about disconnects or ESD.
- High-retention ports keep USB cables tightly connected.
- Ports require 3.4 pounds/force to disconnect cables.
- Rated for extreme temperatures of -40 to +80° C.
- Provide up to 15 kV ESD (electrostatic discharge) protection.
- Hubs with isolation offer 4-kV isolation between upstream and downstream ports.
- Have numerous industrial certifications and approvals.
- A great choice for factory, utility, engineering, and even healthcare applications.
- The ICI104A is housed in a rugged, polycarbonate case.
- ICI200 Series Hubs are housed in a durable, IP30-rated metal enclosure.
- All can be DIN Rail mounted.





For full features and specs, go to blackbox.com. For pricing details, call 724-746-5500.

## Tech Support the way it should be: Free, Live, 24/7.

FREE—Whether you buy or not.

Live—From our headquarters in Pittsburgh, PA. 24/7—Call anytime, day or night.

Call: 724-746-5500 or go to blackbox.com/go/TS.





For more specs on these hubs, see pages 86–87.

USB (

Commercial

### USB to Serial Converters



### IC199A-R3, IC138A-R3





- Compatibility and convenience for your serial peripherals.
- Connect non-USB devices, such as modems, printers, and GPS devices, to a USB 1.1-compliant PC.
- Provides a connection for RS-232 peripherals with DB9 or DB25 male connectors.
- Compatible with Windows® 98/SE/Me/XP/2000/7/8.
- Data-transfer rates from 300 bps to 115.2 kbps.
- Differential and bidirectional access.
- Software drivers are included.

USB Solo	
DB9	IC199A-R3
DB25	IC138A-R3

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

### IC1000 Series (USB Director RS-232)

- Turns USB ports into RS-232 ports.
- Add RS-232 devices to your PC, laptop, Thin client, or server via a single USB port.
- Ports support speeds of up to 230 kbps.
- Detects peripheral speed automatically.
- Costs less per port than serial boards.
- Configurable COM port assignment.
- No external power required.



Turn your PC's USB port into high-speed RS-232 ports with the USB Director RS-232. These intelligent, plug-and-play, USB-to-RS-232 converters give you flexible port expansion.

The USB Director RS-232 converts the USB port(s) on your desktop PC, laptop, or Thin client to high-speed RS-232 DB9 serial port(s). Attach any peripheral that uses a standard serial interface—without a serial card.

Installation is easy. The converters auto-detect peripheral speed and connection. Just plug in the included USB cable.

Make connections without powering down the network, rebooting, or removing the cover of your PC. Stack multiple units for additional COM ports (as long as you connect the units through a hub. See pages 90–91 for USB hubs).

USB Director RS-232	
1-Port	IC1000A
2-Port	IC1001A
8-Port	IC1002A

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

FREE, Live, 24/7 Tech Support Talk with an expert at **724-746-5500** or go to **blackbox.com/go/TS**.



#### IC1020 Series (USB Converters)

- Connect your non-USB serial peripherals to your USB bus.
- Makes serial connections easy by putting your RS-232 peripherals on your PC's USB bus.
- No more internal serial adapters. Keep your serial peripheral connections on your PC's exterior.
- Plug-and-play, hot-swappable, autoconfiguring.
- Data rates up to 921.6 kbps.
- Supports USB version 1.1.
- Powered by the USB bus.
- No I/O ports or IRQs required.
- Windows® 98/Me/XP and Windows 2000 compatible.
- Ideal for industrial environments.
- Includes a 6-foot cable.

Why install an internal serial adapter to get extra COM ports when using an external USB connection makes more sense? These USB converters change your serial RS-232 devices to USB-adaptable peripherals without sacrificing serial connection speeds.

The converters feature high-speed UARTs with 128-byte FIFO transmit buffers and 384-byte FIFO receive buffers. They connect easily to peripheral serial devices in external plug-and-play fashion.

They have data rates of up to 921 kbps for RS-422/485 and 460 kbps for RS-232.

The converters are ideal for connecting devices in harsh environments where communication lines may be affected by noise and voltage spikes. Not only do the USB converters give you industrial-quality serial connections, they also support automatic RS-485 data enable/disable and include a DB9 connector that's backward-compatible with PCI and ISA RS-422 products.

The converters connect easily to peripheral serial devices in external plugand-play fashion. Because they're hot-swappable, you can install them without having to power down your PC.



Top: IC1026A, rear view; middle: IC1022A (blackbox.com), rear view; bottom: IC1023A, rear view

USB Converters	
2-Port	
RS-232	IC1026A
RS-232/RS-422/RS-485	IC1020A
4-Port	
RS-232	IC1027A
RS-232/RS-422/RS-485	IC1022A
8-Port	
RS-232	IC1023A
RS-232/RS-422/RS-485	IC1025A

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

### Use a USB Converter in an industrial monitoring application.



Switches Commercial

### **Product Selection Guide**

Connector	Connector	2 to 1	4 to 1	2 to 2
DB9	•••••	SWL030A	SWL031A	SW033A
DB15	••••••	SW040A	SW041A	SW044A
DB25	••••••	SWL025A	_	—
DB37	••••••	SWL350A	_	—
DB50	••••••	SW400A	—	—
Telco 50		SW872A	—	—
RJ-11		SWL036A	SWL037A	—
RJ-45		SWL060A	SW061A	—
10-Mbps RJ-45		SWL065A	—	—
100-Mbps RJ-45		SWJ-100A	_	—
10-Gbps RJ-45		SW1030A	SW1032A	_

### You can also order a prebuilt Rackmount Chassis Switch.

#### Save time! Order our Preassembled Rackmount Manual Switches.

We have four rackmount chassis already loaded in our most frequently requested configurations.



These switches are tested and certified in our Test Lab and backed with our lifetime guarantee.

We ship from stock immediately. Plenty of switches in any of the four configurations listed below are available.

Preassembled Rackmount Manual Switches	
ABC-25 (8 Switches), All Female	
25-Lead	SM025A-FF
ABCDE-25 (5 Switches), Alll Female	
25-Lead	SM026A-FFFF
ABC-Coax (12 Switches), All BNC Female	SM550A-BN0

.........

SM025A-FFF

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

Max. No. per Chassis		Free Punches		
Std.	Mini	Code	Code	Switches (blackbox.com)
				DB25
8	3	SRP025	SR025	ABC–DB25 (25 Leads)
8	3	SRP025	SR084	ABC–DB25 (4 Leads)
5	2	SRP026	SR026	ABCDE–DB25 (25 Leads)
6	3	SRP027	SR027	X–DB25 (25 Leads)
4	1	SRP025	SR059	6-to-1–DB25 Parallel
				Modem & Telco
6	1	SRP870	SR870	ABC–Telco
8	2	SRP037	SR037	ABCDE-RJ-11
4	2	SRP076	SR076	6-to-1-RJ-11
8	3	SRP060	SR060	ABC-RJ-45
5	2	SRP077	SR077	6-to-1-RJ-45
				Other D-Style
8	3	SRP030	SR030	ABC-DB9
5	2	SRP031	SR031	ABCDE-DB9
6	3	SRP033	SR033	X–DB9
5	2	SRP035	SR035	6-to-1–DB9
8	3	SRP040	SR040	ABC-DB15
4	1	SRP360	SR360	ABCDE-DB37

### Pro Switching System, 1U Network Backup System



### **NBS00 Series**



- Prevent costly network downtime with this reliable A/B gang switching system.
- Provides A/B switching between fiber SC multimode, 10/100 copper (NBS008A), or 10/100/1000 copper (NBS0016A) terminated circuits.
- Latches the A/B position to keep signals moving even if power is lost.
- Enables individual or simultaneous (ganged) control of circuits.
- Switch manually or remotely over Ethernet using a local RS-232 serial console.
- Lockable switch with removable key to disable manual control.
- Reliable micro-mirror optical switching mechanisms.
- Transparent to data rates, protocols, formats, and signal levels.
- Includes dual power inputs for redundancy.
- Daisychain multiple units for up to 255 chassis.

With the Pro Switching Network Backup System, it's very simple to switch all users from a main network to a backup network at the chassis itself using a momentary toggle switch on the front or via a serial RS-232 workstation or Ethernet terminal.

Unique latching optical switch mechanisms and micro-mirrors optically route signals between ports.

Each switching circuit has a common (C) port that's latched to its associated A or B port, which means it transmits signals even if the chassis is without AC power. Because its relays are physically latched into position, once a position is set, it stays set.

A key-lockable switch secures the manual gang-switching function. With the key-lock switch in the enabled position, all ports in the Pro Switching System can be simultaneously switched by pressing the momentary toggle switch on the chassis' front.

Port settings are also software controllable, so you can toggle a single connected device, or all devices, from the A to the B position from a workstation. You not only have reliable network paths, but you can automate switching to control individual settings.

Need to add ports later? Simply daisychain multiple Pro Switching System chassis together—up to 255 in all—and control them as a single system.

### Pro Switching System, 1U NBS

Fiber Multimode, SC A/B	
4-Port	NBS004A
6-Port	NBS006A
RJ-45 A/B (Pins 1, 2 & 3, 6)	
8-Port (Pins 1, 2 & 3, 6)	NBS008A
16-Port (Pins 1, 2 & 3, 6)	NBS016A
8-Port (Pins 1, 2 & 3, 6), Network Manageable	NBS008MA
8-Port (All Pins), Network Manageable	NBSALL8MGR

Managed Pro Switching System switches are available at **blackbox.com**. For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

### **Electronic Switches**



### SW540A-R3 (Code-Operated Matrix Switch)



- Centralize your switching chores with the flexible, any-port-to-any-port switch.
- Shows the current status of all ports to any PC user running terminal emulation.
- Port-independent selection of speed, flow control, and data format.
- No "master" port—any port can talk to any other.
- Supports up to two (base unit) or four (expanded) simultaneous connections with optional 4-Port Expansion Board (SW541-C).
- Use with Extended-Distance Data Cable (EDN25C).

Code-Operated Matrix Switch

SW540A-R3

For full features and specs, go to blackbox.com. For pricing details, call 724-746-5500.

### SW590A-R2 (Code-Operated Switch II)



- Control four serial devices from your PC—any speed, any word structure.
- Four ports become eight with the optional 4-Port Expansion Board (SW591C).
- Individual port selection for word size, flow control, speed, parity, and DCE/DTE operation.
- 8-KB buffer for speed and word-format conversion; buffer downshifts data for slower devices.
- Standalone or rackmountable.
- Use with RS-232 Extended-Distance Data (ED/Q) Cable (EDN25T, EDN25C).

Code-Operated Switch II (COS II)

-RS-232 Cable (ECM25T-0010)
-Parallel Printer Cable (EYN600-MM)
-RJ-45 (8-Wire) Modular Cable (EL08MS-07)

• Use with:

SW590A-R2

For full features and specs, go to blackbox.com. For pricing details, call 724-746-5500.

Works locally and remotely with a wide range of input voltages.
Ideal for use in process control and automated environments.
Enables both crossover and standard straight-through operation.

• Choose your remote access port: RS-232, RS-422, RS-485, RS-530, TTL, or dry contacts.

• Switch remotely through EIA or TTL control signals, or switch locally by turning the knob.

### SW980A Series (Local/Remote Electronic Switches)



 Local/Remote Electronic Switches
 SW980A

 ABC (2 to 1)
 SW980A

 ABCDE (4 to 1)
 SW982A

 X (2 to 2)
 SW981A

Switches

### Fiber Optic A/B Switches



### SW1000 Series

- For ultra-secure, critical-circuit switching, use these micro-mirror optical devices.
- No optical-to-electrical conversion between fiber connections.
- Switches use internal mirrors to optically move data between ports—technology that's trusted and time-tested.
- Good for government, healthcare, financial, or other applications where a
  private, data-sensitive network connects to a publicly accessible network.
- Connect a single workstation to two or more networks or remote devices.
- Non-latching switches fall back to C-to-A position if power is lost.
- Operate transparently to signal rates, formats, and wavelengths.
- Universal 100-240-VAC power supply.

There's a reason why this type of manual switch continues to be the switch of choice for networking professionals everywhere: It's a tried-and-true optical switch that performs as promised year after year.

It's secure because it uses micro-mirrors instead of electronics to route data signals from one fiber optic port to the next. And unlike conventional electronic switches, there are no complex and vulnerable electronic circuits to monitor and protect from intrusion, component failure, or interference.

The switches are available in latching and non-latching models. The optical mirror movement on the latching versions maintains the selected position even when there's a power failure.

You can also order an A/B switch with unique loopback capabilities (SW1011A-R2).

Using loopbacks, you can verify the integrity of your backup fiber link while still connected to your primary fiber link. This is especially useful in failover applications where you want to continuously test the "unused" circuit to ensure that it's available if needed.

1334
34A
35A
36A

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

BLACK BOX 724-746-5500	NON-LATCHING FIBER OPTIC AIR SWITCH
BLACK BOX 724-746-5500	LATCHING FIBER OPTIC A/B/C SWITCH
Power A	8 C
BLACK BOX 724-746-5500	LATCHING FIBER OPTIC A/B/C/D SWITCH
Power A	всь

Fiber Optic A/B Switches, 62.5-Micron Multimode	
Non-Latching	
ST	SW1000A-R2
with Off Position, ST	SW1003A
with Loopback, SC	SW1011A-R2
Latching	
ST	SW1002A
SC	SW1008A
with Loopback, ST	SW1010A
Fiber Optic ABC Switch	
Non-Latching, ST	SW1007A-R2
Fiber Optic ABCD Switches	
Non-Latching, ST	SW1006A-R2
Latching, ST	SW1005A

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

### What others are saying...

"I wanted to take a moment to express my appreciation of the Black Box Technical Support department. I have called twice in the past six months with technical questions. Both times I have been met with great enthusiasm and eagerness to assist. Not only did I get my questions answered, but I got off the phone with a greater understanding of fiber optics. Great customer service overall."

Mo Harouny, Athena Engineering, Inc.

Switches

### Commercial

### Layer 1 A/B switches for DBx, Video, Fiber, and Ethernet Connections



### SM960 Series (Pro Switching System Plus)

- Holds up to 16 switch modules. Mix and match data, voice, video, and AC power switching modules in a single chassis.
- Offers secure switching via latching relays or micro-mirror switching mechanisms.
- Cascade multiple 18-slot chassis to support up to 4080 ports.
- Supports CAT6 10-GbE as well as legacy RS-232 connections via optional modules.
- Switch operates at Layer 1 and is transparent to data formats and protocols.
- Choose a separately available Controller Card to control switching locally or remotely.

Network Disaster Recovery/Continuation of Operations

• Single-mode model also available.



SM960A: front view



The Pro Switching System Plus is an intelligent ganged switching system consisting of a chassis and individual interface cards (order separately). The advanced design of this system gives you incredible operational flexibility and performance.

You can switch one card individually or switch the entire rack through a Controller Card. You can even daisychain multiple chassis to control up to 4080 individual ports.

The chassis includes a backplane for plugging in the cards. Just order the cards you need, as well as a Power Supply Module. (For redundancy, order two Power Supply Modules).

### Switch securely.

For fail-safe operation, the system uses proprietary micro-mirror or latching relay switching technology. That means data can continue to pass through even if the power has been cut off. The cards perform Layer 1 switching, so the system operates independently of data rates, protocols, or formats.

#### The Controller Card.

The key to the system is the Controller Card. One is required for each 18-slot chassis. The Controller Card enables you to individually switch any port from the front panel, or gang switch the entire system.

For more capabilities, choose models with an RS-232 serial controller, or an SNMP-based Ethernet controller, which also includes GUI Switch center software. These intelligent cards enable you to switch from anywhere in the world via an RS-232 or IP connection.

Each chassis also has a keyed switch so you can enable/disable manual switching from the front-panel toggle switches.

#### Mix it up.

Switching cards are available for RS-232, video, fiber, and CAT5 and CAT6 connections.

Use the system to support both new and legacy technologies. Add cards for fast CAT6 10-GbE networking while keeping connections for older RS-232 and 75-ohm video connections.

#### Control power.

To power a backup network, choose the 1-In/2-Out Power Switch Modules. Or, to set up a redundant backup power supply, choose the 2-In/1-Out models. Both are available with advanced network reporting functions.

### Pro Switching System Plus

4U Chassis

SM960A

To see all the products in this series, go to **blackbox.com** and enter SM96\* or SM97\* in the search box.



### SM260 Series (Pro Switching System, 2U)



SM260A: left: front view; right: rear view

- Mix and match hot-swappable RS-232, RS-530, video, fiber, CAT5e, and CAT6 A/B switching modules in a single chassis.
- Chassis holds up to 18 modules. Cascade multiple chassis.
- Offers secure switching via latching relays.
- Choose a single power supply or dual-redundant power cards.
- Control switching locally or remotely.
- Single-mode model also available.

The Pro Switching System 2U is an intelligent ganged switching system consisting of an ultracompact 2U 18-slot chassis and a selection of A/B switching, controller, and power supply cards.

Controller Cards take up only one slot, and Power Cards take up one slot or two slots for redundancy, leaving you with 13–16 slots for A/B Switch Cards. All occupy one slot, except for the DB25 Cards, which require three slots.

#### Local and remote control.

The advanced design of this system gives incredible operational flexibility and performance. Switch one card individually or switch the entire chassis through a Controller Card. You'll need one Controller Card per rack chassis. If you plan to daisychain multiple chassis, the Controller Card in any chassis can control the entire system.

You can choose an RS-232 Only Controller Card, which enables you to gang switch via the manual toggle switch or with serial commands, as well as an RS-232/Ethernet (SNMP) Controller Card, which enables you to switch the chassis from anywhere via an RS-232 or IP connection. If you want to extend RS-232/IP control to a second daisychained Pro Switching System chassis, order the SNMP Expansion Controller Card. This enables you to send RS-232 or Ethernet commands to any chassis in the system through the RS-232/Ethernet (SNMP) Controller Card.

#### Pick a card, any card.

A/B Switch Cards are available for RS-232, video, fiber optic, and CAT5e/CAT6 connections. Use the system for both new and legacy applications. You can add cards for fast CAT6 10-GbE networking while keeping connections for older RS-232 and 75-ohm video connections.

#### Secure and fallback switching.

For fail-safe operation, all the cards (except those noted) use proprietary latching or micromirror relay switching technology—which means data can continue to pass through even if the power has been cut off. Because the cards perform Layer 1 switching, the system operates independently of data rates, protocols, formats, or signal levels. The non-latching fiber cards fall back to a Port C (common) to Port A connection when the power fails. When power is restored, the non-latching switch card reconnects Port C to the originally selected port (A or B). These types of cards are typical when you want a fallback or failover connection during power outages.

Each chassis also has a keyed switch so you can enable/disable manual switching from the front-panel toggle switches.

#### Control power.

To power your chassis, order one or two external power supplies and the power adapter. For backup power, add a Redundant Power Supply.

Pro Switching System, 2U	
18-Card Chassis	SM260A

To see all the products in this series, go to **blackbox.com** and search for SM26\* or SM27\* for the chassis, controller cards, and power.

Comm Gear Co

Commercial

### Modems



### MT660 Series (FlexPoint T1/E1 to Fiber Line Drivers)

- Extend T1/E1 networks over fiber.
- Works as a standalone or hot-swappable chassis-based extender.
- Easy installation with no software.
- Includes an AC power supply.
- Optional rackmount power chassis holds 14 converters and AC or DC power supplies.
- Can also be mounted on a wall or DIN rail with optional hardware.
- Connects T1 or E1 PBXs, CSUs, or routers over fiber to protect against noise and increase network reliability.
- A crossover switch on the RJ-45/RJ-48 port enables easy equipment connections.
- Extensive diagnostics, including local and remote loopbacks, and all 1s (AIS) insertion mode.
- LEDs display T1/E1 link status, modes of operation, and line segment errors.
- Must be used in pairs.

# 

### Product Selection Guide

Product Code	Fiber	Connector	Distance	Power Options
MT660A-MM	Multimode Multimode	ST	5 km	
MT662A-MSC		SC	5 km	115–230 AC
MT661A-SM	Single-Mode	ST	28 km	48 VDC
MT663A-SSC		SC	28 km	18–72 DC
MT664A-SSC		SC	58 km	

For full features and specs, go to blackbox.com. For pricing details, call 724-746-5500.

### MT195A-T1 (T1 Extender for Copper)



- Extend T1 lines to 5.6 km (3.5 miles) over a single twisted pair.
- Use for legacy T1 backhauls from a remote site, relocation, extension across a campus, and last-mile TDM delivery.
- Completely plug-and-play—no configuration required.
- Put one unit on each side of the dry copper pair, connect your T1 devices, and go.
- Use only two polarity-insensitive pins so you can connect either wire to either pin.
- Operate in Clear Channel mode to easily transport voice and data circuits (F-bit included).
- Check status via the front-panel LEDs.

#### T1 Extender for Copper, 2-Pack

MT195A-T1

### Commercial **Com**

Comm Gear

### TL500A (Out-of-Band Network Switch, Telephony Firewall, Call Router)

- Provides a secure and controlled "out-of-band" communications path to service ports.
- Telephony firewall protects device access with user-defined security access codes.
- Automatically screens and routes all incoming voice, fax, and modem calls to the correct equipment.
- Multiple emergency barge-in ports assigned by user, for priority outbound calls.
- Caller ID "store and forward" CID is sent to device on first ring.
- Display shows port in use and read back during programming.
- Enables secure access control to third-party service providers.
- Phone-line sharing reduces telecom costs by eliminating dedicated phone lines.
- Security access codes programmed by user, up to seven digits.
- Operates on AC or DC power.



The Out-of-Band Network Switch, Telephony Firewall, and Call Router Switch enables businesses to communicate with remote telecom and IT network assets more efficiently and securely while cutting costs. Share up to five connections on one phone line. The TL500A can be used to routinely access remote service ports to network equipment and to provide redundant POTS connectivity to equipment when the IT network is down. The switch automatically routes incoming calls to modems, faxes, phones, and/or service points. Vulnerable PSTN pathways are protected with seven-character security access codes (DTMF), creating a telephony firewall for dial-up devices.

#### Out-of-Band Network Switch, Telephony Firewall, Call Router

TL500A

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

### MD1000A (Modem 3600)



- This secure dialup model features 33.6-kbps speeds.
- Use for legacy equipment transmissions.
- Operates over dialup analog or 2-/4-wire leased lines.
- Provides sync, async, and fax capabilities for links between a local computer and a remote computer, fax, or other legacy device.
- Switches to a dialup line if the leased-line connection fails and automatically returns with the leased line is back up.
- Includes features that enhance operations on less-than-ideal transmission lines, such as: echo canceling, automatic adaptive line equalizing, trellis coding techniques, and adaptive baud rate selection.
- Security includes passwords and programmable dialback security.
- Remote configuration lets you tend to distant modems from your office.

Modem 3600, Standalone, AC-Powered

MD1000A

### Comm Gear

### Commercial

### **Copper Line Drivers**



### ME800A-R4 (Short-Haul Modem)

- Ideal for point-of-sale applications.
- Transmits RS-232 up to 6.4 km (4 miles), at 9600 bps, over 4-wire connection.
- At a maximum speed of 115.2-kbps you can go up to 1.2 km (4000 feet).
- The ME800A-R4 is backwards compatible with the ME800A-R3.
- Must be used in pairs.



#### Short-Haul Modem-C Async (SHM-C Async)

ME800A-R4

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

4-Wire, Standalone

### ME890A-R2 (CAT5 DB9 Line Driver)



- Put your RS-232 equipment where you want—up to 3000 feet away.
- Run signals over CAT5 cable and break the RS-232 distance limitation.
- Plug-and-play. The driver is a pure hardware solution providing real-time data transfer with no software conflicts.
- Pass control signals from one end to the other.

### CAT5 DB9 Line Driver

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

### LR0300 Series (T1/E1 Ethernet Network Extender Kits)



### ME475A-R2 (Async/Sync Short Haul Modem)



- Sends your data 12.2 km (7.6 miles) at up to 56.7 kbps over 24 AWG wire (speed dependent).
- Point-to-point or multipoint operation.
- Transformer isolation and surge protection.
- V.54 loopback and V.52 BERT pattern generator.

#### Async/Sync Short-Haul Modem

ME475A-R2

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

- Kits include two extenders equipped with one, four, or eight T1/E1 ports, as well as dual Ethernet ports.
- Bridge 10BASE-T/100BASE-TX Ethernet across a single T1/E1 line.
- Support speeds up to 1.544 Mbps on T1 and 2.048 Mbps on E1.
- Support Fractional E1/T1 in framed and unframed mode.
- Autosensing, autonegotiating 10-100-Mbps ports.
- Auto MDI/MDI-X means you never nedd a crossover cable on the Ethernet side.

T1/E1 Ethernet Network Extender Kits

8-Port	LR0308A-KIT
4-Port	LR0304A-KIT
1-Port	LR0301A-KIT

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

ME890A-R2

### Comm Gear

### **Fiber Line Drivers**



### ME540A-ST (Fiber Optic Multipoint Line Driver)

- Ideal for electrically "noisy" environments.
- Supports RS-232, RS-485, or Current Loop installations.
- Speeds as high as 128 kbps.
- Provides centralized control of a multipoint polled system from just one PC.
- Monitor and control up to 64 industrial devices—time clocks, conveyor belts, even printers and controllers.
- Configure in any of three modes: network, master/slave, or full-duple, point to point.
- Must be used in pairs.



#### Fiber Optic Multipoint Line Driver, ST

ME540A-ST

MD650A-85

MD650A-13

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

### MD650 Series (Universal Fiber Optic Line Drivers)

- Use fiber instead of copper to send your RS-232/422/485 data—without routing it through interface converters.
- Mix protocols. One transceiver can be set to interface with an RS-232 device at one end and another to interface with an RS-485 device at the opposite end.
- Transmit and receive signals in both point-to-point and drop-and-repeat topologies.
- Ideal for fiber applications that use different interface standards.
- End-to-end interface conversion—no separate box is needed.
- Communicate signals in a point-to-point or ring topology.
- Speeds up to 10 Mbps for RS-422 and RS-485, 200 kbps for RS-232.



Universal Fiber Optic Line Driver Transceivers 850-nm Multimode, 4 km 1310-nm Single-Mode, 35 km

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

### ME660 Series (FlexPoint RS-232 to Fiber Line Drivers)

- Works as a standalone driver or as a hot-swappable chassis-mount driver in a FlexPoint Media Converter Chassis.
- Operates as a serial Interface RS-232 fiber extender.
- Autosenses speeds up to 115.2 kbps.
- Features DTE/DCE configuration.
- Async, point-to-point communications.
- Supports half- and full-duplex.
- Must be used in pairs.

### **Product Selection Guide**





ME663A-SSC

ME660A-MST

Product Code	Fiber	Connector	Distance	Power Options
ME660A-MST	850-nm Multimode	ST	2.5 km (1.6 mi.)	
ME660A-MSC	850-nm Multimode	SC	2.5 km (1.6 mi.)	
ME661A-MRJ	1310-nm Multimode	MT-RJ	5 km (3.1 mi.)	115–230 AC
ME661A-MST	1310-nm Multimode	ST	5 km (3.1 mi.)	48 VDC 18–72 DC
ME662A-SST	Single-Mode	ST	30 km (18.6 mi.)	
ME662A-SSC		SC	30 km (18.6 mi.)	
ME663A-SSC		SC	60 km (37.2 mi.)	9 VDC/500 mA or 5 VDC/750 mA

For full features and specs, go to blackbox.com. For pricing details, call 724-746-5500.

LANs, WANs, and Beyond: blackbox.com/networking.

### **Line Sharers**

DESKTOP	DB25

### **TL070 Series (Modem Splitters)**



• Modem sharing for three or six users.

- Connect multiple terminals to one modem.
- Perfect for workgroups with limited datacom needs.
- Work in sync and async environments.
- Transparent to speed and protocol.
- Both models include DB25 extension cable and a serial adapter.
- Inexpensive, non-powered, easy to use.

Use a Modem Splitter to connect three or six terminals to one modem and save money—you won't need extra modems and extra lines.

No special cables are needed. The splitters use ordinary straight-pinned cables for hookup, and include a 6-foot DB25 male/DB25 female extension cable and a serial DB9 female/DB25 male AT adapter.

The splitters are transparent to speed and protocol and work equally well in sync and async environments.

If you need port contention or advanced features such as prioritized port scanning, see our RS-232 Data Sharers (TL601A-R2) (facing page).

Modem Splitters	
3-Port (MS-3)	TL073A-R4
6-Port (MS-6)	TL074A-R4

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**.

### TL421A (4-Port Modem Splitter)

- Enables four RS-232 terminal devices to share a single modem.
- Transmits data received from the modem to all attached terminal devices.
- Passive, non-powered. Operates transparent to data formats and speeds.

Featuring multiple ports for splitting modem signals, the compact 4-Port Modem Splitter (RS-232 on RJ-45) makes it easy and affordable for four terminals to share a single modem.

With it, you can avoid the cost of having to purchase and install multiple modems and multiple modem lines.

Plus, it's easy to set up and use. There are no user-configurable switches, jumpers, or settings on the modem splitter. Simply connect the modem and terminal (DTE) devices to it, then power up your modem and terminals as normal.

The splitter's master port connects to your modem using an RJ-45 straight-through cable and the appropriate RJ or DB adapter. Its other ports (Port 1 through Port 4) connect to your DTE terminal devices.

NOTE: Only one terminal device can send data to the modem at a time.



### 4-Port Modem Splitter (RS-232 on RJ-45)

TL421A



### TL500, TL600 Series (RS-232 Data Sharers)

- Cut modem costs and leased-line charges by linking up to eight RS-232 devices to one modem and phone line.
- Use a single phone line and modem to share multiple RS-232 devices.
- Transparent to data rates up to 64 kbps.
- Run sync or async half- or full-duplex.
- Front-panel switches enable and disable RTS on each input port.
- Feature anti-streaming circuitry to lock out any port the instant it begins to stream.
- On the 4- and 8-port models, hardware-prioritized scanning lets the most frequently used channels go first.

Reduce line costs in your RS-232 system by using Black Box® RS-232 Data Sharers to connect two, four, or eight devices to a single modem and phone line.

The Data Sharers feature transparent operation up to 64 kbps and convenient LED monitoring. Front-panel switches enable and disable RTS on each input port.

In addition, they have anti-streaming circuitry to lock out any port the instant it begins to stream. Hardware-prioritized scanning lets the most frequently used channels go first.



Top: TL553A-R3; bottom: TL554A-R3





RS-232 Data Sharers	
2-Port	TL601A-R2
4-Port	TL553A-R3
8-Port	TL554A-R3

Comm Gear

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### Data Broadcast Units



### TL150 Series, TL160A-R2, TL305A

#### **TL150 Series**

- Send async data to as many as eight printers, terminals, PCs, plotters, or other slave devices.
- All ports are DTE/DCE switch-selectable.
- Put one between your async CPU and up to eight terminals. Students see everything on your screen.
- Ideal for polling applications or other controlled environments.
- DB25 model is rackmountable and enables you to connect each port directly and quickly to slave ports.
- Use RJ-11 version in modular wiring environments. Order an optional RJ Adapter Kit to connect it to premise DTEs equipped with DB25 connectors.



TL160A-R2 (Buffered)

- Broadcasts data to four printers or terminals without delay.
- Add the optional four-port expansion card (TL160-C) to broadcast to eight terminals.
- Buffers data individually for each port.
- Add 32 KB Memory Expansion (TL484) and keep data on slower devices moving.
- Broadcasts async RS-232 data simultaneously to multiple terminals or printers.
- Dynamically allocates memory.
- All ports are DTE/DCE switch selectable.



This broadcast unit features an internal buffer that's dynamically allocated to its individual ports, so your connected printers and other devices receive data continuously—regardless of their speeds.

It features dynamic allocation, so a varying amount of buffer is given to each port as it needs it, instead of having a set size of buffer for each port.

This dynamic memory allocation works in both directions, too. For example, if a terminal sends data to the host, data from other terminals is sent to the buffer and queued. When the first terminal ends its transmission, the unit pulls the remaining information in order from the buffer.

TL158A-R4
TL159A
TL160A-R2
Taps

### Copper and Fiber Taps, Aggregators

#### **TS200 Series**

- Get an accurate view of your copper network.
- Provide a complete copy of data from full-duplex network links.
- Offer complete network visibility regardless of traffic levels.

Get a complete view of the traffic on your 10-/100-/1000-Mbps Ethernet network without disruption or downtime by using 10/100/1000 Copper Tap and 10/100/1000 Copper Aggregators.

The 10/100/1000 Copper Tap provides a complete copy of data from a full-duplex copper link to your network analyzer.

If you want to monitor, transmit, and receive data streams at the same time, choose a 10/100/1000 Copper Aggregator. They combine, transmit, and receive data streams so you can see them together without switching from one to the other. Even better, you can choose between models with either a 256 or 512 MB buffer, which continues to collect the data stream during spikes in network traffic.

Because you can leave the Tap or Aggregators inserted permanently without interfering with network operation and minimizing points of failure, you can easily connect and disconnect different devices. Use them with network and protocol analyzers, security monitoring devices, remote monitoring applications, RMON probes, and more.





#### 10/100BASE-T and 10/100/1000 Copper Taps

- A redundant power supply supports the flow of traffic to the monitoring device.
- If no power is available, network traffic flows uninterrupted.
- Monitor 10/100/1000 Ethernet networks.
- Use a straight CAT5 cable to connect the two network ports to DTE and a crossover cable to connect the monitor ports to DCE.

#### Gigabit Fiber Tap

- Monitors traffic at up to 1000 Mbps.
- Features three multimode duplex SC 62.5-/125-µm fiber connectors and a fiber wavelength of 850 nm, 1300 nm, or 1550 nm.
- · Portable plug-in, plug-out design with no power source required.
- Order the 1-meter SC/SC fiber patch cord for use between the module and your LAN analyzer.

#### Single-Channel 10-Gbps Optical Tap

- Monitors high-speed fiber links with no network disruption.
- Tap splits the full-duplex signal in 50/50 ratios from the network into two signals.
- Monitors network traffic at up to 10 Gbps, troubleshoot problems, and run test equipment with no interruption in data flow.
- Get an accurate view of your fiber optic network.

10/100/1000 Copper Aggregators	
256 Mb Buffer	TS254A
512 Mb Buffer	TS255A
10/100BASE-T Copper Tap	TS230A-R2
10/100/1000 Copper Tap	TS250A
Gigabit Fiber Tap	TS240A-R2
Single-Channel 10-Gbps Optical Tap	
50/50 Split Ratio, Single-Mode, 9-µm	TS246A

For full features and specs, go to **blackbox.com**. For pricing details, call **724-746-5500**. Infrastructure Commercial

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#### B Cold Front<sup>™</sup> Liquid Cooling

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#### C Elite<sup>™</sup> Cabinets with Containment Doors and Chimneys

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Largest cooling capacity in the industryup to 75 kW per cooling unit. Use with or without containment.



Commercial Infrastructure

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