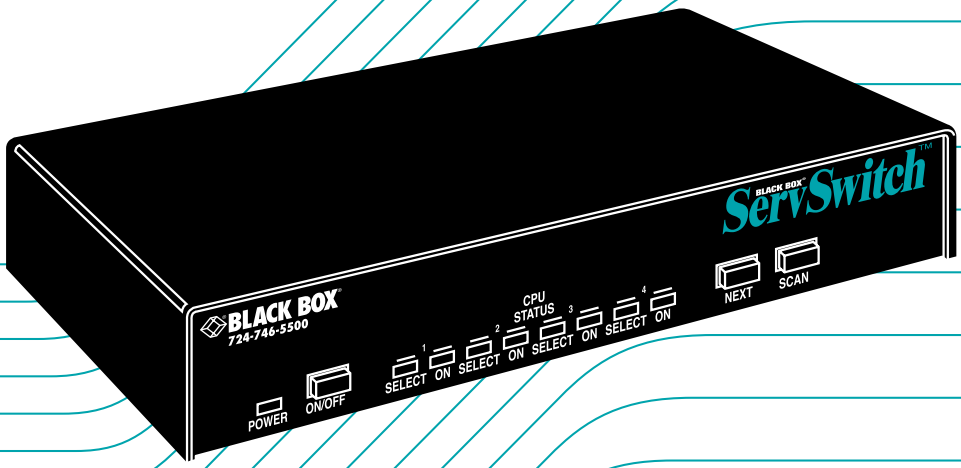
NOVEMBER 1996

"-R2" BLACK BOX® ServSwitch™



SW721A(E)-R2
SW722A(E)-R2
SW723A(E)-R2
SW724A(E)-R2
SW725A(E)-R2

BLACK BOX®
NETWORK SERVICES

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

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

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

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

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

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 connectado 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 fisica 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 lineas de energia.

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 objectos liquidos 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: Objectos 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.

Contents

1. Specifications

Compliance — FCC Class A, DOC Class/MDC classe A

Standards — With original Serv cabling: VGA (color, monochrome, or page white), EGA (color or monochrome), or CGA video;
With original Serv cabling (minimal) or coaxial cabling (recommended): SVGA video;
With coaxial cabling: XGA (color or monochrome) video;
With special cabling: True monochrome video

Interfaces — CPU and MONITOR/KEYBOARD/MOUSE Ports: Proprietary composite of IBM AT or PS/2 keyboard, RS-232 or PS/2 mouse, and video (standards listed above);
RS-232 Port: Proprietary variant of EIA RS-232D using 6-wire RJ-11 connectors, DTE

Resolution — With original Serv cabling: Up to 1024 x 768 noninterlaced;
With coaxial or special cabling: Up to 1280 x 1024 noninterlaced

Protocols — RS-232: Asynchronous

Data Formats — RS-232: 8 data bits, 1 stop bit, no parity

Speed — RS-232: 9600 bps

Max. Distance — Depending on the CPU, monitor, and video resolution (see **Section 4.1.3**), either:
25 ft. (7.6 m) of total original Serv cable from the keyboard, monitor, and mouse to any CPU, including up to 5 ft. (1.5 m) from any ServSwitch to any other Serv unit (submaster) attached to it; or
20 ft. (6.1 m) of coaxial cable—possibly as much as 100 ft. (30.5 m), depending on CPUs—from any ServSwitch to any device attached to it;
Also, 50 ft. (15.2 m) of serial cable from any ServSwitch's RS-232 port to a non-local computer

User Controls — Keyboard commands;
(3) Front-mounted pushbuttons:
ON/OFF (power), NEXT (switch to next port),
SCAN (operate normally or automatically scan ports)

Indicators — SW721 models: (5) Front-mounted LEDs:
(1) POWER, (2) SELECT, (2) ON;
SW722 models: (9) Front-mounted LEDs:
(1) POWER, (4) SELECT, (4) ON;
SW723 models: (17) Front-mounted LEDs:
(1) POWER, (8) CURRENT PORT, (8) CPU POWER;
SW724 models: (25) Front-mounted LEDs:
(1) POWER, (12) CURRENT PORT, (12) CPU POWER;
SW725 models: (33) Front-mounted LEDs:
(1) POWER, (16) CURRENT PORT, (16) CPU POWER

Connectors — All rear-mounted;
All models:
(1) 5-pin DIN female: POWER;
(1) 6-wire RJ-11 female: RS-232 (for remote control);
(1) DB25 female: MONITOR/KEYBOARD/MOUSE;
SW721 models: (2) DB25 female: CPU;
SW722 models: (4) DB25 female: CPU;
SW723 models: (8) DB25 female: CPU;
SW724 models: (12) DB25 female: CPU;
SW725 models: (16) DB25 female: CPU

Power — *For 120-VAC, 60-Hz operation:*
From wallmount power supply:
SW721A-R2, SW722A-R2:
Optimal input: 120 VAC, 60 Hz at 100 mA;
Output: 17 VAC CT at 700 mA;
Consumption: Up to 11.9 VA;
SW723A-R2, SW724A-R2, SW725A-R2:
Optimal input: 120 VAC, 60 Hz at 100 mA;
Output: 16.5 VAC CT at 1.45 amps;
Consumption: Up to 23.9 VA;

Power (cont'd)— *For 240-VAC, 50-Hz operation:*
From desktop power supply:
SW721AE-R2, SW722AE-R2:
Optimal input: 230 VAC, 50 Hz at 60 mA;
Output: 17 VAC CT at 700 mA;
Consumption: Up to 11.9 VA;
SW723AE-R2, SW724AE-R2, SW725AE-R2:
Optimal input: 230 VAC, 50 Hz at 60 mA;
Output: 16.5 VAC CT at 1.45 amps;
Consumption: Up to 23.9 VA

Maximum Altitude — 10,000 ft. (3048 m)

Temperature Tolerance — 32 to 131° F (0 to 55° C)

Humidity Tolerance — 5 to 80% noncondensing

Enclosure — Steel

Size — SW721, SW722 models:
2.25"H x 8.8"W x 4.9"D (5.7 x 22.4 x 12.4 cm);
SW723, SW724, SW725 models:
5.5"H x 13.5"W x 4.9"D (14 x 34.3 x 12.4 cm)

Weight — SW721, SW722 models:
Net: 3 lb. (1.4 kg); Shipping: 4 lb. (1.8 kg);
SW723, SW724, SW725 models:
Net: 10 lb. (4.5 kg); Shipping: 12 lb. (5.4 lb.)

2. Introduction

Thank you for choosing a ServSwitch. Designed with your needs in mind, your new ServSwitch will simplify your job by helping you organize your multiple-computer application. Because the ServSwitch lets you use one keyboard, monitor, and mouse to access a number of IBM® PC compatible computers, you can significantly reduce your equipment overhead and end keyboard and monitor clutter.

This chapter describes everything that comes with the Switch, the external and operating features of the Switch, and the cabling you'll need for the Switch.

2.1 The Complete Package

Your ServSwitch package includes the ServSwitch unit, its power supply, and this manual. If you didn't receive everything, or if anything arrived damaged, contact Black Box.

2.2 Operating Features

Some of the useful features of your ServSwitch:

- Access up to 256 CPUs with one keyboard, monitor, and mouse.
- Microprocessor-controlled keyboard and mouse switching.
- Mouse can be PS/2® or RS-232 type.
- Supports all modes of IBM PS/2 and AT® compatible keyboards.
- Supports SVGA; XGA, VGA, or EGA color or monochrome; CGA; and true monochrome video at resolutions up to 1280 x 1024 noninterlaced (although all video types except VGA, EGA, and CGA require coaxial or special cables).
- Select desired CPU from keyboard, front panel, or RS-232 port.
- Front-panel LEDs show selected CPU and its power-on state.

- Remembers and restores Num Lock, Caps Lock, Scroll Lock, and keyboard mode among CPUs.
- Screen-save function can turn off video after 1 to 999 seconds of inactivity.
- Scan function can sequence between CPUs every 1 to 15 seconds.
- You can program the keyboard's typematic rate and delay.
- Custom settings for each CPU can be saved in nonvolatile memory.
- Rackmount kits are available.

2.3 The Front Panel

The KVM ServSwitch's front panel features three push-button switches and several LED indicators. To familiarize yourself with these controls and indicators, refer to Figures 2-1 and 2-2 below and the descriptions that follow.

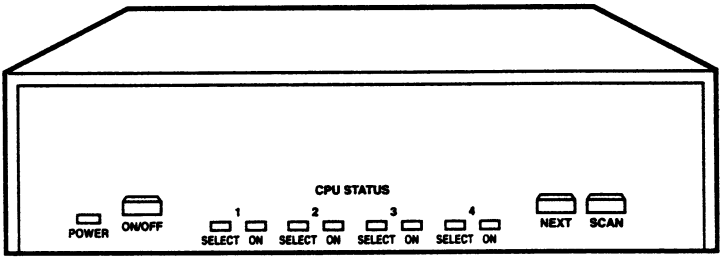


Fig. 2-1. The front panel of a KVM 4 to 1 ServSwitch (SW722).

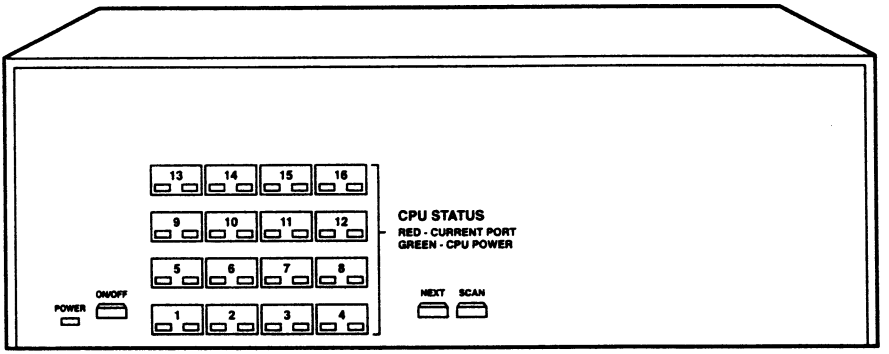


Fig. 2-2. The front panel of a KVM 16 to 1 ServSwitch (SW725).

POWER Power LED: Lights to indicate that unit is powered ON.

ON/OFF Power Button: Pressing this button turns the unit ON and OFF when the power supply is plugged into the unit and into a working outlet.

CPU STATUS CPU Status LEDs: Numbered pairs of LEDs indicate the statuses of the CPUs or submaster (cascaded) Serv devices connected to the corresponding ports on the rear panel:

SELECT or CURRENT PORT (red)
Lights if the corresponding port is the currently selected port.

ON or CPU POWER (green)
Lights if the device on the corresponding port is powered ON.

NOTE

The 2- and 4-port models both share the same chassis, which has 4 each of the SELECT and ON LED slots. The 8-, 12-, and 16-port models all share a different chassis that has 16 each of the CURRENT PORT and CPU POWER LED slots. The extra LED slots in the chassis of the 2-, 8-, and 12-port models are left blank, but are protected by material mounted inside the chassis.

NEXT Next Port Button: Press this button to manually switch the shared monitor, keyboard, and mouse from the currently selected computer to the next one in sequence.

SCAN Scan-Mode Button: When the ServSwitch is ON and operating normally (not scanning), press the button once to put the button in the "in" position. This causes the unit to begin automatic sequential scanning of connected ports. (If the scan does not begin immediately, quickly press the button twice more, so that it moves to the "out" position and back to the "in" position again.) Pressing the button again (returning it to the "out" position") ends the scan. For normal operation, the SCAN button should be "out."

Don't press this button on submaster (subsidiary cascaded) units—you could lock up the system. If you do press this button by accident, try pressing it again. If the system doesn't function normally after you return the SCAN button to the "out" position, perform a factory reset (see **Section 5.1**).

2.4 The Rear Panel

All cable connections are made at the ServSwitch's rear panel, as illustrated in Figure 2-3 and described below.

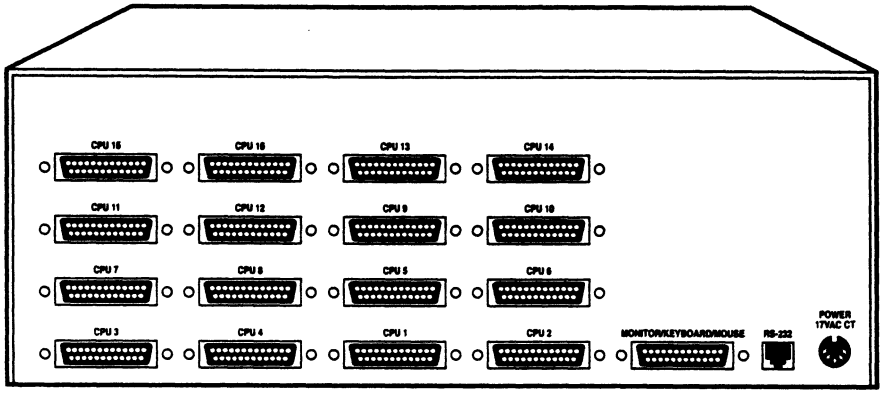


Fig. 2-3. The rear panel of a KVM 16 to 1 ServSwitch (SW725).

Panel Label	Connector	Description
CPU *X* [*X* = a number from 1 to either 2, 4, 8, 12, or 16, depending on which model you have]	DB25 F	Connect the sharing computers to these ports with "CPU Adapter Cables." At the Switch end these cables have a DB25 male connector; at the other ends, they have appropriate connectors to plug into your CPUs' video, keyboard, and mouse ports. These cables take the signals that would normally pass between the CPUs' ports and the monitor, keyboard, and mouse, and carry them between the CPUs' ports and the ServSwitch instead. You could also connect "submaster" Serv type switches to these ports using "ServSwitch-to-ServSwitch Expansion Cables." These cables have DB25 male connectors at both ends; at the submaster end, they should be plugged into a MONITOR/KEYBOARD/MOUSE port.

Panel Label	Connector	Description
CPU *N* (continued)		For each submaster you plan to connect, you must have an Expansion Cable; you must have an Adapter Cable for each CPU you plan to connect. See **Section 2.5**.
MONITOR/ KEYBOARD/ MOUSE	DB25 F	Connect the shared monitor, keyboard, and mouse to this port using an "MKM Adapter Cable." At the Switch end, this cable has a DB25 male connector; at the other ends, it has appropriate connectors to plug into your monitor, keyboard, and mouse cables. Only one MKM Adapter Cable is needed. See **Section 2.5**.
RS232	RJ-11 F	If you connect a more distant computer or terminal to this RS-232 serial port, you'll be able to send switching commands to the ServSwitch from a secondary location.
POWER	5-pin DIN F	Connect the ServSwitch's power-supply cord here. This is *not* a keyboard input. Power transformers are available for 110 VAC or 230 VAC. Both have center-tapped output of 17 VAC at 700mA.

NOTE

The 2- and 4-port models both share the same chassis, which has 4 CPU *N* connector slots. The 8-, 12-, and 16-port models both share a different chassis that has 16 of these slots. The extra connector slots in the chassis of the 2-, 8-, and 12-port models are left blank, but are protected by material mounted inside the chassis.

2.5 Cable Requirements

Many switches of this type have what seems like ten million connectors on their rear panels: one for each CPU's video cable, one for each keyboard cable, and a third for each mouse cable. The potential for tangling or mismatching cables is high.

By contrast, you can connect the ServSwitch to your CPUs with one "CPU Adapter Cable" for each CPU. This single cable reaches the CPU's video-output, keyboard, and mouse ports.

Likewise, to connect "submaster" (slave) Serv type switches, you need one "ServSwitch-to-ServSwitch Expansion Cable" for each subsidiary unit.

Lastly, you can connect the ServSwitch to the shared monitor, keyboard and mouse with a single "MKM Adapter Cable."

The exact variety or varieties of these cables that you'll need will depend on the equipment you are connecting for your application. Refer to **Appendix B** for the available types of these cables and the corresponding product codes. Also refer to **Chapter 1** or the first Caution notice on page 19 for information about maximum cabling distances.

NOTES

SVGA (over longer distances) and XGA video place special demands on cabling that the regular MKM Adapter Cables and CPU Adapter Cables typically cannot meet. For these applications, you should use coaxial cables that can carry video signals not only farther but also at higher resolutions. See Appendix B **and the first** Caution **notice on page 19.**

To carry true monochrome video, or to share a 9515, 9517, or 9518 monitor, you will need special cabling. Call Black Box for technical support; we can give you a quote on these types of cable.

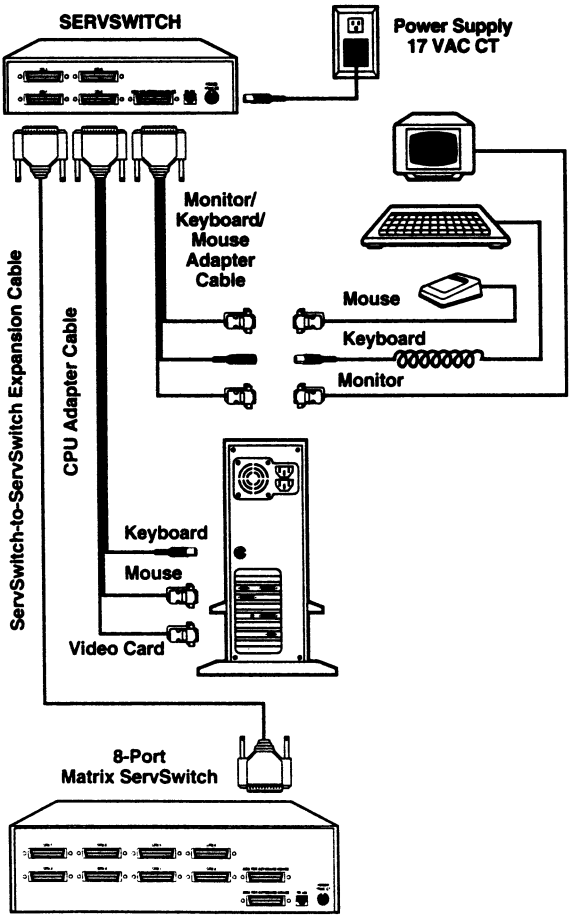
For systems in which some CPUs output EGA video and others output VGA, SVGA, or XGA, you would need regular VGA-type or coaxial SVGA/XGA-type CPU Adapter Cables for all CPUs, as well as an EGA-to-VGA adapter for each EGA computer. Call for a quote on EGA-to-VGA adapters.

3. Installation

3.1 Quick Setup Guide

Figure 3-1, below, shows a basic example of connecting a CPU, a submaster, a keyboard, a monitor, and a mouse to the ServSwitch unit. Connectors will vary depending on the types of equipment you are installing.

Fig. 3-1. Basic system setup for a 4-port (SW722) unit.



3.2 Installation Procedure

This section provides complete basic instructions for the hardware setup of a single ServSwitch. (For detailed instructions on the capabilities and concerns involved in installing a cascaded ServSwitch system, see **Section 3.3**; to make troubleshooting the installation easier, we recommend that you check the master and each submaster as it is installed, rather than installing all units, then checking the entire cascade.) For an illustrated example of the elements of a basic setup, see Figure 3-1 on the previous page.

3.2.1 Rackmounting (Optional)

If you want to mount the ServSwitch in a 19" rack, you will need a ServSwitch Rackmounting Kit (our product codes SW727 for the 2- and 4-port models, SW728 for the 8-, 12-, and 16-port models). The ServSwitch is pre-drilled to accept the Kit's rackmounting screws. If you want to mount the Switch in a 23" or 24" rack, call Black Box for a special quote on a 23" or 24" Kit.

3.2.2 Connecting the Monitor, Keyboard, and Mouse

A Monitor/Keyboard/Mouse (MKM) Adapter Cable connects your monitor, keyboard, and mouse to the ServSwitch. Because various styles of electrical connectors are used by different classes of equipment, we supply this cable in various styles to match (see **Appendix B**). This cable also comes in the different lengths supported by different applications (see **Section 4.1.3**, **Appendix B**, and the first Caution notice on the next page).

CAUTION!

Make sure that the monitor, keyboard, and mouse you plan to use can meet the demands of your application. See Section 4.1. **Also, note that the ServSwitch does *not* support dongles at the time of this writing.**

1. After you verify that the ServSwitch is turned OFF, plug the DB25 male connector of the MKM Adapter Cable into the port labeled MONITOR/KEYBOARD/MOUSE on the ServSwitch's rear panel.

2. Plug the cables from your shared monitor, keyboard, and mouse into the corresponding connectors on the other ends of the MKM Adapter Cable.

3.2.3 Connecting CPUs

CPU Adapter Cables run from the ServSwitch to the keyboard port, mouse port, and video-output port of each CPU you want to directly attach to it. Different types of this cable fit the connectors on different computers (see **Appendix B**). This cable also comes in the different lengths supported by different applications (see **Section 4.1.3**).

CAUTION!

Avoid routing cable near fluorescent lights, air-conditioning compressors, or machines that may create electrical noise. Total length of original Serv cable from the keyboard, monitor, and mouse to any given CPU should not exceed 25 ft. (7.6 m). For typical equipment and video resolutions, length of coaxial cable should not exceed 20 ft. (6.1 m) from a ServSwitch to any attached device (keyboard, monitor, mouse, CPU, or submaster). However, we do provide coaxial cable in lengths up to 100 ft. (30.5 m), because some CPUs can drive and receive keyboard and mouse signals at greater distances than others; consult with the manufacturers of your CPUs about this. To go even farther, you might want to use Station Extenders (see Appendix B**).**

1. Plug the DB25 male connector of the first CPU's CPU Adapter Cable into the lowest-numbered CPU port on the ServSwitch's rear panel that isn't going to be occupied by a submaster Serv type switch. Use consecutively higher-numbered ports for the rest of the CPUs. For example, if you planned to put three submasters and three CPUs on an 8-port master Switch, you would put the submasters on ports CPU 1 through CPU 3 (see **Section 3.2.4**), and you would plug the three CPUs into ports CPU 4 through CPU 6.

2. Plug the CPU Adapter Cable's video-, keyboard-, and mouse-port connectors into the corresponding ports on the CPU. The CPU should be OFF when you do this; the Switch will automatically adjust to the CPU's keyboard mode when you power up the CPU. Avoid plugging CPUs into the ServManager if they are already ON; if you accidentally do so, see **Section 4.3.7** to make sure the ServSwitch is set for the proper keyboard mode.)

CAUTION!

Do *not* attach docking stations for ThinkPad® or other portable computers, no matter what type or make, to the ServSwitch. At the time of this writing, the ServSwitch does not support docking stations; your ServSwitch system might not function properly if any are attached.

3.2.4 Connecting Submasters (Optional)

To connect a submaster ServSwitch, ServManager, Matrix ServSwitch, etc., to a master ServSwitch, run a ServSwitch-to-ServSwitch Expansion Cable (our product code EHN055 for original cable or EHN274 for [recommended] coaxial cable) from one of the master ServSwitch's CPU ports to (one of) the submaster's MONITOR/KEYBOARD/MOUSE port(s). Connect the first submaster to the ServSwitch's CPU 1 port and use consecutively higher-numbered ports (CPU 2, CPU 3, and so on) for the rest of the submasters. If you are connecting each of several submaster Matrix ServSwitches to two master ServSwitches (see **Section 3.3**), connect one master to each submaster's MONITOR/KEYBOARD/MOUSE A port and the other master to each submaster's MONITOR/KEYBOARD/MOUSE B port.

Before installing an advanced configuration, please call Black Box and discuss your application with a technician.

NOTE

Because regular ServSwitches don't have bus-mouse ports and can't carry the bus-mouse signal, they can't function adequately as masters for submaster ServSwitches BusM.

3.2.5 Powering Up the System

1. Making sure that the connected CPUs and any connected submasters are OFF (powered down), take the output cord of the ServSwitch's power supply and plug its 5-pin DIN male connector into the power jack on the rear panel of the Switch. Plug the power supply (115 VAC) or its input cord (230 VAC) into a working outlet.

2. Push the ON/OFF button on the front of the ServSwitch to power up the Switch.

3. Power up the connected CPUs and any connected submasters one by one, giving each one time to boot completely before turning ON the next one. When the CPUs are powered up after the ServSwitch, the Switch emulates all keyboard and mouse functions for automatic boot-up, although you might have to issue the Mode command ***Mn*** (see **Section 4.3.7**) to get proper keyboard communication.

4. Power up any CPUs connected to submasters one by one, giving each CPU time to boot completely before turning ON the next one.

3.2.6 Switching from the Keyboard

Your ServSwitch is now ready for operation using its default settings. To take full advantage of the Switch's features, refer to **Chapter 4**, which gives detailed information about each of the ServSwitch commands, describing each command's function and keystroke sequence. For your convenience, this information is summarized in **Section 4.2**. To begin switching immediately, however, just press and release your keyboard's left Control Key ([CTRL]), then—within the next two seconds—type in your desired port number with the regular number keys (*not* the numeric keypad). (This procedure is slightly more complicated if there are more than nine CPUs in your ServSwitch system; refer to **Section 4.3.1**.)

3.3 Cascading in ServSwitch Systems

In a normal cascaded ServSwitch system, the shared monitor(s), keyboard(s), and mouse (mice) are directly attached to one or more "master" Serv-Switches, while all the CPUs are indirectly attached through "submasters" (other ServSwitches, ServManagers, Matrix ServSwitches, etc.) that provide port expansion but may or may not perform any control functions of their own. When you cascade in this way, you can expand your system to include up to 256 ports (sixteen 16-port submasters on a 16-port master unit).

CAUTION!

If you use any ServManagers as submasters, do not attach any CPUs to them that are not IBM PC type. All of the CPUs attached to any submaster must use the same type of keyboard and mouse.

You can add submasters to your ServSwitch system as you need them. For each submaster you add to the system, you add as many ports as are on that submaster, minus the one port on each ServSwitch "above" it that's now occupied. Refer to Figure 3-2 on the next page:

- Connecting one 4-port submaster ServSwitch to a 4-port master ServSwitch (top view) gives you a total of 7 ports: 4 on the submaster and another 3 (4 minus the one that the submaster is attached to) on the master.
- Connecting four 4-port submaster ServSwitches to a 4-port master ServSwitch (bottom view) gives you a total of 16 ports, 4 on each submaster. (All 4 ports on the master are now occupied.)

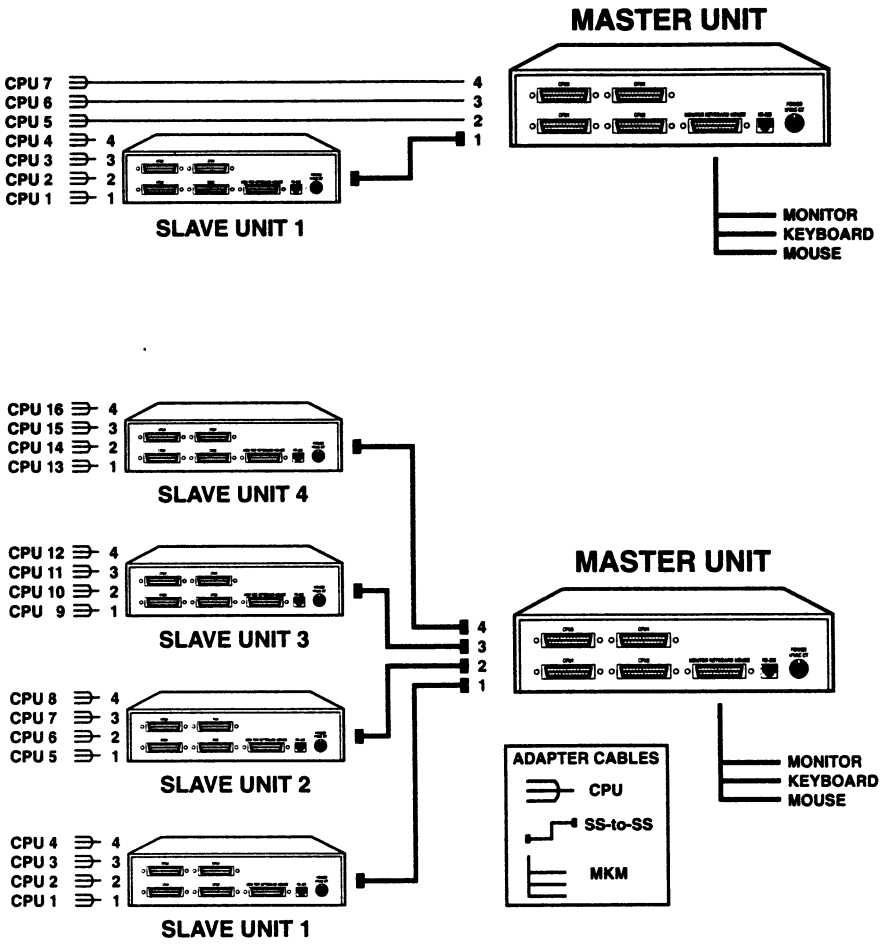


Fig. 3-2. Cascading 4-port units.

NOTE

You can mix 2- and 4-port units in a cascade, and you can mix 8-, 12-, and 16-port units in a cascade, but do not put 8-, 12-, or 16-port units in the same cascade with 2- or 4-port units. In particular, if your master is a 2- or 4-port unit, use *only* other 2- or 4-port ServSwitches as submasters.

When you use Matrix ServSwitches as submasters, the setup is a little more complicated. Refer to Figure 3-3 on the next page: Connecting two 4-port Matrix ServSwitch submasters to an 8-port ServSwitch master gives you a total of 14 ports on that master. (Each of the masters in Figure 3-3 can access 14 ports, but while both masters share CPUs 1 through 8, CPUs 9 through 14 on either master can only be accessed by the monitors, keyboards, and mice on that master.) Adding a third 4-port submaster unit would give you a total of 17 ports, and so on.

3.3.1 Cable Requirements for Expansion

To connect submaster units to a ServSwitch, you'll need one ServSwitch-to-ServSwitch Expansion Cable for each submaster unit. You will also need a CPU Adapter Cable for each CPU you will be connecting to the submaster's CPU ports. (Remember that one MKM Adapter Cable is required to connect the master unit to your keyboard, monitor, and mouse.) See **Sections 3.2.2** through **3.2.4**.

3.3.2 Installing a Cascade

Laying out your ServSwitch system prior to installation will make the installation process go more smoothly. It will also help you to keep the port-selection numbers you'll use in keyboard commands in a rational sequence. Figure 3-2 on the previous page illustrates the proper layout and numbering of your submasters and CPUs.

Keep these restrictions in mind when you design your ServSwitch system:

- If you use original Serv cables, the total distance from any CPU to any monitor, keyboard, and mouse should not exceed 25 ft. (7.6 m). Depending on your application, this distance might be less; see **Section 4.1.3**.
- If you use coaxial cables, the maximum recommended distance from the ServSwitch to the attached monitor, keyboard, and mouse is 20 ft. (6.1 m) with typical monitors and video resolutions, but see the first Caution notice on page 19. For typical CPUs, this is also the maximum recommended distance from any submaster to any attached CPU. Depending on your application, this distance might vary; see **Section 4.1.3**.

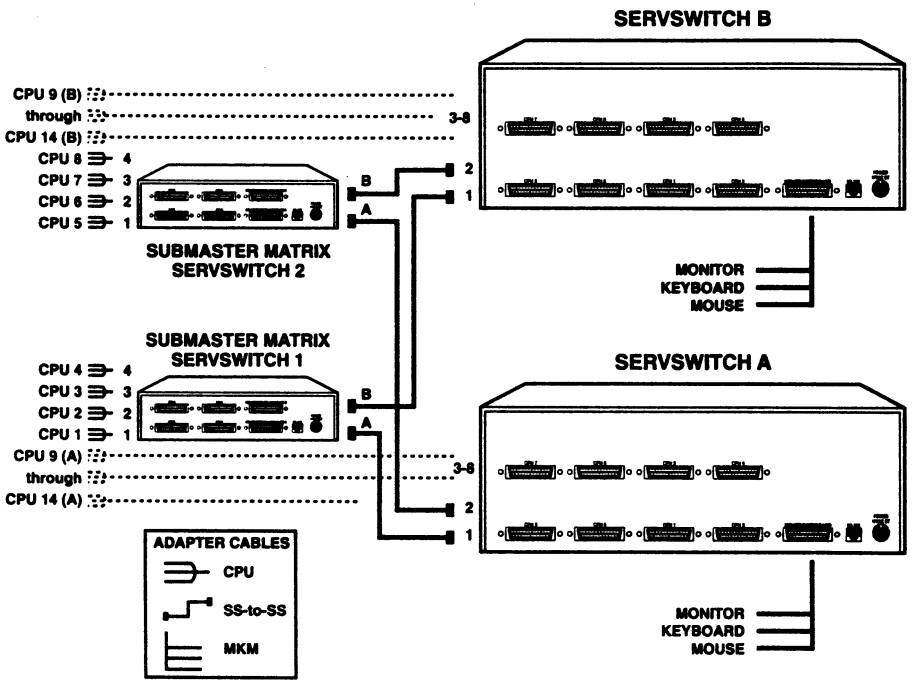


Fig. 3-3. Cascading 4-port Matrix ServSwitch submasters with 4-port ServSwitch masters.

- The distance between any ServSwitch and any submaster plugged into one of its ports must not exceed 20 ft. (6.1 m) of original Serv cable. For coaxial cable, the maximum recommended distance is 20 ft. (6.1 m), but see the first Caution notice on page 19.

- The total number of CPU ports accessible by any ServSwitch master unit must not exceed 256.

- *2- and 4-port units:* You must not start a new "layer" until you fill an existing one. In this context, a "layer" is a set of masters or submasters that have the same number of other Serv units between them and the shared keyboard, mouse, and monitor. For example, assuming there is one master unit directly attached to shared equipment, it constitutes the

first layer: It is the only Serv unit in the cascade with no other Serv units between it and the shared equipment. Any submasters on that ServSwitch's CPU ports are the second layer: One Serv unit comes between them and the shared equipment. Any submasters on the CPU ports of second-layer submasters constitute the third layer, and so on. To illustrate this restriction, let's say you've installed a four-port submaster on a four-port master ServSwitch and you have a four-port submaster yet to install. You must install the second submaster on the master's CPU 2 port, not on the first submaster's CPU 1 port. A third submaster would have to go on the master's CPU 3 port, a fourth on the CPU 4 port. Only the fifth four-port submaster can be legitimately installed on the first submaster's CPU 1 port.

CAUTION!

You may cascade 2- or 4-port ServSwitches to as many as four layers (that is, one master and three layers of submasters). Do *not* cascade 8-, 12-, or 16-port ServSwitches—or any other Serv type switch, no matter how many ports it has—to more than two layers (that is, one or two masters and one layer of submasters). If it becomes necessary to attach more CPUs after "maxing out" on submasters, you must upgrade your master or submasters.

- If you are attaching more than one submaster to an 8-, 12-, or 16-port master ServSwitch, we strongly recommend that all of the submasters have the same number of ports. This is because the larger ServSwitches' Width command/parameter—the value they use to calculate how many ports each attached submaster has (see **Section 4.3.9**)—is *global* rather than *port-specific*. In other words, a master 8-, 12-, or 16-port ServSwitch always expects *every* submaster attached to it to have the number of ports specified in Width.

  For example, if you attach one 8-port submaster and one 12-port submaster to a master ServSwitch, then set Width to 8 (and Units to 2 and Max Ports to 20—see **Sections 4.3.8** and **4.3.10**), you will be unable to scan or switch to the upper 4 ports on the 12-port submaster—the ServSwitch has no way of knowing they are even there. On the other hand, if you set Width to 12 (and Units to 2 and Max Ports to 24), your system will include 4 "phantom" ports (nonexistent ports 9 through 12 on the 8-port submaster) that the master will think are there and will try to scan or switch to, displaying a blank screen.

When you're ready to begin hooking up the actual units, follow these steps:

1. If this hasn't already been done, connect the monitor(s), keyboard(s), and mouse (mice) to the MONITOR/KEYBOARD/MOUSE port of your master device(s) as outlined in **Section 3.2.2**.

2. If the number of submasters you're installing is less than or equal to the number of CPU ports on your master unit, use ServSwitch-to-ServSwitch Expansion Cables to connect all the submaster units to the master unit's CPU ports, beginning with the port labeled CPU 1 and continuing with CPU 2, CPU 3, etc.

   2- and 4-port models only: If you're installing more submasters than there are CPU ports on the master unit (that is, you're cascading 2- or 4-port ServSwitches to more than two "layers"), connect submasters to all of the master's CPU ports, then connect lower layers of submasters as if the next-higher layer were one giant master unit. For example, referring to the lower half of Figure 3-2, if you were adding more submasters to form part or all of a third layer, you would plug a submaster into the port identified with CPU 1 (port "CPU 1" of submaster unit 1), then another into CPU 2's port (port "CPU 2" of submaster unit 1), and so on, until you plugged the 16th third-layer submaster into CPU 16's port (port "CPU 4" of submaster unit 4). If all the submasters on your complete third layer were two-port models, this would give you a total of 32 available CPU ports; if all the third-layer submasters had four ports, you would have 64 total CPU ports available. We don't recommend expanding to a fourth layer, but if you did, you would begin as you started the third layer, by plugging a submaster into the port now identified with CPU 1, and the process would repeat itself.

NOTE

To avoid any further port-numbering headaches, we recommend that you (a) attach submasters in sequence (to CPU 1, CPU 2, etc.) and (b) avoid installing submasters with different numbers of CPU ports on the same layer (if possible, every Serv unit in your cascade should have the same number of ports).

3. Using CPU Adapter Cables, attach your computers to available CPU ports: the first computer into the port identified as CPU 1, CPU #2 into its port, etc. (**Section 3.2.3**). The computers should all be OFF; do *not* turn them ON yet.

4. Attach the power supplies to the master(s) and to the submasters. Plug in the power supplies, but do *not* turn the master(s) or submasters ON.

5. Turn ON all of the submaster units, then the master unit(s).

6. Turn ON the computer identified as CPU 1. Wait until the boot process is complete, then turn ON CPU 2, wait until it boots, turn ON CPU 3, etc., until all of your computers are powered up.

NOTE

In the next three steps, "[CTRL]" represents pressing and releasing the left Control Key, "[ENTER]" represents pressing and releasing the Enter or Return Key, and "xxx" represents a number consisting of one to three ASCII digits.

7. Set each master's Maximum Ports value (as well as the Units and Width values on 8-, 12-, and 16-port models) so that it can scan correctly and properly control the interplay of the submaster units. You can do this with these keyboard commands (see **Sections 4.3.8** through **4.3.10**):

   - *8-, 12-, and 16-port models only:* The Units command, to tell the master how many submasters there are: [CTRL] Uxxx [ENTER]
   - *8-, 12-, and 16-port models only:* The Width command, to tell the master how many CPU ports are on each submaster: [CTRL] Wxxx [ENTER]
   - The "Maximum Ports" command, to tell the master the total number of ports available in the system: [CTRL] Pxxx [ENTER]

8. You might need to set any or all of each master's remaining configuration parameters, especially the keyboard mode for some of your ports (see **Sections 4.3.4** through **4.3.7** and **4.3.11**).

9. To save the "Maximum Ports" and (for 8-, 12-, and 16-port masters) "Units" and "Width" numbers you entered to the master unit's nonvolatile memory, along with any of the other configuration settings you might have changed, enter the "Keep Settings" command, [CTRL] K [ENTER].

10. Your cascaded ServSwitch system should now be ready for operation.

4. Operation

The first part of this chapter, **Section 4.1**, gives you some guidelines that you should follow to make sure your ServSwitch works properly with your equipment.

Section 4.2 summarizes the ServSwitch's keyboard commands, and **Section 4.3** describes these commands in detail.

Section 4.4 outlines how you can select ports from an optional computer or terminal connected to the ServSwitch's RS-232 port.

NOTES

To start any ServSwitch keyboard command, you must press and release the left Control Key ([CTRL]). Pressing and releasing [CTRL] cues the ServSwitch to expect command characters from the keyboard. You then have two seconds in which to start entering a valid command. If no command is begun within two seconds or if an invalid command is entered, the ServSwitch aborts the command.

When entering commands that contain numbers or math symbols, use only the numeral keys located at the top of your alphanumeric keyboard. Numbers and symbols entered from the numeric keypad to the right will not be recognized as valid.

4.1 Guidelines for Using the ServSwitch with Your Equipment

4.1.1 CPUs

Use only IBM AT or PS/2 or 100% compatible machines. The ServSwitch does not support IBM PC/XT™ or compatible machines.

4.1.2 Mouse and Keyboard

When you power up your ServSwitch system, make sure that your CPUs, mouse (mice), and keyboard(s) are properly cabled to the ServSwitch (or to the appropriate master or submaster unit). When you boot up your CPUs, the master(s) and/or submasters to which they are connected should already be ON. Unless it's absolutely necessary, don't disconnect and reconnect a mouse or keyboard from a ServSwitch while the Switch is ON; if you *have* to do this, issue the Reset command ([CTRL] R—see **Section 4.3.10**) after you reconnect the mouse or keyboard.

The mouse must be a 2-button PS/2 or RS-232 type mouse by Microsoft® or Logitech™. In your system, do not mix CPUs that use RS-232 mice with CPUs that use PS/2 mice.

Use only the generic Microsoft mouse driver MOUSE.COM, version 4.0 at least and preferably version 9.01 or higher. If you're running Windows®, this driver must be loaded in Windows as well as in the base operating system. Do not, on any of your switched CPUs, run any programs or TSRs, or enter any DOS commands, that change the settings of the mouse port after the driver has been loaded.

Although the ServSwitch resists minor transient surges that can be caused by rapidly cycling power, certain keyboards are sensitive to such transients. Since your shared keyboard's power is provided by the ServSwitch, wait at least three seconds after powering down the Switch before powering it up again, or the keyboard might not reset correctly.

The ServSwitch is designed to support IBM PC compatible 101-key keyboards and IBM PC keyboard-scan modes 1, 2, and 3, and it's designed to work with CPUs/keyboards that use 5-pin DIN or 6-pin mini-DIN keyboard connectors. The ServSwitch might not work properly with keyboards that have proprietary keys or connectors or use proprietary keyboard-scan modes.

4.1.3 MONITOR

NOTE

No keyboard/video switch can provide perfect video. You will see at least a little fuzziness on your monitor no matter how close to ideal your ServSwitch system is.

The ServSwitch is designed to support standard VGA video, including VGA monochrome and VGA "page white." It does not support PCs that use proprietary versions of VGA that depart from the original specifications. Consult your PC's manual, and if that doesn't tell you whether or not the PC uses standard VGA, consult with the PC's or the video card's manufacturer.

The ServSwitch is also designed to support CGA video and standard color or monochrome EGA video. It will support SVGA, although it doesn't handle higher resolutions or longer distances very well without coaxial cabling (see the next two pages). With coaxial cables, it will also support XGA. Lastly, it will also support true monochrome video, but this requires special cabling; call Black Box for technical support.

NOTE

If you are running a mixed VGA-and-EGA system, you will need VGA cables and EGA-to-VGA adapters for all your CPUs. You will also need a multisync monitor capable of synchronizing to a horizontal scan rate of 15.5 to 35 KHz. These can be hard to find. One set of models that fit the bill is older NEC Multisync II monitors.

The ServSwitch will support SVGA (Super VGA) video, but with original Serv cables the video quality will decrease markedly at higher resolutions and distances. Table 4-1, below, illustrates this. The distances in the table are total cable lengths measured from the CPU to the monitor. The table assumes that one ServSwitch is between the CPU and monitor; in a cascaded application with a ServSwitch and one or more submasters between the CPU and monitor, video quality will always be lower.

Table 4-1. Video Quality vs. Distance for Original Serv Cables

Resolution \ Distance	5' (1.5 m)	10' (3 m)	15' (4.6 m)	20' (6.1 m)	25' (7.6 m)
640 x 480	3	3	3	3	3
800 x 600 noninterlaced	3	3	3	2	2
1024 x 768 interlaced	3	3	2	2	2
1024 x 768 noninterlaced	3	2	2	2	2
1280 x 1024 interlaced	2	1	1	1	1
1280 x 1024 noninterlaced	2	1	1	1	1

Quality **3** = Near perfect; screen defects are not conspicuous

Quality **2** = Good to very good; images are clear; there are small reflections around text lettering depending on the color; screen defects are sometimes conspicuous

Quality **1** = Fair to poor as distance increases; images run from slightly fuzzy to badly smeared; text runs from fuzzy but readable to completely washed out

By contrast, coaxial cables do much better at maintaining video quality, as shown in Table 4-2 below. (For the meaning of quality numbers **3**, **2**, and **1**, see the bottom of page 31.) As before, the distances in the table are total cable lengths measured from the CPU to the monitor. Also as before, the table assumes a single ServSwitch is between the CPU and monitor; if there is a submaster as well, video quality will always be lower.

Table 4-2. Video Quality vs. Distance for Coaxial Cables

Resolution \ Distance	10 ft. (3 m)	20 ft. (6.1 m)	30 ft. (9.1 m)	50 ft. (15.2 m)	75 ft. (22.9 m)	100 ft. (30.5 m)	150 ft. (45.7 m)	200 ft. (61 m)
640 x 480	3	3	3	3	3	3	2	2
800 x 600 noninterl.	3	3	3	3	3	3	2	2
1024 x 768 interlaced	3	3	3	3	3	3	2	2
1024 x 768 noninterl.	3	3	3	3	2	2	2	1
1280 x 1024 interlaced	3	2	2	2	2	1	1	1
1280 x 1024 noninterl.	3	2	2	1	1	1	1	1

CAUTION!

Some CPUs can't drive or receive keyboard and mouse signals across longer runs of coaxial cable. Consult with the manufacturers of your CPUs before installing this cable in lengths greater than 20 ft. (6.1 m).

For CPU-to-monitor distances over 200 feet (61 m), Station Extenders might be required. Call Black Box for technical support.

One last note of caution about video: The IBM 9515, 9517, and 9518 monitors that come with some PS/2 systems are not normal VGA monitors and require special cabling in order for video to be correctly sized and synchronized. Call Black Box for technical support if you want to use one of these monitors.

4.2 Keyboard-Command Summary

Table 4-3 below and on the next two pages summarizes the commands that can be sent to the ServSwitch. To enter any command at the shared keyboard, first press and release the left Control Key, represented by "[CTRL]." (This cues the ServSwitch to look for commands from that keyboard.) Then enter the command followed by any arguments you wish to specify (the port number, for example).

Letter commands are not case-sensitive; they are all shown in uppercase for clarity only.

When you enter numeric commands or arguments, use only the numbered keys at the top of your alphanumeric keyboard. Numbers entered from the numeric keypad to the right will not be recognized as valid commands.

All of these commands have a two-second timeout between characters. This means that if you begin entering a command, but you stop for more than two seconds at any time before you type the final character, the command is aborted and the ServSwitch returns to normal operation. This keeps the ServSwitch from getting stuck waiting for you to finish the command.

The [CTRL] character is always passed through to the CPU. The command characters and operands, however, are absorbed by the ServSwitch and are not sent to the CPU.

Table 4-3. The ServSwitch's Keyboard Commands

Command	Keystroke Sequence	Description
Select Port	[CTRL] *xxx* (*xxx* = a 1- to 3-digit port number)	Connects your shared monitor, keyboard, and mouse to the specified port.
Switch to the Next Port	[CTRL] +	Switches to the next port in sequence. (You can also access the next port by pressing the NEXT button on the ServSwitch's front panel.)
Switch to the Previous Port	[CTRL] -	Switches to the previous port in sequence.
Scan ON	[CTRL] S	Turns Scan mode ON, causing the ServSwitch to start scanning sequentially from the current port through the remaining ports and then begin again at Port 1.

Table 4-3. The ServSwitch's Keyboard Commands (cont'd.)

Command	Keystroke Sequence	Description
Scan OFF	[CTRL] X	Turns Scan mode OFF (the port being scanned at the time the command is entered is given access to the shared monitor, keyboard, and mouse). Note: Scan can also be stopped by entering a Select Port command.
Keep Settings	[CTRL] K	Enter this command after you enter any of the following seven commands (it saves new settings to nonvolatile memory):
Set Scan-Delay Time	[CTRL] T*xx* [ENTER] (*xx* = delay in seconds from 1 to 15)	Sets the time, in seconds, that the ServSwitch will pause at each port when scanning.
Set Screen Saver's Delay Time	[CTRL] V*xxx* [ENTER] (*xxx* = delay in seconds)	Sets the time of inactivity, in seconds, after which the ServSwitch will blank the shared monitor's screen. (The monitor is reactivated when the PS/2 mouse is moved or any key on the shared keyboard is pressed.)
Set Keyboard Mode	(Select port, then:) [CTRL] M*x* [ENTER] (*x* = 1, 2, or 3)	Tells the ServSwitch the keyboard mode of the CPU on the given port. Issue this command to force a port to operate in a given mode, or before any time you attach an already-booted CPU to the ServSwitch.
Set Maximum Number of Ports	[CTRL] P*xxx* [ENTER] (*xxx* = a 1- to 3-digit number from 2 to 256)	Tells the ServSwitch the total number of ports to which devices are (or will be) connected. Issue this command when you're not using all of the ports on a unit with 4 or more ports, or when you cascade units.
Set Width of Submasters*	[CTRL] W*xxx* [ENTER] (*xxx* = a 1- to 3-digit number from 2 to 255)	Tells the ServSwitch how wide all of the attached submasters are (that is, how many CPU ports each submaster has).
Set Units*	[CTRL] U*xxx* [ENTER] (*xxx* = a 1- to 3-digit number from 0 to 255)	Tells the ServSwitch how many submasters are attached to it.
Set Keyboard Typematic	[CTRL] A*xxx* [ENTER] (*xxx* = a decimal value from 0 to 127)	Sets the keyboard typematic (automatic key-repeat) function of the currently selected CPU. This command works only with CPUs that have standard 101-key keyboards and CMOS that allows users to program the typematic function.

*Available on 8-, 12-, and 16-port (SW723 through SW725) models only.

Command	Keystroke Sequence	Description
Reset	[CTRL] R	Resets and enables the keyboard and mouse; also refreshes the monitor. Issue this command to correct your keyboard or mouse if one of them malfunctions or gets stuck.
Send Null Byte	[CTRL] N	Causes the ServSwitch to send a null byte to the CPU's PS/2 mouse port. Issue this command to correct the current CPU if it gets "out of sync" with the PS/2 mouse (see Section 4.3.13).
Identify ROM	[CTRL] I	Causes the ServSwitch to report the version of ROM it is using. Issue this command if you are asked to do so by a technical-support person.

4.3 The Commands in Detail

4.3.1 Selecting a Port From the Shared Keyboard

To select a port from your keyboard, press and release your keyboard's left Control Key ([CTRL]), then type in the port number:

If "Maximum Ports" is set to 1 to 9: The ServSwitch will immediately switch to the desired port when you press the one-digit number's numeral key.

If "Maximum Ports" is set to 10 to 99: The ServSwitch will immediately switch to the desired port when you press the two-digit number's second numeral key. For single-digit ports, you can enter the number by including a leading zero ("01" for port 1) or by pressing [ENTER] after you press the single numeral key. If you press the key of only one digit, and do not follow it with [ENTER], the ServSwitch will wait two seconds for you to press [ENTER] or another numeral key; then, if no key is pressed, it will switch immediately to the single-digit port.

If "Maximum Ports" is set to 100 to 256: The ServSwitch will immediately switch to the desired port when you press the three-digit number's third numeral key. For single- and double-digit ports, you can enter the number by including one or two leading zeros ("001" for port 1 or "027" for port 27) or by pressing [ENTER] after you press the single or second numeral key. As noted above, the ServSwitch will wait two seconds for you to enter another digit, then will switch to the partially entered port number.

4.3.2 Switching to the Next or Previous Port

From the keyboard you can go forward or backward through the ServSwitch's ports by selecting either the next or the previous port respectively. To switch to the next port, press and release the left Control Key ([CTRL]), then press the plus key (the key at the top of the keyboard marked with [=] and [+]). To switch to the previous port, press and release [CTRL], then press the minus key (the key at the top of the keyboard marked with [-] and [_]). The command is not case-sensitive. Do *not* use the [+] and [-] keys on the keyboard's numeric pad; the ServSwitch doesn't recognize these.

You can also select the next port manually from the ServSwitch's front panel by pushing the button labeled NEXT. Each time you press the button, the next port in sequence is selected. You cannot select the previous port from the Switch's front panel without cycling through all the ports.

4.3.3 Scan Mode

To enable scanning (switching from CPU to CPU in a continuous rotation) from the keyboard, press and release the left Control Key ([CTRL]), then press [S]. The ServSwitch will begin scanning sequentially from its currently selected port through the higher-numbered ports, then begin again at CPU Port 1. As it scans, it delays 1 to 15 seconds at each port. (This "Scan-Delay Time" is user-selectable; see **Section 4.3.5**.) To stop scanning, press and release [CTRL], then press [X]. You can also disable scanning by entering a Select Port command. ServSwitch letter commands are not case-sensitive: You can enter upper- or lower-case letters.

To enable scanning from the front panel of a single or master ServSwitch, use the SCAN button (see **Section 2.3**).

4.3.4 Keep Settings

The Keep Settings command saves the current state of the ServSwitch's keyboard-selectable settings to nonvolatile memory (NVRAM), where they become the new default (loaded at power-up) settings. To enter the command, press and release the left Control Key, then type [K]. The seven keyboard-selectable settings are described in the next seven sections.

4.3.5 Set Scan-Delay Time

Issue the Set Scan-Delay Time command to set the time, in seconds, that the ServSwitch will pause at each of the CPU ports when it's scanning them. The factory-default setting is 5 seconds. To set a different delay time, press and release the left Control Key, type [T] followed by the new delay time in seconds (1 to 15), and press [ENTER]. Enter the Keep Settings command after you enter this.

If you issue this command with an argument of zero, the ServSwitch will set the scan-delay time to the default value most recently saved in NVRAM.

4.3.6 Set Screen-Saver Interval

This feature reduces the wear on your shared screen and provides security for your system by blanking the screen when there has been no keyboard activity for a specified length of time. To set the screen-saver interval, press and release the left Control Key, type [V] followed by the interval time in seconds (1 to 999, or 0 to disable the screen saver), and press [ENTER]. Enter the Keep Settings command after you enter this command.

To reactivate the screen when it's been blanked, press any key on the keyboard or—if your mouse is PS/2 type—move the mouse. The default setting of this option is 0 (screen saver disabled).

NOTE

When the ServSwitch is in the Screen-Saver state, all of its SELECT or CURRENT PORT LEDs will be OFF.

4.3.7 Set Keyboard Mode

Keyboard "modes" are electrical signaling protocols that determine how a powered CPU and keyboard interact. A CPU and keyboard must use the same mode in order to work with each other. Of the three standard keyboard modes currently in use, mode number 2 is the one used by the vast majority of CPUs. It is also the default state of all 101-key and PS/2 keyboards. Mode 1 is used primarily by certain PS/2 CPUs. Mode 3 is used by certain specialized servers.

The ServSwitch supports all three of these modes: As it receives signals from the keyboard, it sends them to the currently selected CPU by emulating a keyboard of the appropriate mode for that CPU; as it receives signals for the keyboard from the currently selected or scanned CPU, it sends them to the keyboard by emulating a CPU of the appropriate mode.

Most CPUs that use keyboard mode 1 or 3 send a "mode command" to the keyboard at power-up, to put the keyboard in the proper mode. ServSwitches (even submaster units) can use these commands to automatically detect each such CPU's keyboard mode when you turn on the CPU *after* it has been cabled to the Switch.

When they detect the mode, 2- and 4-port units automatically save it to NVRAM, so that if they are turned OFF they will remember it when they are turned ON again. 8-, 12-, and 16-port units don't perform this automatic save; unless you send them a Keep Settings command, they will forget the modes they have detected when they are turned OFF, then default to each port's most recently saved setting when they're turned ON again.

The ServSwitch can't detect the CPU's keyboard mode if your CPU doesn't send "mode commands" (most CPUs that use mode 2 fall into this category) or the CPU is already ON when you connect it to the ServSwitch (it shouldn't be). In these situations, the ServSwitch tries to use the keyboard-mode setting stored in its nonvolatile memory for that port. The factory-default is mode 2 for all ports. Send the Set Keyboard Mode command to change the keyboard mode for a port if:

- the CPU on that port uses mode 1 or 3,
- it uses mode 2, but the default setting of the port you want to connect it to has been changed, or
- you don't know which mode the CPU uses or the port is set for, but the keyboard's behavior makes you suspect that the port's setting is wrong.

To set the keyboard mode of the currently selected port on a single or master ServSwitch, press and release the left Control Key, type [M], and press the numeral key of the mode number ([1], [2], or [3]). After you enter this command, enter the Keep Settings command to save the mode setting in NVRAM, so that the new setting becomes the default value (preserved during power-down and reloaded at power-up).

Before you can set the keyboard mode of the currently selected port on a submaster ServSwitch, you have to isolate it from the rest of the system. (Note that this step might be unnecessary; the Switch should be able to automatically detect the keyboard mode when you turn ON CPUs that use mode 1 or 3, and mode 2—used by most PCs—is the ServSwitch's default keyboard mode.) First disconnect the submaster from the master or

submaster "above" it, plug a keyboard into its MONITOR/KEYBOARD/ MOUSE port (this will require an MKM cable), make sure the SCAN button is in the "out" position, and select the port as if the ServSwitch were a single unit. Then issue the Set Keyboard Mode and Keep Settings commands as described in the previous paragraph. Unplug the keyboard and reconnect the submaster to the Switch "above" it. The port's keyboard mode should now be properly configured.

If most or all of the CPUs you'll be connecting to your ServSwitch system use a keyboard mode other than 2, you might want to change the defaults of their Switch ports at installation time. This is because when power outages occur, the Switch ports will return to their default keyboard mode when the power comes back on.

4.3.8 Set Maximum Ports

Use this command to tell a ServSwitch the total number of ports in its system (on that ServSwitch and all attached submasters) to which devices are or will be coonnected. This allows the scan function to cycle correctly with CPUs connected to more or fewer ports than the factory default for this option, which (except for the 2-port model) is the total number of ports on the ServSwitch ("4" for a 4-port unit, "8" for an 8-port, etc.). (The factory-default Maximum Ports for 2-port units is "4.") Although this command is used primarily for cascading, it can also be used to enable only some of the ports of a single ServSwitch with 4 or more ports.

To issue the Set Maximum Ports command to a single or master ServSwitch (*not* to any submasters), press and release the left Control Key, type [P] followed by the total number of ports accessible to that Switch (from 1 to 3 digits), and press [ENTER]. To save the new setting, issue the Keep Settings command after you issue this command.

Maximum Ports can be set to any value from 2 to 256. We don't recommend attaching submasters with different numbers of ports to the same ServSwitch; if you do, you might have to count ports that do not actually exist (see **Section 3.3.2**). Also note that if you are sharing Matrix ServSwitch submasters between two regular ServSwitch masters in your system, the Maximum Ports value might have to be set differently for each master.

4.3.9 Set Width of Submasters (8-, 12-, and 16-Port Models Only)

Use this command to tell an 8-, 12-, or 16-port ServSwitch master how "wide" your submasters are (that is, how many ports each of your submasters has). If your submasters are all 4-port models, set the Width to 4; if they are all 8-port models, set the Width to 8; and so on.

Because initial configuration and reconfiguration would be complex and time-consuming otherwise, Width is an all-or-nothing proposition for the ServSwitch: One Width value is used for every port. Because this is true, we strongly recommend that all submasters you attach to a master ServSwitch be the same size. If you must attach different-sized submasters, please recognize that you will probably either be unable to use some ports or will have to account for nonexistent ports when you calculate port numbers and when you scan. See **Section 3.3.2**.

Figure 4-1 on the next page is an illustration of why ServSwitches need to know this value. Without a number for Width—even assuming that Units is set correctly to 4—if you were to select CPU 7 on either ServSwitch, they would not know whether CPU 7 was attached to the submaster on port 4, the one on port 2, or (though an example of this isn't shown) on port 1. With Width, the ServSwitch knows to switch to port 4 and send the "switch to port 1" command if Width is 2, or to switch to port 2 and send the "switch to port 3" command if Width is 4.

The default setting for Width is 16. To issue the Set Width of Submasters command for a larger ServSwitch (which you may do at any time), press and release the left Control Key, type [W] followed by the number of ports on the attached submasters (from 1 to 3 digits), and press [ENTER]. Enter the Keep Settings command after you enter this command. Width can be set to any value from 2 to 255, but Width values higher than 16 (allowed in order to support future expansion capabilities) might cause the ServSwitch to behave unpredictably.

NOTE

2- and 4-port master ServSwitches autosense submasters, so they don't require the Width command.

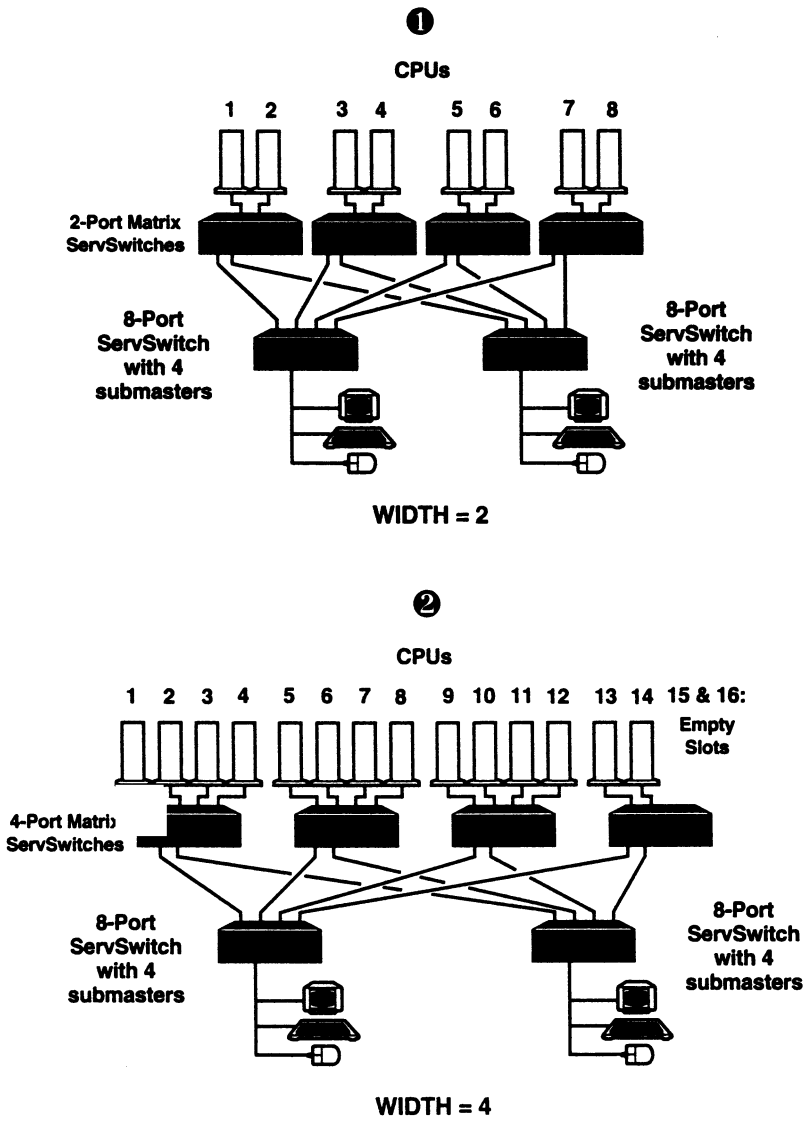


Fig. 4-1. Alternative configurations which the ServSwitch uses Width to help resolve.

4.3.10 Set Units (8-, 12-, and 16-Port Models Only)

Use this command to tell an 8-, 12-, or 16-port ServSwitch how many submasters (as opposed to CPUs) are directly attached to it. It doesn't matter what kind of Serv device the submaster is. For example, if you were to take an 8-port ServSwitch and directly attach three other ServSwitches, a Matrix ServSwitch, a ServManager, and two CPUs, the Matrix ServSwitch would have five submasters on it, so you would set Units to 5.

CAUTION!

We strongly recommend that you do not attach submasters of different types to a master ServSwitch. If you must do so, make sure that all of the CPUs attached to each such submaster use the same type of keyboard and mouse input.

Larger ServSwitches use the Units value to find CPU ports. If you select a CPU that is directly attached to the ServSwitch, the ServSwitch can simply switch to that CPU port. However, if you select a CPU attached to a submaster, the ServSwitch has to switch to the submaster's port and issue switching commands to the submaster. The Units setting is the only way it knows where, for example, CPU 18 is, and how to go about accessing that port.

Figure 4-2 on the next page shows a typical pair of alternatives that the ServSwitch can't resolve properly unless Units is set correctly. The ServSwitch in the diagram can't tell merely from its hardware connections how many submasters it is attached to. Without a number for Units—even assuming that Width is set correctly to 4—if you were to select CPU 7 on that ServSwitch, it would not know whether CPU 7 was attached to a submaster on port 2 or directly attached on port 4. With Units, the ServSwitch knows to switch to port 4 if Units is 1 or to switch to port 2 and send the "switch to port 3" command if Units is 2.

The default value for Units is 0. However, if Maximum Ports (see **Section 4.3.8**) is set to a number higher than the current Units setting can support, the ServSwitch automatically recomputes Units. It divides Maximum Ports by the current Width setting, uses the dividend as Units, and figures the remainder are directly attached CPUs. For example, suppose you have an 8-port ServSwitch whose Width setting is 16 and whose Units setting is zero. If you do not set Units differently before setting Maximum Ports to 52, the ServSwitch will realize that it can't support 52 ports unless it has submasters, and will perform this calculation: 52 (Maximum Ports) divided by 16 (Width) is 3, with a remainder of 4. The

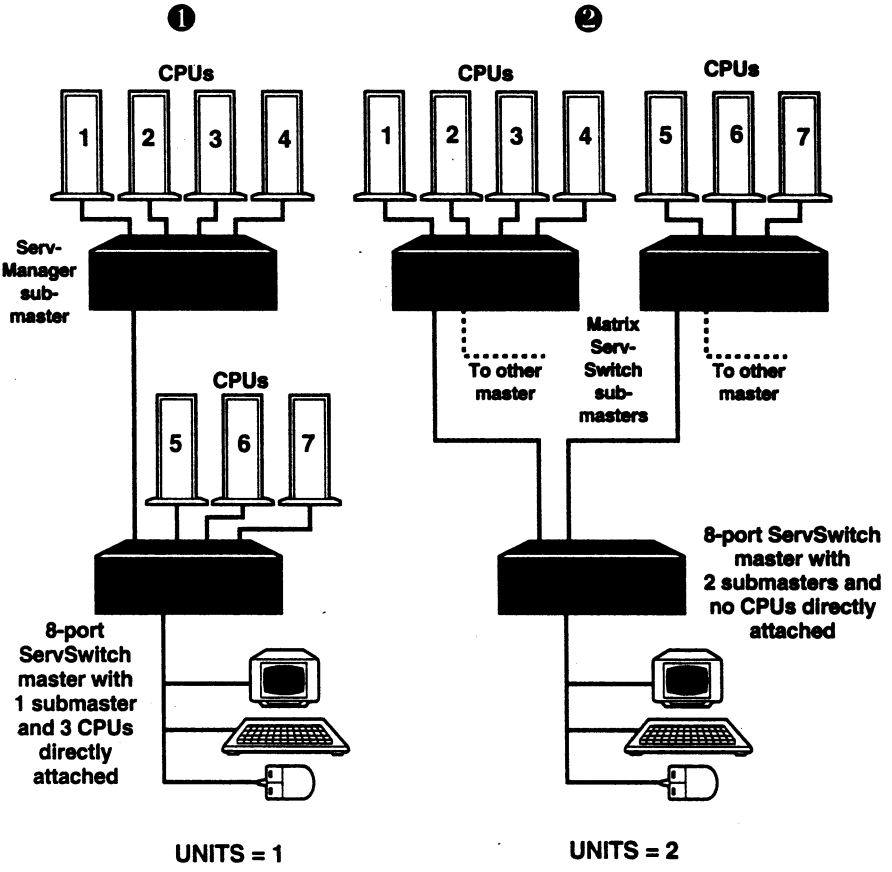


Fig. 4-2. Alternative configurations which the ServSwitch needs Units to resolve.

ServSwitch therefore sets Units to 3; it assumes that there are three 16-port submasters on ports 1 through 3, and that there are 4 CPUs on ports 4 through 7.

To set Units for a larger ServSwitch (which you may do at any time), press and release the left Control Key, type [U] followed by the number of submasters (from 1 to 3 digits), and press [ENTER]. Enter the Keep Settings command after you enter this command. Units can be set to any value from 0 to 255, but Units values higher than the number of ports on your ServSwitch (allowed in order to support future expansion capabilities) might cause the ServSwitch to behave unpredictably.

Please note that if you are sharing Matrix ServSwitch submasters between two ServSwitch masters in your system, and especially if you have submasters of other types attached to one or both of the masters, the Units value might have to be set differently for each master.

If you are having difficulty switching between ports or scanning, and one or more of your CPUs are receiving spurious data, check the Units setting of the ServSwitch you are using; you are probably seeing misdirected switching commands that the ServSwitch thinks it is sending to submasters.

NOTE

2- and 4-port master ServSwitches autosense submasters, so they don't require the Units command.

4.3.11 Set Keyboard Typematic

Most keyboards have an internal seven-bit "typematic" setting which governs the way the keyboard responds when you hold a key down to force it to repeat. The five "low" bits of this setting represent the *rate* at which the key repeats; the two "high" bits represent the *delay* after you begin holding down the key before it begins to repeat. Sometimes a keyboard's typematic setting isn't suitable for a given operator or for a given application. To change the shared keyboard's typematic setting, issue the Set Keyboard Typematic command: Press and release the left Control Key, type [A] followed by the desired "typematic value," and press [ENTER]. The "typematic value" is the decimal equivalent of the binary seven-bit typematic setting: While the typematic setting = delay bits + rate bits, the typematic value = *decimal* delay value + *decimal* rate value (see Table 4-4 below and Table 4-5 on the next page). For example, to set the shared keyboard to register a key 16 times per second after the key has been held down for half a second (typematic value = 7 + 32 = 39), enter [CTRL] [A] [3] [9] [ENTER].

Table 4-4. Typematic Delay

Decimal Value	Binary Bit Values	Delay Before Key Repeats
0	00[*xxxxx*]	1/4 second (250 ms)
32	01[*xxxxx*]	1/2 second (500 ms)
64	10[*xxxxx*]	3/4 second (750 ms)
96	11[*xxxxx*]	1 second (1000 ms)

Table 4-5. Typematic Rate

Decimal Value	Binary Bit Values	Repeat Rate in Keys per Second
0	[xx]00000	30
1	[xx]00001	26.7
2	[xx]00010	24
3	[xx]00011	21.8
4	[xx]00100	20
5	[xx]00101	18.5
6	[xx]00110	17.1
7	[xx]00111	16
8	[xx]01000	15
9	[xx]01001	13.3
10	[xx]01010	12
11	[xx]01011	10.9
12	[xx]01100	10
13	[xx]01101	9.2
14	[xx]01110	8.6
15	[xx]01111	8
16	[xx]10000	7.5
17	[xx]10001	6.7
18	[xx]10010	6
19	[xx]10011	5.5
20	[xx]10100	5
21	[xx]10101	4.6
22	[xx]10110	4.3
23	[xx]10111	4
24	[xx]11000	3.7
25	[xx]11001	3.3
26	[xx]11010	3
27	[xx]11011	2.7
28	[xx]11100	2.5
29	[xx]11101	2.3
30	[xx]11110	2.1
31	[xx]11111	2

4.3.12 Reset

This command, along with the two commands described in the next two sections, comes in handy when certain problems arise. It will reset or refresh your shared equipment. Issue it if (a) your shared keyboard gets stuck or begins behaving oddly, (b) you need to send mouse data to a CPU that hasn't enabled the mouse (this can happen if you boot up the CPU while the ServSwitch is off or disconnected), (c) your video display has not been updated to show current conditions, or (d) while using a PS/2 type mouse, you unplug it, then plug it back in. To issue the Reset command, press and release the left Control Key, then type [R].

If you're using a PS/2 type mouse, don't issue this command to a CPU that doesn't have a mouse driver loaded. Many CPUs will crash if you send them unexpected mouse data.

4.3.13 Send Null Byte

PS/2 type mice send control data to CPUs in three-byte increments. Sometimes, because of electronic transients, unusual power-up effects, or plugging and unplugging of cables from live equipment, the currently selected CPU in a ServSwitch system can lose one or two bytes of this control information and get "out of sync" with the shared mouse. In this situation, the mouse might seem to refuse to move the pointer or cursor, open windows for no reason, or exhibit other strange behavior. To get the CPU back in sync, send this command to tell the ServSwitch to send a "null byte" to the CPU's PS/2 mouse port (this has no other effect than getting the CPU "caught up"). To issue the Send Null Byte command, press and release the left Control Key, then type [N].

If the mouse still isn't right after you issue this command, the CPU must have been two bytes out of sync. Issuing the command again should do the trick.

The CPU will be thrown out of sync if it uses a PS/2 mouse and it's in sync when you issue this command. Issue this command two more times to get it back in sync again. This command has no effect on serial mice, or on CPUs that are not attached to your ServSwitch system through a PS/2 mouse port.

If you have version 9.01 or higher of the Microsoft mouse driver, the CPU should never get out of sync. Contact Microsoft if you would like to upgrade your Microsoft mouse driver.

4.3.14 Identify ROM

Unfortunately, as with all complex equipment, problems might arise with your ServSwitch that require the assistance of technical-support personnel. One of the things technicians might want to know when they attempt to diagnose and correct your problem is the revision level of your ServSwitch's ROM. This command causes the ServSwitch to send the three-character "*xx*" ROM level to the currently selected CPU; these characters will be echoed back to the shared monitor if you are at some type of prompt. To issue the Identify ROM command, press and release the left Control Key, then type [I].

4.4 Using the RS-232 Port (Optional)

For your convenience, a computer or terminal with an RS-232 serial port can be connected to the RS-232 serial port on the ServSwitch's rear panel. This allows you to send switching commands from a non-local keyboard rather than from the shared keyboard. You'll need a twisted-pair serial cable with 6-pin RJ-11 connectors plus the appropriate adapter: either DB25 female to RJ-11 female (our product code FA044) or DB9 female to RJ-11 female (our product code FA043), depending on your computer/terminal.

Take these steps:

1. Plug one end of the cable into the RS-232 serial port on the ServSwitch's rear panel, and the other end of the cable into the RJ-11 female connector on the appropriate adapter.

CAUTION!

Serial cabling in excess of 50 feet (15.2 m) should be routed with caution. The maximum cable length depends upon the construction of the cable and its routing. For extended runs, shielded cable should be used. Avoid routing near fluorescent lights, air-conditioning compressors, or machines that may create electrical noise. If you experience a lot of data errors, use shorter cables. The ServSwitch's data rate of 9600 bps cannot be changed to alleviate this problem.

2. Connect the adapter to one of the computer's (or terminal's) COM ports.

3. Set your computer for serial communication at 9600 bps, no parity, 8 data bits, and 1 stop bit.

4. To switch the ServSwitch to a different port, type or send the desired port number followed by `[ENTER]` (a return).

5. Troubleshooting

The first two sections of this chapter discuss things to try when problems arise in a ServSwitch system. If the trouble you're having with the Switch is something you haven't seen before, or if the trouble seems minor, try the procedures detailed in **Sections 5.1** and **5.2** before doing anything else.

The third section of this chapter suggests possible causes and solutions to frequently encountered problems; if the trouble is chronic, see **Section 5.3**.

Sections 5.4 and **5.5** discuss what's involved in calling Black Box and shipping your ServSwitch.

CAUTION!

We strongly recommend that you avoid opening the ServSwitch's cover. If for some reason you need to do this, be very careful to replace each screw in the same hole you took it from. There are three different lengths of screws involved, and putting a longer screw in a hole reserved for a shorter screw can ground the chassis to the circuit boards and cause serious damage.

5.1 Diagnostic Information

If you're having difficulty with the ServSwitch, there is always the possibility that it has accidentally been configured or set incorrectly. To receive diagnostic information from a ServSwitch, including the current settings of its parameters, take these steps:

1. Establish a remote-control connection with the ServSwitch as described in **Section 4.4**. (If you want to be able to save or print this information, or even see the first part of it before it scrolls off the screen, you should connect the ServSwitch to a computer running a terminal-emulator program set to "capture" mode.)

2. Press the ServSwitch's NEXT and SCAN buttons simultaneously, then return them to their previous positions. The unit should immediately begin sending ASCII text of a diagnostic report out of its RS-232 port.

You might want to compare the reported conditions with the default and possible settings listed in **Appendix A** and the command descriptions in **Sections 4.2** and **4.3**.

5.2 Restoring Factory-Default Settings

If you're having difficulty with a ServSwitch, something that often helps is resetting the Switch to its factory defaults. Follow these steps *carefully*:

1. Make sure that the ServSwitch, any submasters attached to it, and all CPUs directly or indirectly connected to it are turned OFF.

2. Press and hold in the NEXT button on the front of the ServSwitch. While holding in the NEXT button, push the ON/OFF button on the front of the ServSwitch to power up the Switch.

3. Wait until Port 2's red LED lights up, then release the NEXT button.

4. Cycle power to the Switch (push the ON/OFF button once to turn the Switch OFF, then push it again to turn the Switch ON).

5. Select Port 1 on the ServSwitch. Power up the device on Port 1; if the device is a CPU, wait for it to go completely through its boot-up process. Then select Port 2, power up that device, and so on.

6. Starting with the lowest-numbered CPU and proceeding to the highest-numbered one, power up the CPUs on the Switch's submasters one at a time, waiting for each to boot completely before going to the next.

Now reconfigure the box to your desired settings. If you're still having difficulty, refer to **Section 5.3**. If it doesn't help you to solve your problem, call Black Box for technical support.

5.3 Common Problems

5.3.1 A CPU Connected to Your ServSwitch or a Submaster Doesn't Boot, and You Get a Keyboard or Mouse Error

A. First make sure your ServSwitch and (if one is involved) your submaster are plugged in and powered up.

B. If the Switch and submaster are ON, check the master's configuration. The keyboard and mouse settings for that CPU might not be correct.

C. If the configuration is OK, check your cables. Tighten any loose connections. If the keyboard and mouse strands of either the CPU cable or the MKM cable have been reversed, plug them into the proper ports.

D. If you don't find a cable error, try swapping in different keyboards and/or mice one at a time. If the problem goes away when you substitute a device, the old one might have gone bad.

E. If swapping input devices doesn't solve the problem, begin swapping your cables one at a time. If the problem goes away when you substitute a cable, the old cable is probably defective.

F. If swapping cables doesn't solve the problem, try plugging the CPU into a different CPU port on the ServSwitch. If the CPU boots when it's connected to a different port, the old port is probably defective.

G. If swapping ports doesn't solve the problem, try plugging a known-good keyboard and mouse directly into the CPU that's having the problem. If the CPU boots, the ServSwitch or submaster might be defective; call Black Box.

H. If the CPU still doesn't boot, the CPU's keyboard or mouse port (or other components) might be defective. (If the CPU's Power LED doesn't light, the fuse on the CPU's motherboard might be blown.) If you still have them, plug that CPU's original monitor, keyboard and mouse into it and try again. If the CPU does *not* boot with its original equipment, something in the CPU is defective; call the CPU's manufacturer. If the CPU *does* boot, there is some kind of unusual mismatch between that CPU and the shared monitor, keyboard, or mouse; call Black Box for technical support.

5.3.2 You Can't Switch Ports from the Keyboard

A. Can you do *anything* from the keyboard? If not, the keyboard strand of your MKM cable has probably come loose. Reconnect it.

B. The ServSwitch might have lost power for less than three seconds. (This can cause the keyboard to lock up.) Disconnect the keyboard and plug it back in.

C. The keyboard mode that the currently selected CPU port is set for might not match the mode that the CPU on that port expects. Issue the Set Keyboard Mode command to change the port's mode (see **Section 4.3.7**). Sometimes this situation can confuse the CPU or keyboard so badly that it is necessary to reboot the CPU or to reset the keyboard by unplugging it and plugging it back in.

D. For PS/2 type equipment, if the keyboard and mouse strands of either the CPU cable or the MKM cable have been reversed, plug them into the proper ports.

E. You might be using the keyboard incorrectly. Make sure to use the *left* Control key to start port-switching commands. Make sure to use the numeric keys at the top of the keyboard rather than the numeric keypad when you type in port numbers. Make sure to release the Control key before you start typing in a port number. Make sure you don't wait too long before you enter a port number. Make sure you don't accidentally hit keys such as Shift or Alt.

5.3.3 Characters That You Type Come Up Wrong or Missing

The keyboard mode that the currently selected CPU port is set for might not match the mode that the CPU on that port expects. See item C under **Section 5.3.2**.

5.3.4 Your Mouse Driver Doesn't Load

A. What type of mouse are you using? If it's an RS-232 serial mouse, see steps B and D. If it's a PS/2 mouse, see steps C and D. If it's a Microsoft BallPoint mouse, see step D. At the time of this writing, the ServSwitch does not support other types of mice.

B. RS-232 serial mouse: Make sure that you're using the right COM port, and that the mouse driver is looking for the correct port.

C. PS/2 mouse: To recognize the mouse, the CPU must be directly connected to it, or indirectly connected to it through the ServSwitch and (if one is involved) the submaster, at boot-up time. Make sure that all cables are properly seated and that the Switch and submaster are ON, then reboot the CPU.

D. Your mouse driver might be old or incompatible with your mouse. Try the latest version of the Microsoft mouse driver.

5.3.5 You can't Access All the Functions of Your Mouse

A. What type of mouse is it? If it is any other type than those listed as being supported in item A under **Section 5.3.4**, chances are that the ServSwitch doesn't support it.

B. If your mouse is a Microsoft BallPoint, you need the latest version of the Microsoft mouse driver.

C. If your mouse is a Logitech mouse, the ServSwitch supports the two-button models but not the three-button models.

5.3.6 Your PS/2 Mouse Gets Out of Sync

Cabling might have been disturbed during mouse movement. Issue the Send Null Byte command (see **Section 4.3.13**) once or twice to get the mouse back in sync. You need the latest version of the Microsoft mouse driver to stop this from happening.

5.3.7 Your Mouse Doesn't Move the Pointer/Cursor

A. What type of mouse is it? If it is any other type than those listed as being supported in item A under **Section 5.3.4**, chances are that the ServSwitch doesn't support it.

B. If your mouse is a PS/2 type, it might not have been connected to the ServSwitch when the ServSwitch was turned ON. It might also have been disconnected and reconnected after the Switch was turned ON.

C. Your mouse must be connected to a powered ServSwitch when the CPUs are booted and when mouse applications are run. Try exiting and re-entering your application; if this doesn't work, issue the Reset command (see **Secrion 4.3.12**).

5.3.8 Your Monitor Display Is Fuzzy

A. Check the settings of your monitor, especially the sharpness control.

B. If you can't solve the problem by changing the monitor settings, you might have run cable too far; maximum distance of original Serv cable from any CPU to the shared monitor, keyboard, and mouse is 25 ft. (7.6 m). The distance you can run will be less than the maximum if you are using SVGA video or if you are cascading submasters. You might need to upgrade from original Serv cables to coaxial cables that carry the video signal better. If you are already using coax cables, you might need to add Station Extenders (our product codes AC253 etc.); call Black Box for technical support. See **Section 4.1.3** and **Appendix B**.

5.3.9 Your Video Is Not Synchronized or Is the Wrong Color

A. If you are trying to use true monochrome video or a 9515, 9517, or 9518 monitor, you need special cables to carry the video correctly. Call Black Box for technical support.

B. Check the settings of your monitor, especially the sync or color controls.

C. Your monitor might not be capable of synching to the selected video resolution or frequency (refresh rate). Try a lower resolution or frequency or a more powerful monitor.

D. If the video problem is not centered on the monitor, check the video strands of your cables. Tighten any loose connections.

E. If no cable connectors are loose, begin swapping your cables one at a time. If the problem goes away when you substitute a cable, the old cable is probably defective.

F. If swapping cables doesn't solve the problem, try plugging the CPU into a different CPU port on the ServSwitch or submaster. If the problem goes away when the CPU is connected to a different port, the old port is probably defective.

5.3.10 Your Video Is OK in Low-Resolution Mode, But You Can't Get Into High-Resolution Mode

A. If you're using XGA, you *must* use coaxial cables (see **Section 4.1.3** and **Appendix B**).

B. Check your video driver. It might not be set up correctly for your desired resolution.

5.3.11 You Can't Seem to Scan or Switch to One or More of Your CPUs

A. The Units value might not be set correctly. (If any of the CPUs you *can* access are receiving garbage characters, this is a good indicator.) Try setting it now (see **Section 4.3.10**).

B. The Maximum Ports or Width value might not be set correctly. Try setting it now (see **Sections 4.3.8** and **4.3.9**).

C. If issuing the command doesn't help, the SCAN button of a master and/or submaster ServSwitch might have been in the wrong ("in") position when the unit was powered up. Try turning OFF the attached CPUs, turning OFF the master and/or submaster, putting the button(s) in the "out" position, turning ON the master and/or submaster, and rebooting the attached CPUs.

5.3.12 One or More of Your CPUs Lock Up When You Load Windows 3.x

The usual cause of this problem is that the affected CPUs are set to load a Logitech or other type of mouse driver when Windows starts up. Set the CPU to load the generic Microsoft mouse driver instead.

5.3.13 One or More of Your CPUs Has Problems Exiting Windows 3.x

If a CPU running Windows 3.x locks up or (if it's also running EMM386®) displays "EMM386 EXCEPTION ERROR #06" when you try to exit Windows, this is probably what causes it: Windows tries to unload its mouse drivers and reinstate any DOS drivers specified in AUTOEXEC.BAT and CONFIG.SYS. The ServSwitch sees this as a reboot and sends a [CTRL] [M] to the CPU to set the mouse driver for Microsoft mouse compatibility. If the CPU doesn't actually load a mouse driver in DOS, it will crash or at least display the EMM386 error when it receives the [CTRL] [M]. Make sure all of your CPUs load mouse drivers in *both* operating-system environments, even if you don't use a mouse in DOS.

5.3.14 The ServSwitch Doesn't Work With Your Docking Station

At the time of this writing, the ServSwitch does *not* support docking stations for portable computers.

5.3.15 The ServSwitch Doesn't Work With Your Dongle-Protected Software

At the time of this writing, the ServSwitch does *not* support dongles (the devices required to be inserted into the keyboard line by some software for copy protection).

5.4 Calling Black Box

If you determine that your ServSwitch is malfunctioning, *do not attempt to alter or repair the unit.* It contains no user-serviceable parts (and see the Caution notice on page 50). Contact Black Box Technical Support at (412) 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 nature and duration of the problem.
- when the problem occurs.
- the components involved in the problem.
- any particular application that, when used, appears to create the problem or make it worse.

5.5 Shipping and Packaging

If you need to transport or ship your ServSwitch:

- Package it carefully. We recommend that you use the original container.
- If you are shipping the ServSwitch for repair, make sure you include its power supply and the adapter cables you're using with it. If you are returning the ServSwitch, make sure you include its manual as well. Before you ship, contact Black Box to get a Return Materials Authorization (RMA) number.

Appendix A: NVRAM Factory Defaults

The table below shows, for the ServSwitch's saveable options, the default values stored in nonvolatile memory (NVRAM) when the ServSwitch is shipped from the factory. It also shows what commands or actions can change these settings for the ServSwitch's current operating period, as well as what commands or actions can save changed settings to NVRAM, so that they become the new defaults.

Option	Factory-Default Setting	To Change	To Save Changes
Caps/Scroll/ Num Lock	Num Lock ON (fixed)	Select port, then press the corresponding button on the keyboard	Can't be saved
Scan	OFF	Push the SCAN button on the ServSwitch or type [CTRL] S (to turn ON) or [CTRL] X (to turn OFF)	Can't be saved
Scan-Delay Time	5 seconds	Type [CTRL] T*xx* [ENTER] (*xx* = any 1- or 2-digit number, time in seconds)	[CTRL] K
Screen Saver's Delay Time	OFF (disabled, set to zero)	Type [CTRL] V*xxx* [ENTER] (*xxx* = any 1- to 3-digit number, time in seconds)	[CTRL] K
Keyboard Mode	Mode 2	Select port, then type [CTRL] M*x* (*x* = 1, 2, or 3)	[CTRL] K
Maximum Ports	SW721: 4; other models: no. of CPU ports on unit	Type [CTRL] P*xxx* [ENTER] (*xxx* = any 1- to 3-digit number)	[CTRL] K
Width of Submasters	SW721, SW722: 4; SW723-5: 16	Type [CTRL] W*xxx* [ENTER] (*xxx* = 2 to 255)	[CTRL] K
Units	0 (no submasters)	Type [CTRL] U*xxx* [ENTER] (*xxx* = 0 to 255)	[CTRL] K
Keyboard Typematic	43 (delay of 1/2 second, rate of 10.9 characters per second)	Type [CTRL] A*xxx* [ENTER] (*xxx* = 0 to 127; see **Section 4.3.11**)	[CTRL] K

Appendix B: Cable Product Codes

The table below and on the next page lists the product codes for all the types of cables we currently offer for use with the ServSwitch. The four digits that follow the dash in each product code indicate how long each cable is in feet (one foot = 305 cm).

For some cables, xxx's are shown in place of the last three digits of the product code because the cables come in several stock lengths. For original (standard) CPU adapter cables, these last three digits can be "005," "010," or "020" for 5-foot (1.5-m), 10-foot (3-m) or 20-foot (6.1-m) cables respectively. For coaxial cables, these last three digits can be "005," "010," "020," "050," "075," or "100" for 5-foot (1.5-m), 10-foot (3-m), 20-foot (6.1-m), 50-foot (15.2-m), 75-foot (22.9-m), or 100-foot (30.5-m) cables respectively.

The table also lists the product codes for the Station Extenders and their cables. Depending on your equipment and the video resolution you're using, you might be able to use the Extenders to connect the ServSwitch to monitor/keyboard/mouse stations or CPUs as much as 200 ft. (61 m) away.

If your monitor/keyboard/mouse-sharing system has cabling requirements that can't be met by what you see here, call Black Box for a possible quote on custom cables or adapters.

Original Monitor/Keyboard/Mouse Adapter Cables:

Monitor Type (Connector on Cable)	Keyboard Type (Connector on Cable)	Mouse Type (Connector on Cable)	Product Code
VGA (DB15HD female)	IBM AT (5-pin DIN female)	Serial RS-232 (DB9 male)	EHN052-0001
EGA/CGA (DB9 female)	IBM AT (5-pin DIN female)	Serial RS-232 (DB9 male)	EHN053-0001
VGA (DB15HD female)	IBM PS/2 (6-pin mini-DIN female)	PS/2 (6-pin mini-DIN female)	EHN054-0001

Coaxial Monitor/Keyboard/Mouse Adapter Cables:

Monitor Type (Connector on Cable)	Keyboard Type (Connector on Cable)	Mouse Type (Connector on Cable)	Product Code
VGA (DB15HD female)	IBM AT (5-pin DIN female)	Serial RS-232 (DB9 male)	EHN270-0xxx
VGA (DB15HD female)	IBM PS/2 (6-pin mini-DIN female)	PS/2 (6-pin mini-DIN female)	EHN273-0xxx

Original CPU Adapter Cables:

Video Type (Connector on Cable)	Keyboard Type (Connector on Cable)	Mouse Type (Connector on Cable)	Product Code
VGA (DB15HD male)	IBM AT (5-pin DIN male)	Serial RS-232 (DB9 female)	EHN048-0xxx
EGA/CGA (DB9 male)	IBM AT (5-pin DIN male)	Serial RS-232 (DB9 female)	EHN049-0xxx
VGA (DB15HD male)	IBM PS/2 (6-pin mini-DIN male)	PS/2 (6-pin mini-DIN male)	EHN051-0xxx

Coaxial CPU Adapter Cables:

Video Type (Connector on Cable)	Keyboard Type (Connector on Cable)	Mouse Type (Connector on Cable)	Product Code
VGA (DB15HD male)	IBM AT (5-pin DIN male)	Serial RS-232 (DB9 female)	EHN271-0xxx
VGA (DB15HD male)	IBM PS/2 (6-pin mini-DIN male)	PS/2 (6-pin mini-DIN male)	EHN272-0xxx

Original ServSwitch-to-ServSwitch Expansion Cable: EHN055-0001

Coaxial ServSwitch-to-ServSwitch Expansion Cable: EHN274-0xxx

Station Extenders:

CPU to ServSwitch (RS-232 Mouse): AC254A

ServSwitch to Station (RS-232 Mouse): AC255A

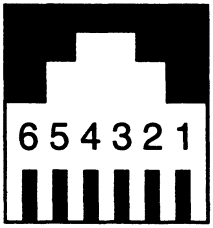
CPU to ServSwitch (PS/2 Style Mouse): AC257A

ServSwitch to Station (PS/2 Style Mouse): AC258A

Station-Extender Cables: EHN250-0xxx, where "xxx" = 050, 100, 150, or 200

Appendix C: Pinout of RS-232 Port

The table below shows the pinout of the ServSwitch's RJ-12 (6-wire RJ-11) female RS-232 port.



Pin	Signal Name	Abbrev.	Direction	Description
1	Data Set Ready	DSR	Input	Reserved (not used)
2	Data Terminal Ready	DTR	Output	Pulled high with 1-KΩ resistor
3	Transmit Data	TXD	Output	Serial data from port
4	Signal Ground	SGND	N/A	DC ground reference
5	Receive Data	RXD	Input	Serial data to port
6	Request to Send	RTS	Output	Pulled high with 1-KΩ resistor

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