



October, 2003

**Express
Ethernet Switch
LB9019A-R2**



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.

Table of Contents

About This Manual..... 5

Product Overview..... 5

 Front View..... 5

 Package Contents..... 5

 Front Panel Display 6

 Physical Ports 7

 QoS (Quality of Service) Settings 8

Installation 10

 Selecting a Site for the Equipment 10

 Connecting to Power 11

 Connecting to Your Network 12

 Network Segmentation 12

Cable Specifications Table..... 12

Technical Specifications 13

Physical Specifications 13

Trouble-shooting Guide 14

 No Power to the Switch..... 14

 No Connectivity to the Data Terminal Equipment 14

 No Connectivity to Certain Nodes on the Network 15

 Transmission Problems 15

Glossary 16

About This Manual

This manual describes how to install and use LB9019A-R2: 16 Ports QoS Switch. The switch introduced here auto-negotiates the presence of 10/100Mbps and full/half-duplex mode.

To get the most out of this manual, you should have an understanding of networking concepts such as bridging, IEEE 802.3 Ethernet, 100BASE-TX/FX Fast Ethernet, and local area networks (LANs).

In this manual, you will find:

- Introduction on the Switch
- Product features
- Illustrative LEDs functions
- Installation instructions
- Specifications

Product Overview

Front View

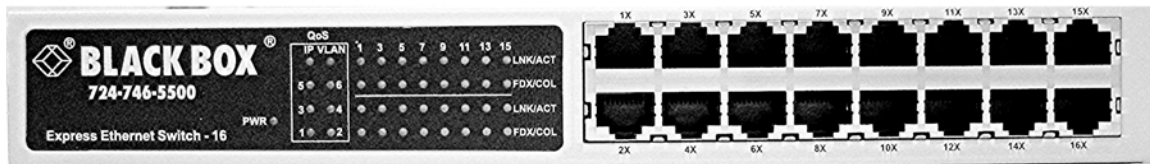


Figure 1: LB9019A-R2: 16 Ports QoS Switch

Package Contents

When you unpack the product package, you shall find these items listed below.

- ✓ ***LB9019A-R2: The 16 Ports QoS Switch***
- ✓ ***One AC power cord***
- ✓ ***User's Manual***

Please inspect the contents, and report any apparent damage or missing items immediately to your authorized reseller.

Product Features

- ◆ PLUG-AND-PLAY
- ◆ PROVIDES 16 × 10/100MBPS PORTS USING RJ-45 CONNECTORS
- ◆ SUPPORTS 16- PORT RJ-45 CONNECTORS WITH AUTO MDIX
- ◆ SUPPORTS 16K MAC ADDRESSES FOR THE 16-PORT SWITCH
- ◆ AUTO-NEGOTIATION FOR SPEED AND DUPLEX MODE ON TX PORTS
- ◆ TRUE NON-BLOCKING ARCHITECTURE
- ◆ STORE-AND-FORWARD MECHANISM
- ◆ FULL WIRE SPEED FORWARDING RATE
- ◆ BACK-PRESSURE AND IEEE 802.3X COMPLIANT FLOW CONTROL
- ◆ THREE QoS (QUALITY OF SERVICE) LEVELS CHECKED VIA IP HEADER AND 802.1Q VLAN TAG AND/OR SELECTED PER PORT BASIS
- ◆ BROADCAST THROTTLING
- ◆ FRONT PANEL PORT STATUS LEDs

Front Panel Display

An array of LED indicators on the front panel provides you with instant feedback on each port status, and, helps you monitor and troubleshoot the switch.

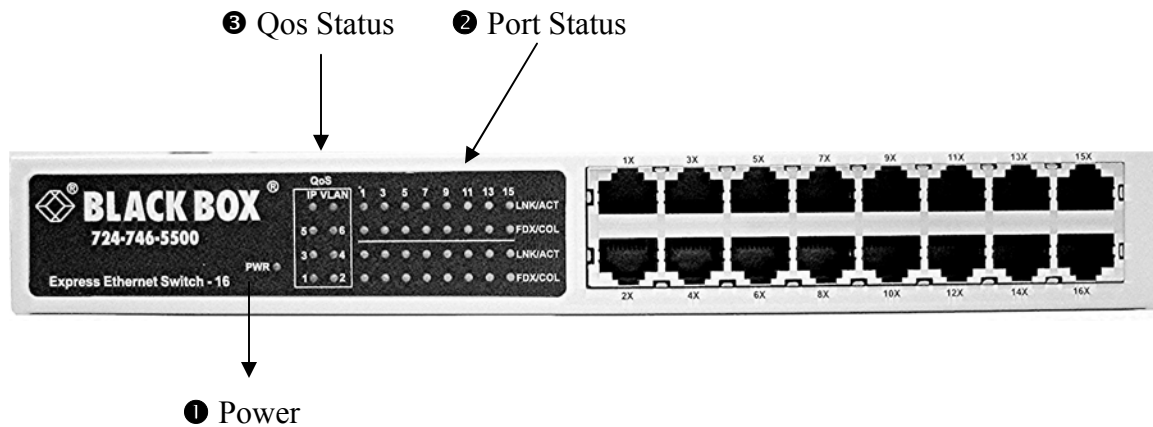


Figure 2: LB9019A-R2: Front Panel LEDs

1 Power

This LED comes on when the switch is properly connected to power and turned on.

2 Port Status

The RJ-45 ports numbered from 1 to 16 in one section on the 16 Ports QoS Switch.

The LEDs are located at the left side of 16 RJ-45 ports, displaying status for each respective port. Please refer to the table below for more information.

③ QoS (Quality of Service) Status

The LEDs displaying status for Layer 3 IP Header priority, Layer 2 VLAN Tagging priority, and Port 1~6 Port based priority.

- ① Before you use this table for troubleshooting, make sure the switch is properly connected to power and turned on.

Physical Ports

The 16 Ports QoS Switch has sixteen 10/100Mbps ports using RJ-45 connectors with AUTO MDIX function.

Understanding Front Panel Design

Power LED		On	Power feeding in
		Off	Power switched off
			Improper connection
Port LED	LNK/ACT	On	A valid network connection LNK stands for LINK
		Flashing	Transmitting or receiving data ACT stands for ACTIVITY
		Off	No connection
	FDX/COL	On	Full duplex mode FDX stands for Full Duplex
		Flashing	Collision occurred COL stands for Collision
		Off	Half duplex mode
QoS Status LED	IP	On	Layer 3 IP Header priority on
		Off	Layer 3 IP Header priority off
	VLAN	On	Layer 2 VLAN Tagging priority on
		Off	Layer 2 VLAN Tagging priority off
	Port 1~6	On	Port 1~6 Port based priority on
		Off	Port 1~6 Port based priority off

QoS (Quality of Service) Settings

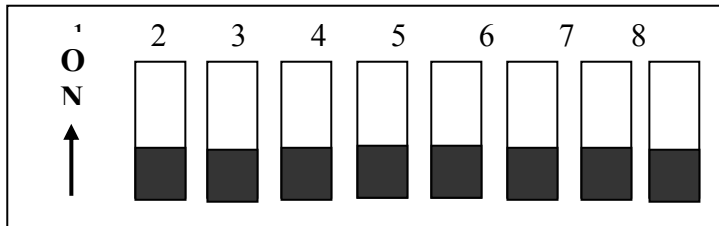


Figure 3: Default Setting of the QoS (Quality of Service) DIP Switch on the Rear Panel

There are three Priority Queues on 1616Q, Normal (N), High (H), and Very High (VH) Queues.

On the rear panel of the switch, there are eight pins on the DIP Switch for QoS (Quality of Service) Settings.

- Toggle ON Pin 1 to enable Port based QoS on Port 1.
- Toggle ON Pin 2 to enable Port based QoS on Port 2.
- Toggle ON Pin 3 to enable Port based QoS on Port 3.
- Toggle ON Pin 4 to enable Port based QoS on Port 4.
- Toggle ON Pin 5 to enable Port based QoS on Port 5.
- Toggle ON Pin 6 to enable Port based QoS on Port 6.
- Toggle ON Pin 7 to enable layer 2 VLAN Tagging QoS.
- Toggle ON Pin 8 to enable layer 3 IP Header QoS.
- There is no DIP Switch pin for Port based QoS on Port 7 through Port 16.

If none of the DIP Switch pins are toggled ON, all packets are sent to the Normal Queue.

If PIN 1 or 2 is ON, Port 1 or 2 is set to VH priority. All packets entering these two ports are sent to Very High Queue.

If PIN 3, 4, 5, or, 6 is ON, the corresponding port is set to H priority. All packets entering these ports are sent to High Queue.

There is no pin for Port 7 through Port 16. These ports have default port-based priority set to Normal. Packets entering these ports are sent to Normal Queue.

If PIN 7 is ON, the 3-bit CoS of tagged VLAN will decide which queue the packet to join. Packets with CoS (Class-of-Service) bits of 000(or 0) are sent to Normal Queue, 001(or 1) to High Queue, and 010 or higher (2 or higher) to Very High Queue.

If PIN 8 is ON, the ToS (Type-of-Service) byte in IP header will decide which queue the packet to join. Packets with ToS value 0-63 are sent to Normal Queue, 64-127 to High Queue, and 128-255 to Very High Queue.

If there is more than one applicable priority setting on a packet, the setting with the highest priority will take effect.

The bandwidth distribution can be observed in the table below:

Priority Queues If Empty	Transmission Bandwidth Allocation		
	Normal (Low) Priority	High Priority	Very High Priority
Normal	X	33%	67%
High	11%	X	89%
Very High	20%	80%	X
None	8%	30%	62%

Installation

Selecting a Site for the Equipment

As with any electric device, you should place the equipment where it will not be subjected to extreme temperatures, humidity, or electromagnetic interference. Specifically, the site you select should meet the following requirements:

- The ambient 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 (RF) standards for IEC 801-3, Level 2 (3V/M) field strength.
- Make sure that the equipment receives adequate ventilation. Do not block the ventilation holes on each side of the switch or the fan exhaust port on the side or rear of the equipment.
- The power outlet should be within 1.8 meters of the switch.

The switch can be placed on any flat surface with adequate space and ventilation. If you want to place it onto a shelf, make sure the shelf can withstand the weight of the switch.

Step 1: Simply put the switch on the desired place.

Step 2: Ensure the switch receives good ventilation.

Step 3: Proceed to the “Connecting to Power” section.

Connecting to Power

Locate the supplied AC power cord.

Step 1: Connect the AC power cord to the receptacle at the back of the switch.

Step 2: Attach the plug into a standard AC outlet with a voltage range from 100~260Vac.

Step 3: Locate the power ON/OFF switch beside the receptacle at the back.
Turn on the switch by flipping the ON/OFF switch to ON position.
The power LED on the front panel will come on then.



Figure 4: LB9019A-R2: Rear view of the switch

Connecting to Your Network

Cabling

Step 1: First, ensure the power of the switch and end devices are turned off.

i It may cause electric shock or any possible harm to you if the power is not switched off.

Step 2: Prepare cable with corresponding connectors for each type of port in use.
Consult the table below for cabling requirements based on connectors and speed considerations.

Step 3: Connect one end of the cable to the switch and the other end to a desired device.

Step 4: Once the connections between two end devices are made successfully, turn on the power and the switch is operational.

Network Segmentation

Cable Specifications Table

Ethernet Standards	Connector	Port Speed Half/Full Duplex	Cable	Max. Distance
10BASE2	BNC	10/20 Mbps	Coaxial	185 m
10BASE-T	RJ-45	10/20 Mbps	Cat. 3, 4 or 5 UTP/STP	100 m
100BASE-TX	RJ-45	100/200 Mbps	Cat. 5 UTP/STP	100 m
100BASE-FX Multi-mode	ST, SC, MT-RJ, VF-45	100/200 Mbps	62.5/125 μ m multi-mode fiber	2 km
100BASE-FX Single-mode	SC	100/200 Mbps	10/125 μ m single-mode fiber	15 km
100BASE-FX Single-mode	SC	100/200 Mbps	10/125 μ m single-mode fiber	40 km
100BASE-FX Single-mode	SC	100/200 Mbps	10/125 μ m single-mode fiber	75 km

Technical Specifications

LB9019A-R2	16 Ports QoS Switch
Applicable Standards	IEEE 802.3 10BASE-T, IEEE 802.3u 100BASE-TX Back Pressure and Flow Control IEEE 802.3x Compliant, IEEE 802.1Q VLAN Tagging
Fixed Ports	Sixteen ports for the 16 Ports QoS Switch
Speed	100BASE-TX: 200Mbps for full-duplex; 100Mbps for half-duplex 10BASE-T: 20Mbps for full-duplex; 10Mbps for half-duplex
Switching Method	Store-and-Forward
Performance	148,800pps forwarding rate per port for 100Mbps 14,880pps forwarding rate per port for 10Mbps
Chassis LED Indicators	Power For fixed ports: LNK/ACT; FDX/COL (2 LEDs)
QoS LED Indicators	For IP QoS, IP (1 LED) For VLAN QoS, VLAN (1 LED) For Port based QoS, 1~6 (1 LED for each Port, Port 1~6)

Physical Specifications

LB9019A-R2	16 Ports QoS Switch
Dimensions	254 × 135 × 35 mm (10 × 5.3 × 1.4 inch) Compact Size
Weight	Approx. 1.6kg (3.5lb.)
Power Input	100 ~ 260 Vac, 47~63 Hz
Power Consumption	15W Max.
Operating Temperature	0° ~ 40°C (32° ~ 104°F)
Storage Temperature	-25° ~ 70°C (-13° ~ 158°F)
Humidity	10 ~ 90%, non-condensing
Emissions	FCC part 15 Class A, CISPR Class A, VCCI Class A, CE Mark
Safety	UL

Trouble-shooting Guide

This trouble-shooting guide describes problems that could occur with the Express Ethernet Switch. The guide states possible reasons for the symptoms, and proper 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 1 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	Express Ethernet Switches are all equipped with auto-negotiation to communicate with other DTEs on the network for the best available performance. <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 runts 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.