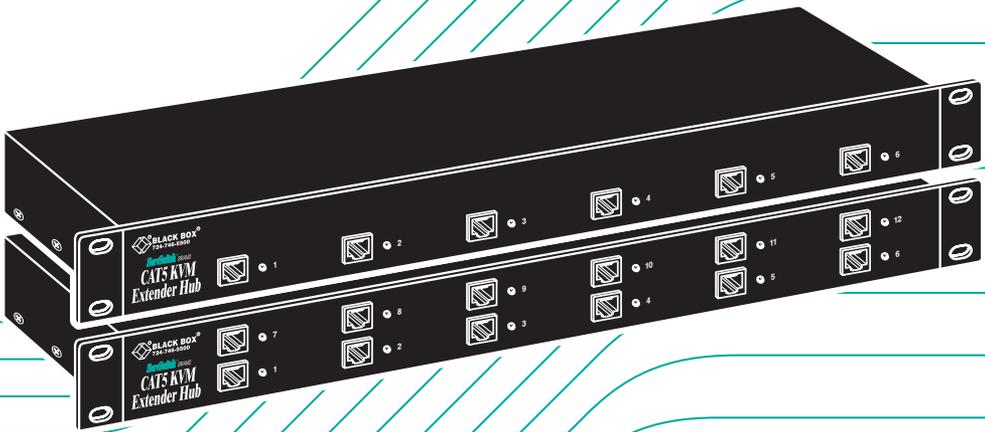


# Rackmount ServSwitch™ BRAND CAT5 KVM Extender Local Hubs



ACU1006RA  
ACU1006DRA  
ACU1006DSRA  
ACU1006DVRA  
ACU1006SRA  
ACU1006VRA  
ACU1012RA

# 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 Rackmount ServSwitch™ Brand CAT5 KVM, KVM/Serial, or KVM/Serial/Audio Extender system, including how to install, operate, and troubleshoot it. For an introduction to the Rackmount Extender, see **Chapter 3**. The Rackmount Extender Hub product codes covered in this manual are:

<b>ACU1006RA</b>	<b>ACU1006DRA</b>	<b>ACU1006DSRA</b>	<b>ACU1006DVRA</b>
<b>ACU1006SRA</b>	<b>ACU1006VRA</b>	<b>ACU1012RA</b>	

*(continued on next page)*

For the remote keyboard/video/mouse user stations in your Rackmount Extender system, you'll also need ServSwitch™ Brand CAT5 KVM, KVM Micro, KVM/Serial, KVM/Serial/Audio, or KVM/Serial/Audio Micro Extender Remotes (each comes with its own installation guide):

<b>ACUREM</b>	<b>ACUMREM</b>	<b>ACUSREM</b>	<b>ACUVREM</b>
<b>ACUWREM</b>	<b>ACUREMSW</b>	<b>ACU1006MRA</b>	<b>ACU1006MRVA</b>

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### 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 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.

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 **Chapter 8** or call Technical Support.

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



## 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

## NOTE

There are a large number of different models in the Rackmount Extender series. If you ever need a quick rundown of the features of any particular model, refer to Appendix E.

## 1.1 Configuring the Extender System

Configuring the Rackmount ServSwitch™ Brand CAT5 KVM, KVM/Serial, or KVM/Serial/Audio Extender Local Hub involves setting some internal controls. Read the paragraphs in this section that apply to your equipment, and if you find that you'll need to change configuration settings, follow the procedures listed in those paragraphs. (If you're not certain which Extender models you're working with, refer to **Chapter 3**.) Which configuration settings you'll need to consider depend on the combination of Local Hub and "Remote" (Remote Unit or Remote Hub) that you're using (the numbers are those of the paragraphs that follow):

- ACU1006RA or ACU1012RA with ACUREM, ACUMREM, or ACU1006MRA: **1, 2**
- ACU1006RA or ACU1012RA with ACUREMSW: **1, 5**
- ACU1006DRA with ACUREM: **1, 2, 7**
- ACU1006DRA with ACUMREM or ACU1006MRA: **1, 2**
- ACU1006SRA with ACUSREM: **1, 2, 3, 4**
- ACU1006DSRA with ACUSREM: **1, 2, 3, 4, 7**
- ACU1006VRA with ACUVREM, ACUWREM, or ACU1006MRVA: **1, 5, 6**
- ACU1006DVRA with ACUVREM: **1, 5, 6, 7**
- ACU1006DVRA with ACUWREM or ACU1006MRVA: **1, 5, 6**

(These are the only Local-to-Remote links that work.)

### 1. All Hub-to-Remote links: How far will CAT5 cabling run between the Local Hub and any given Remote?

- *If you're using Micro Remotes (ACUMREM, ACUWREM, ACU1006MRA, or ACU1006MRVA):* If the cable distance will be 25 m (80 ft.) or less, you don't need to set anything. If it will be 25 to 50 m (80 to 160 ft.), move position 1 of the two-position DIP switch for that link on the bottom of the Remote to the DOWN (ON) setting.

- *If you're using any other type of Remote Unit:* If the cable distance 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 985 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 5.2**.
2. **All Hub-to-Remote links except KVM/Serial/Audio types or those with Switching Remote Units: Does your application require the [Scroll Lock] key?** If not, you don't need to set anything. If it does:
    - *If you're using a Micro Remote (ACUMREM or ACU1006MRA):* Set position 2 of the DIP switch for that link on the Remote to ON. Refer to **Section 5.1**.
    - *If you're using any other type of Remote Unit:* Set position 4 of the Remote Unit's DIP switch SW1 to OFF. Refer to **Section 5.3.1**.

(Be aware that this will disable the Extender's reset function and, with the Dual-Access Local Hubs, will disable the "Private Mode" feature as well.)
  3. **KVM/Serial links only: Will you be using hardware flow control on your serial link?** If not, you don't need to set anything. If you will be, install jumpers as necessary on the signal jumper posts in your Local Hub and your Remote Units (refer to Figure 5-3 at the end of **Chapter 5**).
  4. **KVM/Serial links only: What data rate will your serial link be using?** If you'll be running 9600 bps, you don't need to set anything. If you'll be running 19,200 bps, install a jumper on the jumper posts in your Remote Unit labeled "Baud." See Figure 5-2 in **Section 5.4**.
  5. **KVM/Serial/Audio links and Hub-to-Switching-Remote links only: 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 ACUREMSW or ACUVREM, or position 2 of the two-position DIP switch for that link on the bottom of the ACU1006MRA or ACU1006MRVA, to ON. Refer to **Section 5.3.2**.

6. *KVM/Serial/Audio links only: 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 Hub. 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 for that link inside the Remote. Refer to **Section 5.6**.
7. *All Dual-Access links except those with Micro Remotes:* If you don't want a given remote monitor to be blanked in Private Mode, set position 1 of DIP-switch SW1 in that Remote Unit to ON. If you want to lengthen the inactivity timeout for automatic local/remote switching to 15 seconds, set position 2 to OFF. If you want automatic switching to be triggered by mouse activity as well as keyboard activity, set position 3 to OFF.

To set a Remote Unit's internal controls (which only needs to be done once), open it while it's 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. Open a hub in roughly the same way to set its internal controls (which also only needs to be done once, and only for the Remote Hubs and KVM/Serial Local Hubs); unscrew the five screws on its lid and remove the lid. For more information about configuration, refer to **Chapter 5**.

## 1.2 Installing the Extender System

To install your Rackmount Extender system, refer to the appropriate figure on the pages at the end of this chapter:

- Figure 1-1 for a non-serial Single-Access KVM Extender Hub system with a full-size Remote Unit (ACU1006RA or ACU1012RA with ACUREM).
- Figure 1-2 for a non-serial Single-Access KVM Extender Hub system with a Micro Remote Unit (ACU1006RA or ACU1012RA with ACUMREM).
- Figure 1-3 for a non-serial Single-Access KVM Extender Hub system with a Micro Remote Hub (ACU1006RA or ACU1012RA with ACU1006MRA).
- Figure 1-4 for a non-serial Single-Access KVM Extender Hub system with a Switching Remote Unit (ACU1006RA or ACU1012RA with ACUREMSW).
- Figure 1-5 for a non-serial Dual-Access KVM Extender Hub system with a full-size Remote Unit (ACU1006DRA with ACUREM).
- Figure 1-6 for a non-serial Dual-Access KVM Extender Hub system with a Micro Remote Unit (ACU1006DRA with ACUMREM).

- Figure 1-7 for a non-serial Dual-Access KVM Extender Hub system with a Micro Remote Hub (ACU1006DRA with ACU1006MRA).
- Figure 1-8 for a Single-Access KVM/Serial Extender Hub system (ACU1006SRA with ACUSREM).
- Figure 1-9 for a Dual-Access KVM/Serial Extender Hub system (ACU1006DSRA with ACUSREM).
- Figure 1-10 for a Single-Access KVM/Serial/Audio Extender Hub system with a full-size KVM/Serial/Audio Remote Unit (ACU1006VRA with ACUVREM).
- Figure 1-11 for a Single-Access KVM/Serial/Audio Extender Hub system with a KVM/Serial/Audio Micro Remote Unit (ACU1006VRA with ACUWREM).
- Figure 1-12 for a Single-Access KVM/Serial/Audio Extender Hub system with a KVM/Serial/Audio Micro Remote Hub (ACU1006VRA with ACU1006MRVA).
- Figure 1-13 for a Dual-Access KVM/Serial/Audio Extender Hub system with a full-size KVM/Serial/Audio Remote Unit (ACU1006DVRA with ACUVREM).
- Figure 1-14 for a Dual-Access KVM/Serial/Audio Extender Hub system with a KVM/Serial/Audio Micro Remote Unit (ACU1006DVRA with ACUWREM).
- Figure 1-15 for a Dual-Access KVM/Serial/Audio Extender Hub system with a KVM/Serial/Audio Micro Remote Hub (ACU1006DVRA with ACU1006MRVA).

Use the indicated types of extension cables to attach CPUs to the Local Hub and any Switching Remote Units; plug the remote keyboards, monitors, mice, and any serial or audio devices directly into the Remotes; and (with the Dual-Access Local Hub) plug the local keyboard, monitor, and mouse directly into the Local Hub. Connect the Local Hub to the Remotes with straight-pinned four-pair CAT5 cable. Power the Remotes with their included power supplies. For more information about installation, refer to **Chapter 6**.

## CAUTION!

**Connect non-serial Local Hubs to non-serial Remotes only. Similarly, connect KVM/Serial Local Hubs only to KVM/Serial Remotes and connect KVM/Serial/Audio Local Hubs only to KVM/Serial/Audio Remotes. Do *not* mix any of these three types with any of the others—for example, don't connect a KVM/Serial Local Hub to non-serial or KVM/Serial/Audio Remotes. Extender systems with intermixed non-serial and/or KVM/Serial and/or KVM/Serial/Audio Extender equipment do *not* work.**

### **1.3 Operating the Extender System**

For the most part, your Rackmount Extender system should operate automatically and transparently. Some functions, though, are handled with keyboard commands. For descriptions of these commands, refer to **Section 7.3**.

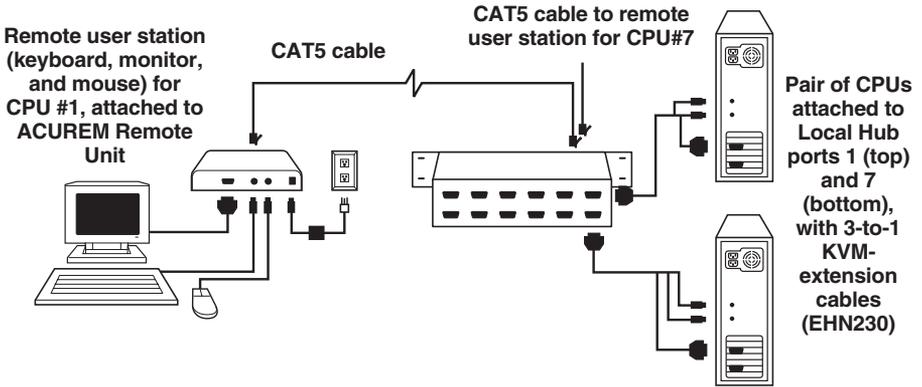


Figure 1-1. A non-serial Single-Access KVM Extender Hub system (ACU1012RA shown) with a full-size Remote Unit. (For compactness and clarity, only the CPUs for ports 1 and 7 and the user station for port 1 are illustrated.)

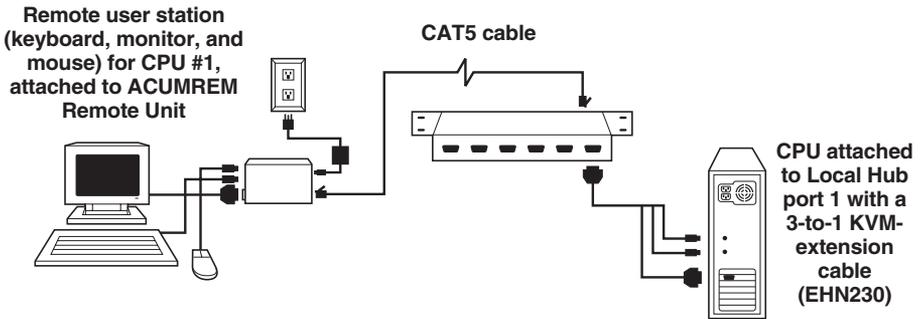
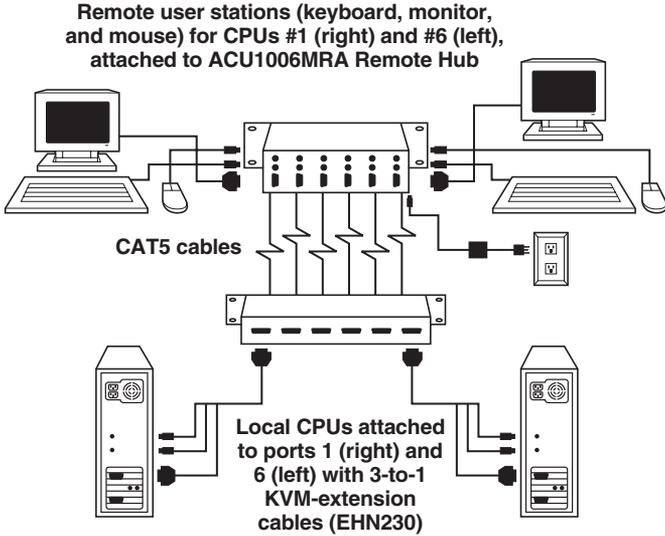
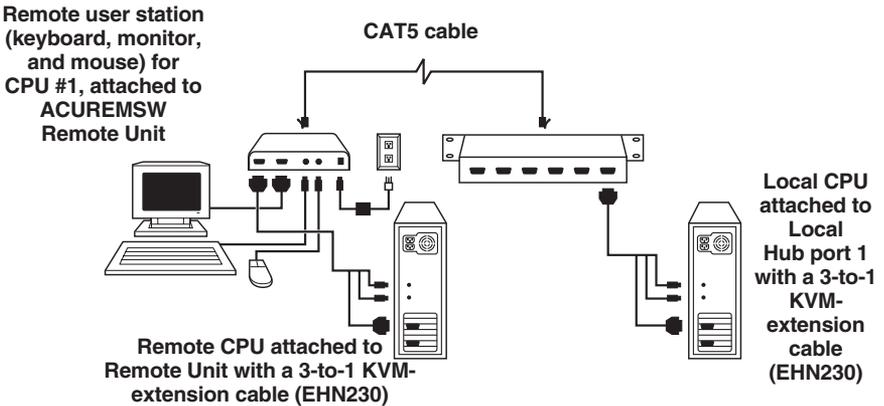


Figure 1-2. A non-serial Single-Access KVM Extender Hub system (ACU1006RA shown) with a Micro Remote Unit.



**Figure 1-3. A non-serial Single-Access KVM Extender Hub system (ACU1006RA shown) with a Micro Remote Hub. (For clarity, only two CPUs and two stations are shown.)**



**Figure 1-4. A non-serial Single-Access KVM Extender Hub system (ACU1006RA shown) with a Switching Remote Unit.**

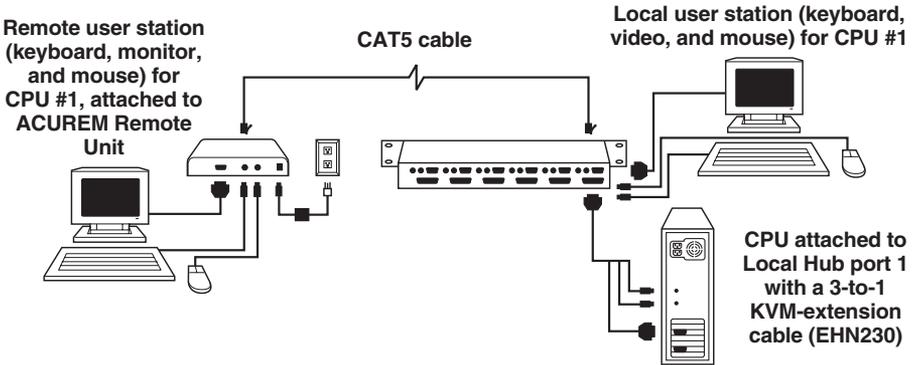


Figure 1-5. A non-serial Dual-Access KVM Extender Hub (ACU1006DRA) system with a full-size Remote Unit.

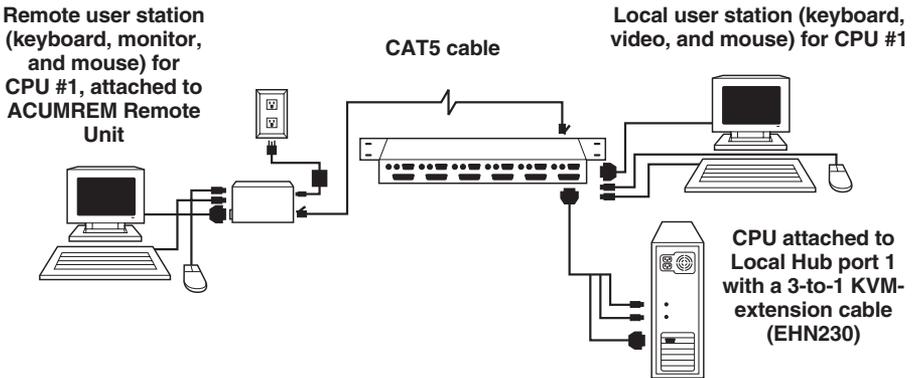
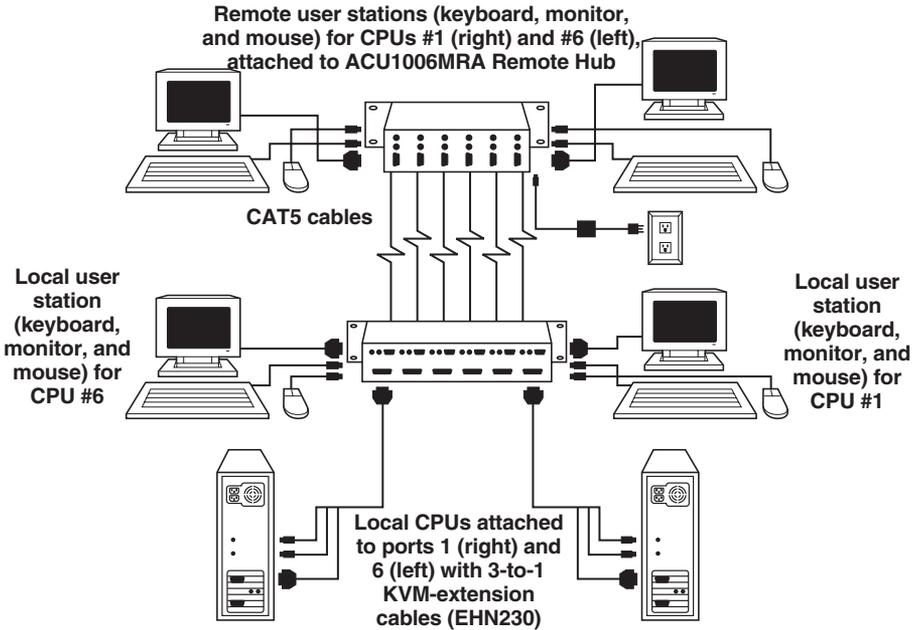
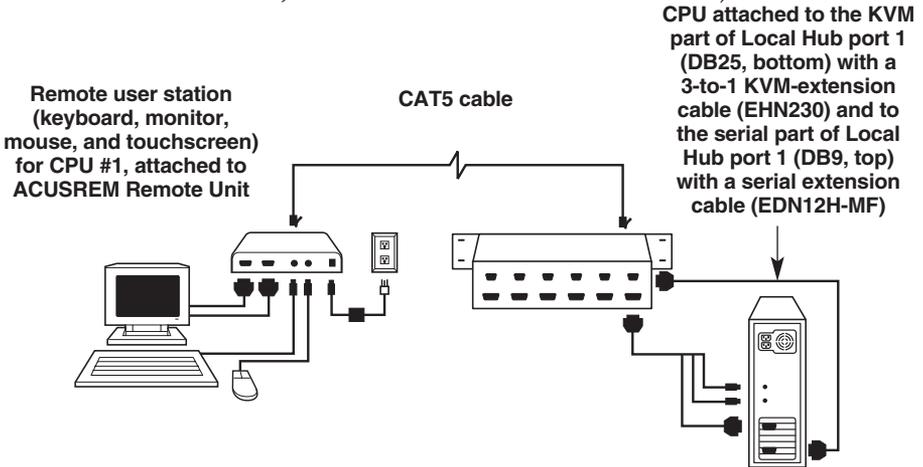


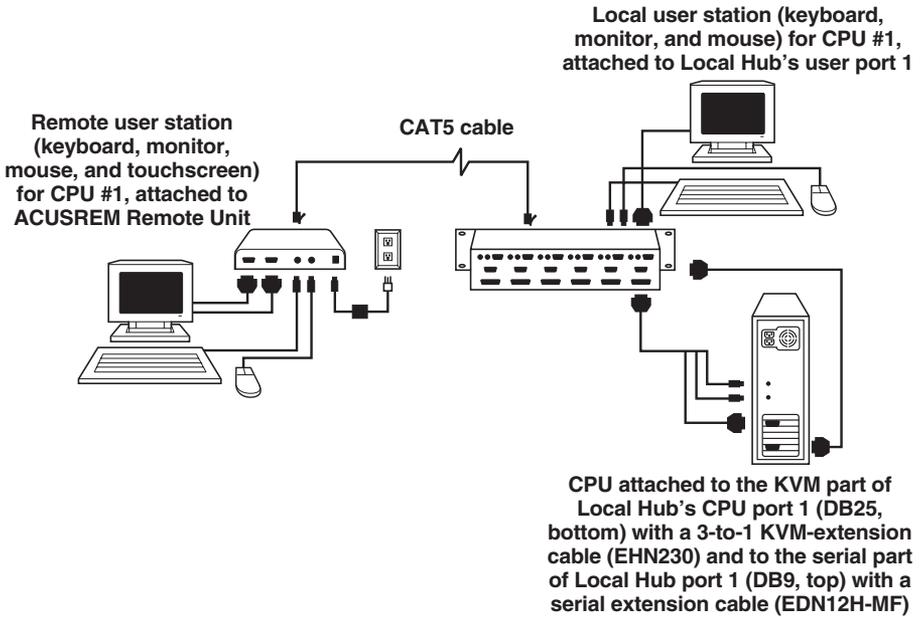
Figure 1-6. A non-serial Dual-Access KVM Extender Hub (ACU1006DRA) system with a Micro Remote Unit.



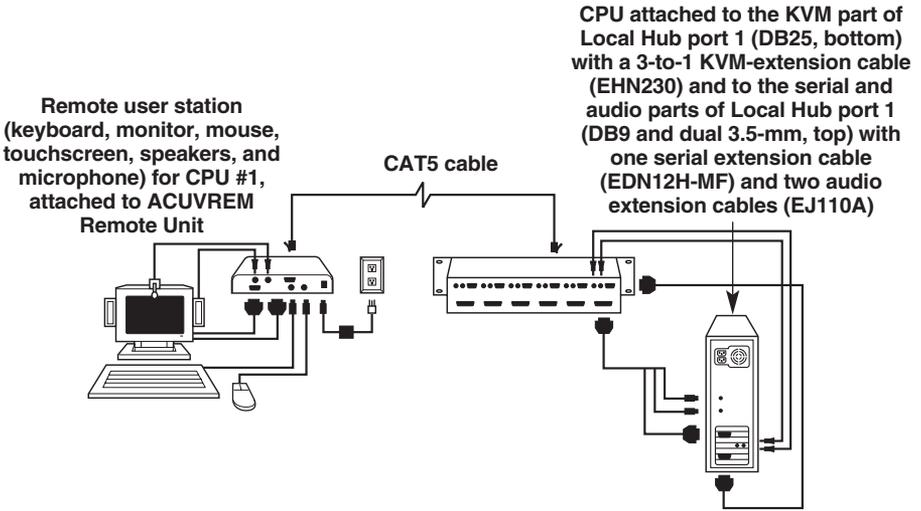
**Figure 1-7. A non-serial Dual-Access KVM Extender Hub (ACU1006DRA) system with a Micro Remote Hub. (For clarity, only two CPUs, two local stations, and two remote stations are shown.)**



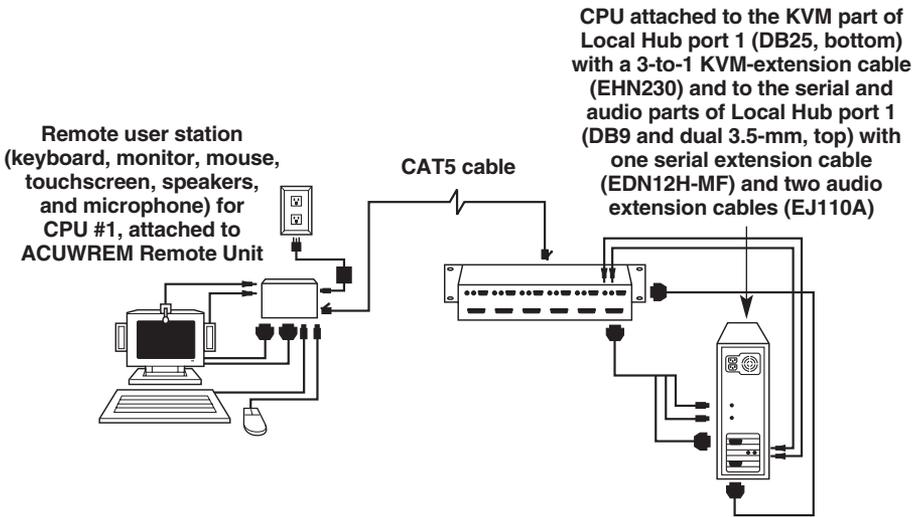
**Figure 1-8. A Single-Access KVM/Serial Extender Hub (ACU1006SRA) system.**



**Figure 1-9. A Dual-Access KVM/Serial Extender Hub (ACU1006DSRA) system.**

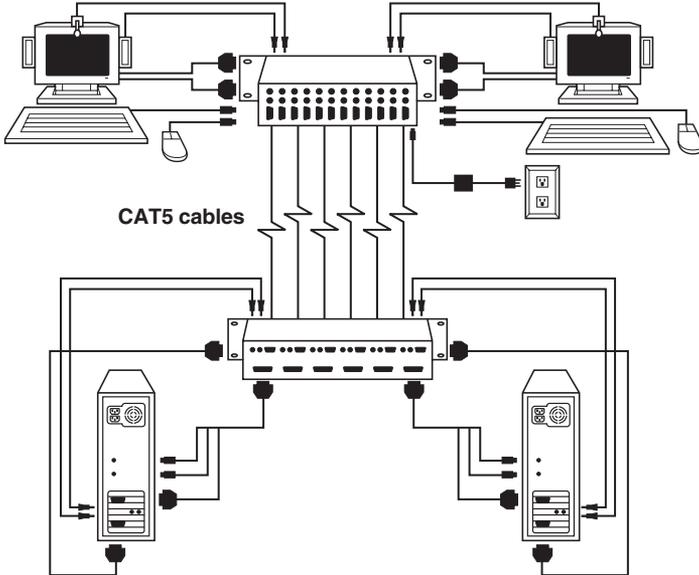


**Figure 1-10. A Single-Access KVM/Serial/Audio Extender Hub (ACU1006VRA) system with a full-size Remote Unit.**



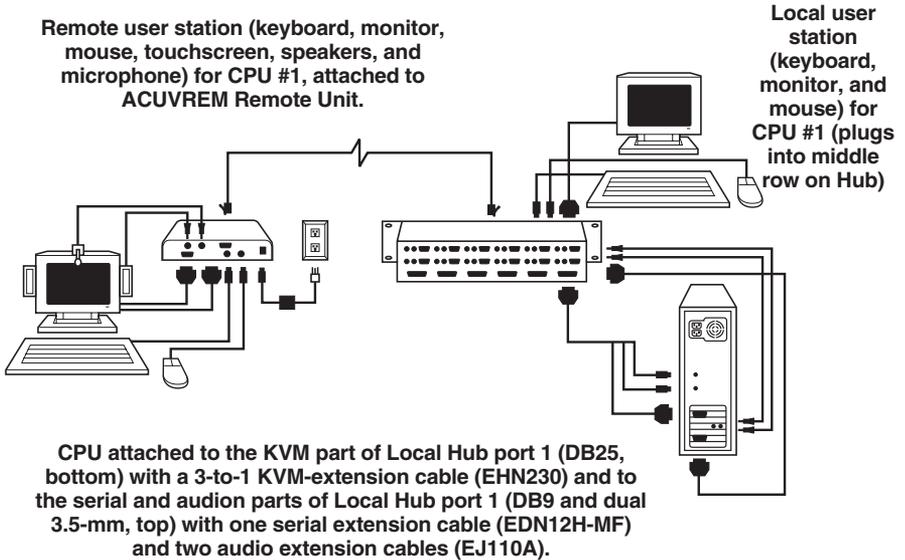
**Figure 1-11. A Single-Access KVM/Serial/Audio Extender Hub (ACU1006VRA) system with a Micro Remote Unit.**

Remote user stations (keyboard, monitor, mouse, touchscreen, speakers, and microphone) for CPUs #1 (right) and #6 (left), attached to ACU1006MRVA Remote Hub

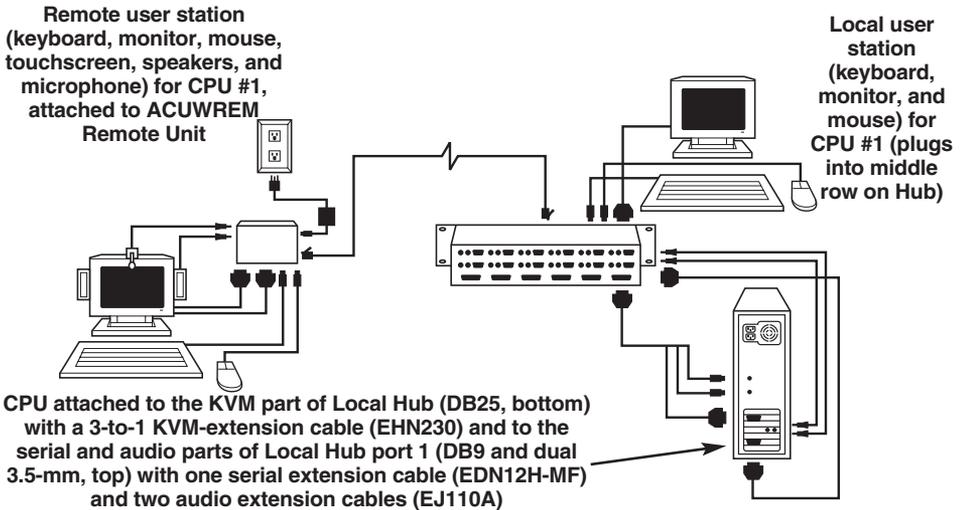


CPUs attached to the KVM part (DB25, bottom) of Local Hub ports 1 (right) and 6 (left) with a 3-to-1 KVM-extension cable (EHN230) and to the serial and audio parts (DB9 and dual 3.5-mm, top) of Local Hub ports 1 (right) and 6 (left) with one serial extension cable (EDN12H-MF) and two audio extension cables (EJ110A)

Figure 1-12. A Single-Access KVM/Serial/Audio Extender Hub (ACU1006VRA) system with a Micro Remote Hub. (For clarity, only two CPUs and two stations are shown.)

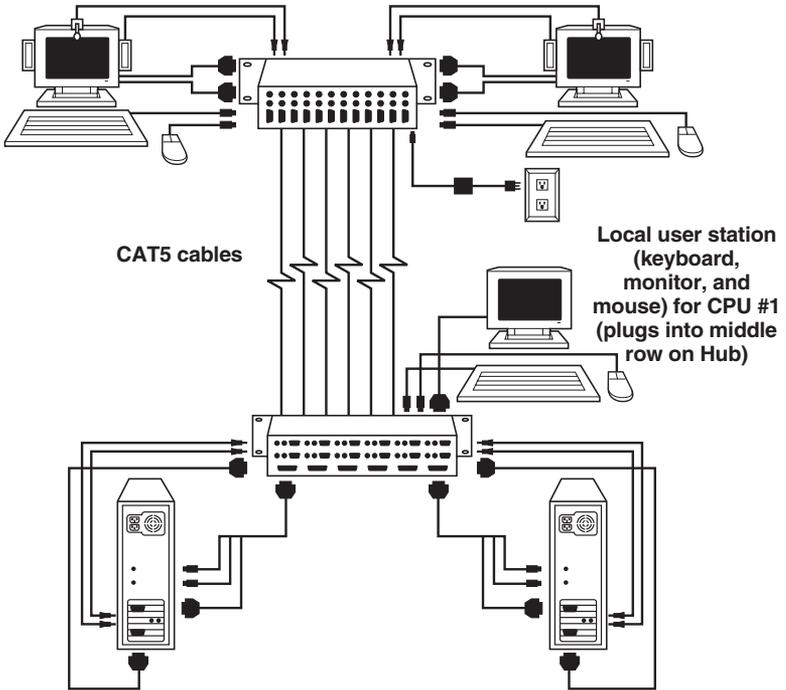


**Figure 1-13. A Dual-Access KVM/Serial/Audio Extender Hub (ACU1006DVRA) system with a full-size Remote Unit.**



**Figure 1-14. A Dual-Access KVM/Serial/Audio Extender Hub (ACU1006DVRA) with a Micro Remote Unit.**

Remote user stations (keyboard, monitor, mouse, touchscreen, speakers, and microphone) for CPUs #1 (right) and #6 (left), attached to ACU1006MVRA Remote Hub



CPUs attached to the KVM part (DB25, bottom) of Local Hub ports 1 (right) and 6 (left) with a 3-to-1 KVM-extension cable (EHN230) and to the serial and audio parts (DB9 and dual 3.5-mm, top) of Local Hub ports 1 (right) and 6 (left) with one serial extension cable (EDN12H-MF and two audio extension cables (EJ110A).

**Figure 1-15. A Dual-Access KVM/Serial/Audio Extender Hub (ACU1006DVRA) system with a Micro Remote Hub. (For clarity, only two CPUs, two remote stations, and one local station are shown.**

## 2. Specifications

- Cable Required:** Between Local Hub and Remotes: 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 A; FCC Part 15 Subpart B Class A, IC Class/classe A
- Compatibility:** Video: VGA, SVGA, XGA, XGA-2, or RGsB (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:** Between Local Hubs and Remotes: Proprietary composite of all supported types of computer I/O;  
On Local Hubs, to CPUs:  
Proprietary composite of VGA compatible video and IBM PS/2 compatible keyboard and mouse;  
ACU1006DSRA, ACU1006SRA, and ACU1006VRA only: EIA/TIA RS-232, DCE;  
ACU1006VRA only: Bidirectional 3.5-mm mini stereo audio;  
On Dual-Access Local Hubs, to local user-station equipment:  
To local monitor: VGA;  
To local keyboard and mouse: IBM PS/2 compatible;  
On Remotes, to attached equipment:  
Depending on the type of unit, either separate or proprietary composite VGA video and IBM PS/2 compatible keyboard and mouse;  
KVM/Serial and KVM/Serial/Audio Remotes only: EIA/TIA RS-232, DTE;  
KVM/Serial/Audio Remotes only: Bidirectional 3.5-mm mini stereo audio

**Video Bandwidth****(to -3 dB):**

Local Hubs: 150 MHz per port;

Each non-Micro Remote:

Intrinsic: 300 MHz;

Across 100 meters (330 feet) of UTP: 95 MHz (with equalization)

**Resolution and****Refresh Rate:**

With Micro Remotes: Up to 1280 x 1024 noninterlaced;

With other types of Remotes:

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 (985 ft.)

**Video I/O****Signal Levels:**

0.7 volts peak-to-peak

**Video****Compensation:**

With Micro Remotes: For short- or long-distance (user-switchable);

With other types of Remotes: 3-stage continuously variable

**Synchronization:**

H/V or composite, TTL signal levels; sync polarity is preserved

**Video Coupling:**

DC

**Serial****Characteristics:**

KVM/Serial systems:

Data rate: 9600 or 19,200 bps (user-selectable); can also be set to 1200 bps (see **Appendix C**);

Data format: 8 data bits, no parity, 1 stop bit (fixed);

Flow control:

Hardware: RTS/CTS passed through or looped back, DTR/DSR passed through or looped back, or none (user-selectable);

Software: Transparent to software flow control;

## Serial

### Characteristics

#### (continued):

KVM/Serial/Audio systems:

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:

KVM/Serial/Audio systems only:

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 $\Omega$ ;

Signal direction: Simultaneous bidirectional;

Extra microphone support at Remote: Pullup resistor provides bias for condenser microphone; optional amplification to +17 dB for external microphone

## Maximum

### Distance:

5 m (16 ft.) from a Local Hub to the attached local equipment;

5 m (16 ft.) from each Remote to the attached remote equipment;

50 m (160 ft.) between a Local Hub and a Micro Remote;

300 m (985 ft.) between a Local Hub and any other type of Remote

## NOTE

**With high-quality cables, it might be possible to run farther than 5 m (16 ft.) from a Local Hub or a Remote to attached equipment.**

- User Controls:** ACU1006DSRA and ACU1006SRA only:  
(6) Internal data-rate jumpers (1 for each port);  
(6) Internal flow-control jumper blocks (1 for each port);  
All full-size (non-Micro) Remotes:  
(2) Front-mounted dials: Brightness and Focus;  
(3) Internal video-distance (cable-length) jumpers;  
(1) Internal 4-position DIP switch for various options;  
ACUMREM, ACUWREM: (1) Bottom-mounted 2-position DIP switch for video distance (cable length) and keyboard-command recognition;  
ACU1006MRA, ACU1006MRVA: (6) Internal 2-position DIP switches for video distance (cable length) and keyboard-command recognition, (1) for each Local-to-Remote link;  
ACUSREM only:  
(1) Internal data-rate jumper;  
(1) Internal flow-control jumper block;  
ACUVREM, ACUWREM:  
(1) Internal microphone-amplification jumper;  
ACU1006MRVA only:  
(6) Internal microphone-amplification jumpers,  
(1) for each Local-to-Remote link
- Indicators:** On Local Hubs: Front-mounted LEDs (1 for each port) for power and link integrity
- Connectors:** On Local Hubs:  
(1) Rear-mounted 2.1-mm center-positive barrel jack for optional video power;  
Front-mounted RJ-45 female for local/remote interconnection:  
ACU1012RA: (12);  
All other models: (6);  
Rear-mounted DB25 female for video, mouse, and keyboard I/O to and from computers:  
ACU1012RA: (12);  
All other models: (6);

**Connectors  
(continued):**

On Local Hubs (continued):

*Dual-Access models only:*

Rear-mounted:

(6) HD15 female for video output to local monitors;

(12) 6-pin mini-DIN female: (6) for input from local keyboards, (6) for input from local mice;

*KVM/Serial and KVM/Serial/Audio models only:* (6) Rear-mounted DB9 female for serial I/O to and from computers;

*KVM/Serial/Audio models only:* (12) Rear-mounted 3.5-mm mini stereo jacks for audio I/O to and from computers: (6) for speaker/headphone output, (6) for microphone input;

On Remotes (Remote Units support [1] user station and Local-to-Remote link, Remote Hubs support [6]):

On the right side of each ACUMREM, on the front of all other models:

(1) RJ-45 female for each Local-to-Remote link;

On the right side of each ACUMREM, on the rear of all other models:

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

On the left side of each ACUMREM, on the rear of all other models:

(1) HD15 female for video output to each user station's monitor;

(2) 6-pin mini-DIN female for input from each user station's keyboard and mouse;

On the rear of each KVM/Serial and KVM/Serial/Audio model:

(1) DB9 male for serial I/O to/from each user station's RS-232 device;

On the rear of each KVM/Serial/Audio model:

(2) 3.5-mm mini stereo jacks for each user station: (1) for speaker/headphone output, (1) for microphone input;

On the rear of each ACUREMSW only:

(1) DB25 female for composite I/O to/from the keyboard, mouse, and video ports of the remote CPU

**Temperature****Tolerance:** 32 to 104°F (0 to 40°C)**Humidity****Tolerance:** 5 to 90% noncondensing**Enclosure:**

Steel

**Power:**

To Local Hub:

5 VDC at up to 120 mA from each attached CPU's keyboard and mouse ports;

Optionally (recommended for ACU1006VRA), from desktop power supply (certified to the relevant international safety standards):

Input: 100 to 240 VAC at 50 to 60 Hz from utility-power (mains) outlet, through detachable power cord and IEC 320 male inlet, to external transformer;

Output: 5 VDC regulated, at 1.5 amps minimum, from transformer to Local Hub;

To Remote:

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 Remote

**CAUTION!**

**Be very careful to use the Local Hub's power supply only with the Local Hub and the Remote's power supply only with the Remote. If you swap power supplies, you will damage your equipment; the Local Hub, in particular, will be ruined.**

**Along the same lines, if you ever need to replace a Local Hub's or Remote'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 equipment.**

## RACKMOUNT SERVSWITCH™ BRAND CAT5 KVM EXTENDER LOCAL HUBS

<b>Size:</b>	ACU1006DSRA and ACU1006DVRA: 3.5"H (2U) x 19"W x 4.5"D (8.9 x 48.3 x 11.4 cm); All other Local Hubs: 1.75"H (1U) x 19"W x 4.5"D (4.4 x 48.3 x 11.4 cm); ACUMREM: 1.1"H x 4.4"W x 3.3"D (2.8 x 11.2 x 8.4 cm); ACUWREM: 1.7"H x 4.4"W x 3.3"D (4.3 x 11.2 x 8.4 cm); ACUVREM: 1.75"H (1U) x 7.7"W x 4"D (4.4 x 19.6 x 10.2 cm); ACU1006MRA and ACU1006MRVA: 1.75"H (1U) x 17.25"W x 4.2"D (4.4 x 43.8 x 10.7 cm); rear-panel connectors protrude an additional 0.2" (0.5 cm); All other Remote Units: 1.4"H x 7.7"W x 4"D (3.6 x 19.6 x 10.2 cm)
<b>Weight:</b>	ACU1006DSRA and ACU1006DVRA: 6.6 lb. (3 kg); ACU1012RA and ACU1006VRA: 4.4 lb. (2 kg); All other Local Hubs: 3 lb. (1.4 kg); ACUMREM: 8.3 oz. (235 g); ACUREMSW: 1.4 lb. (0.6 kg); ACU1006MRA and ACU1006MRVA: 4 lb. (1.8 kg); All other Remote Units: 1.1 lb. (0.5 kg)

## 3. Introduction

### NOTE

**There are a large number of different models in the Rackmount Extender series. If you ever need a quick rundown of the features of any particular model, refer to Appendix E.**

The Rackmount ServSwitch™ Brand CAT5 KVM (including KVM/Serial and KVM/Serial/Audio) Extenders are multiple keyboard/video/mouse extension systems. By using an Extender Local Hub together with a set of standalone Extender “Remotes” (Remote Units or Remote Hubs), you can place up to six or twelve VGA monitors, keyboards, and mice as far as 50 meters (160 ft.) or 300 meters (985 ft.) from the PC-compatible CPUs they communicate with. This means that you can rackmount the Local Hub and the CPUs in a secured central location and put your keyboards, monitors, and mice in regular offices where they belong. These Local Hub models are available:

- 6- and 12-Port Single-Access (“regular”) KVM Extender Local Hubs (product codes ACU1006RA and ACU1012RA respectively). Use these with the non-serial full-size KVM Extender Remote Units (product code ACUREM), KVM Micro Extender Remote Units and Hubs (ACUMREM and ACU1006MRA), and Switching Remote Units (ACUREMSW), which also support an attached remote CPU.
- 6-Port Dual-Access KVM Extender Local Hub (ACU1006DRA). This has all of the capabilities listed above, and also supports a local monitor, keyboard, and mouse for each CPU. Use it with the non-serial full-size KVM Extender Remote Units and the KVM Micro Extender Remote Units and Hubs (ACUREM, ACUMREM, and ACU1006MRA).
- 6-Port Single-Access (ACU1006SRA) or Dual-Access (ACU1006DSRA) KVM/Serial Extender Local Hub. These have all of the capabilities listed above, and also support a connection between each CPU and a remote touchscreen or other RS-232 serial device. Use these with the KVM/Serial Extender Remote Units (ACUSREM).
- 6-Port Single-Access KVM/Serial/Audio Extender Local Hub (ACU1006VRA). These have all of the capabilities of the KVM/Serial Local Hubs, and can also support a connection between each CPU and a remote microphone and speakers (or other sources of audio input and output). Use it with the full-size KVM/Serial/Audio Extender Remote Units and the KVM/Serial/Audio Micro Remote Units and Hubs (ACUVREM, ACUWREM, and ACU1006MRVA).

## IMPORTANT NOTES

Throughout this manual, serial and audio devices/connections/etc. will often be listed without qualification along with video/monitor, keyboard, and mouse devices/connections/etc. Just keep in mind that, except where noted, all references to serial communication apply to KVM/Serial and KVM/Serial/Audio Extender systems only, and all references to audio apply to KVM/Serial/Audio Extender systems only.

Also, there are three main varieties of CAT5 KVM Extender equipment: non-serial, KVM/Serial, and KVM/Serial/Audio. Do *not* connect Local Hubs of one variety to Remotes of a different variety. Extender systems with mismatched Local and Remote Units *do not work*.

The Local Hubs and Remotes are designed to be interconnected with a single industry-standard Category 5 UTP or STP 4-pair cable. All keyboard, mouse, video, and serial signals are fully buffered to ensure consistent remote operation of your PCs.

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 your Local Hub and all of your Remotes (see **Chapter 5**), just connect the Local Hub and Remotes to each other and to your equipment as described in **Sections 6.2** and **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 attached PCs without having a keyboard or mouse attached to them. They will boot even if the matching Remotes are not powered or have no keyboard or mouse connected to them.

## 3.1 Compatibility

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

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

- **CPUs:** IBM® PC/AT®, PS/2, and 100% compatible clones. These should be desktop machines; laptops and docking stations are not supported.
- **Monitors:** VGA, SVGA, XGA, XGA-2, or RGSB (sync on green). Be aware that a few monitors and graphics cards might not work with the “as is” Rackmount Extender—at least in their factory-default settings—because they exchange monitor IDs or VESA DDC (Display Data Channel) information. Call Black Box Technical Support for help with “ID bit” problems. The Extender doesn't support DDC, so you'll need to go into the settings of each PC's graphics card, turn DDC off, and manually configure the card for your monitor.
- **Keyboards:** 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 product code 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 the keyboard you want to use is some other type or has some other type of connector, call Black Box for 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. The KVM/Serial/Audio Extenders can handle serial mice if they are attached to the Extenders' serial ports, and the KVM/Serial Extenders can be *set* to work with serial-mouse-type devices, but the other models are *not* compatible with serial mice and require adapters to support PCs with PC/AT type serial mouse ports—see the Note on the next page. The Extenders are *not* compatible at all 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:** *KVM/Serial Extenders:* Standard asynchronous RS-232 devices that operate at 9600 or 19,200 bps; use 8 data bits, no parity, and 1 stop bit; and don't require any hardware control signals other than RTS, CTS, DSR, and DTR. The KVM/Serial Extenders are especially designed for use with most touchscreens.  
*KVM/Serial/Audio Extenders:* Standard asynchronous RS-232 devices, including serial mice and trackballs, that operate at up to 19,200 bps and don't require any hardware 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.)

### NOTE

The Extenders do not support serial mice on their PS/2 mouse ports. The KVM/Serial/Audio Extenders support serial mice on their serial-device ports without requiring any special configuration.

In their standard settings, the KVM/Serial Extenders do not support serial mice on their serial-device ports. If a PC you want to attach to a KVM/Serial Extender system has a serial mouse port, we recommend plugging a PS/2 mouse into the Remote Unit, then running a PS/2 mouse-extension cable to the CPU and using a mouse-port adapter such as product code AC244A to connect the cable to the PC's serial mouse port.

If, however, you need to use a special serial-mouse device such as an industrial trackball running at 1200 bps, the KVM/Serial Extender system can be set to that data rate. See Appendix C.

- **Audio Device (KVM/Serial/Audio Extenders only):** 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 Rackmount ServSwitch Brand CAT5 KVM and KVM/Serial Extenders have a number of useful features which contribute to the transparent remote operation of your PCs. Some of the more important ones are:

- **Distance up to 50 m (160 ft.) with Micro Remotes or 300 m (985 ft.) with other types of Remotes**

Operate your PCs from almost anywhere in the same building.

- **Fully adjustable video equalization**

Compensates for the loss of image quality caused by the signals passing through such a long run of cable.

- **Fully buffered signals**

Remote operation of the PCs is consistently smooth and transparent.

- **Local Hubs are self-powered**

Each of a Local Hub's CPU ports is powered by the keyboard and mouse ports of the attached PC—external power supplies aren't normally needed (although we recommend that you use one with the ACU1006VRA). Refer to the paragraphs between steps 3 and 4A in **Section 6.3**.

- **Local Hubs' CPU ports are electrically isolated**

Each of a Local Hub's CPU ports is on a separate circuit from the others. If you have a mild electrical problem on one port, it shouldn't affect the others.

- **Intelligent PS/2 keyboard and mouse emulation**

With this, the PCs boot and operate correctly under most circumstances, and you can freely detach and reconnect the keyboards and mice as necessary (the Rackmount Extender automatically initializes the keyboards and mice as soon as it detects that you've reattached them).

- **Microsoft® IntelliMouse™ compatibility**

Use this and compatible "wheel mice" with confidence. In a Dual-Access system, you can even use a standard PS/2 mouse at one of a PC's user stations and an IntelliMouse at the other.

- **Ready for rackmounting**

Local Hubs fit comfortably in just 1U or 2U of vertical space in standard 19" racks. Remote Hubs come with included rackmount brackets. And if you'd like to rackmount any of your non-Micro Remote Units, we offer a separate rackmount kit (product code RMK19U-R2) for them as well. See **Appendix B**.

- **LEDs make status monitoring easy**

They show you right away whether the Local Hub is powered and whether the links from the Local Hub's ports to the Remotes are functioning.

- ***Dual-Access Local Hubs only: Supports local stations***

With the Dual-Access Local Hubs, you can operate the PC either locally or remotely (but not both at the same time).

- ***Non-Serial Single-Access Local Hubs with Switching Remote Units only: Supports remote CPUs***

You can attach a CPU as well as a user station to the Switching Remote Unit, so that the remote user can switch between local and remote CPUs.

- ***KVM/Serial and KVM/Serial/Audio Local Hubs only: Support for serial peripherals***

With the KVM/Serial Local Hubs, you can connect any attached CPU to a touchscreen or to just about any other remote RS-232 device that doesn't have sophisticated hardware flow-control requirements and can communicate at 9600 or 19,200 bps using 8 data bits, no parity, and 1 stop bit.

With the KVM/Serial/Audio Local Hubs, you can connect almost any RS-232 device that can communicate at 19,200 bps or less.

- ***KVM/Serial/Audio Local Hubs only: Support for audio peripherals***

With the KVM/Serial/Audio Local Hubs, you can connect almost any standard audio device or sound card.

- ***Remote Hubs: Support for multiple colocated user stations***

With the Remote Hubs, you can link clusters of user stations to as many as six distant CPUs, even if the CPUs are attached to different Local Hubs.

Typical applications for this include connecting secured CPUs to multiscreen trading desks and connecting data-center KVM switches to remote clusters of user stations.

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

# 4. Checklist of System Components

## 4.1 The Complete Package

At the time of this writing, these items should be included in the package with *the Local Hub* of your Rackmount ServSwitch™ Brand CAT5 KVM Extender:

- (1) Rackmount Extender Local Hub.
- (1) 5-VDC (1.5 amps or higher) power-supply transformer and output cord for optional video power.
- (1) Input cord for the optional power supply, suitable for your country or region.
- (1) Copy of this manual.

These items should be included in the package with *each Remote* that you'll use in your Extender system:

- (1) Rackmount Extender Remote.
- (1) 9-VDC, 1-amp power-supply transformer and output cord.
- (1) Input cord for the power supply, suitable for your country or region.
- (1) Copy of the Remote's installation guide.
- *Switching Remote Unit (ACUREMSW) only:* (1) 1-m (3.3-ft.) three-to-one CPU KVM-extension cable that will run from the Remote Unit to the remote CPU. This cable has a DB25 male connector on the Extender end and an HD15 male and two 6-pin mini-DIN male connectors on the CPU end.
- *Remote Hub (ACU1006MRA and ACU1006MRVA) only:* (2) Rackmount brackets for mounting the Remote Hub in a standard 19" rack (see **Appendix B**).

The components of the Extender package are, however, subject to change without notice.

Please contact Black Box right away if any of these items are damaged when you receive them.

## 4.2 The Cables You'll Need

The basic application for the Rackmount Extender is to get greater distance between rackmounted CPUs and user stations consisting (depending on what types of Local Hubs and Remotes you're using) of VGA monitors, PS/2 keyboards, PS/2 mice, touchscreens or other RS-232 serial devices, and/or audio devices. Between your Rackmount Extender Local Hub and Remote packages, you should have received everything you'll need for this kind of application except for your serial, audio, CAT5, and CPU KVM-extension cables, which you'll have to order separately. For this kind of application, read **Sections 4.2.1, 4.2.3, and 4.2.5** carefully, then proceed with **Chapter 5**.

If you are using the Rackmount Extender to get greater distance between a ServSwitch family KVM switch and either a CPU, a user station, or a compatible switch, you might need to order additional non-included cabling. Read the relevant sections from **Section 4.2.1** through **Section 4.2.5**.

### 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 some combination of these adapters:

- To attach a CPU or KVM switch with a 5-pin DIN female keyboard connector to a CPU port on a Local Hub: A keyboard-port adapter such as product code FA211.
- *All except the KVM/Serial/Audio models:* To attach a CPU or KVM switch with an RS-232 serial DB9 male mouse connector to the Local Hub: A mouse-port adapter such as product code AC244A. (Avoid attaching a serial mouse or a CPU's serial mouse port to a serial connector on a KVM/Serial Extender Local Hub or Remote. If you really need to use an industrial trackball or some other device that functions like a serial mouse, see **Appendix C**.)
- *KVM/Serial Local Hubs only:* To attach a CPU or KVM switch with a DB25 male serial-port connector to the Local Hub: A serial-port adapter such as product code FA521A.
- To attach a keyboard or KVM switch with a 5-pin DIN male keyboard connector to a Remote or to a user-port keyboard connector on a Dual-Access Local Hub: A keyboard adapter such as product code FA212.

**4.2.1 TO CONNECT CPUs TO CPU PORTS ON A LOCAL HUB OR SWITCHING REMOTE UNIT**

You'll need three-to-one CPU KVM-extension cables (product code EHN230) to connect the Rackmount Extender Local Hub's DB25 composite CPU ports to the CPUs' keyboard, mouse, and video ports. Order one such cable for each CPU (or one for each CPU video card if you're attaching CPUs with multiple video outputs). As mentioned on the previous page, you might also need port adapters if any of your CPUs have PC/AT type ports.

To attach the DB9 CPU-port serial connectors of a KVM/Serial or KVM/Serial/Audio Extender Local Hub to the CPUs' serial ports, you'll need DB9 male-to-female serial-extension cables such as product code EDN12H-MF. Order one of these cables for each CPU whose serial I/O you're extending.

To attach the 3.5-mm CPU-port audio connectors of a KVM/Serial/Audio Extender Local Hub to the CPUs' audio ports, you'll need standard 3.5-mm stereo audio-extension cables such as product code EJ110-0010.

**4.2.2 TO CONNECT A SERVSCHWITCH FAMILY KVM SWITCH TO A CPU PORT ON A LOCAL HUB OR SWITCHING REMOTE UNIT**

You would do this to extend the distance you can run from the KVM switch to a monitor, a keyboard, a mouse, and possibly serial and/or audio devices. (You could also do this to extend the distance you can run between two cascaded switches, but for this to work, each switch *must* be either a ServSwitch Jr. or one of the ServSwitch family models with DB25 composite interfaces listed in **Section 4.2.2.B.**)

Which cable(s) you'll need will depend on what type of user ports the switch model has, as detailed in the following three subsections.

*4.2.2.A Switches Whose User Ports Are a Set of Separate Interfaces*

The user ports of some ServSwitch family KVM switches are a set of separate interfaces: Each user port consists of separate interfaces/connectors for video, keyboard, mouse, and (on the ServSwitch Multi only) serial and audio communication. At the time of this writing, some of the important ServSwitch family models in this category are:

- ServSwitch™ Duo
- ServSwitch™ Wizard, Wizard LP, Wizard MP, and Wizard Pro
- ServSwitch™ Jr.
- Personal ServSwitch™
- ServSelect™
- ServSwitch™ Multi Base Unit ("local console" user port only)

You'll need a three-to-one KVM-extension cable (product code EHN230) for each KVM-switch user port of this type that you're attaching to the CPU port of a Local Hub or Switching Remote Unit. If the user port is a console port on a ServSwitch Multi, you might also need a DB9 male-to-female serial-extension cable such as product code EDN12H-MF and/or a pair of 3.5-mm male-to-male audio-extension cables such as product code EJ110-0010.

#### *4.2.2.B Switches with DB25 Composite User Ports*

The user ports of some ServSwitch family KVM switches are specially pinned DB25 connectors that function as composite (all-in-one) interfaces. At the time of this writing, some of the important ServSwitch family models in this category are:

- ServSwitch™
- ServSwitch™ Ultra
- Matrix ServSwitch™
- ServSwitch™ Affinity
- ServShare™

You'll need a ServSwitch-to-ServSwitch Expansion Cable (product code EHN284) for each such KVM-switch user port you're attaching to the CPU port of a Local Hub or Switching Remote Unit.

#### *4.2.2.C ServSwitch Multi (HD62 Composite User Ports)*

The user ports on User Cards installed in the ServSwitch Multi are HD62 female connectors that function as composite (all-in-one) interfaces. To attach one of these ports to the CPU port of a Local Unit or Switching Remote Unit, first you'll need a many-to-one ServSwitch Multi User Cable such as product code KV2505 (for just KVM extension) or KV2515 (for KVM, serial, and/or audio extension). You'll need to add to this a three-to-one CPU KVM-extension cable (product code EHN230) *and*—if you're doing serial or audio extension—a DB9 male-to-female serial-extension cable such as product code EDN12H-MF and/or a pair of 3.5-mm male-to-male audio-extension cables such as product code EJ110-0010. Refer to **Section 6.2.3.B** for a description of how this cabling all fits together.

**4.2.3 TO CONNECT A MONITOR, KEYBOARD, MOUSE, SERIAL DEVICE, AND AUDIO DEVICES TO A USER PORT ON A REMOTE OR DUAL-ACCESS LOCAL HUB**

You'll be plugging the monitor, keyboard, and mouse directly into the corresponding user-port connectors on the Remote or Dual-Access Local Hub. If your touchscreen or other serial device is made to plug directly into a CPU, it will plug directly into the same user port's serial connector on the KVM/Serial or KVM/Serial/Audio Remote; if not, you'll 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.
- 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**

***KVM/Serial/Audio Extender systems only:*** Because the KVM/Serial/Audio 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 connectors. Call Black Box Technical Support if you'd like to do this.

If your audio devices are made to plug directly into a CPU, they'll plug directly into the same user port's audio connectors on the KVM/Serial/Audio Remote; if not, you'll need an audio cable such as product code EJ110-0010 to attach the device.

#### **4.2.4 TO CONNECT A SERVSWITCH FAMILY KVM SWITCH TO A USER PORT ON A REMOTE OR DUAL-ACCESS LOCAL HUB**

You would do this to extend the distance you can run from the KVM switch to a CPU. (You could also do this to extend the distance you can run between two cascaded switches, but for this to work, each switch *must* be one of the ServSwitch family models with regular ServSwitch style DB25 composite interfaces listed in **Section 4.2.4.B.**)

Which cable(s) you'll need will depend on what type of CPU ports the KVM switch has, as detailed in the following three subsections.

##### *4.2.4.A Switches Whose CPU Ports Are a Set of Separate Interfaces*

The CPU ports of some ServSwitch family KVM switches are a set of separate interfaces: Each CPU port consists of separate interfaces/connectors for video, keyboard, and mouse communication. At the time of this writing, some of the important ServSwitch family models in this category are:

- ServSwitch™ Duo
- ServSwitch™ Wizard, Wizard LP, Wizard MP, and Wizard Pro
- Personal ServSwitch™

You'll need individual keyboard-, video-, and mouse-extension cables (such as product codes EVMPS03-MM for keyboard and mouse, EVNPS05-MM for video) or a specially bonded three-to-three CPU-extension cable (product code EHN408) for each KVM-switch CPU port of this type that you're attaching.

##### *4.2.4.B Switches with Regular ServSwitch Style DB25 Composite CPU Ports*

The CPU ports of the regular ServSwitch and several other ServSwitch family KVM switches are specially pinned DB25 connectors that function as composite (all-in-one) interfaces. At the time of this writing, some of the other important ServSwitch family models in this category are:

- ServSwitch™ Ultra
- Matrix ServSwitch™
- ServSwitch™ Affinity
- ServSwitch™ Jr.
- ServShare™

**(Note:** The ServSelect also has DB25 composite CPU ports, but they are pinned differently. See **Section 4.2.4.C.**)

You'll need a three-to-one KVM-extension cable (product code EHN230) for each such KVM-switch CPU port you're attaching.

#### 4.2.4.C Switches with Other Types of Composite CPU Ports

The CPU ports of some ServSwitch family KVM switches are composite (all-in-one) interfaces that are not the same as those on the regular ServSwitch, but the principle for connecting them is the same:

- The CPU ports on the CPU Cards of the ServSwitch Multi are HD44 female connectors. You'll need a ServSwitch Multi Server Cable such as product code KV2020-R2 (for just KVM extension) or KV2040-R2 (for KVM, serial, and/or audio extension) for each of the switch's CPU ports you're attaching.
- The CPU ports on the ServSelect are DB25 connectors pinned *differently from* the DB25 connectors on the regular ServSwitch. You'll need a ServSelect Cable (product code EHN056) for each of the switch's CPU ports you're attaching.

#### 4.2.5 TO CONNECT A LOCAL HUB TO REMOTES

To connect the Rackmount Extender Local Hub to your Remotes, you'll need industry-standard structured cabling (Category 5 UTP or STP, 4-pair) terminated with RJ-45 plugs. You'll need CAT5 patch cables such as 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.)**

Although most CAT5E cables will work well with the Extender, especially for shorter runs and patch cables, some CAT5E cables might distort the video if you use them for local-to-remote runs longer than 120 m (400 ft.). And you should *avoid* using "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 analog video signals. Having said that, however, the signal-skew problems caused by tightly twisted pairs in these cables can sometimes be resolved by swapping which pairs are used for which signals or by using an external delay line. Please contact Tech Support if you have problems getting a good picture with CAT5e cable or if you *must* use cables with bandwidths higher than 155 Mbps.

Also, even though your network might use the same type of 4-wire twisted-pair cabling, do *not* connect the Rackmount Extender to 10/100BASE-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 Rackmount Extender is designed for use up to a maximum cable length of 50 m (160 ft.) with each Micro Remote or 300 m (985 ft.) with each of the other types of Remotes. At these lengths, the video quality on monitors attached to Micro Remotes should be acceptable at 1280 x 1024 resolution, while the quality should be OK on monitors attached to other types of Remotes at 1024 x 768 resolution.

Although a single continuous length of interconnect cable is preferable, it's possible to operate an Extender system if the Local Hub and Remotes 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 Rackmount 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

You might need to configure your Rackmount ServSwitch™ Brand CAT5 KVM Extender system before you use it. The two-position DIP switches on the Micro Remotes are external; see **Section 5.1**. All of the Extender's other configuration controls are internal, but should only need to be set once; see the relevant sections starting with **Sections 5.2**. To get at them, first open the Local Hub or Remote by unscrewing the screws on its case (five on each hub, four on each Remote Unit) and lifting off the top half of the case. When you've finished setting the configuration jumpers and switches as described in the rest of this chapter, close the hub or Remote 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 least discharge yourself on a metal surface before opening any Extender component; if possible, stand on an anti-static mat and wear a grounding strap or anti-static gloves.**

### 5.1 Setting the 2-Position DIP Switches on the Micro Remotes

There's one two-position DIP switch on the bottom of the ACUMREM and ACUWREM Micro Remote Units; there are six of these two-position DIP switches on the bottom of the ACU1006MRA and ACU1006MRVA Micro Remote Hubs. Position 1 governs the Micro Remote's video equalization, while position 2 controls how the Micro Remote handles keyboard-command recognition:

- **Position 1 (video equalization):** The Micro Remote contains video-equalization circuitry which compensates for the loss in image quality that occurs when you drive video across cables longer than 25 m (80 ft.). If you'll be running cable to such distances between your Local Hub and the Micro Remote, you need to configure the Extender for extra equalization before you install it.

To do this, set position 1 of the Remote's DIP switch for that link to UP (OFF) if you'll be running cable for that link up to (but not more than) 25 m (80 ft.). To boost the equalization if you'll be running cable between 25 and 50 m (80 and 160 ft.), move position 1 to the DOWN (ON) setting.

If you are not running the cable too far but your video looks bad no matter how you set this DIP switch, the problem is almost certainly being caused by one of two things. First, check your interconnect-cable routing—does the cable pass close to a motor, generator, fluorescent lights, etc.? Second, check the wiring of the interconnect cable. Compare its pinning and pairing with those shown in **Appendix A**. (Please realize that signal equalization cannot be exact; regardless of the setting of this DIP switch, the remote video image might never appear quite as sharp as it would appear with the monitor directly attached to the CPU.)

- **Position 2 (keyboard-command recognition):** The function of this position depends on which type of Micro Remote you have:
  - On the ACUMREM and ACU1006MRA, position 2 controls how the Remote handles [Scroll Lock]. Normally, pressing [Scroll Lock] on the Micro Remote's attached keyboard causes the Extender to reset itself (see **Section 7.3.1**) or, in Dual-Access systems, to go into Private Mode (see **Section 7.3.4**). But the Extender treats this keypress as a command and absorbs it, so there's no way to send [Scroll Lock] to the PC or KVM switch attached to the corresponding CPU port on the Extender Local Hub.

Leave position 2 of the Micro Remote's DIP switch in the factory-default UP (OFF) setting if [Scroll Lock] isn't necessary for your application and can continue to be used to trigger reset/Private Mode on that Local Hub CPU port. If you need to be able to use the [Scroll Lock] key for something else on that port, move position 2 to the DOWN (ON) setting to disable reset and Private Mode and cause the Extender to pass [Scroll Lock] through to the attached PC or switch.
  - On the ACUWREM and ACU1006MRVA, position 2 controls the Remote's keyboard-command hotkey for that link, the character that you can send from that link's 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] for a particular link instead, particularly if (a) a KVM switch you'll be attaching to its CPU port uses right-[Ctrl] as its command hotkey, or (b) a computer you'll be attaching to its CPU port 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 a link 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.)

## 5.2 Setting the Cable-Length Jumpers in All Non-Micro Remote Units

The full-size (non-Micro) Remote Units contain video-equalization circuitry that compensates for the loss in image quality that occurs when you drive video across long cables. With cables in the neighborhood of 300 meters (985 feet) long, this loss is considerable.

There are three jumpers on the main circuit board of these Remote Units that you can use to select an equalization-adjustment range appropriate to the length of the interconnect cable you'll be running between the Remote Unit and the Local Hub. (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 Meters (Feet)	Jumper Position
0 to 100 (0 to 330)	Off  (factory default)
100 to 200 (330 to 655)	A 
200 to 300 (655 to 985)	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.

# RACKMOUNT SERVSWITCH™ BRAND CAT5 KVM EXTENDER LOCAL HUBS

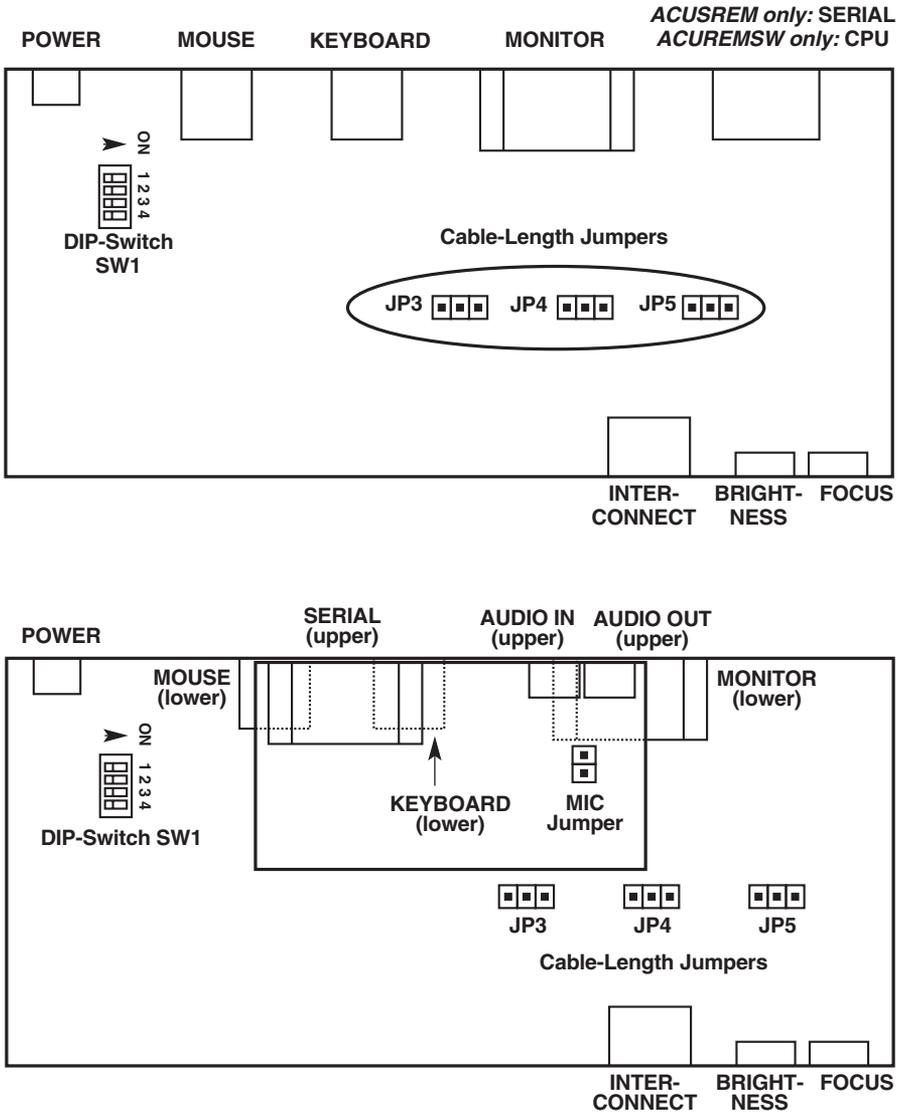


Figure 5-1. The full-size Remote Units' PCBs (main PCB of all but the KVM/Serial/Audio shown at top, main PCB and audio daughtercard of the KVM/Serial/Audio below), showing the jumpers and DIP switch.

## 5.3 Setting the 4-Position DIP Switch in All Non-Micro Remote Units

You'll also find a four-position DIP switch labeled SW1 on the main circuit board inside the full-size (non-Micro) Remote Units. The functions of this DIP switch are different for different Extender models.

### 5.3.1 ACUREM AND ACUSREM

For ACUREM and ACUSREM, position 4 of this switch is usable in all applications, but do *not* change the settings of positions 1 through 3 of this switch unless you are using the Remote Unit in a Dual-Access (ACU1006DRA or ACU1006DSRA) system. Each position controls a configuration setting that will apply to the Remote Unit's attached remote user station and (in Dual-Access systems) any corresponding local user station:

- **Position 1 (Dual-Access systems only):** When position 1 (the topmost jumper, or the leftmost if you hold the Remote Unit by its left end) is in its factory-default OFF setting, the remote monitor attached to that Remote Unit is blanked while the Extender is in Private Mode for the corresponding CPU (see **Section 7.3.4**), so that users at the remote station can't see what the user at the local station is doing. However, if you want to prevent the remote monitor from being blanked during Private Mode—so that users at the remote station can still see what's going on—set position 1 to ON.
- **Position 2 (Dual-Access systems only):** When position 2 (the second one from the top, or second from the left if you hold the Remote Unit by its left end) is in its factory-default ON setting, the inactivity timeout for the corresponding CPU (see **Section 7.3.3**) is set to two seconds: Once the local or remote keyboard and mouse have been idle for two seconds, the user at the other station can take control of the CPU. If you suspect that the system will be switched too quickly with that setting, move position 2 to OFF to set the timeout to 15 seconds instead.

*KVM/Serial systems only:* Note that serial activity or inactivity has no effect on the inactivity timeout; KVM switching will take place without regard for (or effect on) serial transmissions.

- **Position 3 (Dual-Access systems only):** When position 3 (the third one from the top) is in its factory-default ON setting, Extender users have to press a key on their keyboard to take control of their CPU when it becomes idle; see **Section 7.3.3**. If you want users to be able to take control by typing at their keyboard *or* by moving their mouse, move position 3 to OFF.

*KVM/Serial systems only:* The remote user can send or receive serial data while the local user is in KVM control (active or idle), but this *won't* cause KVM control to be switched to the remote user.

- **Position 4:** When position 4 (the bottom one, or the rightmost one if you hold the Remote Unit by its left end) is in its factory-default ON setting, the Extender resets the keyboard and mouse at your station (and at your station *only*) when you press [Scroll Lock] (see **Section 7.3.1**). But if you need the [Scroll Lock] key for some other function, you can force the Extender to pass [Scroll Lock] through to the corresponding PC—disabling the reset function for that PC—by setting position 4 to OFF.

Be aware that in a Dual-Access Extender system, disabling Scroll-Lock reset *also* affects the *local station's* keyboard and mouse, and disables Private Mode for that CPU (see **Section 7.3.4**) as well.

### 5.3.2 ACUREMSW AND ACUVREM

For ACUREMSW and ACUVREM, 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.) This setting applies to the the Remote Unit's attached remote user station and (in Dual-Access systems) any corresponding local user station. It controls the Extender's keyboard-command hotkey (see **Section 7.3**), the character that you can send from an 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 to this Extender link's CPU port uses right-[Ctrl] as *its* command hotkey, or (b) a computer you'll be attaching to this Extender link's CPU port 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.)

## 5.4 KVM/Serial Systems Only: Setting the Remote Units' Data-Rate Jumper

There's also a daughtercard inside the KVM/Serial Extender Local Hubs (ACU1006SRA and ACU1006DSRA) for each of the Local Hub's CPU ports, and a matching daughtercard in each KVM/Serial Remote Unit (ACUSREM), that together control serial communication with each attached CPU. (This card is shown in Figure 5-2.) In the Remote Unit, this daughtercard has a pair of jumper posts labeled "Baud" that control the data rate of the serial link. In their factory-default state, there is no jumper linking these two posts; in this setting, the data rate is 9600 bps. If you want the link to operate at 19,200 bps instead, install a jumper on these posts.

### CAUTION!

Do *not* change the settings of any of the jumpers or headers on these daughtercards except for this data-rate jumper and the flow-control jumpers discussed in the next section.

### NOTE

It is possible to set a KVM/Serial Extender system to operate at 1200 bps in order to support *some* of the devices that run at this speed, including some industrial trackballs. See Appendix C.

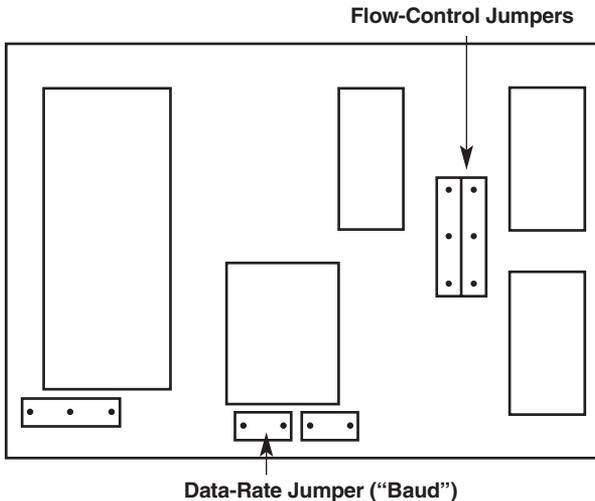


Figure 5-2. The serial daughtercard and its controls.

## 5.5 KVM/Serial Systems Only: Setting the Flow-Control Jumpers in the Local Hub and the Remote Units

Most applications for the serial connection in KVM/Serial Extender systems won't require hardware flow control. However, some PCs still need to see active flow-control signals in order for their serial ports to function, so the Extender's factory-default setting for hardware flow control is "all signals looped back." If you need a different setting, each of the serial daughtercards in the ACU1006SRA or ACU1006DSRA Local Hub and the matching card in each ACUSREM Remote Unit have a series of jumpers that allow you to select either RTS/CTS or DTR/DSR flow control, or to loop back one pair of signals but not the other.

Figure 5-2 on the previous page shows the daughtercard and Figure 5-3 on the next page shows how the flow-control jumpers should be set for various handshaking options. (For each attached CPU, you *must* set both sets of Extender flow-control jumpers—the one in the Local Hub and the one in the Remote Unit—the same way.) Please call Black Box Technical Support if you're unsure what kind of flow control your application will call for.

## 5.6 KVM/Serial/Audio Systems Only: Setting the Microphone-Amplification Jumper in the Remote (Not Normally Necessary)

All sound cards that we have tested so far with the KVM/Serial/Audio Extenders 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 daughtercard for that microphone's Extender link. There's one daughtercard inside the ACUVREM Remote Unit (see Figure 5-1 in **Section 5.2**) and the ACUWREM Remote Unit; there are six daughtercards (one for each link) inside the ACU1006MRVA Remote Hub. Once you install a jumper on the MIC jumper posts for a particular link (there should already be a jumper "hanging off" one of the posts that you can use), the Extender will amplify that link's incoming microphone signal by +17 dB.

For microphone-installation directions, see **Section 6.2.1**.

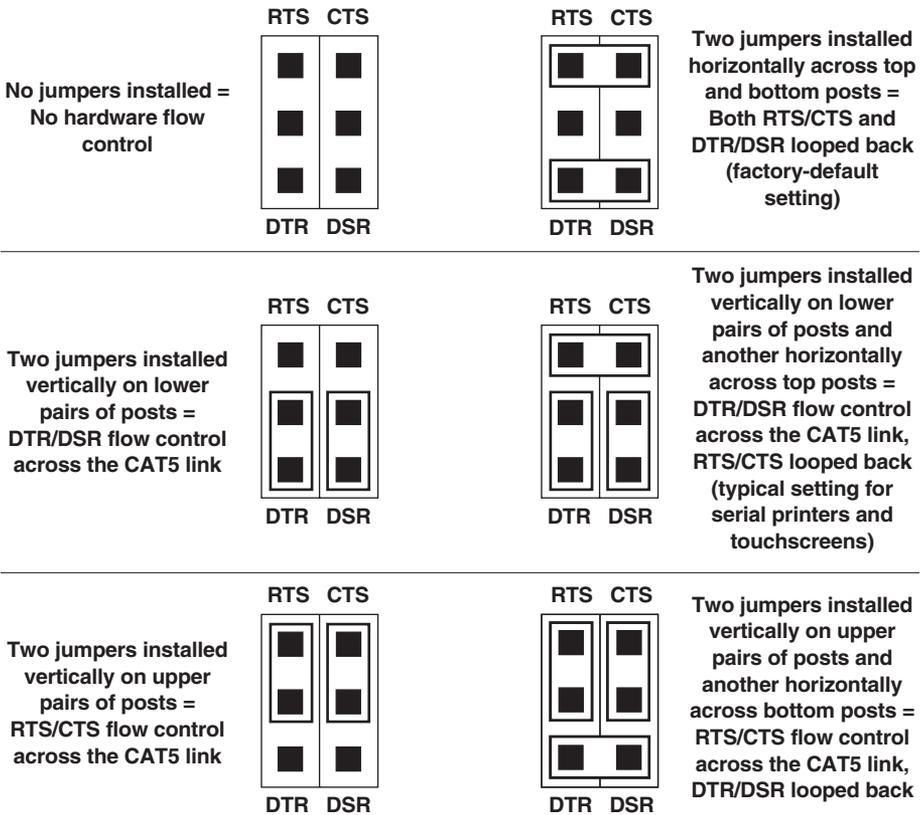


Figure 5-3. Flow-control jumper settings.

## 6. Installation and Adjustment

To install your Rackmount ServSwitch™ Brand CAT5 KVM Extender system, 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 of any full-size (non-Micro) Remote Units as described in **Section 6.4**.

### 6.1 Test-Placing the Extender System (Optional)

We recommend testing your Rackmount 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 Hub and Remotes, and the equipment you'll be attaching to them, in your desired locations. (You can mount a Local Hub—using your own screws, bolts, or cage nuts—in 1U or 2U of space in a standard 19" rack. If you'd like to rackmount any of your Remote Hubs or full-size [non-Micro] Remote Units, 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 making audio connections in a KVM/Serial/Audio system.
- **Section 6.2.2** for attaching a CPU to one of a Local Hub's CPU ports or to the CPU port on a Switching Remote Unit.
- **Section 6.2.3** for attaching a KVM switch to one of a Local Hub's CPU ports or to the CPU port on a Switching Remote Unit.
- **Section 6.2.4** for attaching a monitor, keyboard, mouse, etc., to a user port on a Remote or Dual-Access Local Hub.
- **Section 6.2.5** for attaching a KVM switch to a user port on a Remote or Dual-Access Local Hub.

To attach a serial device to a KVM/Serial or KVM/Serial/Audio Local Hub or Remote, follow the instructions in **Section 6.2.4**. Also refer to that section to attach an audio device to a KVM/Serial/Audio Local Hub or Remote. Because few KVM switches handle serial communication in a way that's compatible with the KVM/Serial Extender, we generally don't recommend attaching KVM switches to it. (One exception is the ServSwitch Multi; to attach it to the KVM/Serial or KVM/Serial/Audio Extender, follow the instructions in **Section 6.2.3** or **6.2.5**.)

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

- *Use caution if you are attaching KVM switches:* Different ServSwitch family KVM switches use different proprietary signaling between cascaded switch units. The only ServSwitch family switch models whose cascade signals the Rackmount Extenders can carry are the models with a regular ServSwitch style DB25 composite interface (see the list in **Section 4.2.4.B**), so these are the only models for which you can install a Rackmount Extender between two cascaded (master and submaster) switch units.

*Under no circumstances* should you ever try to use a Rackmount Extender to connect two incompatible ServSwitches. Having an Extender between them will not make them compatible.

- Each powered device should be powered OFF when you attach it.
- Make sure you don't attach your keyboard and mouse, or the keyboard and mouse strands of any multi-stranded cable, backwards. (Fortunately, the strands of most multi-stranded cables used with the Extender are fairly easy to identify: The keyboard strand is usually orange or purple and labeled with a "K" or a picture of a keyboard, while the mouse strand is usually green and labeled with an "M" or a picture of a mouse.)
- The 3.5-mm stereo "audio in" and "audio out" connectors on the various Hubs and Remotes will be labeled differently, but "audio in" will always be associated with the word "In" and "audio out" will always be associated with the word "Out."
- If you run audio cables to and from a KVM/Serial/Audio model, make sure to run from the "audio out" connector on the device to the "audio in" connector on the Extender Local Hub or Remote, and from "audio in" or "microphone" on the device to "audio out" on the Extender Local Hub or Remote.
- If your Local Hub is a Dual-Access model, connect CPUs or the user ports of KVM switches to the Local Hub's CPU ports (on the *bottom* row) only, and connect user equipment or the CPU ports of KVM switches to the Local Hub's local user-station ports (on the *top* row) only.

### 6.2.1 SPECIAL CONCERNS ABOUT CONNECTING AUDIO DEVICES TO THE KVM/SERIAL/AUDIO EXTENDER

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 ("audio 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 ("audio 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 Hub's or Remote's "audio out" connector. Run a standard 3.5-mm mini stereo audio cable such as product code EJ110-0010 from the "audio in" connector of the Remote or Local Hub at the other end of the link to the "LINE OUT" connector of a PC or sound card—colored lime (yellow-green) in the PC99 specifications, but often colored differently—of a CD player or other audio source.
- To attach a microphone that the sound card will be amplifying (the preferred type of microphone attachment): Plug the microphone directly into the Remote's "audio in" connector. Run a standard 3.5-mm mini stereo audio cable such as product code EJ110-0010 from the Local Hub's "audio out" connector to the sound card's "MIC" ("microphone in") connector (colored pink in the PC99 specifications, but often colored differently).

To attach a self-amplified microphone, CD player, etc.: Plug the device directly into the Local Hub's or Remote's "audio in" connector. Run an audio cable such as EJ110-0010 from the "audio out" connector of the Remote or Local Hub 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 5.6**. Plug the microphone directly into the Remote's "audio in" connector. Run an audio cable such as EJ110-0010 from the Local Hub's "audio out" connector to the sound card's "LINE IN" connector (colored light blue in the PC99 specifications).

6.2.2 ATTACHING A CPU TO A CPU PORT ON A LOCAL HUB OR SWITCHING REMOTE UNIT

Attach the keyboard, video, and mouse connectors of a CPU-style three-to-one KVM-extension cable to the matching ports on the CPU, as shown in Figure 6-1. (This cable is included with the Switching Remote Unit; it's available separately as product code EHN230 otherwise.) Attach the DB25 male connector of this cable to one of the Local Hub's DB25 female composite CPU-port KVM connectors, or to the connector of the same type on the Switching Remote Unit.

To make the additional serial connection from a CPU to a KVM/Serial or KVM/Serial/Audio Local Hub, attach the female end of a DB9 male-to-female serial-extension cable such as EDN12H-MF to the CPU's serial (COM) port, then attach the male end of the cable to the matching DB9 female serial port in the Local Hub's *top* row of connectors, directly above the DB25 that you just plugged the EHN230 cable into.

To make the additional audio connections from a CPU to a KVM/Serial/Audio Local Hub, first run a standard 3.5-mm male-to-male stereo audio-extension cable such as EJ110-0010 from the CPU's audio-out port to the Local Hub's "audio in" port. Then run another such cable from the CPU's microphone port to the Local Hub's "audio out" port. See Section 6.2.1 for additional guidelines.

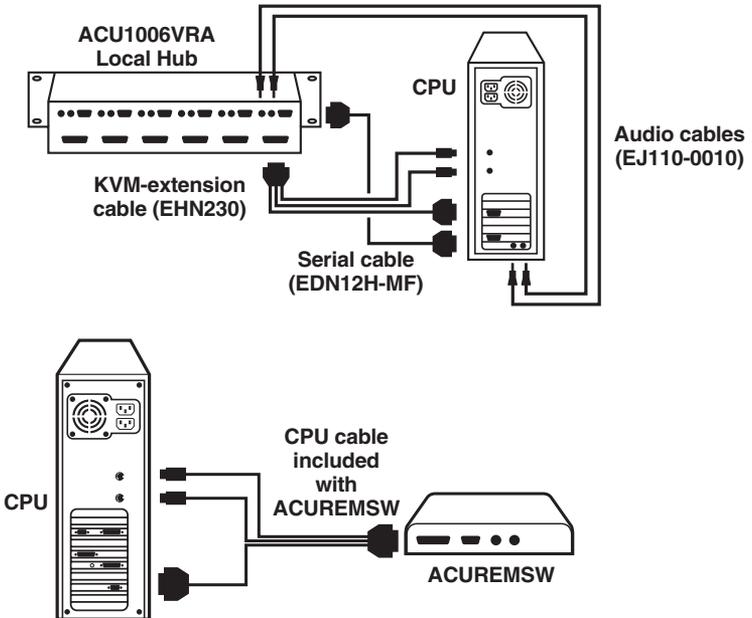


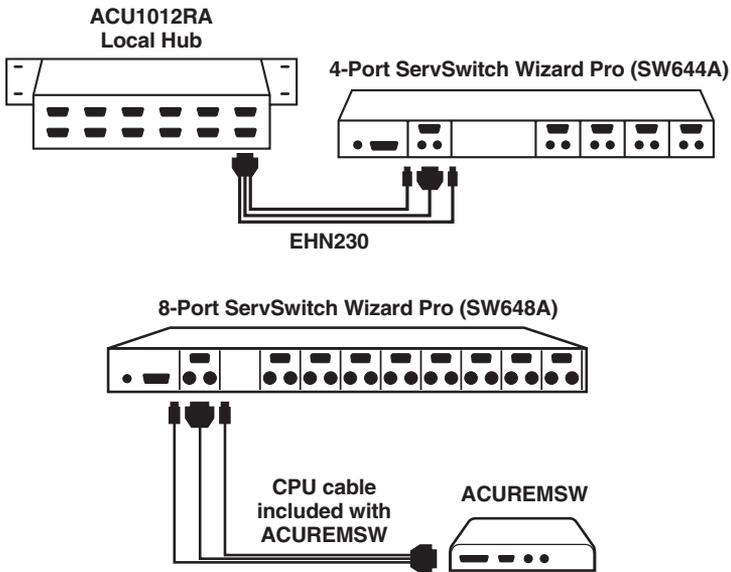
Figure 6-1. Attaching a CPU to a Local Hub (Single-Access KVM/Serial/Audio Local Hub shown, top) or a Switching Remote Unit (bottom).

## 6.2.3 ATTACHING A KVM SWITCH TO A CPU PORT ON A LOCAL HUB OR SWITCHING REMOTE UNIT

The way you'll do this will depend on whether the KVM switch's user ports are multiple connectors (see **Section 6.2.3.A**) or single composite connectors (see **Section 6.2.3.B**). (Refer to the listings in **Section 4.2.2** for which ServSwitch family models are in which category.)

### 6.2.3.A Attaching a KVM Switch with Multiple User-Port Connectors

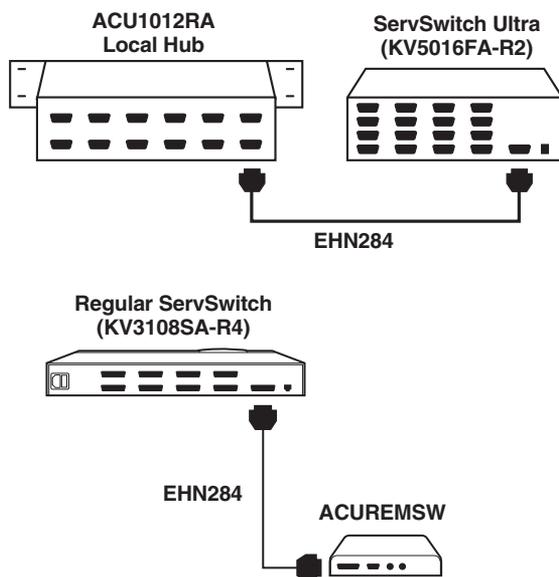
Attach the keyboard, video, and mouse connectors of a CPU-style three-to-one KVM-extension cable to the matching user-port connectors on the KVM switch, as shown in Figure 6-2. (This cable is included with the Switching Remote Unit; it's available separately as product code EHN230 otherwise.) Attach the DB25 male connector of this cable to one of the Local Hub's DB25 female composite CPU-port KVM connectors, or to the connector of the same type on the Switching Remote Unit.



**Figure 6-2.** Attaching a KVM switch with multiple user-port connectors to a CPU port on a Local Hub (12-Port non-serial Local Hub shown, top) or a Switching Remote Unit (bottom).

### 6.2.3.B Attaching a KVM Switch with Single Composite User-Port Connectors

If the KVM switch's user ports are ServSwitch style DB25 connectors, run a ServSwitch to ServSwitch Expansion Cable (product code EHN284) from one of these connectors to one of the Local Hub's DB25 female composite CPU-port KVM connectors, or to the connector of the same type on the Switching Remote Unit, as shown in Figure 6-3.



**Figure 6-3. Attaching a KVM switch with single ServSwitch style DB25 user-port connectors to a CPU port on a Local Hub (12-Port non-serial Local Hub shown, top) or a Switching Remote Unit (bottom).**

If the KVM switch's user ports are some other type of composite connectors (as is the case for the ServSwitch Multi), first plug a User Cable designed for the KVM switch (see Section 4.2.2.C for ServSwitch Multi cable product codes) into one of the switch's user ports. Then plug a CPU-style three-to-one KVM-extension cable into one of the Local Hub's DB25 female composite CPU-port KVM connectors, or to the connector of the same type on the Switching Remote Unit. (This cable is included with the Switching Remote Unit; it's available separately as product code EHN230 otherwise.)

If your Local Hub is a KVM/Serial or KVM/Serial/Audio model and you want to do serial extension, also plug the male end of a DB9 male-to-female serial-extension cable such as product code EDN12H-MF into the matching DB9 female serial port in the Local Hub's *top* row of connectors, directly above the DB25 that you just plugged the KVM (EHN230) cable into.

If your Local Hub is a KVM/Serial/Audio model and you want to do audio extension, also plug one end of a pair of standard 3.5-mm male-to-male stereo audio-extension cables such as product code EJ110-0010 into the matching 3.5-mm female “audio in” and “audio out” audio ports in the Local Hub’s *top* row of connectors, directly above the DB25 that you just plugged the KVM (EHN230) cable into.

Finally, connect the other ends of the Extender’s KVM-extension cable (and any serial-extension or audio-extension cables) to the matching strands of the switch’s User Cable as shown in Figure 6-4 on the next page.

### NOTES

**If the switch is a ServSwitch Multi, keep these things in mind as you match the serial and audio cables/strands:**

- The proper DB9 serial connector to use on its User Cable is the one *without* a yellow band.
- The audio cable from the Extender’s “audio out” connector should be plugged into the *blue-banded* audio connector on the User Cable.
- The audio cable from the Extender’s “audio in” connector should be plugged into the audio connector *without* a blue band on the User Cable.

**Also bear in mind that the microphone strand of the ServSwitch Multi User Cable (the one with the *blue-banded* connector) is mono only, so any stereo information that passes through this strand will be lost.**

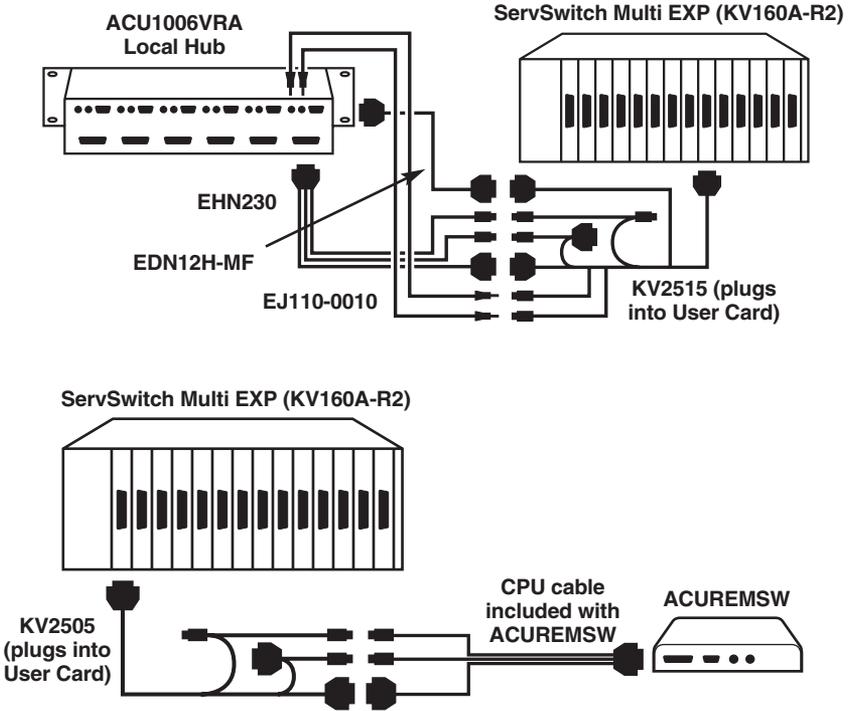


Figure 6-4. Attaching a KVM switch with single composite user-port connectors unlike those on the ServSwitch to a CPU port on a Local Hub (Single-Access KVM/Serial/Audio Local Hub shown, top) or a Switching Remote Unit (bottom).

## 6.2.4 ATTACHING USER EQUIPMENT TO A USER PORT ON A REMOTE OR DUAL-ACCESS LOCAL HUB

Plug a remote user station's monitor, keyboard, mouse, any touchscreen or other serial device, and any audio devices directly into the matching user-port connectors on a Remote Unit, as shown in Figure 6-5, or the matching connectors of one of the user ports on a Remote Hub, as shown in Figure 6-6 on the next page.

Plug a local user station's monitor, keyboard, and mouse directly into the matching connectors of one of a Dual-Access Local Hub's user ports (the *top* row of connectors), as shown in Figure 6-7 on the next page.

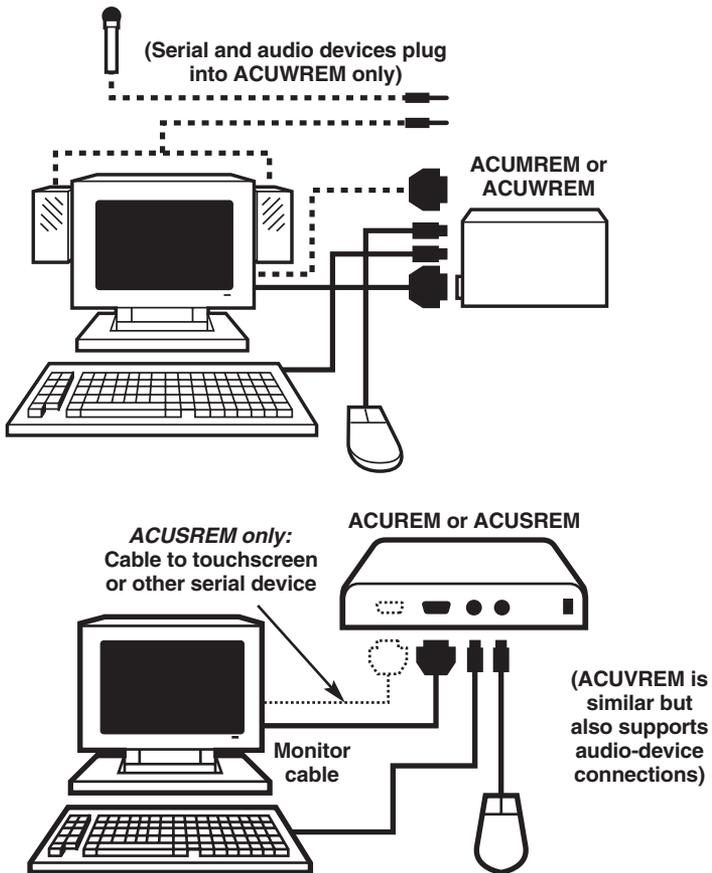


Figure 6-5. Attaching user equipment to a Micro Remote Unit (top) or a full-size (non-Micro) Remote Unit (bottom, ACUREM or ACUSREM shown).

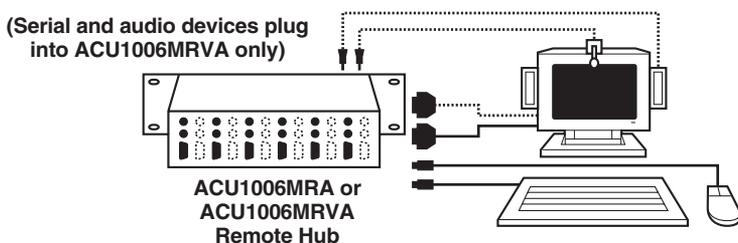


Figure 6-6. Attaching user equipment to a user port on a Remote Hub.

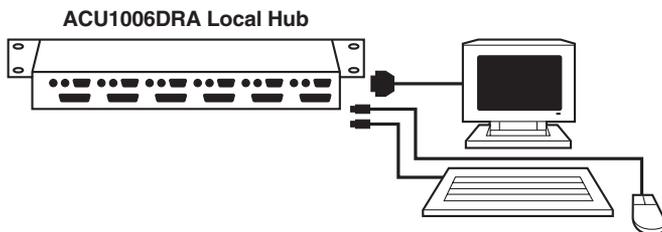


Figure 6-7. Attaching user equipment to a user port on a Dual-Access Local Hub (regular [non-serial] model shown).

### **6.2.5 ATTACHING A KVM SWITCH TO A USER PORT ON A REMOTE OR DUAL-ACCESS LOCAL HUB**

The way you'll do this will depend on whether the KVM switch's CPU ports are multiple connectors (see **Section 6.2.5.A**) or single composite connectors (see **Section 6.2.5.B**). (Refer to the listings in **Section 4.2.4** for which switch models are in which category.)

#### *6.2.5.A Attaching a KVM Switch with Multiple CPU-Port Connectors*

Run extension cabling from the Remote's or Local Hub's user-port connectors to the matching CPU-port connectors on the KVM switch. This extension cabling can be individual keyboard-, video-, and mouse-extension cables (product codes EVMPS03-MM for keyboard and mouse, EVNPS05-MM for video), but we recommend our specially bonded three-to-three CPU-extension cable (product code EHN408):

- If you're using individual extension cables, run the video-extension cable between the two video/monitor connectors, the keyboard-extension cable between the two keyboard connectors, and the mouse-extension cable between the two mouse connectors.
- If you're using one of our three-to-three bonded extension cables, run the cable's video strand between the two video/monitor connectors, the cable's keyboard strand between the two keyboard connectors, and the cable's mouse strand between the two mouse connectors, as shown in Figures 6-8 and 6-9 on the next page. (The keyboard and mouse connectors on the bonded cable have different colors and icon labels for easy identification.)

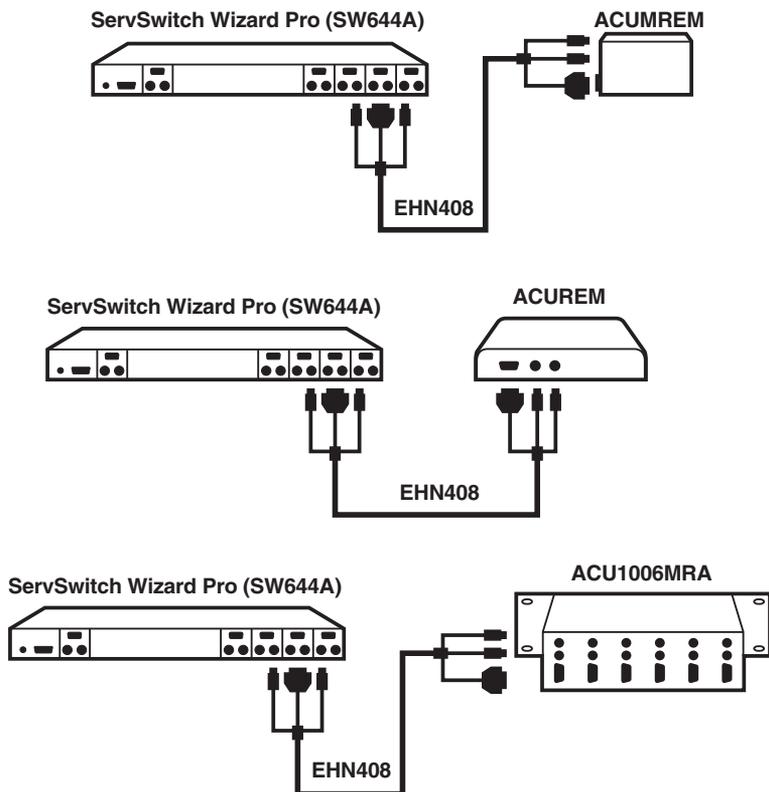


Figure 6-8. Attaching a KVM switch with multiple CPU-port connectors to a Micro Remote Unit (top), a full-size (non-Micro) Remote Unit (middle, ACUREM shown), and an ACU1006MRA Remote Hub (bottom).

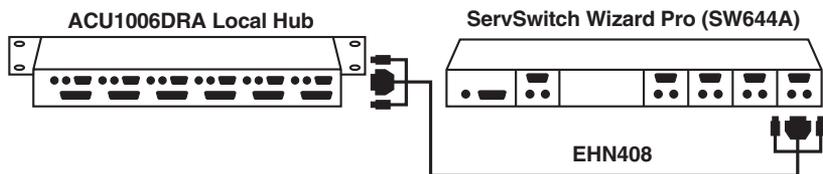


Figure 6-9. Attaching a KVM switch with multiple CPU-port connectors to a user port on a Dual-Access Local Hub (regular [non-serial] model shown).

## 6.2.5.B Attaching a KVM Switch with Single Composite CPU-Port Connectors

Run a CPU Cable designed for the KVM switch—refer to **Sections 4.2.4.B** and **4.2.4.C** for product codes—from one of the switch’s CPU-port connectors to the user-port connectors of the Remote or Dual-Access Local Hub, as shown in Figure 6-10 below and Figures 6-11 and 6-12 on the next page.

### NOTES

If the switch is a ServSwitch Multi, keep these things in mind as you match the serial and audio cables/strands:

- The proper DB9 serial connector to use on its User Cable is the one *without* a yellow band.
- The audio cable from the Extender’s “audio out” connector should be plugged into the *blue-banded* audio connector on the User Cable.
- The audio cable from the Extender’s “audio in” connector should be plugged into the audio connector *without* a blue band on the User Cable.

Also bear in mind that the microphone strand of the ServSwitch Multi User Cable (the one with the *blue-banded* connector) is mono only, so any stereo information that passes through this strand will be lost.

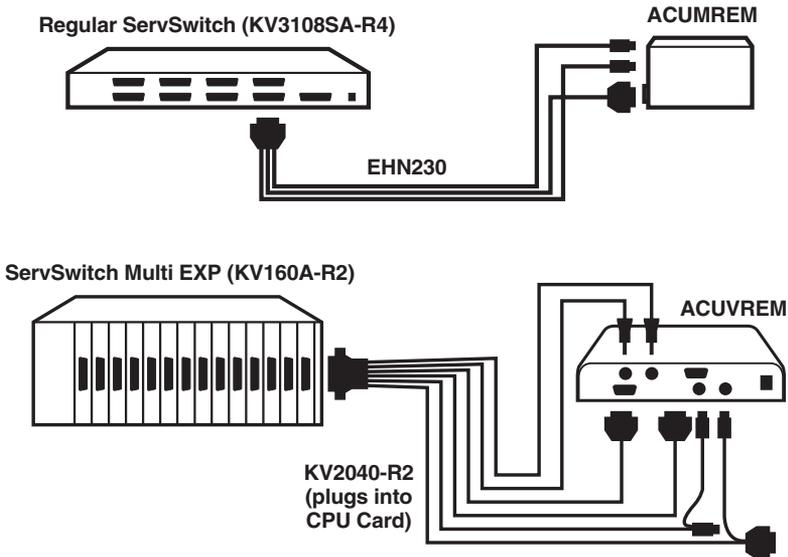


Figure 6-10. Attaching a KVM switch with single composite CPU-port connectors to the user-port connectors on a Micro Remote Unit (top, ACUMREM shown) or a full-size (non-Micro) Remote Unit (bottom, ACUVREM shown).

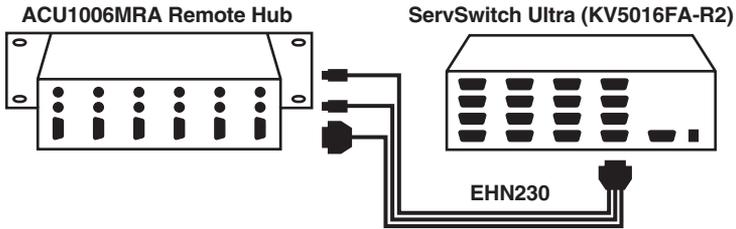


Figure 6-11. Attaching a KVM switch with single composite CPU-port connectors to user-port connectors on a Remote Hub.

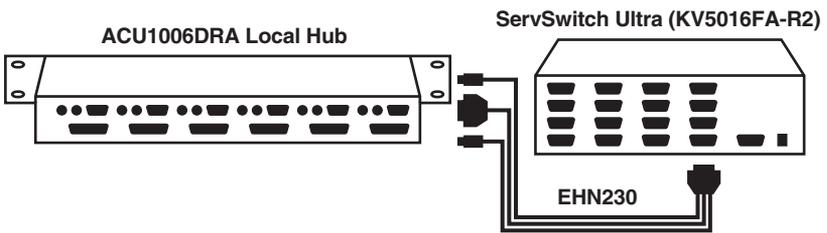


Figure 6-12. Attaching a KVM switch with single composite CPU-port connectors to the user-port connectors on a Dual-Access Local Hub (regular [non-serial] model shown).

## 6.3 Finishing Your Installation

To finish installing your Rackmount Extender system after attaching devices to it as described in **Section 6.2**, take these steps:

1. Interconnect the Local Hub and the Remotes by running CAT5 cabling between their front-panel modular “Interconnect” jacks. Refer to the guidelines for this cabling in **Section 4.2.5**.

### CAUTION!

The Switching Remote Unit (ACUREMSW) has more advanced firmware than the regular Single-Access Local Hubs (ACU1006RA and ACU1012RA); this minor incompatibility will cause the Scroll Lock LED not to light on the remote keyboard, although the [Scroll Lock] key will still work.

Although we don't recommend doing so, the Switching Remote Unit can in theory be used with a regular Dual-Access Local Hub (ACU1006DRA) that's running its original firmware. However, in this case the firmware incompatibility is more serious. Do *not* use Private Mode in a system with a Switching Remote attached to a Dual-Access Local Hub that's still running its original firmware—you will not be able to turn Private Mode off! We *strongly recommend* that you upgrade the firmware at least to version S5.0 on any Dual-Access Local Hub that you want to attach to a Switching Remote Unit. Call Black Box Tech Support if you want to do this.

2. If you have any full-size (non-Micro) Remote Units in your system, turn their Brightness and Focus dials counterclockwise, by hand or with a screwdriver, as far as they will go.
3. Attach the output cord of each Remote's power supply to the Remote's power jack. (Make sure this is the correct power supply—see the Caution notice that follows step 4A.) Then plug the IEC 320 end of the power supply's input cord into the IEC 320 inlet on the power supply's transformer. Finally, plug the other end of the input cord into a utility (mains) power outlet. The Remotes should power up immediately; they have no ON/OFF switch. (Any Remote that's in the location you want it to be, you can leave plugged in and powered up more or less indefinitely.) Lastly, power ON the devices attached to your Remotes.

The next step involves powering the Local Hub. Be careful about how you do this:

- With KVM/Serial/Audio Local Hubs (ACU1006VRA), enough applications have high power demands that we recommend you use its external power supply.
- With other Local Hubs, in one-to-one situations where there is a keyboard-port connection for each video or serial connection, each Local Hub port with a CPU attached should be able to independently draw all of the power it needs from that CPU's keyboard port, **but—**
- If you are using any of the Local Hub's ports to extend CPU video and/or serial output, but *not* keyboard or mouse output (that is, there's no keyboard or mouse connection), you *must* power the Local Hub's video circuitry with its optional external 5-VDC power supply. This would apply to CPUs with multiple video outputs, for example, as is often the case in financial houses (see Figure 7-1 in **Section 7.4**), as well as to CPUs that are functioning only as displays or passive serial receivers.

If you'll need to power the Local Hub with its external power supply, take step 4A below. If the Local Hub can be powered by the attached PCs or KVM switches, take step 4B on the next page.

- 4A. If you need to power the Local Hub with its external power supply, make sure you use the *Local Hub's* power supply and no other (see the Caution notice on the next page). Attach the power supply's output cord to the power jack on the rear of the Local Hub. 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 Local Hub should power up immediately and all of its LEDs should light; like the Remotes, it has no ON/OFF switch. (If you're sure that the Local Hub is in the location you want it to be, you can leave it plugged in and powered up more or less indefinitely.) Lastly, power ON the PCs or KVM switches attached to the Local Hub.

Each of the Local Hub's ports will try to detect both (a) the presence of the corresponding Remote and (b) initial keyboard commands from the attached PC or KVM switch. The ports that detect these will start flashing their LEDs regularly (to show that the link between the port and the Remote is working); those that don't will keep their LEDs steadily lit.

If any LEDs remain dark when you plug in the Local Hub, those ports are probably defective; call Black Box Technical Support. If any LEDs that should flash remain steadily lit, even after more than a minute (it might take some older CPUs that long to boot to the point at which they attempt to communicate with the keyboard), check the CAT5 cable between the Local Hub and the matching Remote (is it secure at both ends? is it intact, or is it broken?).

**CAUTION!**

Be very careful to use the Local Hub's power supply only with the Local Hub and the Remote's power supply only with the Remote. If you swap power supplies, you will damage your equipment; the Local Hub, in particular, will be ruined.

Along the same lines, if you ever need to replace the power supply of the Local Hub or of a Remote, 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.

- 4B. If the Local Hub will be powered by the attached PCs or KVM switches, power them ON. Each Local Hub port that a device is connected to will start operating as soon as the device begins providing DC voltage on its keyboard port. The LED of each operating Local Hub port should light steadily (to show that it's powered); then, if the Local Hub port detects both (a) the presence of the corresponding Remote and (b) initial keyboard commands from the attached PC or KVM switch, the LED should start flashing regularly (to show that the link between the Local Hub and that Remote is working). One exception: On the Dual-Access Local Hubs, the port LEDs will continue to be steadily lit while the local keyboard and mouse are active; they'll only flash when the Local Hub is communicating with the Remote.

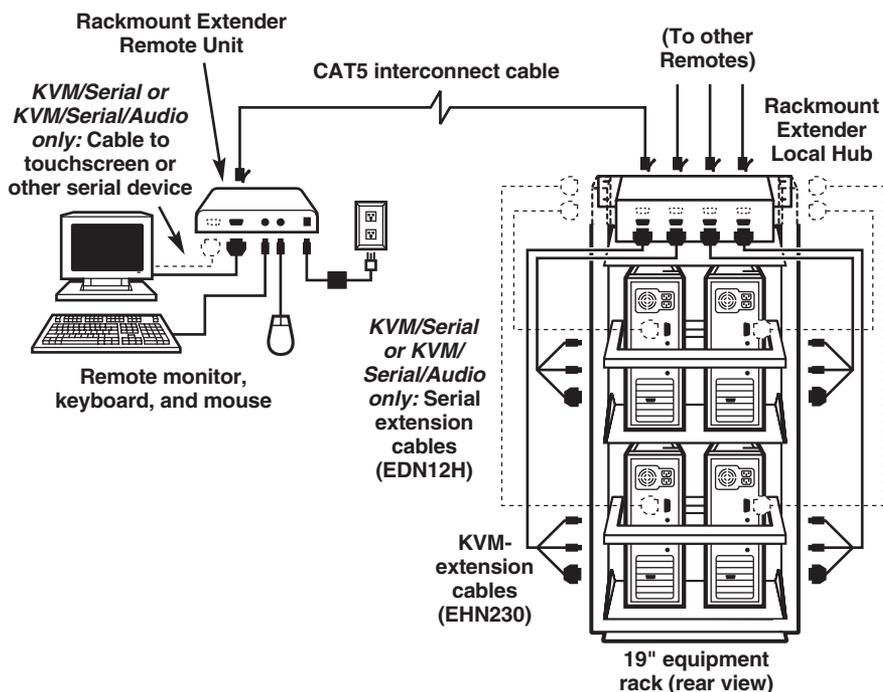
If this LED doesn't light, check the CPU (is it plugged in?) and the KVM-extension cable (is it securely connected to the proper ports at both ends?). If this LED lights but remains steadily lit, even after more than a minute (it might take some older CPUs that long to boot to the point at which they attempt to communicate with the keyboard), check the CAT5 cable between the Local Hub and the Remote (is it secure at both ends? is it intact, or is it broken?).

5. If your Local Hub's LEDs seem to indicate that all of the Extender links you've installed are up and running, make sure that the keyboards attached to all of the Remotes are working. Also make sure that you're getting video on all of the monitors attached to your Remotes. (Be aware that remote monitors, keyboards, and mice might take up to fifteen 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.]; see **Section 6.4**.)
6. Make sure that the mice attached to all of the Remotes are working. (You will need to run Windows® or some application that supports the mouse on any PCs that normally boot up in DOS.)

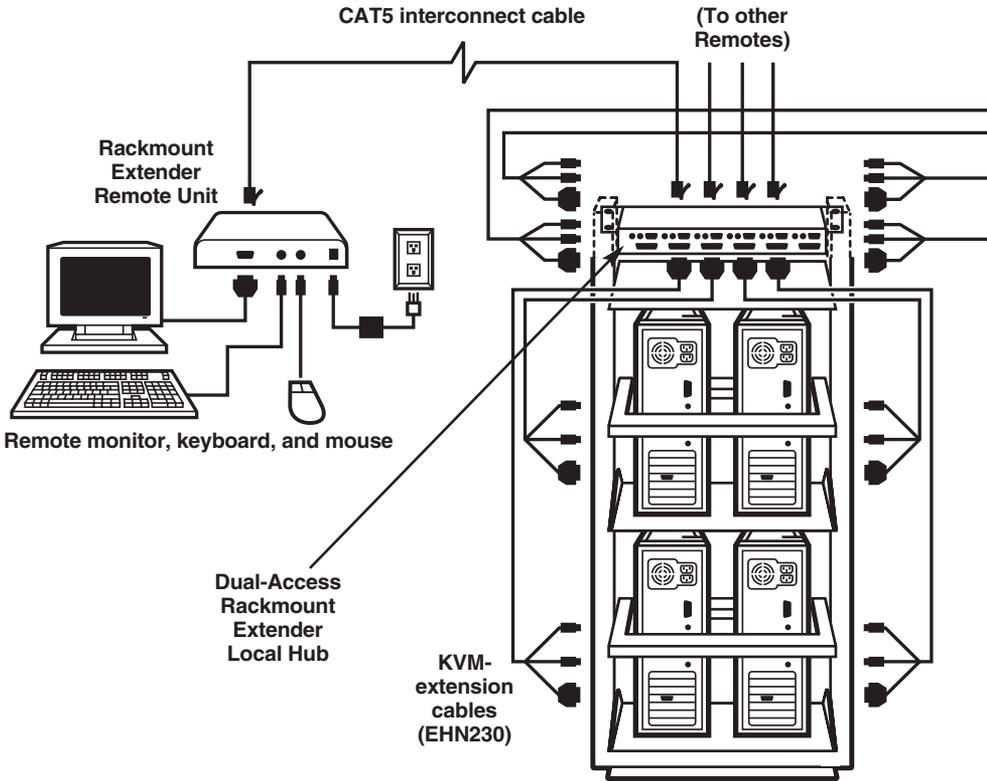
7. *KVM/Serial and KVM/Serial/Audio systems only*: Make sure that any serial devices attached to your Remotes are working. You might need to load a driver or run an application in order for the CPU to be able to detect and handle the serial data.
8. *KVM/Serial/Audio systems only*: Make sure that any audio devices attached to your Remotes are working.

If everything works in your test setup, repeat the above steps for your actual installation. (You can mount the Local Hub—using your own screws, bolts, or cage nuts—in 1U of space in a standard 19" rack. For information about rackmounting any of your full size [non-Micro] Remote Units or Remote Hubs, see **Appendix B**.) If everything works in the actual installation, you can proceed to adjust the remote sites' video (see **Section 6.4**).

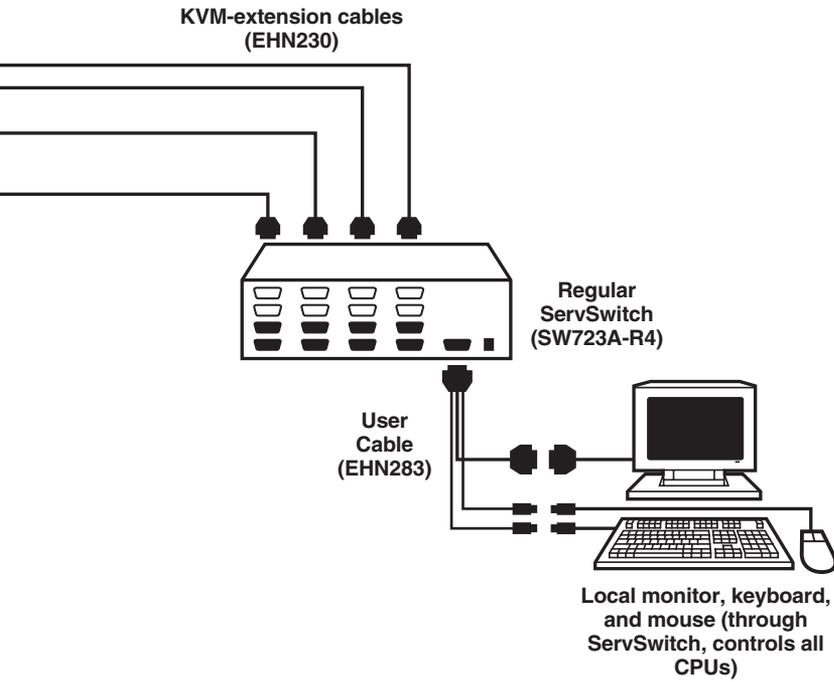
Figures 6-13 through 6-16 below and on the following pages show completed Rackmount Extender installations.



**Figure 6-13. A Single-Access Extender-system installation.** (For clarity, only four of the Local Hub's CPU ports are shown, and no audio or remote-CPU connections are included. All of the serial cables and connectors are illustrated with dashed lines. )



**Figure 6-14. A non-serial Dual-Access**



(ACU1006DRA) Extender-system installation.

# RACKMOUNT SERVSWITCH™ BRAND CAT5 KVM EXTENDER LOCAL HUBS

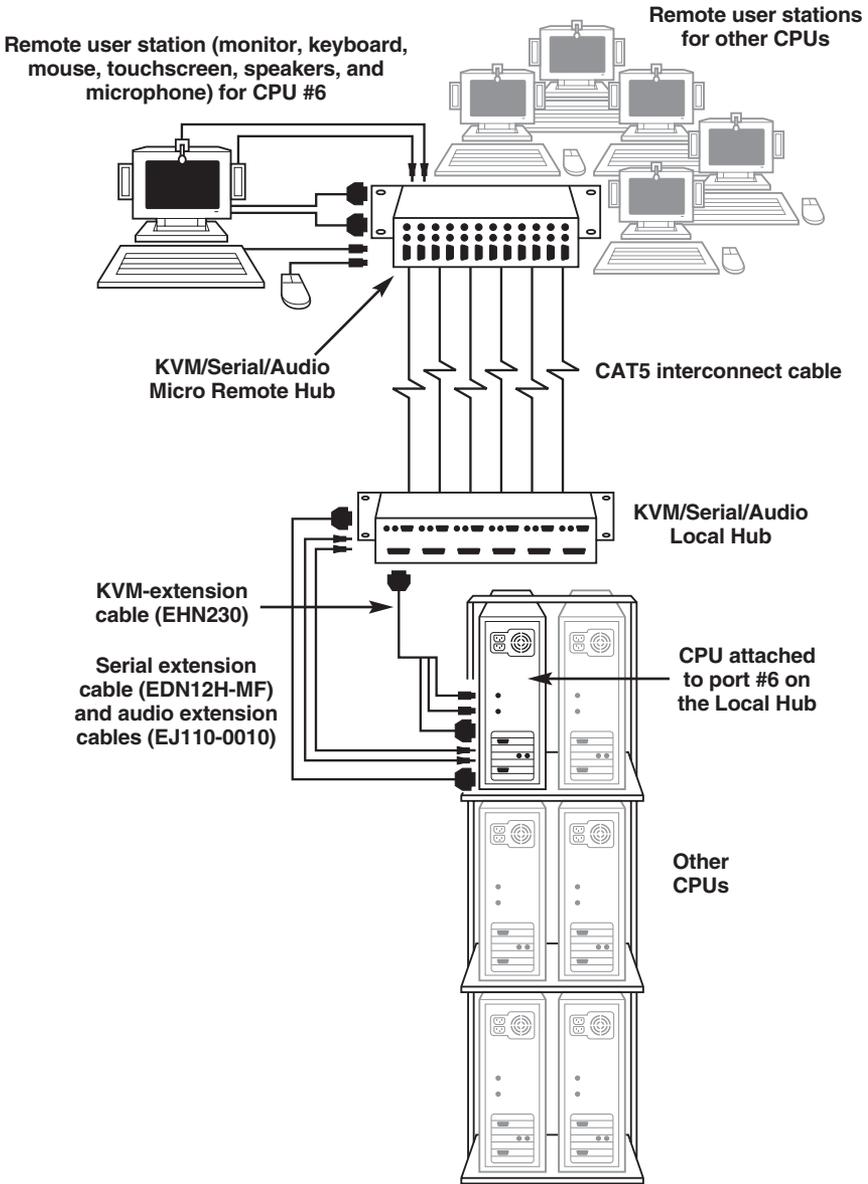


Figure 6-15. A KVM/Serial/Audio Extender-system installation with a Remote Hub. (Only one set of CPU and station cables is shown.)

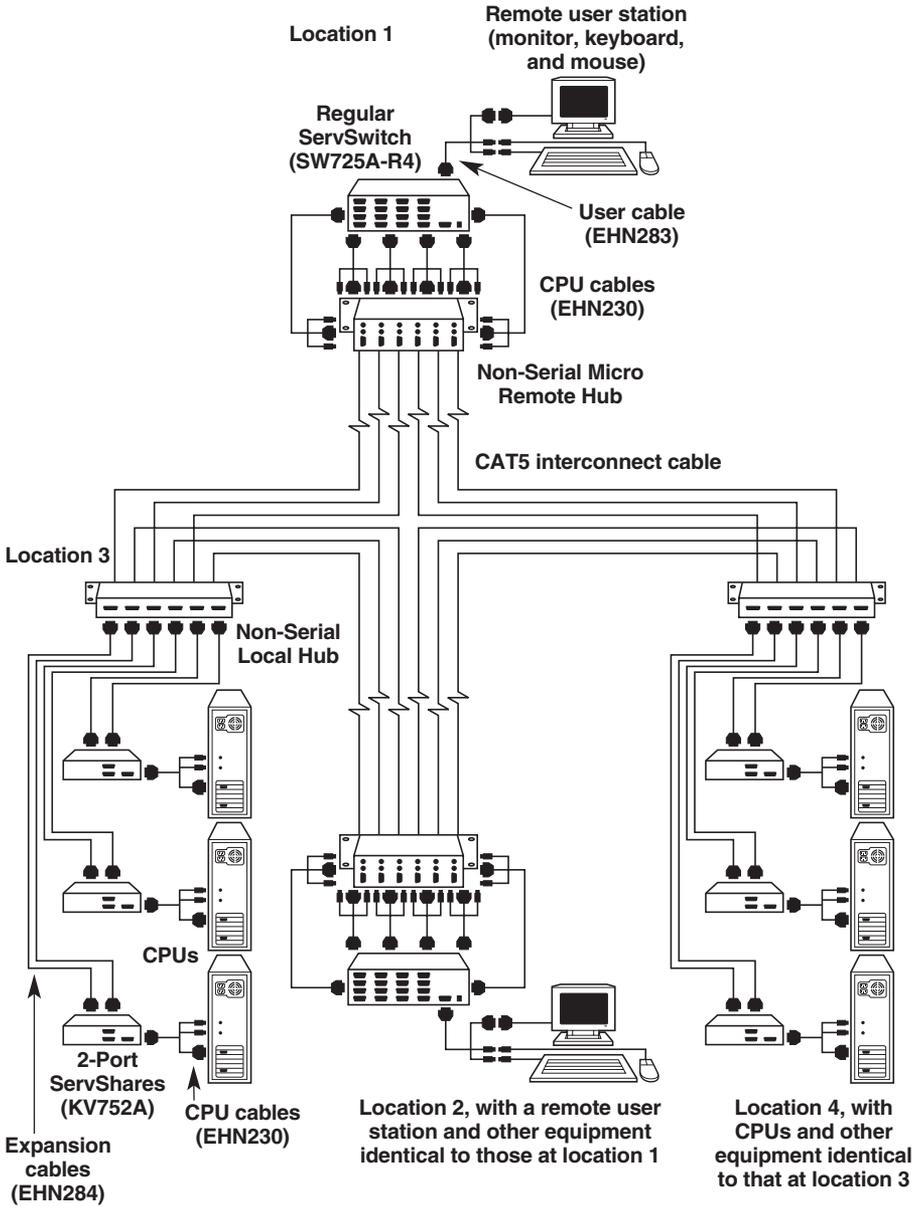


Figure 6-16. A more complex non-serial Extender-system installation with a pair of Local Hubs and a pair of Remote Hubs.

## 6.4 Adjusting the Video Compensation on Non-Micro Remote Units

For any given full-size (non-Micro) Remote Unit, you should only need to take the steps in this section if the interconnect cabling between the Local Hub and the Remote Unit is longer than 25 m (80 ft.). If the cabling 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 cabling. 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 in **Section 5.2**.)
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.

Once you've finished adjusting the video, your Rackmount Extender system should be ready for continuous operation.

# 7. Operation

## 7.1 Keyboard and Mouse Emulation

The Rackmount ServSwitch™ Brand CAT5 KVM Extenders use a microprocessor to emulate the presence of a directly connected keyboard and mouse for the attached PCs. This means that you don't have to connect a keyboard or mouse to the PCs in order for them to boot; in fact, the PCs will boot with only the Local Hub or Switching Remote Unit connected.

This feature makes several other things possible:

- Your PCs can operate continuously regardless of whether or not the Remote or Local Hub at the other end of the Extender link is powered, connected, or even present.
- You can “hot-plug” or “hot-swap” the remote or local keyboards and mice at any time; that is, you can unplug and replug the keyboards and mice without disrupting the operation of the PCs.
- You can connect different CPUs to different Remotes at different times in order to create a “switched” KVM-extension system. You can do this by moving cable between patch-panel ports or directly between Units or Local Hub ports, 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 Rackmount Extender should operate continuously and transparently, maintaining the long-distance connection between the local devices (CPU or KVM switches) 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 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 different Extender Remotes have different command formats:

- Extender links with ACUREM, ACUMREM, ACUSREM, or ACU1006MRA Remotes use [Scroll Lock] as a single multipurpose “command key”—pressing and releasing it different numbers of times, sometimes while pressing the mouse buttons, causes the Extender to do various things.

Very few of today’s software applications make use of the [Scroll Lock] key, but if you’re using such an application on the PC attached to the Extender, you can force the Extender to ignore the [Scroll Lock] character and pass it through to the PC. Do this by setting position 2 of an ACUREM’s DIP switch to ON (see **Section 5.1**) or position 4 of an ACUREM’s or ACUSREM’s internal DIP-switch SW1 to OFF (see **Section 5.3.1**). Turning off [Scroll Lock] recognition will disable the Extender’s reset command (see **Section 7.3.1**), and on Dual-Access models it will disable Private Mode as well (see **Section 7.3.4**).

- Extender links with ACUREMSW, ACUVREM, ACUWREM, or ACU1006MRVA Remotes use either left-[Ctrl] 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 an ACUWREM’s or ACU1006MRVA’s DIP switch to ON (see **Section 5.1**) or position 2 of an ACUREMSW’s or ACUVREM’s internal DIP-switch SW1 to ON (see **Section 5.3.2**).

For a quick summary of all of the Extender’s keyboard commands, see **Appendix D**.

### 7.3.1 RESETTING THE KEYBOARD AND MOUSE

When an Extender system is set to its factory defaults, or if a keyboard or mouse attached to the Extender ever lock up, you can reinitialize a user station’s keyboard and mouse by typing in a reset command at the keyboard of a user station attached to the Extender:

- In a Single-Access non-serial or KVM/Serial Extender link with a full-size or Micro Remote (ACU1006RA or ACU1012RA to ACUREM, ACUMREM, or ACU1006MRA; ACU1006SRA to ACUSREM), press and release the [Scroll Lock] key *once*.

- In a Dual-Access non-serial or KVM/Serial Extender link with a full-size or Micro Remote (ACU1006DRA to ACUREM, ACUMREM, or ACU1006MRA; ACU1006DSRA to ACUSREM), press and release the [Scroll Lock] key *once* at the Remote or *twice* at the Local Unit.
- In a Single-Access non-serial Extender link with a Switching Remote Unit (ACU1006RA or ACU1012RA to ACUREMSW) or a KVM/Serial/Audio link (ACU1006VRA to ACUVREM, ACUWREM, or ACU1006MRVA), 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).

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.

Very few applications today make extensive or important use of the [Scroll Lock] key. But if you are using such an application on a PC attached to a non-audio Extender system that doesn't include a Switching Remote Unit, you can force the Extender to pass [Scroll Lock] through to the PC, disabling both the reset function and Private Mode (see **Section 7.3.4**) by setting DIP-switch position 2 for that link on a Micro Remote to ON (see **Section 5.1**) or position 4 of DIP-switch SW1 on a non-Micro Remote Unit to OFF (see **Section 5.3.1**).

### 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 you're using has gotten "out of sync" with the Rackmount Extender, or that the Rackmount Extender has gotten out of sync with the CPU's PS/2 mouse port.

Explanation: 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 Rackmount 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. In a Single-Access non-serial Extender link with a Switching Remote Unit (ACU1006RA or ACU1012RA to ACUREMSW) or a KVM/Serial/Audio link (ACU1006VRA to ACUVREM, ACUWREM, or ACU1006MRVA), 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). For any other type of Extender link, take these steps:

1. Press and hold down both the left and right mouse buttons.
2. Press and release the [Scroll Lock] key on the associated keyboard, then release the mouse buttons.
3. Check mouse operation.
4. If the mouse isn't yet operating correctly, repeat steps 1 through 3 as many as two more times. (If this still doesn't help, call Black Box Technical Support.)

When the Rackmount Extender receives the Null Mouse command, it sends a "null byte" of mouse data to the corresponding 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 are running Windows 95/98/2000, Windows® Me, Windows NT®, or Windows XP, we recommend that you install the latest Microsoft mouse driver on your PC, or even the Microsoft IntelliMouse driver (regardless of whether you are actually using an IntelliMouse or not). The Rackmount Extender will translate the mouse signals for the IntelliMouse 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 SYSTEMS ONLY)

Because two user stations (one local, one remote) can be attached for each CPU, Dual-Access Rackmount Extender systems have “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 the duration of the “inactivity timeout” period, the Extender will switch to the first station from which it detects user activity. With the Micro Remotes and the Switching Remote Unit, both keyboard keypresses and mouse movements always register as user activity. The default behavior with the other Remotes is to register only keyboard keypresses as user activity, but you can set them to register mouse movements as well if you want to (see **Section 5.3.1**).

**(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.)

The “inactivity timeout” prevents a user at the other station from interrupting work in progress at the active station. With the Micro Remotes and Switching Remote Unit, the timeout is fixed at two seconds. This is also the default timeout length for the other Remotes, but you can set them to fifteen seconds if control is being switched too quickly (see **Section 5.3.1**).

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 Switching Remote Unit boots up, it gives any local user station control of the local CPU and the remote user station control of any attached and powered remote CPU. But when a Dual-Access Extender system without a Switching Remote Unit 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 in a Dual-Access system might be blank, and the remote keyboard and mouse inactive, for up to several seconds.

## 7.3.4 PRIVATE MODE (DUAL-ACCESS SYSTEMS ONLY)

**CAUTION!**

**Do *not* use private mode on any Extender link that goes through a Switching Remote Unit (ACUREMSW) attached to a regular Dual-Access (ACU1006DRA) Local Hub whose firmware version is lower than S5.0. See the first Caution notice in Section 6.3.**

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.

The Extender will not go into Private Mode unless there’s a powered PC attached to the corresponding CPU port on the Local Hub. Other specifics of Private Mode are handled differently by Switching Remote Units than they are by other types of Remotes:

- In a Dual-Access Extender link that doesn’t include a Switching Remote Unit, the local user station can go into Private Mode and lock out the remote station, but not vice versa. When users at the local station have control of the Extender link, they can force it into Private Mode (taking exclusive control of the PC) by pressing [Scroll Lock] *once* on the local keyboard. The Scroll Lock LED will light on *both* the local *and* remote keyboards. Other than this indication, the remote station is almost completely disabled: The monitor goes blank and the keyboard and mouse stop working. (If you’re using a full-size [non-Micro] Remote Unit and you don’t want the remote monitor to be blanked during Private Mode, set DIP-switch position 1 to ON—see **Section 5.3.1**.)

Local users must press [Scroll Lock] again to re-enable the remote user station; when they do so, the Extender also reinitializes the local keyboard and mouse. (To reset the local keyboard and mouse without going into Private Mode, quickly press and release [Scroll Lock] *twice*, as directed in **Section 7.3.1**.)

Very few applications today make extensive or important use of the [Scroll Lock] key. But if you are using such an application on a PC attached to the Extender, you can force the Extender to pass [Scroll Lock] through to the PC, disabling both Private Mode and the reset function (see **Section 7.3.1**) by setting DIP-switch position 2 for that link on a Micro Remote to ON (see **Section 5.1**) or position 4 of DIP-switch SW1 on a non-Micro Remote Unit to OFF (see **Section 5.3.1**).

- If your Dual-Access link includes a Switching Remote Unit and a Local Hub that's been upgraded to S5.0 or higher firmware, 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 as long as the remote user has the local PC selected. The remote user can switch to the remote PC (see **Section 7.3.5**), during which time the Scroll Lock LED will behave normally, but Private Mode will remain in effect: The local user will still not have access to the local PC, and the remote keyboard's Scroll Lock LED will resume flashing as soon as the remote user selects the local PC again. To exit Private Mode, the remote user must select the local PC, 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 station will be automatically switched to any attached and powered remote PC. (If a remote PC isn't attached and powered, the remote monitor's screen will be blanked, the remote 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. In that situation, the remote station will be unusable until the local station exits Private Mode or the remote PC is switched ON—if the remote PC is switched ON, the remote user will be able to switch to it.) In the meantime, the local keyboard's Scroll Lock LED will continue to flash and the local user will have exclusive use of the local PC; the remote user will be able to access the remote PC as normal, but the Extender won't allow the remote user to switch back to the local PC while Private Mode is in effect. To exit Private Mode, the local user must press and release the hotkey, then press and release [Scroll Lock].

### 7.3.5 SWITCHING BETWEEN CPUs (SWITCHING REMOTE UNIT ONLY)

If the local user isn't using the local PC, the remote user of an Extender link with a Switching Remote Unit is able to switch back and forth between the local and remote PCs and access either of them as necessary. To do this, the remote user must press and release the hotkey, then press and release the plus key (“[+]”) on the keyboard's numeric keypad (*not* the plus/equals key on the top row of the keyboard). The keyboard's Num Lock, Caps Lock, and Scroll Lock LEDs will flash to show which PC is selected: once for the remote PC, twice for the local PC. (When the Extender is in Private Mode, switching might be constrained and the LEDs will behave differently; see **Section 7.3.4**.)

Be aware that automatic switching can happen at startup. When the Switching Remote Unit powers up, it will search for a powered PC. If powered PCs are attached to both the Local Hub and the Remote Unit, it will connect the remote station to the remote PC, so that the remote user can use the remote PC and the local user can use the local PC. However, if the only powered PC attached to the Extender is attached to the Local Unit, the remote user will be automatically switched to the local PC instead (see **Section 7.3.3**).

## 7.4 Applications

The Rackmount ServSwitch Brand CAT5 KVM Extender is ideal for connecting centralized CPUs to distributed user stations. In many situations, these connections will be simple one-to-one links: one CPU to one keyboard, monitor, mouse, serial device, pair of speakers, and microphone, as shown in several of the illustrations in **Chapter 1**.

In others, these connections will involve linking one CPU with multiple video outputs to one keyboard, one mouse, and several monitors, as shown in Figure 7-1 on the next page. Such applications, common at financial institutions, *require* that the Local Hub be powered with its optional external power supply. Another version of this same application, using a Remote Hub to connect several such CPUs, is shown in Figure 7-4.

Some of the most important applications for the Rackmount ServSwitch Brand CAT5 KVM Extender involve, not surprisingly, extending the distances that are possible in a ServSwitch type KVM-switching system. One example, typical at museums, is shown in Figure 7-2: A ServSwitch is used to control several nearby secure CPUs, which send and receive I/O to/from touchscreens located throughout the building. In a second example, shown in Figure 7-5, uses a Remote Hub to connect a few distant servers to an otherwise localized ServSwitch Multi system.

Another application involving a ServSwitch is shown in Figure 7-3: Three rackmounted Matrix ServSwitches are each used to control a separate rack of CPUs. The “MONITOR/KEYBOARD/MOUSE A” ports of the Switches are connected—through a Rackmount Extender Local Hub, three Remote Units, and a “master” regular ServSwitch—to an administrator’s user station. Users at this station can access and control all of the CPUs in all three of the CPU racks. The “MONITOR/KEYBOARD/MOUSE B” ports of the Matrix ServSwitches are connected, through the Local Hub and three other Remote Units, to three departmental user stations in different areas of the building. Users at each of these stations can access and control the CPUs in *one and only one* of the CPU racks.

### CAUTION!

**Different ServSwitch KVM switches use different proprietary signaling between cascaded units, not all of which the Extenders can carry. Before you use Extenders to extend cascading distance, please call Black Box Technical Support to discuss your application.**

# RACKMOUNT SERVSWITCH™ BRAND CAT5 KVM EXTENDER LOCAL HUBS

Trading desk with three Rackmount Extender Remote Units, three monitors, and one keyboard and mouse

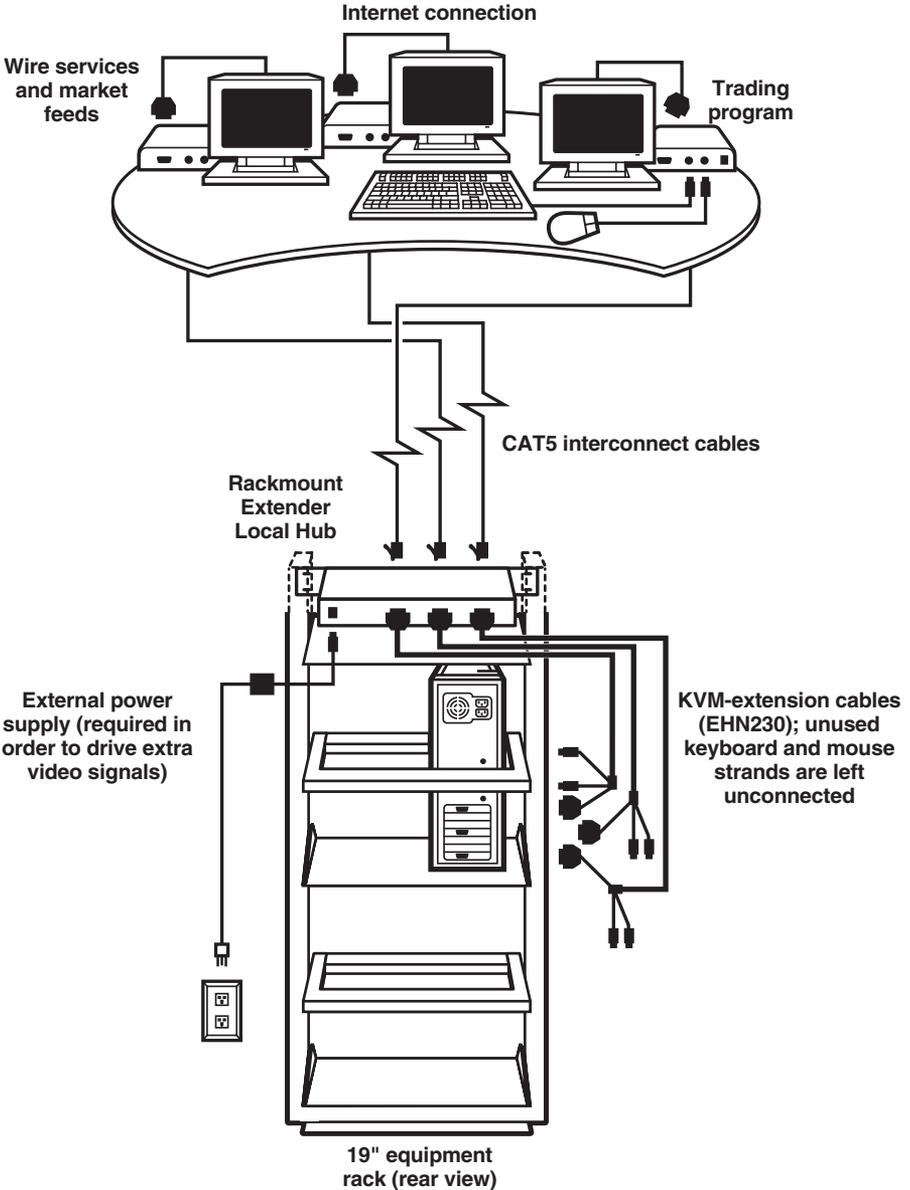


Figure 7-1. Using the Rackmount Extender to carry multiple video signals from the same CPU. (For clarity, only three Local Hub CPU ports are shown.)

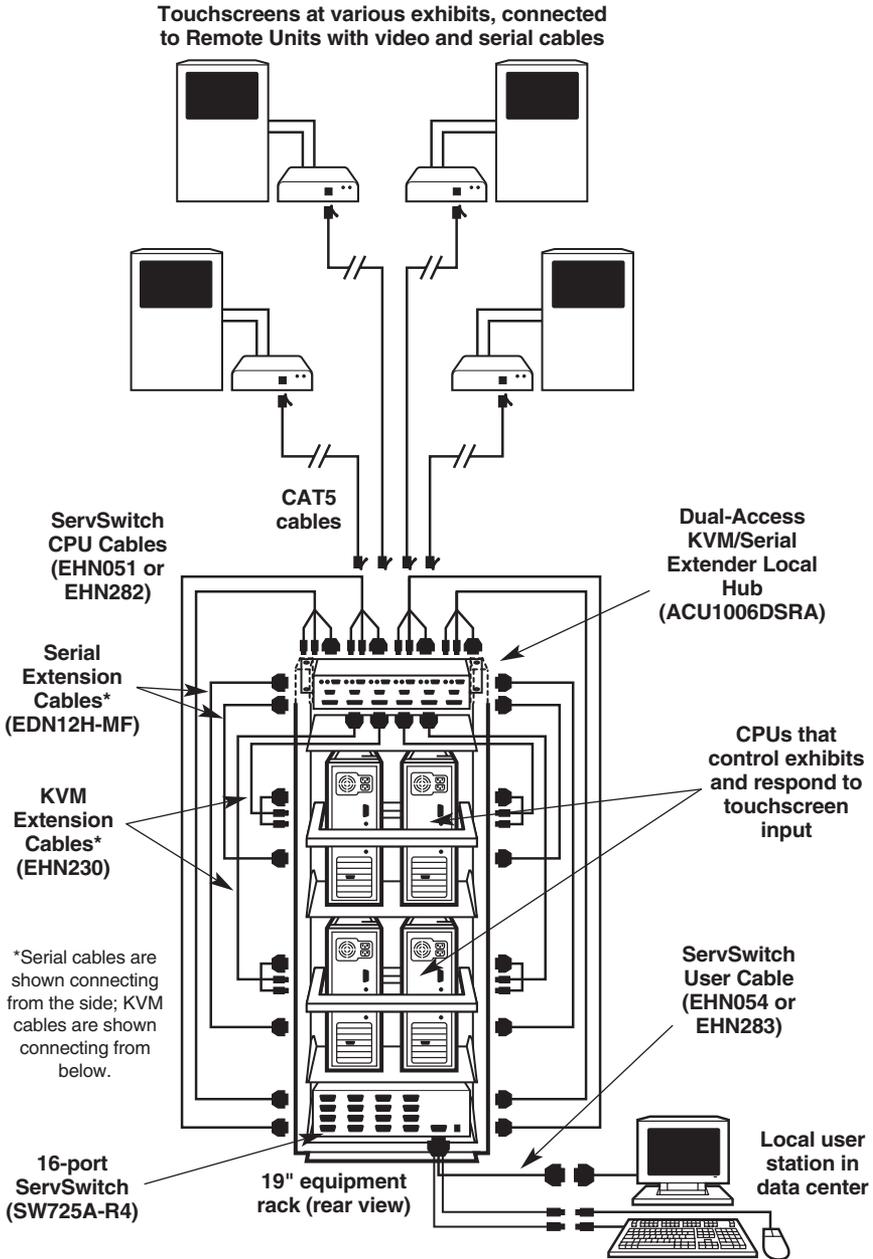


Figure 7-2. Using the Rackmount Extender to help manage a distributed touchscreen system. (Only four sets of device connections are shown.)

# RACKMOUNT SERVSWITCH™ BRAND CAT5 KVM EXTENDER LOCAL HUBS

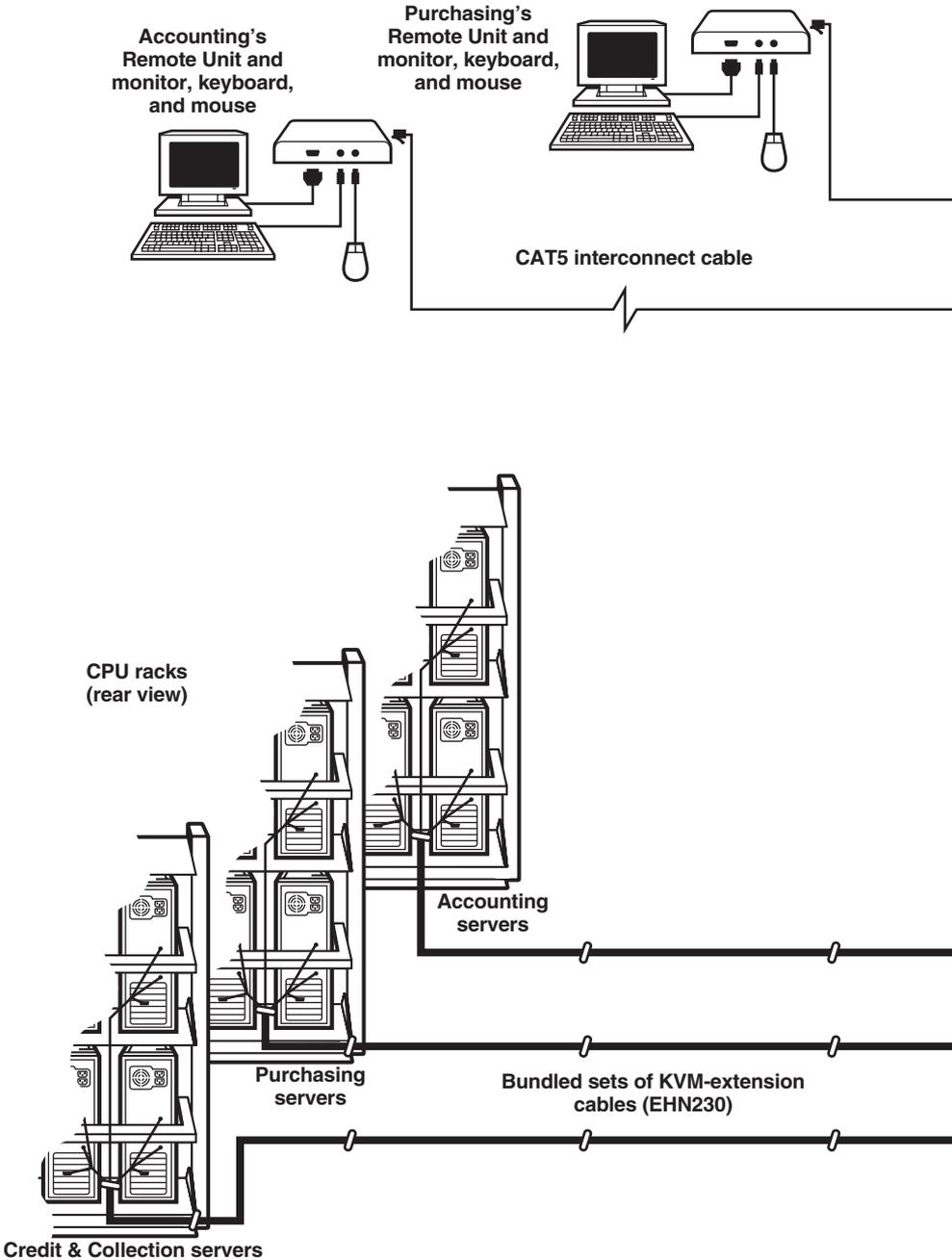
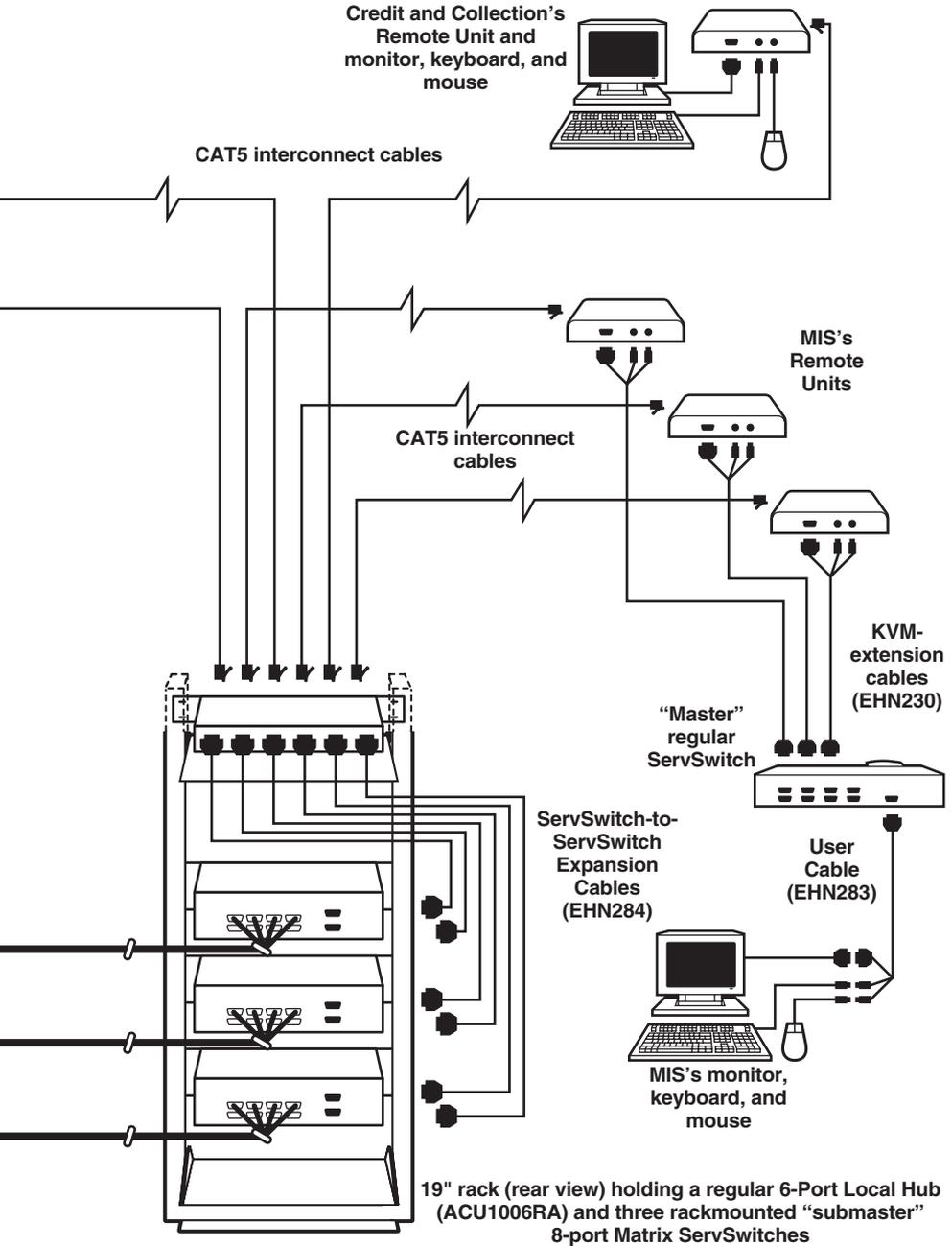
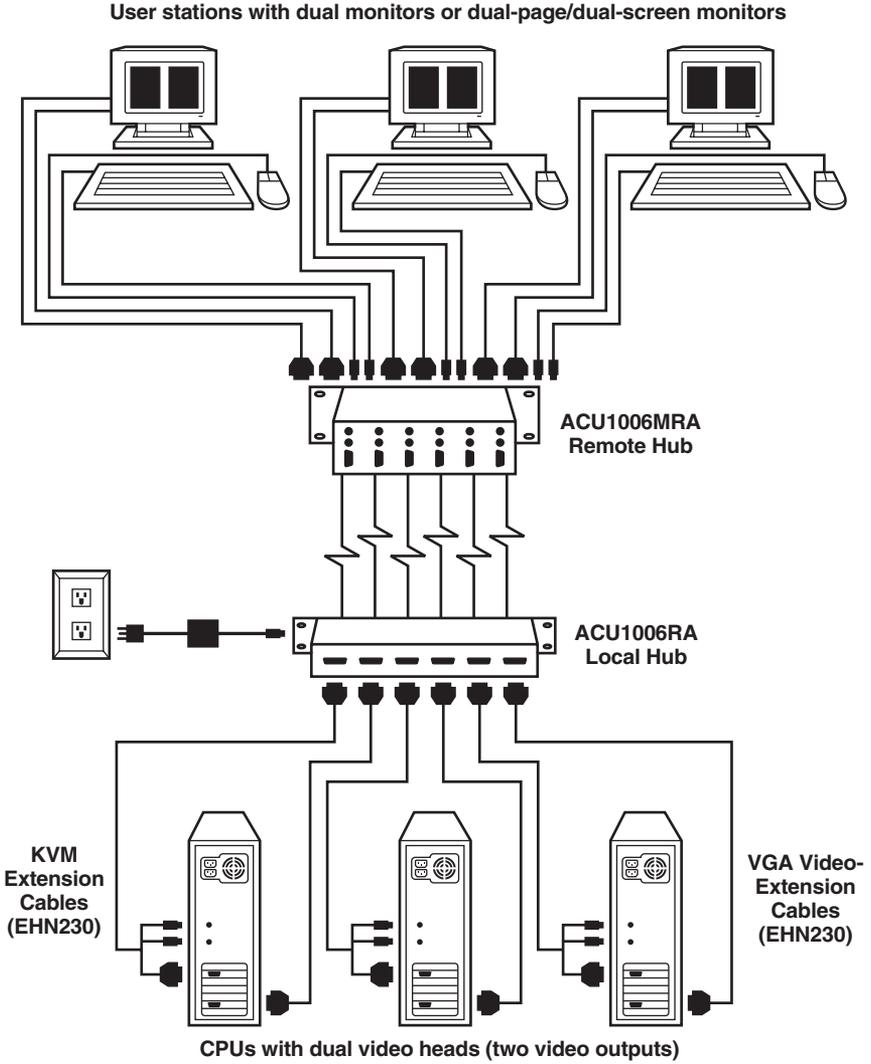


Figure 7-3. An example of a large



Rackmount Extender application.



**Figure 7-4. Using the Rackmount Extender with a Remote Hub to carry dual-head video from several CPUs.**

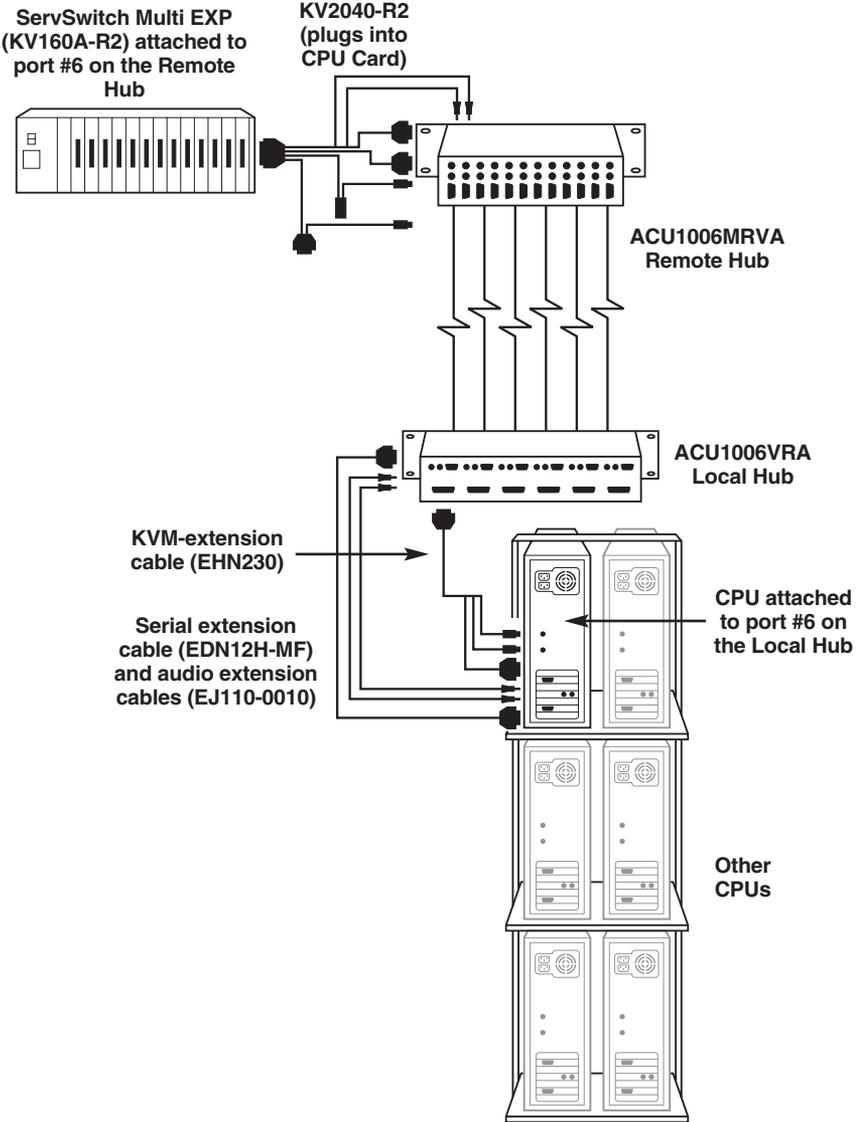


Figure 7-5. Using the Rackmount Extender with a Remote Hub to connect a ServSwitch Multi to a distant cluster of servers. (Only one set of device connections is shown.)

# 8. Troubleshooting

## 8.1 Common Problems

This section discusses difficulties that people sometimes have with the Rackmount ServSwitch™ Brand CAT5 KVM 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

*One of the PCs 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 ports), plug the cabling in properly and reset the keyboard and mouse as described in **Section 7.3.1**.
2. Check the interconnect cables between the Rackmount Extender Local Hub and the affected Remote. Are they solid-core cable? Are they intact along their length and securely connected at both ends? And are they wired correctly? (Compare their wiring with that shown in **Appendix A**.)
3. If the affected PC is a Pentium® class machine, see the entry for the "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 Rackmount Extender).

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

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

*One of the PCs 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 the affected PC is a Pentium® class machine, see the entry for the "Pentium class PC..." problem in **Section 8.1.3**.

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

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

*I'm not using any keyboards, but 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 keyboard and 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 Remote ports), plug the cabling in properly and reset the keyboard and mouse as described in **Section 7.3.1**.
3. If the affected PC is a Pentium® class machine, see the entry for the "Pentium class PC..." problem in **Section 8.1.3**.
4. Check the interconnect cables between the Rackmount Extender Local Hub and the affected Remote. Are they intact along their length and securely connected at both ends? And are they wired correctly? (Compare their wiring with that shown in **Appendix A**.)
5. Try powering the Remote OFF and then ON again.
6. Try using a different model of mouse.
7. Do *any* inputs work at this point? If not, reboot the PC.

*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 keyboard and mouse as described in **Section 7.3.1**.
2. Make sure that the Rackmount Extender Local Hub is receiving power. If the Local Hub is being powered by the attached CPUs, make sure that the cables running from the CPUs' keyboard ports to the Local Hub are intact and securely attached. If the Local Hub is being powered by its optional external power supply, make sure that the power supply's input and output cords are securely plugged in at all connection points.
3. If the affected PC is a Pentium® class machine, see the entry for the "Pentium class PC..." problem in **Section 8.1.3**.

4. Reboot the PC.

*The mouse is behaving erratically.*

1. Reset the keyboard and 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 Rackmount 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 Rackmount Extender in conjunction with one of our ServSwitch family of KVM switches, command the Switch to reset the mouse.
5. Quit and restart the application.
6. Reboot the affected 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 a remote station, cycle power to that station's Remote.

*A Pentium class PC will not boot properly because of keyboard or mouse problems, or After a Pentium class PC boots, the keyboard and/or mouse don't work.*

Try "crossing" the keyboard- and mouse-extension cabling running from the Rackmount Extender Local Hub to the PC. That is, plug the keyboard cable or cable strand into the CPU's mouse port and the mouse cable or cable strand into the CPU's keyboard port.

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 (KVM/SERIAL AND KVM/SERIAL/AUDIO EXTENDERS ONLY)

*A CPU doesn't detect the serial device I'm trying to use with it.*

You'll approach this problem differently on KVM/Serial links and KVM/Serial/Audio links. On KVM/Serial links, take these steps:

1. Make sure that the data rates of the device, the Extender, and the CPU's serial port all match. (See **Section 5.4** for how to set the Extender's data rate.)
2. Make sure that the flow-control settings of the Extender and of your driver or serial-communication program are correct—see **Section 5.5**. If you're using a serial printer or touchscreen, try setting the Extender to loop back RTS/CTS. (If you still have trouble with the touchscreen, set it to loop back both RTS/CTS and DTR/DSR.) If you're using some other kind of serial device, try setting everything to “no flow control.”

On KVM/Serial/Audio links, take these steps:

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.

*A CPU doesn't seem to receive anything from its 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?

From this point on, you'll approach this problem differently on KVM/Serial links and KVM/Serial/Audio links. On KVM/Serial links, take these steps:

3. Check the data rate. Is the device operating at either 9600 or 19,200 bps? Is the Extender set to the same data rate (see **Section 5.4**)?
4. Check the data format. Is the device using 8 data bits, no parity, and 1 stop bit? (This is the only data format the Extender recognizes.)
5. Check the flow control. Is the device using flow-control signals that the Extender can handle, and are the Extender's flow-control jumpers set correctly (see **Section 5.5**)?
6. Is the PC a UNIX<sup>®</sup> 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.

On KVM/Serial/Audio links, take these steps:

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.

*A CPU receives garbage from its serial device or vice versa.*

You'll approach this problem differently on KVM/Serial links and KVM/Serial/Audio links. On KVM/Serial links, take these steps:

1. Check the data rate. Is the device operating at either 9600 or 19,200 bps? Is the Extender set to the same data rate (see **Section 5.4**)?
2. Check the data format. Is the device using 8 data bits, no parity, and 1 stop bit? (This is the only data format the Extender recognizes.)

On KVM/Serial/Audio links, take these steps:

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.

*The KVM/Serial Extender doesn't seem to work with my graphics tablet.*

At the time of this writing, certain serial graphics tablets don't work with the KVM/Serial Extender. This is because their drivers must detect the tablet at 9600 bps, but then dynamically change the data rate to 19,200 bps. The Extender's data rate is fixed at *either* 9600 *or* 19,200 bps (see **Section 5.4**); it can't adapt to on-the-fly data-rate changes. Please call Black Box Technical Support; even if we aren't able to provide a fix for you, we would like to know which tablet models are affected by this and other problems.

### 8.1.5 AUDIO DEVICES (KVM/SERIAL/AUDIO EXTENDERS ONLY)

*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 “audio out” to “audio 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 cables between the Rackmount Extender Local Hub and the affected Remotes. Are they solid-core and 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.) Are the cables intact along their length and securely connected at both ends? And are they wired correctly? (Compare the cables' specs with those listed in **Section 4.2.5** and their 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 cables between the Rackmount Extender Local Hub and the affected Remotes. Are they solid-core cable, rated as Category 5? Are they intact along their length and securely connected at both ends? And are they wired correctly? (Compare the cable's specs with those listed in **Section 4.2.5** 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 distance jumpers in the affected Remotes; you might need to try a higher setting. See **Section 5.2**.

*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, serial, or audio extension—not keyboard or mouse control—but I can't get a picture.*

Even if you are only using the Rackmount Extender for video extension (to drive video to a remote monitor), serial extension (to drive RS-232 to or from a remote touchscreen or other device), or audio extension (to drive audio to or from remote devices), the Local Hub must still get power from (a) the keyboard port of an attached PC or KVM switch or (b) its optional external power supply.

*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 Rackmount Extender is probably being affected by a very strong signal from a nearby broadcast transmitter. Try changing 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 affected Remote. Call Black Box Technical Support.

*I get black & white instead of color video.*

The affected 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.
2. The affected 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 has an adverse effect on the remote video.*

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

*The Rackmount 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 keyboards in my application, but the Extender doesn't work at all unless I have a keyboard line running from the Local Hub to one or more PCs or KVM switches.*

If you aren't using its optional power supply, the Extender's Local Hub normally operates using the 5 volts of DC power that each attached CPU or KVM switch supplies on its keyboard and mouse ports. Either plug in the Local Hub's power supply or—even if you're not using a keyboard or mouse at any of your local or remote user stations—run cabling from the Local Hub's CPU ports to the keyboard ports of your CPUs or KVM switches in order to power the Local Hub.

## 8.2 General Questions About the Extender

*Is it possible to use an interconnection cable longer than 300 meters (985 feet)?*

With the full-size (non-Micro) Remotes, the Rackmount Extender will produce acceptable results with SVGA resolutions at the maximum cable length of 300 m (985 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 the Rackmount Extender be used between buildings?*

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

*Can I hot-swap interconnect cables in order to access different CPUs from different remote user stations?*

Because the Rackmount Extender performs full keyboard and mouse emulation, it is possible (though we do *not* recommend it) to swap or switch the local-remote interconnections to create, in effect, a KVM matrix-switch system. You would just have to remember to always reset the active Remote (see **Section 7.3.1**) after each such swap or switch.

*Is the Rackmount Extender VESA DDC compatible?*

No. It cannot carry the special DDC data lines.

*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 Rackmount 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 Remotes; remote monitors, serial device, audio devices, CPUs, and/or KVM switches; and local CPUs or KVM switches 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 cables 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 Rackmount Extender to my network?*

No. Regardless of the cable similarities, the data signals and voltages used by the Rackmount 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's Remotes?*

The Micro Remote Units (ACUMREM and ACUWREM) are not designed to be rackmounted. The Remote Hubs can be rackmounted with the included brackets. The non-Micro Remote Units can be rackmounted using Rackmount Kits that are available separately. See **Appendix B**.

### 8.3 Calling Black Box

If you determine that your Rackmount Extender system is malfunctioning, *do not attempt to alter or repair the Local Hub or any of the Remotes*. They contain 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 Rackmount Extender Local Hub and Remotes (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 firmware of your Rackmount Extender Local Hub and/or Remotes. 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 Rackmount Extender Local Hub or any Remote:

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

# Appendix A:

## Twisted-Pair Cable Pinning/Pairing

The twisted-pair cable you will use to interconnect the Local Hub and Remotes of your Rackmount ServSwitch™ Brand CAT5 KVM Extender system 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 4.2.5** 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

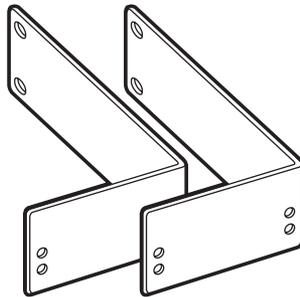
In runs of our EHN840 cable over 200 m (655 ft.) long, you might get much better video quality if, at both ends of the cable, you swap the green and brown pairs so that White/Green is on Pin 7, Green/White on Pin 8, White/Brown on Pin 3, and Brown/White on Pin 6.

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 (985 ft.). *Avoid* using cables rated "Level 6," "Level 7," etc. If you have problems getting a good picture with CAT5e cable, or if you *must* use cables with bandwidths higher than 155 Mbps, please contact Tech Support; the signal-skew problems caused by tightly twisted pairs in these cables can sometimes be resolved by swapping which pairs are used for which signals or by using an external delay line.

## Appendix B: Rackmounting Remotes

If you'd like to mount any of your Rackmount ServSwitch™ Brand CAT5 KVM Extender system's Remote Hubs in a 19" rack, use the two included brackets. If you'd like to mount any of your full-size (non-Micro) Remote Units in a 19" rack, use the two-bracket Rackmount Kit shown in Figure B-1 (product code RMK19U-R2). The Micro Remote Units (ACUREM and ACUMREM) aren't rackmountable.



**Figure B-1. The RMK19U-R2 Rackmount Kit.**

To use the included brackets to mount a Remote Hub, or to use the Kit brackets to mount a Remote Unit, take these steps, referring to Figure B-2 on the next page:

1. Unscrew and keep the two screws on each side of the Remote's case.
- 2A. *Remote Hubs*: Match up the two holes in the "Hub end" of each bracket with the two now-vacant screwholes on each side of the Hub, then fasten the brackets to the unit with the screws you removed in step 1.
- 2B. *Remote Units*: Match up two of the holes in the "Unit end" of each bracket with the two now-vacant screwholes on each side of the Remote Unit. For ACUVREM units, use the bracket's lower pair of holes (one front and one rear); for all other models, use the upper pair. 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 Remote assembly to the rack using your own screws, bolts, or cage nuts (not included).

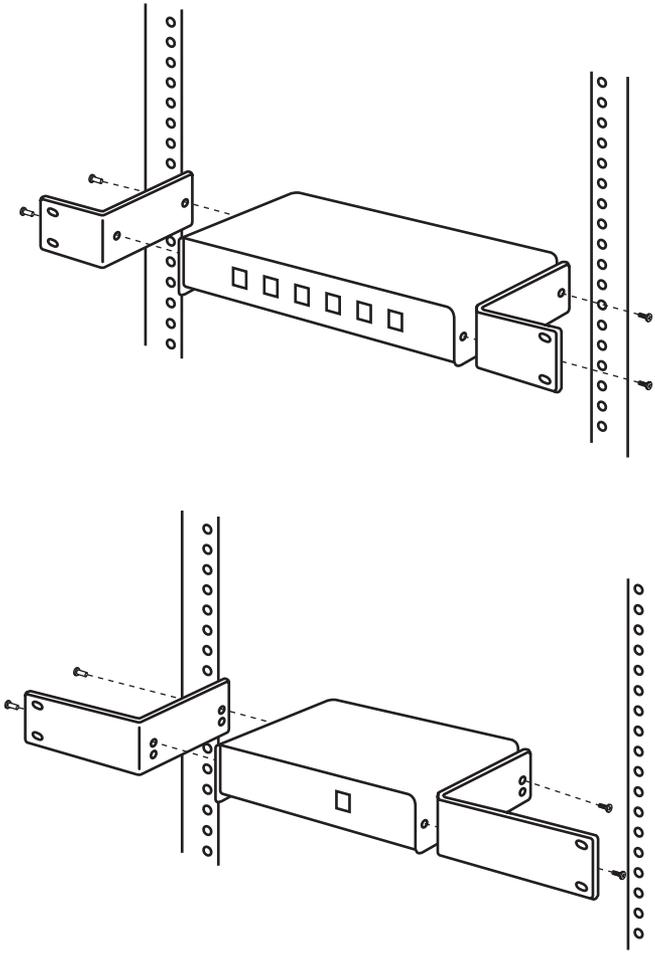


Figure B-2. Mounting the bracketed Remote Hub (top) or Remote Unit (bottom).

# Appendix C: Setting Your KVM/Serial Extender System to 1200 bps

## NOTE

This procedure is intended primarily to meet the needs of customers with industrial trackballs and other 1200-bps serial peripherals whose output can't be converted to PS/2 mouse format. We do not recommend using this procedure to connect standard serial mice; use a PS/2 mouse with a serial-to-PS/2 mouse converter such as product code AC244A instead.

We suggest that you avoid making this change unless you really need to, because (a) your Local Hub shouldn't be opened any more than necessary and (b) it can be very easy to lose track of which Local Hub port is operating at which data rate.

Also note that while this procedure should enable you to use most 1200-bps serial peripherals, it won't work for some of them, because a few types of devices draw more power from the serial port than the Extender can provide.

If you would like to use a 1200-bps serial peripheral such as an industrial trackball with your Rackmount ServSwitch Brand CAT5 KVM/Serial Extender, attach the peripheral to the serial port of the ACUSREM Remote Unit. Then take these steps to set the Extender to operate at 1200 bps on the line that leads from the KVM/Serial Local Hub to that Remote Unit, referring to Figure C-1 on the next page:

1. Unplug both the Local Hub and the Remote Unit, so that both are powered OFF.
2. Following the instructions (including those in the Caution notice) at the start of **Chapter 5**, open up both the Local Hub and the Remote Unit.
3. There are six serial daughtercards in the KVM/Serial Local Hub—one for each of its ports—and there are a pair of jumper posts labeled “Baud” on each of these cards. Each pair of posts has a jumper “hanging off” one post. On the card in the Local Hub that controls serial communication to the 1200-bps peripheral's Remote Unit, move this jumper so that it connects the two posts. This will override the 9600-bps or 19,200-bps data-rate setting in the Remote Unit, so that the Extender system operates at 1200 bps *on that link only*. (Move this jumper back to its original position at any time to set your system back to 9600 or 19,200 bps.)

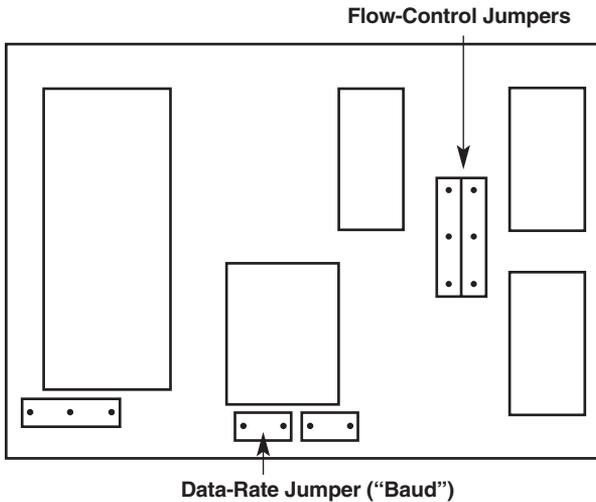


Figure C-1. The serial daughtercard and its controls.

4. Set the flow-control jumpers in *both* the Local Hub *and* the Remote Unit to the “RTS/CTS across link” setting (jumpers vertically linking the upper pairs of posts), as shown in Figure C-2. This will allow the Extender system to detect the mouse properly.

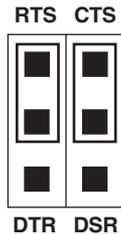


Figure C-2. The necessary “pass RTS/CTS” setting.

5. Close up the Local Hub and Remote Unit and plug them in again.

Unless your serial device draws too much power (see the Note on the previous page), your Extender system should now be ready for 1200-bps operation.

# Appendix D: Keyboard-Command Summary

Here is a brief list of the keyboard commands you can use to control your Rackmount ServSwitch™ Brand CAT5 KVM 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**.

**Single-Access KVM or KVM/Serial Local Hub (ACU1006RA, ACU1012RA, ACU1006SRA) linked to a Remote other than a Switching Remote Unit**

<i>Function:</i>	<i>Keyboard command/activity:</i>
Take control of CPU	Press any key on keyboard or (if Remote is a Micro model or has been set for this—see <b>Section 5.3.1</b> ) move mouse.
Reset keyboard and mouse	Press and release [Scroll Lock] once.
Send null byte to mouse	Press and hold left and right mouse buttons, then press and release [Scroll Lock] once.

**Dual-Access KVM or KVM/Serial Local Hub (ACU1006DRA, ACU1006DSRA) linked to a Remote other than a Switching Remote Unit**

<i>Function:</i>	<i>Keyboard command/activity:</i>
Take control of CPU	Press any key on keyboard or (if Remote is a Micro model or has been set for this—see <b>Section 5.3.1</b> ) move mouse.
Reset keyboard and mouse	Press and release [Scroll Lock] <i>once</i> at Remote, <i>twice</i> at Local Unit.
Send null byte to mouse	Press and hold left and right mouse buttons, then press and release [Scroll Lock] once.
Enter Private Mode	<i>At Local Unit only:</i> Press and release [Scroll Lock] <i>once</i> .

**Single-Access KVM Local Hub (ACU1006RA, ACU1012RA) linked to a Switching Remote Unit (ACUREMSW); also, KVM/Serial/Audio (ACU1006VRA) systems**

<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].
Switch to other CPU	<i>At Remote only:</i> Press and release {hotkey*}, then press and release keypad's plus ([+]) key.

\*The default {hotkey} is right-[Ctrl], but you can set it to left-[Ctrl]; see **Section 5.3.2**.

# Appendix E: Distinguishing Features and Compatibility

This first table lists the various models of the ServSwitch™ Brand CAT5 KVM Local Hub and indicates the number of ports they have; whether they're Single- or Dual-Access; whether they support serial devices (**S**) or audio devices (**A**)—a check mark means “yes,” no check mark means “no”; and which Remotes they're compatible with.

Prod. Code	Ports	Access	S	A	Compatibility
ACU1006RA	6	Single			ACUREM, ACUREMSW, ACUMREM, ACU1006MRA
ACU1006DRA	6	Dual			ACUREM, ACUMREM, ACU1006MRA
ACU1006DSRA	6	Dual	√		ACUSREM
ACU1006SRA	6	Single	√		ACUSREM
ACU1006VRA	6	Single	√	√	ACUVREM, ACUWREM, ACU1006MRVA
ACU1012RA	12	Single			ACUREM, ACUREMSW, ACUMREM, ACU1006MRA

## APPENDIX E: Distinguishing Features and Compatibility

This second table lists the various models of the ServSwitch™ Brand CAT5 KVM Remote and indicates their chassis size/style; whether they support serial devices (**S**), audio devices (**A**), or a switched remote CPU (**C**)—a check mark means “yes,” no check mark means “no”; which Local Hubs they’re compatible with (listed by product code only); and which Extenders’ Local Unit they’re compatible with and can replace or supplement the Remote Unit for (listed by product code and the word “Local”).

Prod. Code	Chassis	S	A	C	Compatibility
ACUREM	Full				ACU1006RA, ACU1006DRA, ACU1012RA, ACU1001A Local, ACU1009A Local
ACUREMSW	Full			√	ACU1006RA, ACU1012RA, ACU1001A Local
ACUMREM	Micro				ACU1006RA, ACU1006DRA, ACU1012RA, ACU1001A Local, ACU1009A Local, ACU3001A Local, ACU3009A Local
ACU1006MRA	Micro Hub				ACU1006RA, ACU1006DRA, ACU1012RA, ACU1001A Local, ACU1009A Local, ACU3001A Local, ACU3009A Local
ACUSREM	Full	√			ACU1006SRA, ACU1006DSRA, ACU1002A Local
ACUVREM	Full	√	√		ACU1006VRA, ACU1006DVRA, ACU1022A Local, ACU1028A Local
ACUWREM	Micro	√	√		ACU1006VRA, ACU1022A Local, ACU1028A Local, ACU3022A Local
ACU1006MRVA	Micro Hub	√	√		ACU1006VRA, ACU1006DVRA, ACU1022A Local, ACU1028A Local, ACU3022A Local

**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

## NOTES



**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

World-Wide Web: [www.blackbox.com](http://www.blackbox.com) • E-mail: [info@blackbox.com](mailto:info@blackbox.com)

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