



September, 2002

**Express
Ethernet Switches:
LB9024A**



CUSTOMER
SUPPORT
INFORMATION

Order toll-free in the U.S. 24 hours, 7 A.M. Monday to midnight Friday: **877-877-BBOX**
FREE technical support, 24 hours a day, 7 days a week: Call **724-746-5500** or fax **724-746-0746**
Mail order: **Black Box Corporation**, 1000 Park Drive, Lawrence, PA 15055-1018
Web site: **www.blackbox.com** • E-mail: **info@blackbox.com**

FEDERAL COMMUNICATIONS COMMISSION AND
CANADIAN DEPARTMENT OF COMMUNICATIONS
RADIO FREQUENCY INTERFERENCE STATEMENT

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

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

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

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

Normas Oficiales Mexicanas (NOM)
INSTRUCCIONES DE SEGURIDAD

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc.
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá a lo descrito en las instrucciones de operación. Todo otro servicio deberá ser referido a personal de servicio calificado.
9. El aparato eléctrico debe ser situado de tal manera que su posición no interfiera su uso. La colocación del aparato eléctrico sobre una cama, sofá, alfombra o superficie similar puede bloquea la ventilación, no se debe colocar en libreros o gabinetes que impidan el flujo de aire por los orificios de ventilación.
10. El equipo eléctrico deber ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.
11. El aparato eléctrico deberá ser conectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.

12. Precaución debe ser tomada de tal manera que la tierra física y la polarización del equipo no sea eliminada.
13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.
14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.
15. En caso de existir, una antena externa deberá ser localizada lejos de las líneas de energía.
16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.
17. Cuidado debe ser tomado de tal manera que objetos líquidos no sean derramados sobre la cubierta u orificios de ventilación.
18. Servicio por personal calificado deberá ser provisto cuando:
 - A: El cable de poder o el contacto ha sido dañado; u
 - B: Objetos han caído o líquido ha sido derramado dentro del aparato; o
 - C: El aparato ha sido expuesto a la lluvia; o
 - D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o
 - E: El aparato ha sido tirado o su cubierta ha sido dañada.

About This Manual

This manual describes the Black Box Express Ethernet Switch in these basic sections:

- Product Features
- Installation
- Trouble-shooting
- Glossary of Terms

Product Features

This section examines the key features, the physical features, and the product specifications of each model.

Installation

This section leads with a Quick Tip, and continues with a detailed description of Connecting to Power and Connecting to Your Network with the two types of cable: copper-based and fiber-optic. The section concludes with instructions on using the Uplink Function.

Trouble-shooting

This guide leads you through trouble-shooting the most common networking problems.

Glossary

A brief glossary defines the terms used in this manual.

This manual services the following Express Ethernet Switches:

SIZE	PART NUMBER	PORT COUNT
RACKMOUNT	LB9024A	24 port TX with module slot

Table of Contents	
About This Manual	4
Product Features.....	4
Installation.....	4
Trouble-shooting.....	4
Glossary	4
Product Features	7
Key Features	7
Physical Features	8
Special features for LB9024A.....	9
Setting up Console Port Connection	9
VLAN and Speed/Duplex port setting for LB9024A.....	10
Establishing a VLAN	10
Performing Port Aggregation.....	11
Configuring Ports.....	11
Fiber Module Installation.....	12
Product Specifications	13
Installation	15
Quick Tip	15
Connecting to Power	15
Connecting to Your Network	15
Copper-based cabling.....	15
Fiber-optic cabling	15
Uplink or MDI Function	16
No Power to the Switch.	17
No Connectivity to the Data Terminal Equipment.....	17
No Connectivity to Certain Nodes on the Network	17
Transmission Problems	18
Trademarks	19
Glossary	19

Product Features

This section addresses:

- Key Features
- Physical Features (including LEDs)
- Product Specification

Key Features

- Auto-negotiation for speed and duplex on every TX port
- Plug & play
- True non-blocking architecture
- Full wire-speed forwarding
- Store-and-forward switching mechanism
- Runt and CRC filtering eliminate erroneous packets to optimize network bandwidth
- Back pressure for half-duplex
- IEEE 802.3x flow control for full-duplex
- MAC address filtering and relearning that automatically adjusts to the network configuration
- Comprehensive array of LED indicators that communicate the status of the switch and trouble-shooting information
- Designed in compliance with 10BASE-T, IEEE802.3u, 100BASE-TX, and 100BASE-FX standards
- Full compatibility with standard Ethernet applications, internetworking systems, and client-side adapters to minimize migration cost

Physical Features

- **AC Input:** 100-250VAC, 47-63Hz internal universal power supply
- **Input Fuse:** 2A
- **Power Consumption:** 30W
- **Operating Temperature:** 0 C- 40 C (32 F- 104 F)
- **Storage Temperature:** -25 C- 70 C (-13 F-158 F)
- **Humidity:** 10%-90% non-condensing
- **Emission Compliance:** FCC part 15 class A, CE Mark, VCCI Class A
- **Safety:** UL
- **Dimensions:** W439mm x D203mm x H46mm (17.3" x 8" x 1.8")
Standard 19" Rack Mount Size
- **Net weight:** 2.9kg (6.4lb)

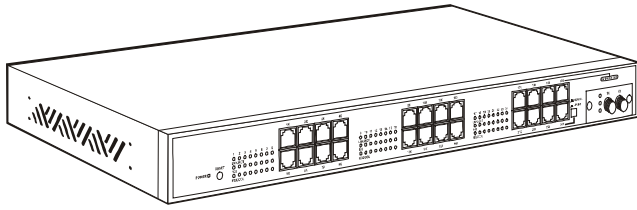
LB9024A

Figure 1: Rackmount size, 24 ports with optional fiber module and special features (see the following special features section) LB9024A

Special features for LB9024A

LB9024A houses a console port that enables connection to establish a VLAN (virtual local area network), port aggregation, the setting of half or full-duplex transmission, and the setting of 10Mbps or 100Mbps for TX transmission.

For these features to operate through the console port, it is necessary to first configure in DOS or a terminal emulation program such as HyperTerminal.

Setting up Console Port Connection

To configure these features through the console port, it is necessary to first configure a terminal emulation program in DOS or in Windows such as HyperTerminal.

- Check the switch, cables, and computers for proper installation before configuration.
- Attach a PC or any VT100 compatible terminal to the console port on the back of the switch (see figure 6) using the following settings:

Terminal type	VT100
Port type	(COM 1~4)
Communication Mode	8 data bits, 1 stop bit, no parity and 9600bps (for initial configuration)
Flow Control	None
Hardware Compression	NA

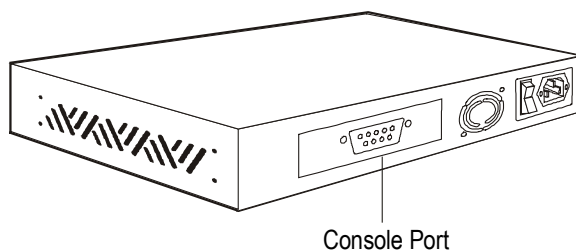


Figure 2: Console Port

VLAN and Speed/Duplex port setting for LB9024A

- After setting up the console port, turn on the switch and press any key to view the main menu shown below:

VLAN		Port List	
V1	1,2,3,4,5,6,7,8,9,10,11,12		
V2	<empty>		
V3	<empty>		
V4	<empty>		

Port	Mode	Flw	VLAN List	Port	Mode	Flw	VLAN List
1	Auto	On	V1	7	Auto	On	V1
2	Auto	On	V1	8	Auto	On	V1
3	Auto	On	V1	9	Auto	On	V1
4	Auto	On	V1	10	Auto	On	V1
5	Auto	On	V1	11	Auto	On	V1
6	Auto	On	V1	12	Auto	On	V1

Figure 3: Console port displaying default settings

Default Settings:

All ports reside in the V1 group using auto-negotiation and flow control in the default mode.

Valid Commands:

- [V] Configure VLAN groups
- [M] Select 10/100Mbps and half or full-duplex mode
- [D] Restore the default settings
- [ESC] Abort and return to the menu

Establishing a VLAN

Virtual Local Networks (VLANs) enable segmentation of the LAN without regards to physical location. Configure the ports to reside in up to four VLANs (virtual local area networks). Attaching the console port to a PC or any VT100 compatible unit launches a main menu screen displayed by hitting any key. The Escape key quits the program functions. The [V] command produces a prompt to enter the VLAN number followed by the corresponding port(s). Use commas (,) or dashes (-) to list multiple ports, but limit the amount of characters on the command line to 35. Follow these steps to assign ports to a VLAN group.

- Enter [V] from the Main Menu
- Select a VLAN group:
 - [V1], [V2], [V3], or [V4]
- Enter the port #.

To return to the default settings, enter [D] from the main menu. A prompt appears to verify this action since all functions are reset to default, not just the VLAN function.

Assign each VLAN group individually and continue assigning ports until all of the ports are assigned to at least one VLAN group. Hit the [ESC] key when done. The [ESC] key will not return the screen to the main menu until each port is assigned.

VLAN Example:

- Key [V1] (NO [ENTER])
- Key 1,2,3,4,5,6,7,8,9
- or 1-9
- [ENTER]
- Key [V2] (NO [ENTER])
- Key 10,11,12
- or 10-12
- [ENTER]
- Key [V3] (NO [ENTER])
- Key 1,9,10,11
- or 1,9-11
- [ENTER]

The following is the screen display of the above example.

Port	Mode	Flw	VLAN List	Port	Mode	Flw	VLAN List
1	Auto	On	V1,V3	7	Auto	On	V1
2	Auto	On	V1	8	Auto	On	V1
3	Auto	On	V1	9	Auto	On	V1,V3
4	Auto	On	V1	10	Auto	On	V2,V3
5	Auto	On	V1	11	Auto	On	V2,V3
6	Auto	On	V1	12	Auto	On	V2

Figure 4: Console port displaying revised VLAN assignments according to above example.

Performing Port Aggregation

The aggregation or trunking of ports enables an aggregate of bandwidth between like switches. Attaching the console port to a PC or any VT100 compatible unit launches a main menu screen displayed by hitting any key. The Escape key quits the program functions. The [T] command displays further parameters that define which ports or number of ports that can be in one trunk, or the number of possible trunks. The VLAN function might become disabled on trunked ports.

Configuring Ports

The same menu allows configuration of individual ports to turn off the auto-negotiation, flow-control, or full-duplex transmission features. Attaching the console port to a PC or any VT100 compatible unit launches a main menu screen that is displayed by hitting any key. The Escape key quits the program functions. The [M] command displays the options for each port configuration. To change the mode, enter the port number, and then the number representing a selection from the options list displayed on the screen. The list differs between the TX and FX ports. Follow these steps to change the speed/duplex mode setting or to toggle flow control ON/OFF:

- Key [M] (NO [ENTER])
- Select a port
- [ENTER]
- Select the media from the list that appears on the screen

- Continue with any further ports

The following table is an example of options:

Table 1: TX Port Settings

#	Communication Media	Description
0	Flow Control	Toggles ON/OFF
1	Auto	Auto-Negotiation
2	100 FL	100Mbps at full-duplex
3	100 HF	100Mbps at half-duplex
4	10 FL	10Mbps at full-duplex
5	10 HF	10Mbps at half-duplex

Media Setting Example:

- Key **[M]** (NO **[ENTER]**)
- Select port 10
- Select mode 5

Hit the **[ESC]** key when done. To return to the default settings, enter **[D]**. A prompt appears to verify this command since all options will revert to default mode, not just the media settings. The following is the screen display of the above example.

```

VLAN Port List
-----
V1 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24
V2 <empty>
V3 <empty>
V4 <empty>
Port Mode Flw VLAN List Port Mode Flw VLAN List
1 Auto On V1 7 Auto On V1
2 Auto On V1 8 Auto On V1
3 Auto On V1 9 Auto On V1
4 Auto On V1 10 10HF On V1
5 Auto On V1 11 Auto On V1
6 Auto On V1 12 Auto On V1

```

Figure 5: Console port displaying mode change

Fiber Module Installation

- Turn off the power. The module is not hot-swappable.
- Remove the cover plate, retaining screws and plate for later replacement
- Slide in the module, following the guides
- Snap in the module to attain a firm connection
- When the module is installed, port 20X on the switch is disabled.

Product Specifications

All Black Box Express Ethernet Switches auto-negotiate 10/100 Mbps, use store-and-forward and non-blocking architectures and use back pressure for half-duplex and IEEE 802.3x compliant flow-control for full-duplex. The Express Ethernet Switches support substantial MAC entries with address filtering and relearning capabilities.

ETHERNET STANDARDS

IEEE 802.3 10BASE-T; IEEE 802.3u 100BASE-TX/FX

CABLE

10BASE-T: 2-pair UTP Cat. 3, 4, or 5;

100BASE-TX: 2-pair UTP Cat. 5;

100BASE-FX: 62.5/125 multi-mode fiber-optic cable

SWITCHING METHOD

Store-and-Forward

FORWARDING RATE

14,800 pps for 10 Mbps;

148,800 pps for 100 Mbps

TEMPERATURE

Operating: 32 to 104°F (0 to 40°C)

Storage: -13 to +158°F (-25 to +70°C)

HUMIDITY

10 to 90% non-condensing

EMISSION COMPLIANCE AND SAFETY STANDARDS

FCC part 15 Class A, CE Mark, VCCI, cUL

Table 3: Specifications per model

Model	Dimension "W x "D x "H	Weight	Output	Pwr
LB9024A	W439mm x D203mm x H46mm (17.3" x 8" x 1.8")	6.4lb. 2.4kg	100-260VAC 47-63 Hz	30W max

Installation

Quick Tip

Install a Black Box Express Ethernet Switch as a plug-and-play device. No special configuration is required. Details below are consistent with the installation of any electronic device

Place the Black Box Express Ethernet Switch where it will not be subjected to extreme temperatures, humidity, or electromagnetic interference. Specifically, the site you select should meet the following requirements:

- The room temperature should be between 32 and 104 degrees Fahrenheit (0 to 40 degrees Celsius).
- The relative humidity should be less than 90 percent, non-condensing.
- Surrounding electrical devices should not exceed the electromagnetic field (RFC) standards for IEC 801-3, Level 2 (3V/M) field strength.
- Make sure that the switch receives adequate ventilation. Do not block the ventilation holes on the side of the switch or the fan exhaust port on the rear of the switch.
- The power outlet should be within 1.8 meters of the switch.

Connecting to Power

Connect the supplied AC power cord to the receptacle on the back of the switch, and then plug the cord into a standard AC outlet with a voltage range from 100 to 120 VAC. For external power supply units, plug the jack into the DC receptacle on the front of the unit, and plug the power supply unit into a 110~220 AC outlet.

Turn the switch on by flipping the ON/OFF switch on the rear of the unit to the I (ON) position. The O position is OFF.

Connecting to Your Network

If you are making a connection to a server or workstation, be sure that it has a properly installed 100BASE-TX (or 100BASE-FX if the switch does not contain 100BASE-TX ports) network interface card. Connect the RX/TX jacks on the target device to the TX/RX jacks on the switch and the RJ-45 jacks on the target device to the RJ-45 jacks on the switch.

Use the uplink port for connecting to a regular (i.e. non-uplink) port of a hub or another switch. If connecting to an uplink port of a hub or another switch, use any port. There is no uplink issue with fiber ports.

Copper-based cabling

Connect cables to computers or network segments into the RJ-45 ports on the front of the switch.

The cable must be a Category 5 shielded twisted-pair or unshielded twisted-pair (STP/UTP) cable for 100BASE-TX, or Category 3, 4, or 5 STP/UTP cable for 10BASE-T. Consult Table 9 for further details.

Fiber-optic cabling

Prepare a pair of fiber optic cables with SC or ST type connectors at both ends. The cable for fiber ports must be a 62.5/125 micron fiber-optic cable for 100BASE-FX. Consult Table 9 for further details.

Table 4: Cable Specifications

Speed	Connector	Port Speed Half/Full Duplex	Cable	Range
100BASE-TX	RJ-45	100/200 Mbps	Category 5 UTP	100 meters
10BASE-T	RJ-45	10/20 Mbps	Category 3, 4, or 5 UTP	100 meters
100BASE-FX	ST or SC	200 Mbps	62.5/125 micron fiber-optic cable	2 kilo-meters

Uplink or MDI Function

A network of switches connected (or cascaded) together via uplink ports is termed a “collapsed backbone.” The uplink function transforms the adjacent or indicated port into an uplink port with a push of the button or by sliding the switch. This allows connection to another switch or hub without preparing crossover cable. However, this is unnecessary when either connecting directly to the uplink port of another switch or hub or when connecting fiber ports between switches or hubs.

Trouble-shooting Guide

This trouble-shooting guide describes problems that could occur with the Express Ethernet Switch. The guide states possible reasons for the problems, and possible steps to take to solve the problems.

No Power to the Switch.

Symptom: Power cord is connected to the switch, but all LEDs, including the Power LED, are off.

Possible Problem	Solution
Loose power connection or faulty power supply	<ol style="list-style-type: none"> 1. Check both ends of the power cord to make certain that they are securely connected to the power receptacle on the switch and to the power outlet. 2. Verify that the power outlet has power.

No Connectivity to the Data Terminal Equipment.

Symptom: An Ethernet switch cannot communicate to the directly connected computers or network segments.

Possible Problem	Solution
Incorrect or faulty cabling	<ol style="list-style-type: none"> 1. Check cables for a secure connection. 2. Verify that the correct type of cable is in use. <ul style="list-style-type: none"> • For connection to a PC or a network interface card (NIC), use a straight-through cable. • For uplink to another switch or hub, use a cross-wire cable, or use a regular straight-through cable connected to the uplink port with the uplink button activated. • Refer to Table 9 for cable specifications. 1. Verify proper cable preparation. 2. Use a time domain reflectometer (TDR) or other cable-checking device to verify that the cable has no opens, shorts, or other problems. 3. Swap the cable with another of the same kind to see if the cable is bad. <ul style="list-style-type: none"> • Replace or fix the faulty cable as necessary.
Dysfunctional NIC on a PC or workstation	Run the diagnostic supplied by the vendor on the NIC to determine if it is functioning properly. If it is not, replace it.
Packet Overflow or Hardware problem	Reset the switch by pressing the reset button or turn the switch off, then on again.

No Connectivity to Certain Nodes on the Network

Symptom: Data terminal equipment (DTE) connected to the switch can not send or receive information from certain segments on the same network or across to another LAN or WAN.

Possible Problem	Solution
Hardware problem	Check for a damaged RJ-45 jack, or fiber SC or ST type connector.

Transmission Problems**Symptom:** Connections across a LAN switch are slow or unreliable.

Possible Problem	Solution
Incorrect full- or half-duplex settings	<p>Express Ethernet Switches are all equipped with auto-negotiation to communicate with other DTEs on the network for the best available performance.</p> <ol style="list-style-type: none"> 1. Verify if the connected NIC is equipped with auto-negotiation (this is not the same as auto-sensing). 2. Change the DIP switch setting if available.
Exceeded cabling distance or misused cable	<ol style="list-style-type: none"> 1. Ensure that the proper cable is in use and that the recommended distance is not exceeded. For information, refer to Table 9. 2. Check the cable distance using a cable tester or TDR. Verify that the cable lengths attached to the switch meet Ethernet/IEEE 802.3 specifications. 3. If the distance is out of specification, reduce the length of the cable or add a repeater, ensuring no more than four repeaters are attached.
Bad adapter in attached device	Check the switch port statistics. If excessive errors are found, run the adapter card diagnostic utility to determine the problem.

Trademarks

Any trademarks are acknowledged to be the property of the trademark owners.

Glossary

10BASE-T	Networking standard for twisted-pair cabling capable of carrying data at 10 Mbps.
100BASE-TX	Networking standard for two pairs of high-quality twisted-pair wires carrying data at 100 Mbps.
100BASE-FX	Networking standard for fiber-optic cabling capable of carrying data at 100 Mbps.
auto-negotiation	Two-part process by which a network device automatically senses the speed and duplex capability of another device.
Category 5	Networking standard certifying that a copper wire cable can carry data at up to 100 Mbps.
collision	Concurrent Ethernet transmissions from two or more devices on the same segment.
Ethernet	Networking standard for transmitting data at 10 Mbps.
Fast Ethernet	Networking standard for transmitting data at 100 Mbps.
fiber-optic cable	Cable made of thin glass threads that carry data in the form of light pulses.
full-duplex	A communications technique that allows bi-directional, simultaneous transmission between two devices on a single segment.
half-duplex	A communications technique in which one device on a segment transmits while the other receives, then the process is reversed.
IEEE 802	Set of Institute of Electrical and Electronic Engineers standards for defining methods of access and control on LANs.
LAN	Local area network. A network where computers are connected in close proximity, such as in the same building or office park. A system of LANs connected at a distance is called a wide-area network (WAN).
MAC address	Media access control address. A hardware address that uniquely identifies each node of a network.
Mbps	Millions of bits per second.
segment	Section of a network bounded by bridges, routers, hubs, or switches. Dividing an Ethernet into multiple segments is a common way to increase bandwidth on a LAN.
store-and-forward	Switching feature where the port receives the entire incoming frame and stores it in the buffers while checking for runs and error frames before forwarding it to the destination port.
switch	Device that filters and forwards packets between LAN segments.
UTP	Unshielded twisted pair; cabling with wires that are twisted around each other. The individual wires are not insulated.
wire speed	The ability to handle the fastest rate of traffic that a generator can deliver without dropping packets. On a 100 Mbps connection, wire-speed traffic is 148,809 packets per second using 64-byte frames or 8,127 packets per second using 1,518-byte frames.