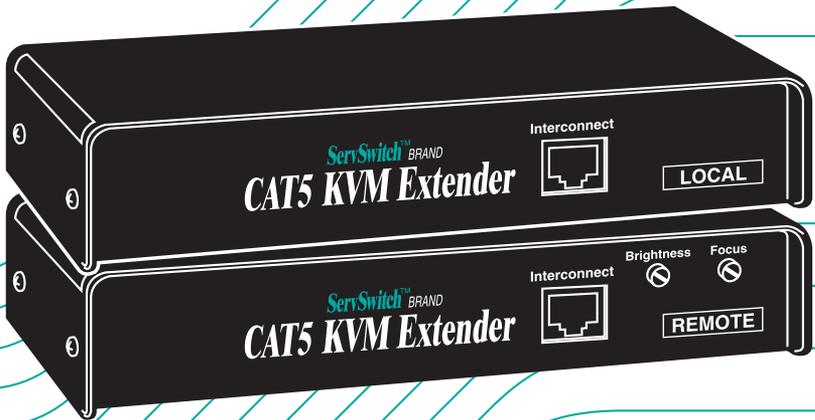


ServSwitch™ BRAND
CAT5 KVM/Serial/Audio Extender



ACU1022A
ACU1028A

Welcome to the ServSwitch™ Family!

Thank you for purchasing a BLACK BOX® ServSwitch™ Brand CAT5 KVM Extender model! We appreciate your business, and we think you'll appreciate the many ways that your enhanced keyboard/video/mouse system will save you money, time, and effort.

That's because our ServSwitch family is all about breaking away from the traditional, expensive model of computer management. You know, the one-size-fits-all-even-if-it-doesn't model that says, "One computer gets one user station, no more, no less." Why not a single user station (monitor, keyboard, and mouse) for multiple computers—even computers of different platforms? Why not a pair of user stations, each of which can control multiple computers? Why not multiple user stations for the same computer?

With our ServSwitch products, there's no reason why not. We carry a broad line of robust solutions for all these applications. Do you have just two PCs, and need an economical alternative to keeping two monitors, keyboards, and mice on your desk? Or do you need to share dozens of computers, including a mix of IBM® PC, RS/6000®, Apple® Macintosh®, Sun Microsystems®, and SGI™ compatibles among multiple users with different access levels? Does your switch have to sit solidly on a worktable and use regular everyday cables? Or does it have to be mounted in an equipment rack and use convenient many-to-one cables? No matter how large or small your setup is, no matter how simple or how complex, we're confident we have a ServSwitch system that's just right for you.

The ServSwitch™ family from Black Box—the one-stop answer for all your KVM-switching needs!

*

This manual will tell you all about your new ServSwitch™ Brand CAT5 KVM/Serial/Audio Extender, including how to install, operate, and troubleshoot it. For an introduction to the Extender, see **Chapter 3**. The Extender product codes covered in this manual are:

ACU1022A
ACU1028A

**FEDERAL COMMUNICATIONS COMMISSION AND INDUSTRY CANADA
RADIO-FREQUENCY INTERFERENCE STATEMENTS**

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

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

Shielded PC-equipment cables must be used with this equipment to maintain compliance with radio frequency energy emission regulations and ensure a suitably high level of immunity to electromagnetic disturbances.

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 Industry Canada.

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 Industrie Canada.

EUROPEAN UNION DECLARATION OF CONFORMITY**WARNING!**

This is a class A product. In a domestic environment, this product might cause radio interference, in which case the user might be required to take adequate remedial measures.

This product complies with the following harmonized standards:

- EN55022 (1994), EN55024 (1998)
- EN61000-3-2 (1995), EN61000-3-3 (1995), EN60950 (2000)

When you use this product in environments that have high levels of electromagnetic interference, you might experience some slight disturbance in its operation. If this occurs, please refer to the Troubleshooting chapter of this manual or call technical support.

To maintain compliance, use only cables supplied (or recommended) for use with this product.

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

INSTRUCCIONES DE SEGURIDAD

1. Todas las instrucciones de seguridad y operación deberán ser leídas antes de que el aparato eléctrico sea operado.
2. Las instrucciones de seguridad y operación deberán ser guardadas para referencia futura.
3. Todas las advertencias en el aparato eléctrico y en sus instrucciones de operación deben ser respetadas.
4. Todas las instrucciones de operación y uso deben ser seguidas.
5. El aparato eléctrico no deberá ser usado cerca del agua—por ejemplo, cerca de la tina de baño, lavabo, sótano mojado o cerca de una alberca, etc..
6. El aparato eléctrico debe ser usado únicamente con carritos o pedestales que sean recomendados por el fabricante.
7. El aparato eléctrico debe ser montado a la pared o al techo sólo como sea recomendado por el fabricante.
8. Servicio—El usuario no debe intentar dar servicio al equipo eléctrico más allá 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.

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1. Quick Start Guide

Configuring the Extender

Configuring the ServSwitch™ Brand CAT5 KVM/Serial/Audio Extender involves setting some internal controls. Read the next couple of paragraphs, and if you find that you'll need to change configuration settings, follow the procedure that's listed afterward. (If you're not certain which Extender model you're working with, refer to **Chapter 3**.) Here's what you need to consider:

- **How far will the CAT5 cabling run between the Extender's Local and Remote Units?** If it will be 100 m (330 ft.) or less, you don't need to set anything. If it will be 100 to 200 m (330 to 655 ft.), install jumpers on the three *right-hand* post pairs in each set of three cable-length jumper posts (JP3 through JP5) in the Remote Unit. If it will be 200 to 300 m (655 to 1000 ft.), install jumpers on the three *left-hand* post pairs in each of these sets of cable-length jumper posts. See Figure 5-1 in **Section 5.1**.
- **What keyboard key do you want to be the "hotkey" to start the Extender's keyboard commands?** If the keyboard's right [Ctrl] key can be used for this purpose (which it probably can if none of your software or hardware looks for a single isolated press and release of this key), you don't need to set anything. If you need to press and release this key by itself to trigger some function of an attached KVM switch or of a software program on an attached computer (common on Compaq® Alpha®, HP®, and other workstations for which right [Ctrl] maps to the [Compose] key), move position 2 of the DIP-switch labeled SW1 on the main circuit board inside the KVM/Serial Extender's Remote Unit to ON. Refer to **Section 5.2**.
- **Does the Extender need to amplify microphone input from the remote site?** This should not be the case if you are connecting a PC's sound card (which can amplify the signal itself) to the local CPU's audio jack on the Local Unit. If you are connecting some kind of recorder or sound-input device that can't amplify the input signal to that jack, and you're using a nonamplified microphone at the remote site, install the jumper on the jumper posts marked "MIC" on the audio daughterboard inside the Remote Unit. Refer to **Section 5.3**.

To get at the internal controls, open the Extender Unit while it is powered off—taking all reasonable precautions against static electricity—by unscrewing the four screws on its case and lifting off the top half of the case. For more information about configuration, refer to **Chapter 5**.

Installing the Extender

To install your Extender system, refer to the illustration below. (A Dual-Access model is shown; the Single-Access model won't have the local user station.) Take these steps:

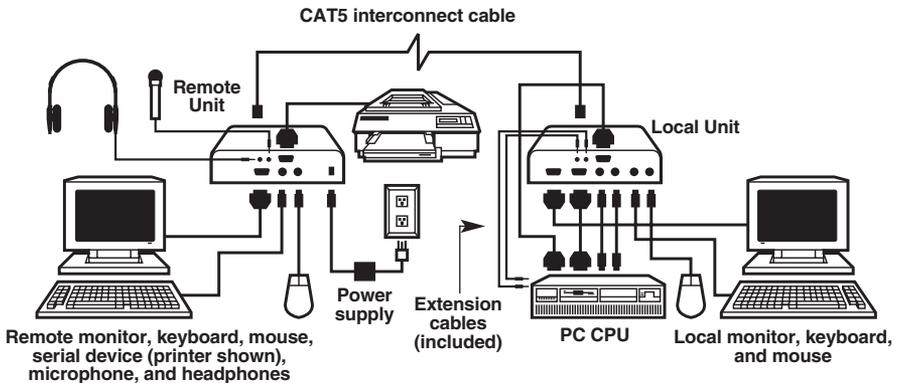
1. Use the included extension cables to attach the CPU's video, keyboard, mouse, serial, and/or audio ports to the Local Unit.
2. *Dual-Access models:* Plug the local keyboard, monitor, and mouse directly into the Local Unit.
3. Plug the remote keyboard, mouse, monitor, serial device, and/or audio devices directly into the Remote Unit.
4. Connect the Local and Remote Units with straight-pinned four-pair CAT5 cable.
5. Power the Remote Unit with its included power supply.

For more information about installation, or if you're attaching any KVM switches to the Extender, refer to **Chapter 6**.

Operating the Extender

For the most part, your Extender system should operate automatically and transparently. Some functions, though, are handled with keyboard commands.

Appendix C summarizes these commands, while **Section 7.3** describes them in detail.



2. Specifications

- Cable Required:** Between Local and Remote Units: Category 5 solid unshielded or shielded twisted pair (UTP or STP), wired to the EIA/TIA-568A or (preferred) -568B standard, terminated with RJ-45 male connectors; for pinning/pairing, see **Appendix A**
- Compliance:** CE Class B, FCC Part 15 Subpart J Class A, IC Class/ classe A
- Compatibility:** Video: VGA, SVGA, XGA, XGA-2, or RGB (sync on green), although if your system has monitor ID-bit requirements, you might need to call Black Box for technical support;
Keyboard: IBM PC/AT or PS/2 compatible (PC/AT types require connector adapter);
Mouse: IBM PS/2 compatible two-button, Microsoft IntelliMouse, or Logitech PS/2 compatible 3-button
- Interfaces:** Video: VGA;
Keyboard and mouse: IBM PS/2 compatible;
Serial: EIA/TIA RS-232; DCE to CPU, DTE to stations
Audio: Bidirectional 3.5-mm mini stereo audio
- Video Characteristics:** Bandwidth (to -3 dB):
Local Unit: 150 MHz;
Remote Unit: 300 MHz;
Across 100 meters (328 feet) of UTP: 95 MHz (with equalization)
Resolution:
Up to 1600 x 1280 noninterlaced at up to 60 m (200 ft.);
Up to 1280 x 1024 noninterlaced at up to 120 m (400 ft.);
Up to 1024 x 768 noninterlaced at up to 300 m (1000 ft.);
I/O signal levels: 0.7 volts peak-to-peak;
Compensation: 3-stage continuously variable;
Synchronization: H/V or composite, TTL signal levels; sync polarity is preserved;
Coupling: DC

Serial

Characteristics: Data rate: Transparent to data rates up to 19,200 bps;
 Data format: Transparent to data format;
 Flow control: Transparent to hardware and software flow control (RTS, CTS, DTR, and DSR are all passed through across the link)

Audio

Characteristics: Signal format: Digitized at almost CD quality (16-bit sampling at 38.4 kHz);
 Signal levels: Line level (5 volts peak-to-peak maximum);
 Input impedance: 47 k Ω ;
 Signal direction: Simultaneous bidirectional;
 Extra microphone support at Remote Unit: Pullup resistor provides bias for condenser microphone; optional amplification to +17 dB for external microphone

Maximum

Distance: 5 m (16 ft.) from the Local Unit to the attached KVM switch or CPU;
 5 m (16 ft.) from the Remote Unit to the attached KVM switch or monitor, keyboard, mouse, serial device, and audio devices;
 300 m (1000 ft.) between Local and Remote Units;
 Dual-Access (ACU1028A) model only: 5 m (16 ft.) from the Local Unit to the attached keyboard, mouse, serial device, and audio devices; 30 m (100 ft.) to the attached monitor

NOTE

With high-quality cables, it might be possible to run farther than 5 m (16 ft.) from the Extender to attached equipment.

User Controls: All on/in Remote Unit:
 (2) Front-mounted dials: Brightness and Focus;
 (3) Internal video-distance (cable-length) jumpers;
 (1) Internal microphone-amplification jumper;
 (1) Internal 4-position DIP switch for hotkey selection

Indicators: None

Connectors:**On Local Unit:**

(1) Front-mounted RJ-45 female for local/remote interconnection;

Rear-mounted:

(1) HD15 male for video input from computer;

(2) 6-pin mini-DIN female for keyboard and mouse output to computer;

(2) 3.5-mm mini stereo jacks for audio I/O to/from computer;

(1) DB9 female for serial I/O to/from computer;

Dual-Access (ACU1028A) model only:**Rear-mounted:**

(1) HD15 female for video output to monitor;

(2) 6-pin mini-DIN female for input from keyboard and mouse;

(1) DB9 male for serial I/O to/from RS-232 device;

On Remote Unit:

(1) Front-mounted RJ-45 female for local/remote interconnection;

Rear-mounted:

(1) HD15 female for video output to monitor;

(2) 6-pin mini-DIN female for input from keyboard and mouse;

(2) 3.5-mm mini stereo jacks for audio I/O to/from audio devices;

(1) DB9 male for serial I/O to/from RS-232 device;

(1) 2.5-mm center-positive barrel jack for power

Temperature

Tolerance: 32 to 104°F (0 to 40°C)

Humidity

Tolerance: 5 to 90% noncondensing

Enclosure:

Steel

Power: Local Unit:
5 VDC at up to 170 mA from CPU's keyboard port;
Remote Unit:
From desktop power supply (certified to the relevant international safety standards):
Input: 100 to 240 VAC at 50 to 60 Hz from utility-power outlet, through detachable power cord and IEC 320 male inlet, to external transformer;
Output (isolated from mains ground): 9 VDC regulated, at up to 1 amp, from transformer to Extender

CAUTION!

If you ever need to replace the Remote Unit's power supply, the replacement power supply must have identical output characteristics. Using a power supply with different output—even if it's "almost the same"—could damage your Remote Unit and the attached equipment.

Size: 1.75"H (1U) x 7.8"W x 4"D (4.4 x 19.8 x 10.2 cm)

Weight: 1.1 lb. (0.5 kg)

3. Introduction

By using the Local and Remote Units that together make up the ServSwitch™ Brand CAT5 KVM/Serial/Audio Extender, you can place your VGA monitor, keyboard, mouse, serial device (such as a touchscreen, modem, or printer), and audio devices (such as a microphone, speakers, or headphones) as far as 300 meters (1000 ft.) from the PC's CPU. The Local and Remote Units are interconnected with a single industry-standard Category 5 UTP or STP 4-pair cable. All keyboard, mouse, video, serial, and audio signals are fully buffered to ensure consistent remote operation of your PC.

The Extender's Single-Access model (ACU1022A) is designed to perform KVM, serial, and audio extension only. With the Dual-Access model (ACU1028A), you can attach an additional monitor, keyboard, and mouse to the Local Unit; the PC can then be operated from either the local or remote user station (they share access on a "first-come, first-served" basis—see **Section 7.3.3**).

The Extender is simple to operate and works with all operating systems—no software is required. Once you've made sure you have everything you'll need (see **Chapter 4**) and you've configured all of your Extender Units (see **Chapter 5**), just connect the Local and Remote Units to each other and to your equipment as described in **Sections 6.1** through **6.3**, adjust your video compensation as necessary (see **Section 6.4**), and you're ready to work!

Because the Extender performs complete PS/2® keyboard and mouse emulation, you can boot the PC without having a keyboard or mouse attached to it. Your PC will boot even if the Extender's Remote Unit is not powered or if no keyboard or mouse is connected to the Local or Remote Unit.

3.1 Compatibility

The KVM/Serial/Audio Extender is designed to operate in various environments and with a mix of hardware from different manufacturers. During development, the Extender was extensively tested with a wide variety of hardware. However, please note that it is impossible for us to guarantee that the Extender will interoperate correctly with every keyboard, mouse, monitor, motherboard variant, RS-232 device, and audio device currently on the market; if you suspect that you're having incompatibility problems, please call Black Box Technical Support.

In general, the Extender is compatible with the following types of equipment:

- **CPU:** IBM® PC/AT®, PS/2, and 100% compatible clones. These should be desktop machines; laptops and docking stations are not supported.
- **Monitor:** VGA, SVGA, XGA, XGA-2, or RGB (sync on green). Be aware that a few monitors and graphics cards might not work with the Extender because they exchange monitor IDs or VESA DDC (Display Data Channel) information. Call Black Box Technical Support for help with “ID bit” problems. As for DDC, the Extender supports it at the local user station but not the remote user station, so either (a) do not use a DDC monitor at your remote station, or (b) go into your graphics card's settings, turn DDC off, and manually configure the card for your monitor.
- **Keyboard:** Standard PS/2 type (101- or 102-key) or enhanced PS/2 type (104- or 105-key, designed for use with versions of Windows® starting with Windows 95). Also supports PC/AT type keyboards with 5-pin DIN connectors, but you'll need keyboard and keyboard-port adapters such as our product codes FA211 and FA212 to attach such keyboards and their native CPUs to the Extender. Some older PC/XT™ or PC/AT type autosensing keyboards might not be compatible with the Extender. If a keyboard or keyboard port you want to use is some other type or has some other type of connector, call Black Box Technical Support.

For information about keyboard typematic support, see **Section 7.2**.

- **Mouse:** Standard PS/2 type, Microsoft® IntelliMouse® compatible, or Logitech® 3-button PS/2 compatible mouse and standard PS/2 type mouse ports. You can use a serial mouse with the Extender, but it must be attached to the Extender's serial port. The Extender is *not* compatible with bus mice or CPUs with bus-mouse ports. If a mouse or mouse port you want to attach is some other type or has some other type of connector, call Black Box Technical Support.

- **Serial Device:** Standard asynchronous RS-232 devices, including serial mice and trackballs, that operate at up to 19,200 bps and don't require any control signals other than RTS, CTS, DSR, and DTR. (The Extender is transparent to data format and to all data rates up to 19,200 bps. It passes the control signals through.)
- **Audio Device:** Just about any standard PC sound card or consumer audio device that doesn't transmit or receive signals at voltages above line level (5 volts peak to peak) should be compatible with the Extender.

3.2 Key Features

The KVM/Serial/Audio Extender has a number of useful features which contribute to the transparent remote operation of your PC. Some of the more important ones are:

- **Distance up to 300 m (1000 ft.)**
Operate your PC from almost anywhere in the same building.
- **Fully adjustable video equalization**
Compensates for the loss of image quality caused by the signal passing through such a long run of cable.
- **Fully buffered signals**
Remote operation of the PC is consistently smooth and transparent.
- **Intelligent PS/2 keyboard and mouse emulation**
With this, the PC boots and operates correctly under most circumstances, and you can freely detach and reconnect the keyboard and mouse as necessary (the Extender automatically initializes the keyboard and mouse as soon as it detects that you've reattached them).
- **Support for serial peripherals**
Connect almost any RS-232 device that can communicate at 19,200 bps or less.
- **Support for audio devices**
Connect almost any standard audio device or sound card.
- **Dual-Access model also supports a local station**
With the Dual-Access model (ACU1028A), you can operate the PC either locally or remotely (but not both at the same time).

- **Microsoft IntelliMouse compatibility**

Use this and compatible “wheel mice” with confidence. On the Dual-Access model, you can even use a standard PS/2 mouse at one user station and an IntelliMouse at the other.

- **Rackmountable**

You can use our Rackmount Kit (product code RMK19U) to place Extender Units in 1U of vertical space in a 19" rack. See **Appendix B**.

We recommend that you read the remainder of this manual before you install the Extender in order to fully familiarize yourself with the product.

4. Checklist of System Components

4.1 The Complete Package

These items should be included with your ServSwitch™ Brand CAT5 KVM/Serial/Audio Extender package (please contact Black Box right away if any are missing or damaged):

- (1) Extender Local Unit.
- (1) Extender Remote Unit.
- (1) 9-VDC 1-amp power-supply transformer and output cord.
- (1) Power-supply input cord suitable for your country or region.
- (1) Copy of this manual.
- Extension cables that will run from your CPU to the Local Unit:
 - (1) 6-ft. (1.8-m) serial extension cable with one DB9 female connector and one DB9 male connector, straight-through-pinned (Pin 1 to Pin 1, Pin 2 to Pin 2, etc.).
 - (2) 6-ft. (1.8-m) audio-extension cables with 3.5-mm plugs.
 - Keyboard-, video-, and mouse-extension cabling that will run from your (local) CPU to the Local Unit. This might be three separate cables, or it might be a single bonded cable with three connectors at each end. In either case, the cabling will be 6 ft. (1.8 m) long and will have the proper connectors to extend PS/2 keyboard (6-pin mini-DIN male to male), PS/2 mouse (also 6-pin mini-DIN male to male), and VGA video (HD15 male to female) interfaces.

NOTE

If your system uses 5-pin DIN keyboard connectors, you'll need keyboard adapters—one of our product code FA211 and one FA212—to attach the keyboard to the Remote Unit and the CPU's keyboard port to the Local Unit respectively.

4.2 The Cables You'll Need

If you are using the KVM/Serial/Audio Extender to get greater distance between a CPU and a VGA monitor, PS/2 keyboard, PS/2 mouse, RS-232 serial device, audio-input device, and/or audio-output device, your Extender package should have included everything you'll need except for your serial-device cable and your CAT5 cable, which you'll have to order separately. Read **Sections 4.2.1, 4.2.2, and 4.2.4** carefully, then proceed with **Chapter 5**.

It is possible to use the Extender to get greater distance between a ServSwitch family KVM switch and a CPU, a user station (monitor/keyboard/mouse/serial device/audio devices), or a compatible switch. However, at the time of this writing, not many of these switches support serial or audio devices, and those that do don't always support touchscreens. The ServSwitch Multi (product code KV150A-R2, KV160A-R2, etc.) should work; see **Sections 4.2.3 and 6.2.5** for instructions on connecting a Multi. Before attaching any other KVM switch to the Extender, please call Black Box Technical Support to discuss your application.

NOTE

When you order any cable listed in this section, you will be asked to specify the length you want. Some cables might be available in a few stock lengths only.

If you are using any equipment with PC/AT style connectors, you might also need to order some combination of these adapters:

- To attach a CPU with a 5-pin DIN female keyboard-port connector to the Extender's Local Unit: A keyboard-port adapter such as product code FA211.
- To attach a CPU with a DB25 male serial-port connector to the Extender's Local Unit: A serial-port adapter such as product code FA521A.
- To attach a keyboard with a 5-pin DIN male keyboard connector to the Extender's Remote Unit: A keyboard adapter such as product code FA212.

4.2.1 To Connect a CPU to the Local Unit

We've included extension cables with the Extender that you can use to connect the CPU-port connectors on the Extender's Local Unit to the CPU's keyboard, mouse, video, serial, and audio ports. As mentioned above, you might also need port adapters if your CPU has PC/AT type ports.

4.2.2 TO CONNECT A MONITOR, KEYBOARD, MOUSE, SERIAL DEVICE, AND AUDIO DEVICES TO THE REMOTE UNIT OR TO THE DUAL-ACCESS LOCAL UNIT

You'll be plugging the monitor, keyboard, and mouse directly into the corresponding user-port connectors on the Extender's Remote Unit. If your serial device is made to plug directly into a CPU, it will plug directly into the Remote Unit; if not, you will need a serial cable to attach the device:

- If the serial device is DCE and has a DB25 female connector, use a DB9 female to DB25 male modem cable such as product code EVMBMC.
- If the serial device is DTE and has a DB25 female connector, use a DB9 female to DB25 male null-modem cable such as EVMBPC.
- If the serial device is DTE and has a DB25 male connector, use a DB9 female to DB25 female null-modem cable such as BC01900-0100.
- If the serial device is DTE and has a DB9 male connector, use a DB9 female to DB9 female null-modem cable such as EYN257H.

NOTE

Because the Extender transparently passes through RTS, CTS, DTR, and DSR, it is possible to substitute additional TD/RD data pairs (to/from a second or third serial device) for each pair of these hardware flow-control signals if you're using software flow control (or no flow control) instead. To do this, you'll need to attach special breakout cables to the Extender's serial ports. Call Black Box Technical Support if you'd like to do this.

If your audio device is made to plug directly into a CPU, it will plug directly into the Remote Unit; if not, you will need an audio cable such as product code EJ110 to attach the device.

4.2.3 TO CONNECT A SERVSWITCH MULTI TO THE EXTENDER

To attach a CPU Card installed in a ServSwitch Multi to the user port of an Extender's Remote Unit, you'll need a one-to-many ServSwitch Multi User Cable with Audio (product code KV2040-R2). To attach a CPU Card to the user port on an Extender Local Unit (which doesn't have the serial and audio connectors), you'll need a regular ServSwitch Multi User Cable (KV2020-R2).

To attach a User Card installed in a ServSwitch Multi to the CPU port of an Extender's Local Unit, you'll need a one-to-many ServSwitch Multi CPU Cable with Audio (KV2515), *plus* the extension cables included with the Extender.

4.2.4 TO CONNECT THE LOCAL UNIT TO THE REMOTE UNIT

To interconnect the Extender's Local and Remote Units, you'll need industry-standard structured cabling (Category 5 UTP or STP, 4-pair) terminated with RJ-45 plugs. Order CAT5 patch cables such as our product code EYN737MS or CAT5 bulk cable such as our EYN840A. The bulk cable should be terminated with high-quality RJ-45 plugs such as those included in our FM732 25-pack.

CAUTION!

This cable *must* be solid-core type; stranded patch cable will give poor results over longer distances. The pairing of the cable and pinning of its connectors must be in accordance with EIA/TIA-568A or (preferably) EIA/TIA-568B. (Refer to the wiring chart in Appendix A. Please note that failure to wire the twisted pairs correctly will dramatically impair video quality and possibly prevent correct operation.)

You might be able to use some makes of CAT5e cable (rated for 155 Mbps) between Extender Units at distances up to 120 m (400 ft.). In general, however, *avoid* using CAT5e, "Level 6" or "Level 7" cables, or other types of cable rated for data rates higher than 100 Mbps (bandwidths higher than 100 MHz). This is because the wires in these cables are twisted much more tightly than those in regular CAT5, which is great for high-speed data but *really bad* for video signals.

Also, even though your network might use the same type of 4-wire twisted-pair cabling, do *not* connect the Extender to 10BASE-T Ethernet devices or *any* other network equipment. Doing so will virtually destroy the Extender's circuitry and could also damage the attached equipment.

The Extender is designed for use up to a maximum cable length of 300 m (1000 ft.) At this length the video quality should be acceptable even at a screen resolution of 1024 x 768 and a refresh rate of 75 Hz.

Although a single continuous length of interconnect cable is preferable, it's possible to operate an Extender system if the Local and Remote Units are connected through multiple patch panels. However, the more patch panels the cable is routed through, the greater the probability that the video signal will be degraded.

NOTE

The Extender has been tested and found to work, *in certain situations*, with 4-pair Category 3 cable or with four pairs of 25-pair UTP trunk cables instead of 4-pair Category 5 cable. We do not recommend such installations; if you want to experiment with them, do so at your own risk.

5. Configuration

The configuration controls for the ServSwitch Brand CAT5 KVM/Serial/Audio Extender are internal, but should only need to be set once. To get at them, first open the Unit by unscrewing the four screws on its case and lifting off the top half of the case. When you've finished setting them, close the Unit by replacing the top half of the case and screwing the screws back in.

CAUTION!

The Extender's circuit boards can be damaged by static electricity, so take every reasonable precaution against it. At the very least, discharge yourself on a metallic surface before opening the Extender; if possible, stand on an anti-static mat and wear a grounding strap or anti-static gloves.

5.1 Setting the Cable-Length Jumpers

The Remote Unit of the KVM/Serial/Audio Extender contains video-equalization circuitry which compensates for the loss in image quality that occurs when you drive video across long cables. With cables in the neighborhood of 300 meters (1000 feet) long, this loss is considerable.

There are three jumpers on the main circuit board of the Extender's Remote Unit that you can use to select an equalization-adjustment range appropriate to the length of the interconnect cable you'll be running between the Local and Remote Units. (Figure 5-1 on the next page shows where these jumpers are.) Once you set them, you can alter the compensation level with the two rotary controls on the Remote Unit's front panel while the Extender is operating in order to "tune in" the image more precisely (see **Section 6.4**).

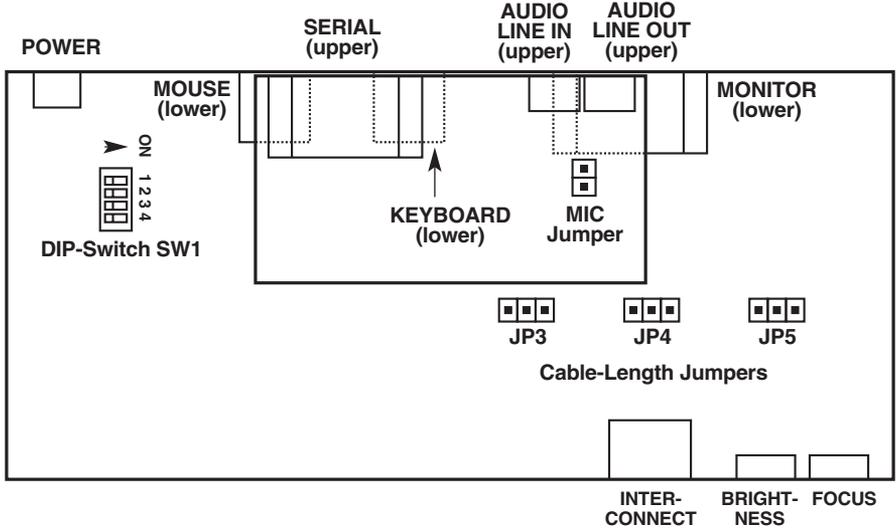
The three cable-length jumpers should be set as follows (*all three jumpers must be set the same way*):

Cable Length in Jumper Meters (Feet)	Position
0 to 100 (0 to 330)	Off  (factory default)
100 to 200 (330 to 655)	A 
200 to 300 (655 to 1000)	B 

NOTE

If you will be running cable to near the limit of one of these cable-length ranges, say as far as 80 m (260 ft.), and you will be using high-resolution (1024 x 768 or higher) video, you might be able to achieve more accurate video compensation (see Section 6.4) by selecting the higher cable length range (the 100-to-200-m range in this case).

If you are conducting a same-room test prior to your final installation, as we recommend—see **Section 6.1**—set the jumpers as appropriate for the length of the test cable first; then, if the Units pass the test, reset the jumpers for your actual installation length.



For cable lengths of 0 to 100 m (0 to 330 ft.), set all three to OFF ().
 For cable lengths of 100 to 200 m (330 to 655 ft.), set all three to A ().
 For cable lengths of 200 to 300 m (655 to 1000 ft.), set all three to B ().

Figure 5-1. The Remote Unit's main PCB and audio daughterboard, showing the cable-length jumpers, MIC jumper, and DIP switch.

5.2 Setting the DIP Switch: Keyboard-Command Hotkey

You'll also find a four-position DIP switch labeled SW1 on the main circuit board inside the KVM/Serial/Audio Extender's Remote Unit (see Figure 5-1 on the previous page). (For directions on opening and closing the Remote Unit's case, including the static-electricity precautions you should take, see the start of **Chapter 5**.)

Only position 2 of this DIP switch is meaningful; don't change the settings of any of the other switch positions. (Position 2 is the second one from the top, or second from the left if you hold the Remote Unit by its left end.) It controls the Extender's keyboard-command hotkey (see **Section 7.3**), the character that you can send from either attached keyboard to cue the Extender to expect to receive a command. Each time you press the hotkey, it will be absorbed by the Extender if it's followed by a valid command character.

The hotkey can be either left-[Ctrl] or right-[Ctrl]. In position 2's factory-default OFF setting, right-[Ctrl] is the hotkey. But you might want to use left-[Ctrl] instead, particularly if (a) a KVM switch you'll be attaching uses right-[Ctrl] as *its* command hotkey, or (b) a computer you'll be attaching to the Extender is a workstation such as a Compaq® Alpha®, HP®, etc. (Instead of a standard right-[Ctrl] key, these workstations' keyboards have a [Compose] key, which shouldn't be absorbed by the Extender because it's required for use with some of the software written for these workstations.) To have the Extender use left-[Ctrl] for its hotkey, move position 2 to ON. (If neither right- nor left-[Ctrl] are suitable for this purpose in your application, please call Black Box Technical Support.)

5.3 Setting the Microphone-Amplification Jumper (Not Normally Necessary)

All sound cards that we have tested so far are able to amplify the incoming signal from a microphone—the card should be set to amplify the signal by +20 dB. If the sound card of the computer you'll be attaching can do this, or if the microphone itself has on-board amplification, you can skip ahead to **Chapter 6**.

However, if you'll be attaching both (a) a microphone that can't amplify itself and (b) a sound card or audio device that can't amplify the microphone's signal, you'll have to set the KVM/Serial/Audio Extender to do the amplification by installing a jumper on the jumper posts labeled "MIC" mounted on the audio daughterboard inside the Remote Unit (see Figure 5-1 on the previous page). (For directions on opening and closing the Remote Unit's case, including the static-electricity precautions you should take, see the start of **Chapter 5**. For microphone-installation directions, see **Section 6.2.1**.) Once you install a jumper on these jumper posts, the Extender will amplify the incoming microphone signal by +17 dB.

6. Installation

To install your ServSwitch™ Brand CAT5 KVM/Serial/Audio Extender, first test-place it (if you want to) as described in **Section 6.1**, then attach devices as described in **Section 6.2**, then finish your installation as described in **Section 6.3**. Lastly, adjust the video compensation as described in **Section 6.4**.

6.1 Test-Placing the Extender (Optional)

We recommend testing your KVM/Serial/Audio Extender system with a test setup confined to a single room; that way, if any components are bad, you can find out before you run cable halfway across your campus. If you want to do this, gather your equipment in your test site; otherwise, place the Extender's Local and Remote Units, and the equipment you'll be attaching to them, in your desired locations. (If you'd like to rackmount a Unit, see **Appendix B**.)

6.2 Attaching Devices

For instructions on making device connections, refer to these subsections:

- **Section 6.2.1** for the special considerations involved in audio connections.
- **Section 6.2.2** for attaching a CPU to the CPU port of an Extender's Local Unit.
- **Section 6.2.3** for attaching a monitor, keyboard, and mouse to the user port of a Dual-Access Extender's Local Unit.
- **Section 6.2.4** for attaching a monitor, keyboard, mouse, serial device, and/or audio devices to the user port of an Extender's Remote Unit.
- **Section 6.2.5** for attaching a ServSwitch Multi to an Extender.

As you attach devices to the Extender, here are some things to keep in mind:

- Each powered device should be powered OFF when you attach it.
- Make sure you don't attach a keyboard and mouse, or any keyboard and mouse extension cabling, backwards.
- Some of the illustrations in this section assume that the extension cabling included with the Extender is three separate cables, while others assume that it's the single bonded extension cable. In either case, the principle is the same—run the video, keyboard, and mouse cable or cable strands between the devices' video, keyboard, and mouse connectors respectively. (The keyboard and mouse connectors on the bonded cable have different colors and icon labels for easy identification.)

6.2.1 SPECIAL CONCERNS ABOUT CONNECTING AUDIO DEVICES

Before you connect any sound equipment to the KVM/Serial/Audio Extender, here are some things you should keep in mind:

The Extender's audio interface is stereo, bidirectional (sound can be transmitted in both directions across the link at the same time), and line-level (it supports devices that transmit and receive at up to 5 volts peak-to-peak). In the output ("line out") direction, it's designed to take the output from a computer's sound card or other line-level source and send it to a set of powered speakers at the remote site. In the input ("line in") direction, it's designed to take input from a microphone at the remote site and send it to a local sound card or other line-level destination. It can also send signals in the opposite directions (for example, sound from a remote source to local speakers, or from a local microphone to a remote recorder), although a local microphone would have to be self-amplified and would have to output signals at line level.

- To attach headphones or powered speakers: Plug the headphones or speakers directly into the Local or Remote Unit's "Line Out" connector. Run an included audio cable from the "Line In" connector of the Unit at the other end of the link to the "LINE OUT" connector of a PC's sound card (colored green in the PC99 specifications) or of a CD player or other audio source.

NOTES

The Dual-Access Extender's Local Unit doesn't have pass-through connectors for local audio. If you want to listen to audio output from the CPU at the local user station, you'll need to attach an audio-jack doubler to your sound card's "LINE OUT" connector. These are inexpensive and are available at many audio and electronics stores.

- To attach a microphone that the sound card will be amplifying (the preferred type of microphone attachment): Plug the microphone directly into the Remote Unit's "Line In" connector. Run an included audio cable from the Local Unit's "Line Out" connector to the sound card's "MIC" ("microphone in") connector (colored pink in the PC99 specifications).

To attach a self-amplified microphone, CD player, etc.: Plug the device directly into the Local or Remote Unit's "Line In" connector. Run an included audio cable from the "Line Out" connector of the Unit at the other end of the link to the "LINE IN" connector of a PC's sound card (colored light blue in the PC99 specifications) or of a tape recorder or other audio destination.

To attach a microphone that the Extender will have to amplify itself: Set the Extender's MIC jumper as described in **Section 5.3**. Plug the microphone directly into the Remote Unit's "Line In" connector. Run an included audio cable from the Local Unit's "Line Out" connector to the sound card's "LINE IN" connector (colored light blue in the PC99 specifications).

6.2.2 ATTACHING A CPU TO THE LOCAL UNIT

Run the included extension cabling from the PC's video, keyboard, mouse, serial, and/or audio ports to the matching connectors of the Local Unit's CPU port. For guidelines on which audio connectors to use on the PC's sound card, see Section 6.2.1.

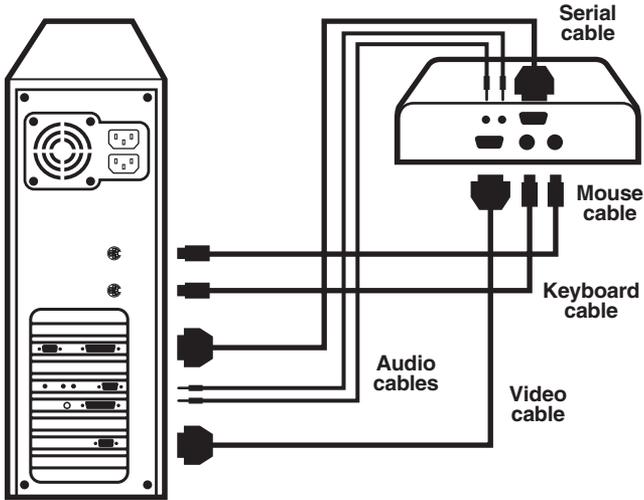


Figure 6-1. Attaching a CPU to the Local Unit (Single-Access model shown).

6.2.3 ATTACHING A MONITOR, KEYBOARD, AND MOUSE TO THE DUAL-ACCESS LOCAL UNIT

Plug the monitor, keyboard, and mouse directly into the matching connectors in the Dual-Access Local Unit's user port.

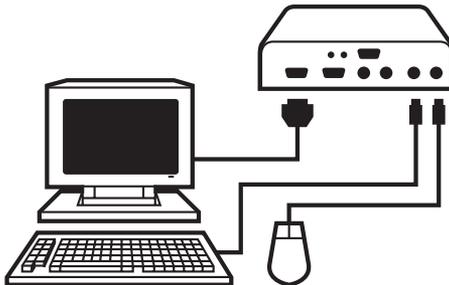


Figure 6-2. Attaching a monitor, keyboard and mouse to the Dual-Access Local Unit.

6.2.4 ATTACHING A MONITOR, KEYBOARD, MOUSE, SERIAL DEVICE, AND/OR AUDIO DEVICES TO THE REMOTE UNIT

Plug the monitor, keyboard, mouse, serial device, and/or audio devices directly into the matching connectors in the Remote Unit's user port. If a serial or audio device doesn't have its own attached cable, you might need to use a serial- or audio-extension cable to connect it. For more guidelines on connecting audio devices, see **Section 6.2.1**. It is theoretically possible to attach two or three serial devices to the Extender, although this will require special cabling; see the Note in **Section 4.2.2**.

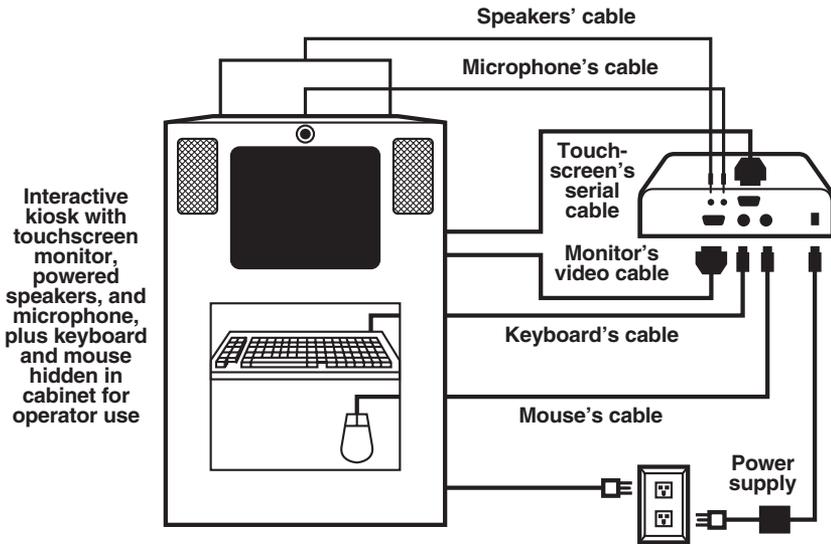


Figure 6-3. Attaching a user station with a monitor, keyboard, mouse, serial device (touchscreen shown), microphone, and speakers to the Remote Unit.

6.2.5 ATTACHING A SERVSWITCH MULTI TO THE EXTENDER

To attach a User Card installed in a ServSwitch Multi to the CPU port of an Extender's Local Unit, first plug the extension cabling included with the Extender into the matching connectors of the Local Unit's user port. Then plug a ServSwitch Multi User Cable such as product code KV2515 into the Multi's User Card. Connect the matching ends of the extension cabling and User Cable together as shown in Figure 6-4.

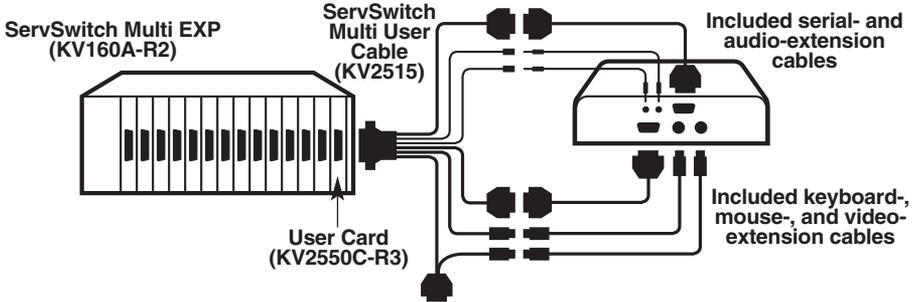


Figure 6-4. Attaching a ServSwitch Multi to the CPU port of a Single-Access Local Unit.

To attach a CPU Card installed in a ServSwitch Multi to the user port of a Dual-Access Extender's Local Unit, which doesn't have serial or audio ports, run a regular ServSwitch Multi CPU Cable such as product code KV2020-R2 from the CPU Card to the appropriate connectors on the Local Unit's CPU port.

To attach a ServSwitch Multi CPU Card to the user port of an Extender's Remote Unit, run a ServSwitch Multi CPU Cable with Audio such as product code KV2040-R2 from the CPU Card to the appropriate connectors on the Extender's Remote Unit, as shown in Figure 6-5.

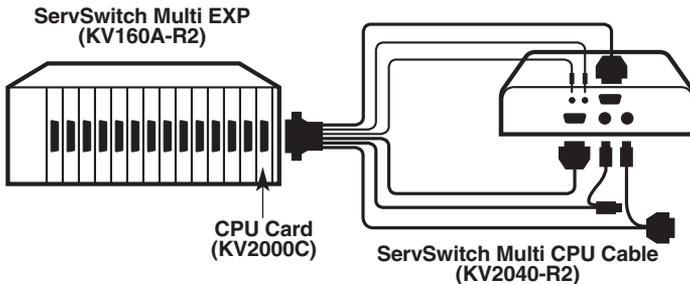


Figure 6-5. Attaching a ServSwitch Multi to the Remote Unit's user port.

6.3 Finishing Your Installation

To finish installing a KVM/Serial/Audio Extender after attaching devices to it as described in **Section 6.2**, take these steps:

1. Interconnect the Remote Unit and the Local Unit by running CAT5 cable between their front-panel modular jacks.
2. Turn the Brightness and Focus dials on the Remote Unit counterclockwise, by hand or with a screwdriver, as far as they will go.
3. Attach the output cord of the Remote Unit's power supply to the power jack on the front of the Unit; then plug the IEC 320 end of the power supply's input cord into the IEC 320 inlet on the power supply's transformer; then plug the other end of the input cord into a utility (mains) power outlet. The Remote Unit should power up immediately; it has no ON/OFF switch. (If the Remote Unit is in the location you want it to be, you can leave it plugged in and powered up more or less indefinitely.)

CAUTION!

If you ever need to replace the power supply of the Remote Unit, the replacement power supply must have identical output characteristics (see the "Power" specification in Chapter 2. Using a power supply with different output—even if it's "almost the same"—could damage your equipment.

4. Power ON the PC CPU or KVM switch attached to the Local Unit's CPU port. Like the Remote Unit, the Local Unit has no ON/OFF switch; it will start up immediately if the CPU or switch provides enough keyboard-line DC voltage.
5. Power ON the monitor or KVM switch (and any powered serial or audio devices) attached to the Remote Unit's user port. *Dual-Access systems:* Power ON any powered devices attached to the Local Unit's user port.
6. Make sure that the remote keyboard functions and that you're getting video and audio at the remote site. (Be aware that even though equipment attached to the Local Unit is usually powered and enabled right away, the remote monitor, keyboard, mouse, and serial and audio devices might take up to two seconds to be properly initialized; see **Section 7.3.3**. Note also that the video quality might be poor at this point if your interconnect cable is longer than 25 m [80 ft.] .)
7. Make sure the remote mouse functions. (If your PC normally boots up in DOS, you will need to run Windows or some application that supports the mouse.)

- Make sure the remote serial device functions. You might need to load a driver or run an application in order for the CPU to be able to detect and handle the serial data.

If everything works in your test setup, repeat the procedures in **Section 6.2** and **6.3** for your actual installation. (For information about rackmounting a Remote Unit, see **Appendix B**.) If everything works in the actual installation, you can proceed to adjust the remote site's video (see **Section 6.4**). For pictures of complete installations, see Figures 6-6 and 6-7 below and Figure 6-8 on the next page.

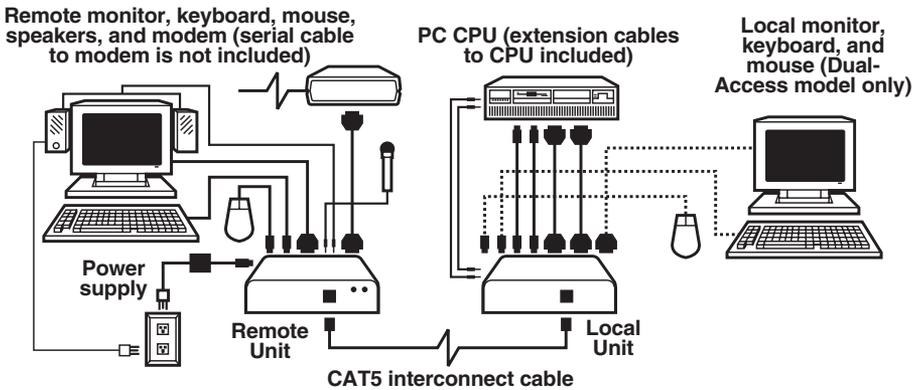


Figure 6-6. An Extender-system installation, front view.

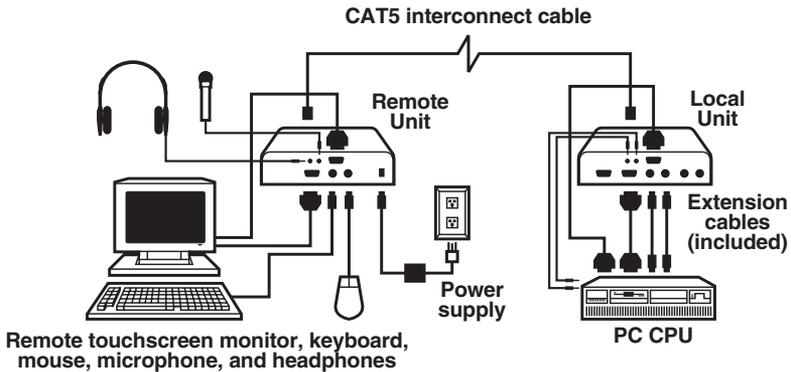


Figure 6-7. A Single-Access Extender-system installation, rear view.

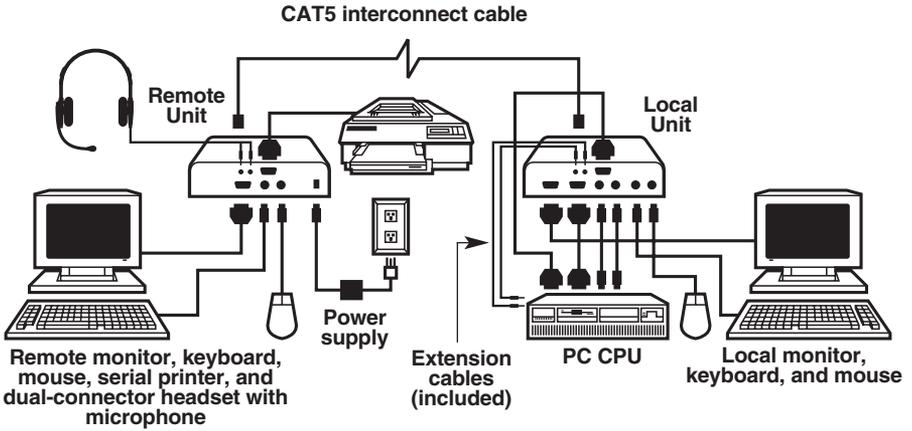


Figure 6-8. A Dual-Access Extender-system installation, rear view.

6.4 Adjusting the Video Compensation

You should only need to take the steps in this section if the interconnect cable between your Local and Remote Units is longer than 25 m (80 ft.). If it isn't that long, but the video at the remote site still looks awful, first try adjusting the Remote Unit's Brightness and Focus dials. If the video looks bad no matter how you set these dials, the problem is almost certainly being caused by bad wiring in your interconnect cable. Compare its pinning and pairing with those shown in Appendix A.

NOTES

For all practical purposes, cable equalization cannot be exact: The remote video image will never be as sharp as the original. The Remote Unit's equalization system is designed to produce very good results on short or medium-length cables and acceptable quality across very long cables (those over 150 m [500 ft.] in length).

At any cable range, you can see how the video would appear without any compensation at all by turning the Focus dial counterclockwise as far as it will go.

1. Run an application you intend to use that requires a high screen resolution, such as a Windows art or design program, a word processor or desktop-publishing package, or even a graphics-intensive game.
2. If the video reaching the remote monitor is "undercompensated," you will notice black smearing on the right-hand edge of large horizontal objects such as title bars. The degradation becomes more noticeable as cable length increases.
3. Keep your eyes on a part of the image where the smearing is evident. Now, turn the Remote Unit's Focus dial clockwise, by hand or with a screwdriver, until the smearing disappears and the edge becomes very bright and too sharp. At this point and beyond the video is "overcompensated."
4. Turn the Focus dial back slightly until you reach a point where the edge looks as it should be (no smearing or over-sharpness). The compensation is now adjusted correctly for the length of interconnection cable used. (If you can't seem to get the compensation close enough, and you're running high-res video to near the limits of the cable length that the Remote Unit is configured for, see the Note at the bottom of page 21.)
5. Use the Brightness dial to adjust the brightness of the overall picture. After you do so, you might need to make a further slight adjustment with the Focus dial.

One you've finished polishing up the video, your KVM/Serial/Audio Extender system should be ready for continuous operation.

7. Operation

7.1 Keyboard and Mouse Emulation

The ServSwitch™ Brand CAT5 KVM/Serial/Audio Extender uses a microprocessor to emulate the presence of a directly connected keyboard and mouse for the attached PC. This means that you don't have to connect a keyboard or mouse to the PC in order for it to boot; in fact, the PC will boot with only the Local Unit connected.

This feature makes several other things possible:

- Your PC can operate continuously regardless of whether or not the Extender's Remote Unit is powered, connected, or even present.
- You can “hot-plug” or “hot-swap” the remote or local keyboard and mouse at any time; that is, you can unplug and replug the keyboard and mouse without disrupting the operation of the PC.
- You can connect different Local Units to different Remote Units at different times in order to create a “switched” KVM-extension system with multiple user stations. You can do this by moving cable between patch-panel ports or directly between Units, although you should do this as infrequently as possible to avoid wearing out the connectors on your cable and devices. Or you can use a CAT5 switch, but the switch must carry all eight wires (maintaining the twists between the wire pairs) and must have enough bandwidth to support your system's video demands. Please call Black Box Technical Support to discuss your application before installing such a system.

7.2 Normal Operation and Keyboard Typematic Rate

With the exception of the shared-access features of the Dual-Access model (see **Sections 7.3.3 and 7.3.4**), the KVM/Serial/Audio Extender should operate continuously and transparently, maintaining the long-distance connection between the local CPU or KVM switch and the remote user station or KVM switch. Note that the remote keyboard's typematic rate—the rate at which a held-down character will repeat—is fixed at 30 characters per second, which is also the default typematic value for Windows.

7.3 Keyboard Commands and Related Functions

This section describes KVM/Serial/Audio Extender functions that can be controlled with commands that users can type in at the user-station keyboards, as well as some related functions. The Extender uses either left- or right-[Ctrl] as a “hotkey” that will trigger the Extender to expect an additional command character. Right-[Ctrl] is the default hotkey, but you can change it to left-[Ctrl] if necessary by moving position 2 of the Remote Unit’s internal DIP switch SW1 to ON (see [Section 5.2](#)).

For a quick summary of all of the Extender’s keyboard commands, see [Appendix C](#).

7.3.1 RESETTING THE REMOTE KEYBOARD AND MOUSE

When an Extender system is set to its factory defaults, or if the keyboard or mouse attached to the Remote Unit ever malfunction, you can reinitialize the remote station’s keyboard and mouse by typing in a reset command at the remote keyboard: Press and release the hotkey, then press and release the up-arrow (number 8) key on the keyboard’s numeric keypad (*not* the number 8 on the top row of the keyboard). This command has no effect if you issue it from the local keyboard.

Note that the Extender will automatically reinitialize the keyboard and mouse whenever you attach them. If a reset doesn’t help your remote keyboard or mouse, try cycling power to the Remote Unit.

7.3.2 CORRECTING THE PS/2 MOUSE IF IT GETS OUT OF SYNC

On rare occasions, you might notice that, instead of behaving normally, your mouse pointer is moving and jumping erratically all over the screen (and possibly selecting things at random). This is usually a sign that the PS/2 mouse has gotten “out of sync” with the Extender or that the Extender has gotten out of sync with the CPU’s PS/2 mouse port.

PS/2 mice send mouse data in 3- or 4-byte packets. As long as the CPU knows which bytes mark the start and end of each packet—which it virtually always does as long as the mouse is directly connected to it—it can correctly interpret the mouse signals. But when mice are disconnected and reconnected, or when mouse signals pass through other devices on their way to the CPU, it is sometimes possible for the CPU or the intervening devices to lose track of where the mouse-data packets begin and end, with the result that the cursor/pointer begins behaving bizarrely.

If this happens in some mouse extender/switch systems, the only solution is to either kill and reload the mouse driver or reboot the PC. But the Extender has a

feature you can use to painlessly recover from this kind of glitch. First try to reset the mouse as described in **Section 7.3.1**. If this doesn't work, send the "Null Mouse Command" in order to resynchronize the CPU's mouse port: Press and release the hotkey, then press and release the left-arrow (number 4) key on the keyboard's numeric keypad (*not* the number 4 on the top row of the keyboard).

When the Extender receives the Null Mouse Command, it sends a "null byte" of mouse data to the CPU; this has no effect other than to get the CPU "caught up" with the mouse. You might have to issue the command as many as three times in order to get a PC with a 4-byte mouse back on track. Note that, unless your mouse driver is an auto-correcting type, sending this command while the mouse is in sync will throw it out of sync.

If the PS/2 mouse frequently gets out of sync in your system, and you're running Windows 95/98/2000, Windows Me®, Windows NT®, or Windows XP®, we recommend that you install a Microsoft IntelliMouse driver on your PC, regardless of whether you're actually using an IntelliMouse or not. The Extender will translate the mouse signals for this driver, and the driver will auto-correct the syncing problem if you let go of the mouse for a second or two.

7.3.3 THE INACTIVITY TIMEOUT (DUAL-ACCESS EXTENDER ONLY)

Because two user stations (one local, one remote) can be directly attached to them, the Dual-Access Extender has "shared access" features, including Private Mode (see **Section 7.3.4**) and an "inactivity timeout." While the inactivity timeout isn't controlled by a keyboard command per se, it responds to general keyboard activity.

The two stations attached to the Extender normally contend for access. When there has been no keyboard or mouse activity on one station for two seconds (the duration of the inactivity-timeout period), the Extender will switch to the first station from which it detects user activity (keyboard keypresses or mouse movements). This inactivity timeout prevents a user at the other station from interrupting work in progress at the active station.

(Important: Serial and audio communication between the CPU and the remote devices do *not* affect, and are *not* affected by, KVM contention. They can begin, continue uninterrupted, and cease regardless of which user is in KVM control, without causing a change of KVM control or resetting the inactivity timeout.)

Here's how it works: A user station is activated by pressing a key on its keyboard or by moving the mouse. This first keypress, or the first packet of mouse data, is absorbed by the Extender and is not passed on to the PC. The Extender "latches onto" this user station; users at the other station can see what's happening on their monitor, but can't control the PC with their keyboard or mouse while the active station is in use. Once the active station's keyboard and mouse are idle for the

length of the “inactivity timeout,” the Extender “lets go” of that station, and will switch to whichever station it next detects keyboard input from.

When the Extender boots up, it gives control (and its total attention) to the local station for at least a portion of the inactivity-timeout period. This means that the remote monitor might be blank, and the remote keyboard and mouse inactive, for up to two seconds.

7.3.4 PRIVATE MODE (DUAL-ACCESS EXTENDER ONLY)

For applications in which one station is not in a secure location, or must be temporarily kept from accessing the local PC, users at one station in a Dual-Access Extender system can trigger the Extender’s “Private Mode,” which prevents the other station from taking control of the local PC even if the inactivity timeout (see **Section 7.3.3**) expires. Either station can go into Private Mode, taking exclusive control of the local PC and locking out the other. When users at either the local or remote station have control of the local PC, they can force the Extender into Private Mode by pressing and releasing the hotkey at their keyboard, then pressing and releasing [Scroll Lock]. The Scroll Lock LEDs on their keyboards will flash to show that Private Mode is active.

If the *remote* station goes into Private Mode and locks out the *local* station, the local monitor’s screen will be blanked, the local keyboard and mouse will be disabled, and all three of the local keyboard’s LEDs (Num Lock, Caps Lock, and Scroll Lock) will light to show that the station is locked out and can’t access the local PC. The local station will be unusable until the remote station exits Private Mode. In the meantime, the Scroll Lock LED on the remote keyboard will continue to flash for the duration of Private mode. To exit Private Mode, the remote user must press and release the hotkey, then press and release [Scroll Lock].

If the *local* station goes into Private Mode and locks out the *remote* station, the remote monitor’s screen will be blanked, the remote keyboard and mouse and audio devices will be disabled (although the remote serial device will continue to function normally), and all three of the local keyboard’s LEDs (Num Lock, Caps Lock, and Scroll Lock) will light to show that the station is locked out and can’t access the PC. In that situation, the remote station will be unusable until the local station exits Private Mode. In the meantime, the local keyboard’s Scroll Lock LED will continue to flash and the local user will have exclusive use of the PC. To exit Private Mode, the local user must press and release the hotkey, then press and release [Scroll Lock].

The Extender will not go into Private Mode unless there’s a powered PC attached to the Local Unit.

8. Troubleshooting

8.1 Common Problems

This section discusses difficulties that people sometimes have with the ServSwitch™ Brand CAT5 KVM/Serial/Audio Extender, and suggests possible remedies. If the recommended actions don't help, if you don't see your problem here, or if your problem keeps recurring, call Black Box Technical Support as directed in **Section 8.3**.

8.1.1 KEYBOARD

The PC boots correctly with no error messages, but the keyboard does not work at all.

1. Check the keyboard cable and (if necessary) the keyboard portion of the extension cabling to your CPU or KVM switch; if it's loose, or if you have the keyboard and mouse cabling reversed (plugged into each other's Extender-port connectors), plug the cabling in properly and reset the keyboard as described in **Section 7.3.1**.
2. Check the interconnect cable between the Extender's Local and Remote Units. Is it intact along its length and securely connected at both ends? And is it wired correctly? (Compare its wiring with that shown in **Appendix A**.)
3. If your PC is a Pentium® class machine, see the entry for the "My Pentium class PC..." problem in **Section 8.1.3**.
4. Try a different model of keyboard. If the new keyboard works, the original one might be incompatible (some older autosensing keyboards don't work with the Extender).

When I press keys on my keyboard the wrong characters appear.

1. Your keyboard may be in the wrong mode. Try resetting it as described in **Section 7.3.1**.
2. Power down and reboot the entire system.

The PC always comes up with "Keyboard Error."

1. If the system appears to work fine after you press [F1] or [ESC], adjust your BIOS setup so that the PC doesn't test the keyboard.
2. If your PC is a Pentium class machine, see the entry for the "My Pentium class PC..." problem in **Section 8.1.3**.

Connecting a keyboard to the Remote Unit has an adverse effect on the remote video.

Try using a newer keyboard. (Some older keyboards require too high a current for the Remote Unit to properly drive the video signal.)

When I don't use a keyboard, the Extender doesn't work at all.

See **Section 8.1.7**.

8.1.2 MOUSE

There is a mouse cursor on the screen, but the mouse does not work.

1. Reset the mouse as described in **Section 7.3.1**.
2. Check the mouse cable and (if necessary) the mouse portion of the extension cabling to your CPU or KVM switch; if it's loose, or if you have the keyboard and mouse cabling reversed (plugged into each other's Extender-port connectors), plug the cabling in properly and reset the mouse as described in **Section 7.3.1**.
3. If your PC is a Pentium class machine, see the entry for the "My Pentium class PC..." problem in **Section 8.1.3**.
4. Check the interconnect cable between the Extender's Local and Remote Units. Is it intact along its length and securely connected at both ends? And is it wired correctly? (Compare its wiring with that shown in **Appendix A**.)
5. Try powering the Remote Unit OFF and then ON again.
6. Try using a different model of mouse.

The system does not detect a PS/2 mouse, or the application cannot find the mouse.

1. Check the mouse cable and (if necessary) the mouse portion of the extension cabling to your CPU or KVM switch; if it's loose, or if you have the keyboard and mouse cabling reversed (plugged into each other's Extender-port connectors), plug the cabling in properly and reset the mouse as described in **Section 7.3.1**.
2. Make sure that the cable running from the keyboard port of the CPU or KVM switch to the Extender's Local Unit is intact and securely attached, so that it provides power to the Local Unit.
3. If your PC is a Pentium class machine, see the entry for the "My Pentium class PC..." problem in **Section 8.1.3**.
4. Reboot the PC.

The mouse is behaving erratically.

1. Reset the mouse as described in **Section 7.3.1**.
2. Issue the Null Mouse Command up to three times (see **Section 7.3.2**).
3. If your PC is running Windows 95/98/2000, Windows Me, Windows NT, or Windows XP, regardless of what type of mouse you have, install the latest Microsoft driver for a standard mouse or (even if you have a standard mouse) the IntelliMouse. The Extender will translate the mouse signals for this driver, and the driver will auto-correct the synchronization problem if you let go of the mouse for a second or two.
4. If you're using the Extender in conjunction with a ServSwitch Multi, command the switch to reset the mouse.
5. Quit and restart the application.
6. Reboot the PC.

8.1.3 BOTH KEYBOARD AND MOUSE

Neither the keyboard nor the mouse operates, or both have locked up.

1. If they have both locked up, first try resetting the keyboard and mouse as described in **Section 7.3.1**.
2. Reset the PC and try again.
3. If the problem is happening at the remote station, cycle power to the Remote Unit.

My Pentium class PC will not boot properly due to keyboard or mouse problems. or After my Pentium class PC boots, the keyboard and/or mouse don't work.

Try “crossing” the keyboard- and mouse-extension cabling running from the Extender to your PC. That is, plug the keyboard cable or cable strand into the mouse connector and the mouse cable or cable strand into the keyboard connector.

If this works, here's why: The BIOS installed in some machines with Intel Pentium family processors checks the PC's keyboard and mouse ports at boot time. If it detects anything that leads it to suspect that the user has plugged the keyboard and mouse in backwards—that is, into each other's CPU ports—it “remaps” the ports, so that the keyboard port functions as the mouse port and vice versa. BIOS of this type sometimes mistakenly activates port remapping when the PC is attached to an Extender.

8.1.4 SERIAL DEVICE

The CPU doesn't detect my serial device.

1. Make sure that the data rates of the device and the CPU's serial port both match, and that the data rate doesn't exceed 19,200 bps.
2. Make sure that the device and your PC's driver or serial-communication program are using the same type of flow control.

The CPU doesn't seem to receive anything from the serial device or vice versa.

1. If possible, attach the serial device directly to the CPU. If it works, skip to #2. If it doesn't, is the device actually standard RS-232? Is it a device the CPU supports? Is a driver for the device loaded, or is software running, that enables the CPU to recognize input from the device?
2. Check the serial cables. Are they intact along their length and securely connected at both ends?
3. Check the data rate. Is the device operating at a rate not exceeding 19,200 bps? Is the CPU's serial port set to the same data rate?
4. Check the data format and flow control. Are the device and your PC's driver or serial-communication program using the same format and flow-control type?
5. Is your PC a UNIX® workstation? In order to operate correctly, some UNIX workstations need to see the DCD signal from the serial device, but the Extender doesn't carry DCD. Call Black Box Technical Support if you've ruled out the other possibilities and suspect that this might be your problem.

The CPU receives garbage from the serial device or vice versa.

1. Make sure that the data rates of the device and the CPU's serial port both match, and that the data rate doesn't exceed 19,200 bps.
2. Make sure that the device and your PC's driver or serial-communication program are using the same data format.

8.1.5 AUDIO DEVICES

Sound doesn't seem to get through from the local site to the remote site or vice versa.

1. Check the audio cables, including those attached to your speakers. Are they intact along their length and securely connected at both ends? Are all cables running correctly from LINE OUT to LINE IN?
2. Is your sound card actually outputting anything? Check this by temporarily attaching some speakers directly to the card.

Sound is distorted.

1. At what level is sound being output to the Extender? If it's above line level (5 volts peak-to-peak), sound will be distorted as it passes through the Extender. The Extender doesn't support devices that output above line level.
2. What type of speakers have you attached to the Extender? The Extender doesn't support the older, cheap, non-amplified speakers that could be plugged into the "SPEAKERS" jack on old sound cards.

8.1.6 VIDEO

The picture is not sharp, or is badly smeared.

1. The video compensation might not be set correctly. See **Section 6.4**.
2. Check the interconnect cable between the Extender's Local and Remote Units. Is it solid-core cable, rated as Category 5? (It might be possible to use CAT5e at distances up to 120 m [400 ft.], but video will degrade if it's run across lengths of CAT5e greater than that.) Is the cable intact along its length and securely connected at both ends? And is it wired correctly? (Compare the cable's specs with those listed in **Section 4.2.4** and its wiring with that shown in **Appendix A**.)
3. Check the video-extension cabling, patch-panel video connections, and other video connections in the system. Make sure everything is properly and securely attached.
4. Are you using an LCD panel? You might need to reduce the refresh rate of your graphics card's output.

Each character has separated into overlapping sets of red, green, and blue pixels; the effect is like trying to watch a 3-D movie without 3-D glasses.

1. Check the interconnect cable between the Extender's Local and Remote Units. Is it solid-core cable, rated as Category 5? Is it intact along its length and securely connected at both ends? And is it wired correctly? (Compare the cable's specs with those listed in **Section 4.2.4** and its wiring with that shown in **Appendix A**.)
2. Check the video-extension cabling, patch-panel video connections, and other video connections in the system. Make sure everything is properly and securely attached.
3. The video compensation might not be set correctly. See **Section 6.4**.
4. Check the settings of the Remote Unit's distance jumpers; you might need to try a higher setting. See **Section 5.1**.

The monitor sometimes loses sync, causing it to go blank for a second or two.

This could happen if your electrical power system is very noisy (particularly on the ground lead). Also, don't route your interconnect cable anywhere near power lines or other powerful sources of interference such as generators, motors, or fluorescent lights. If this is a persistent problem, please discuss it with Black Box Technical Support.

I only need video or serial extension—not keyboard/mouse control—but I can't get a picture.

Even if you are only using the Extender for video extension (to drive video to a remote monitor) or serial extension (to drive RS-232 to or from a remote touchscreen or other device), the Extender's Local Unit must still be attached to the keyboard port of a PC or KVM switch, because that's where it gets its power. If your application makes it impossible to connect the Extender to a keyboard port, call Black Box Technical Support about getting an alternative power supply for the Local Unit.

I get a constant vertical wobble down the screen. What is the cause of this interference?

1. The interconnection cable could be located too close to a source of very strong electrical-power interference; reroute the cable if possible.
2. If the wobble forms a standing "beat pattern," the Extender is probably being affected by a very strong signal from a nearby broadcast transmitter. The solution in this case is to change the vertical refresh rate slightly (for example, from 60 Hz to 70 Hz or vice versa).
3. You might require an alternative power supply for the Remote Unit. Call Black Box Technical Support.

I get black & white instead of color video.

Your CPU probably needs to see monitor ID in order to boot into the correct video mode. Please contact Black Box Technical Support.

Microsoft Windows 3.x, 95, 98, or 2000, Windows Me, Windows NT, or Windows XP will only boot into a low-resolution graphics mode.

1. If your graphics card supports VESA DDC (Display Data Channel), configure the graphics driver by explicitly telling it which make and model of monitor you're using, rather than letting the driver configure itself automatically (and probably erroneously) through DDC, which the Extender doesn't support at the remote station.
2. Your CPU might need to see monitor ID in order to boot into the correct video mode. Please contact Black Box Technical Support.

Connecting a keyboard to the Remote Unit has an adverse effect on the remote video.

Try using a newer keyboard. (Some older keyboards require too high a current for the Remote Unit to properly drive the video signal.)

The Extender doesn't seem to work correctly with my LCD panel.

Try reducing the refresh rate of the video signal that your graphics card is outputting. (The maximum refresh rates supported by most LCD panels are less than those supported by most monitors.)

8.1.7 POWER

I don't need to use a keyboard in my application, but the Extender doesn't work at all unless I have a keyboard line running from the Local Unit to the PC or KVM switch.

The Extender's Local Unit normally operates using the 5 volts of DC power that the attached CPU or KVM switch supplies on its keyboard port. Even if you're not using a keyboard at either the local or remote user station, you should run a cable from the Local Unit's CPU-port keyboard connector to the keyboard port of the CPU or KVM switch in order to power the Local Unit. If this is not possible, please call Black Box Technical Support to discuss your application; you might need a keyboard-port power supply for the Local Unit.

8.2 General Questions About the Extender

Is it possible to use an interconnection cable longer than 300 meters (1000 feet)?

The Extender has been designed to produce acceptable results with SVGA resolutions at the maximum cable length of 300 m (1000 ft.). Therefore, it *might* be possible for you to run as far as 500 m (1640 ft.) at the standard VGA resolution, 640 x 480. However, we do *not* recommend doing this and *cannot* guarantee that it will work.

Can Extenders be daisy-chained to allow operation across a distance greater than 300 meters (1000 feet)?

Though we do not recommend doing so, you can chain two Extenders in order to operate over longer distances. Using cascaded Extenders (CPU→Local Unit 1→Remote Unit 1→Local Unit 2→Remote Unit 2→monitor, keyboard, and mouse), SVGA operation over 500 m (1640 ft.) and standard VGA operation over 600 m (2000 ft.) is theoretically possible, though not guaranteed. In general, the first CAT5 cable segment (the one between the first Extender's Local and Remote Units) should be about 200 m (655 ft.) long and the remaining distance should be covered by the second segment (the one between the second Extender's Local and Remote Units). Such applications require careful setup of the video equalizers. If you plan to cascade Extenders, please contact Black Box Technical Support to discuss your application.

Can the Extender be used between buildings?

No. Ground loops could destroy the Extender and attached equipment.

Can I use multiple Local or Remote Units by swapping interconnect cables or switching the interconnect link?

Because the Extender performs full keyboard and mouse emulation, it is possible to swap or switch the Local-Remote interconnection to create, in effect, a KVM matrix-switch system; you would just have to remember to always reset the active Remote Unit (and, if it's a Dual-Access model, the Local Unit; see **Section 7.3.1**) after each such swap or switch. Please call Black Box Technical Support to discuss your application before deploying such a system.

Is the Extender VESA DDC compatible?

DDC (Display Data Channel) is a two-way monitor-communication/configuration scheme created by VESA (the Video Electronics Standards Association). CPUs and DDC-compliant monitors pass configuration settings and other information back and forth across dedicated signal lines in the video interface. Because the Dual-Access Extender's Local Unit passes these DDC lines through, your local monitor can use DDC if it's DDC-compliant. However, the Extender does not carry the DDC signals across its interconnect cable, so the remote monitor can't use DDC.

In general, we recommend that you simply turn DDC OFF and manually configure your video card for your monitor.

Can the Extender be used with RGB video?

As long as the video has sync on green (the composite sync signal superimposed on the green color signal), there should be no problem.

Which cable type is better: UTP (unshielded twisted pair) or STP (shielded twisted pair)?

In electrically quiet environments, UTP cable will give the best quality video over long distances because it has less capacitance per unit length. However, STP is usually better in electrically noisy environments, because it resists interference more strongly.

When using UTP, what's the best way to make sure that the system does not suffer from any interference?

The Extender is designed to withstand high levels of interference while driving signals over long stretches of UTP. To further reduce the potential for interference, consider taking these actions:

- a) Make sure that the Extender's Remote Unit, the remote monitor or KVM switch, and the local CPU or KVM switch are all connected to the same utility-power (mains) phase.
- b) Make sure that the AC voltage across the utility-power (mains) grounds (at both the local PC and remote monitor) is less than 2V.
- c) Use a "clean earth" or "clean grounding" system (if your site has one installed).
- d) Route the interconnection cable away from generators, motors, compressors, fluorescent lights, and other cables.
- e) Try STP cable if you think noise could be a problem.

This interconnect cable is exactly like the cable I use on my LAN. Can I connect the Extender to my network?

Absolutely not. Regardless of the cable similarities, the data signals and voltages used by the Extender are totally different from those used by Ethernet and other types of networks. Connecting the Extender to a LAN hub, switch, repeater, or other network device, or exposing it to the signal levels present on network data lines, is a sure way to blow out the Extender, and could damage other devices attached to the Extender as well.

Can I rackmount the Extender?

Yes, using Rackmount Kits that are available separately. See **Appendix B**.

8.3 Calling Black Box

If you determine that your KVM/Serial/Audio Extender is malfunctioning, *do not attempt to alter or repair it*. It contains no user-serviceable parts. Contact Black Box Technical Support at 724-746-5500.

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

- the firmware-revision level printed on the bottom of the Extender (very important, especially for keyboard and mouse problems);
- the nature and duration of the problem;
- when the problem occurs;
- the components involved in the problem—that is, what type of computers, what type of keyboard, brand of mouse, make and model of monitor, type and make of CAT5 cable, etc.;
- any particular application that, when used, appears to create the problem or make it worse; and
- the results of any testing you've already done.

To solve some problems, it might be necessary to upgrade the Extender's firmware. If this turns out to be the case for your difficulty, our technical-support technicians will arrange for you to receive the new firmware and will tell you how to install it.

8.4 Shipping and Packaging

If you need to transport or ship your KVM/Serial/Audio Extender:

- Package it carefully. We recommend that you use the original container.
- If you are shipping it for repair, please include all parts of the Remote Unit's external power supply. If you are returning it, please include everything you received with it. Before you ship the Extender back to Black Box for repair or return, contact us to get a Return Authorization (RA) number.

Appendix A:

Cable Pinning/Pairing

The cable you will use to interconnect the Local and Remote Units of your ServSwitch™ Brand CAT5 KVM/Serial/Audio Extender should be terminated with RJ-45 plugs and should be wired according to the EIA/TIA-568 standard (preferably 568B rather than 568A). See **Section 4.2.4** for a more complete set of cable recommendations.

Looking into the interconnect socket on either Extender Unit, or looking at the cable plug from behind, Pin 1 should be on the left and Pin 8 on the right, and the wires should be arranged this way:

Pin	Color	Function, Pair
1	White/Orange	TX, Pair 2
2	Orange/White	RX, Pair 2
3	White/Green	TX, Pair 3
4	Blue/White	RX, Pair 1
5	White/Blue	TX, Pair 1
6	Green/White	RX, Pair 3
7	White/Brown	TX, Pair 4
8	Brown/White	RX, Pair 4

NOTES

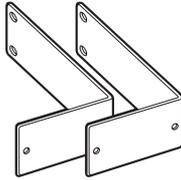
In runs of our EHN840 cable over 200 m (655 ft.) long, you might get much better video quality if, at both ends of the cable, you swap the green and brown pairs so that White/Green is on Pin 7, Green/White on Pin 8, White/Brown on Pin 3, and Brown/White on Pin 6.

The Extender has been tested with all major makes of CAT5 cable including Black Box, Berk-Tek™, Mohawk®, and AT&T®. The Extender has also been tested and found to work, *in certain situations*, with 4-pair Category 3 cable or with four pairs of 25-pair UTP trunk cables instead of 4-pair Category 5 cable. But we do *not* recommend such installations; if you want to experiment with them, do so at your own risk.

We don't normally recommend using CAT5e cable (rated for up to 155 Mbps) for runs longer than 100 m (330 ft.), although our EYN795MS cable has performed well in testing in runs up to the full 300 m (1000 ft.). Avoid using cables rated "Level 6," "Level 7," etc.

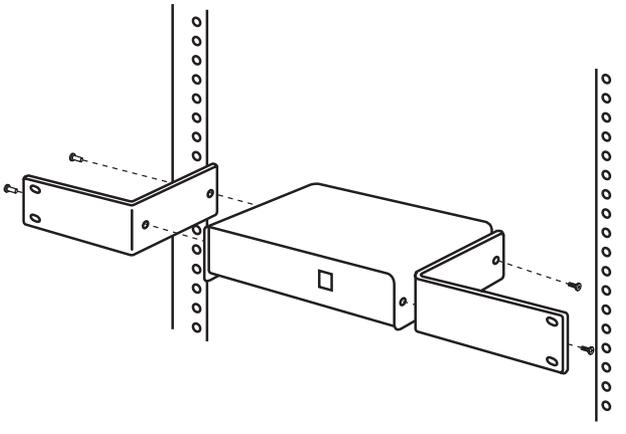
Appendix B: Rackmounting

If you'd like to mount any of your ServSwitch™ Brand CAT5 KVM/Serial/Audio Extender system's Local or Remote Units in a 19" rack, use a two-bracket Rackmount Kit like the one shown below (product code RMK19U):



To use a Kit to mount an Extender Unit, take these steps, referring to the illustration below:

1. Unscrew and keep the two screws on each side of the Unit's case.
2. Match up the two holes in the "Unit end" of each Kit bracket with the two now-vacant screwholes on each side of the Unit, then fasten the brackets to the Unit with the screws you removed in step 1.
3. Once you've attached both brackets, match the holes in the "rack end" of each bracket to an appropriate set of matching holes on your equipment rack. Screw the Unit assembly to the rack using your own screws, bolts, or cage nuts (not included).



Appendix C:

Keyboard-Command Summary

Here is a brief list of the keyboard commands you can use to control your ServSwitch™ Brand CAT5 KVM/Serial/Audio Extender. For detailed descriptions of the commands and the effects they have on the system (including their effects on the keyboard LEDs), refer to **Section 7.3**.

<i>Function:</i>	<i>Keyboard command/activity:</i>
Take control of local CPU	Press any key on keyboard or move mouse
Reset keyboard and mouse	Press and release {hotkey*}, then press and release keypad's up-arrow (number [8]) key
Send null byte to mouse	Press and release {hotkey*}, then press and release keypad's left-arrow (number [4]) key
Enter Private Mode	Press and release {hotkey*}, then press and release [Scroll Lock]

*The default {hotkey} is right-[Ctrl], but you can set it to left-[Ctrl]; see **Section 5.2**.

DISCLAIMERS

While every precaution has been taken in the preparation of this manual, the manufacturer assumes no responsibility for errors or omissions. Neither does the manufacturer assume any liability for damages resulting from the use of the information contained herein. They reserve the right to change the specifications, functions, or circuitry of the product without notice.

The manufacturer cannot accept liability for damage due to misuse of the product or due to other circumstances outside the manufacturer's control. And the manufacturer will not be responsible for any loss, damage, or injury arising directly or indirectly from the use of this product.

NOTES



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Customer Support Information:

FREE tech support 24 hours a day, 7 days a week: Call **724-746-5500** or fax **724-746-0746**.

Mailing address: **Black Box Corporation**, 1000 Park Dr., Lawrence, PA 15055-1018

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