



NTI<sup>®</sup> NETWORK  
TECHNOLOGIES  
INCORPORATED

1275 Danner Dr Tel:330-562-7070  
Aurora, OH 44202 Fax:330-562-1999  
www.networktechinc.com

## KEEMUX<sup>®</sup> Series

# KEEMUX-Px

## PS/2 KVM Switch

### Installation and Operation Manual



**TRADEMARK**

KEEMUX is a registered trademark of Network Technologies Inc in the U.S. and other countries.

**COPYRIGHT**

Copyright © 1999-2007 by Network Technologies Inc. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written consent of Network Technologies Inc, 1275 Danner Drive, Aurora, Ohio 44202.

**CHANGES**

The material in this guide is for information only and is subject to change without notice. Network Technologies Inc reserves the right to make changes in the product design without reservation and without notification to its users.

## **TABLE OF CONTENTS**

INTRODUCTION .....	1
MATERIALS .....	1
FEATURES AND FUNCTIONS.....	2
INSTALLATION .....	3
Prepare To Connect .....	3
Make Connections .....	3
Power Up .....	5
CASCADING .....	5
Limitations.....	5
Configuration .....	6
Cascaded Installation .....	6
USING THE NTI KEEMUX PS/2 KVM SWITCH.....	7
Front Panel Control.....	7
Keyboard Control.....	8
Basic Command Mode .....	8
Scan Mode .....	9
Broadcast Mode.....	9
Normal Mode .....	9
OSD CONTROL .....	10
Security Option .....	10
Enabling the Security Feature .....	10
User Login Mode.....	10
Additional Modes Available With Security .....	11
Administration Mode .....	11
Administrator Password.....	11
User Name List .....	12
System Access List.....	12
User Access Functions .....	13
OSD Command Mode .....	13
Scan Mode .....	14
Broadcast Mode.....	14
Normal Mode .....	14
Edit Mode.....	15
Search Mode.....	16
Maintenance Mode .....	16
Help Mode.....	17
RS232 CONTROL .....	18
RS232 Connections and Configuration .....	18
Remote Connection .....	18
Baud Rate .....	18
Unit Address and Loop Back .....	19
Command Protocol.....	20
Matrix Switcher's Control Program For Windows 9X, NT, 2000 And XP .....	21
SerTest- RS232 Interface Test Program .....	21
Main Options.....	21
KEYBOARD MAPPING .....	22
HOW TO DISABLE OPERATING MODES .....	23
Configuring The Jumper Block .....	24
AUDIO SUPPORT.....	25
DUAL VIDEO SUPPORT .....	25
SPECIFICATIONS FOR STRAIGHT-THROUGH RS232 SERIAL CABLE .....	26
TROUBLESHOOTING .....	26
WARRANTY INFORMATION.....	26

## **TABLE OF FIGURES**

Figure 1- Keyboard dip-switch configuration.....	3
Figure 2- Connect the monitor to the KEEMUX .....	3
Figure 3- Connect the user keyboard and mouse.....	4
Figure 4- Connect a CPU to the KEEMUX.....	4
Figure 5- Cascaded configuration .....	5
Figure 6- Cable connections for cascading.....	6
Figure 7- Connect remote extension cables between cascaded units .....	7
Figure 8- Connections grouped by port number .....	9
Figure 9- Administrator password change .....	11
Figure 10- Command Mode menu .....	13
Figure 11- Press <Ctrl> for more functions .....	14
Figure 12- Edit Mode screen.....	15
Figure 13- Search Mode screen .....	16
Figure 14- Maintenance Mode screen .....	16
Figure 15- RS232 connection with Matrix-Y-1 cable.....	19
Figure 16- Pinout of Matrix-Y-1 cable .....	19
Figure 17- Location of the jumper block.....	23
Figure 18- Remove screws to open case.....	23
Figure 19- Clear the jumper block for configuration access .....	24
Figure 20- Place jumpers according to desired functionality.....	24
Figure 21- Control CPU audio with KEEMUX-P4-A .....	25
Figure 22- Connections for video cables on the KEEMUX-P4-DV .....	25

## INTRODUCTION

The KEEMUX PS/2 KVM switch (KEEMUX) enables access to several IBM PC-AT, PC-AT Clone or PS/2 CPUs from one monitor, keyboard and PS/2 mouse (up to 32 CPUs as a single switch or 152 CPUs when switches are cascaded). These CPUs can be file servers, network managers, etc. Internal microprocessor driven circuitry allows all CPUs to be booted simultaneously and error free with only one keyboard and mouse present. Port selection is accomplished through front panel push buttons or commands typed on the keyboard. Port status LEDs continuously update on the front panel of the switch.

### Available Options

- Switch models are available in 60 or 50 Hz, and 110 or 220V.
- OSD -On Screen Display feature will superimpose operating menus directly onto the monitor for security administration and control. Add "-O" to the part number (i.e. KEEMUX-Px-O)
- RS232 support for alternative control using RS232 connection Add "-RS" to the part number (i.e. KEEMUX-Px-RS)
- Audio support to enable user to connect stereo speakers to receive audio signals from connected CPUs- add "-A" to the part number (i.e. KEEMUX-Px-A)
- Dual Video option supports CPUs with two video outputs. Add "-DV" to the part number (i.e. KEEMUX-Px-DV)

See our catalog, visit our website at <http://www.networktechinc.com>, or contact an NTI sales representative at 800-742-8324 (800-RGB TECH) or 330-562-7070 for more details.

### Limitations

- The KEEMUX Px KVM switch is compatible with PS/2 mice and PS/2 CPU ports ONLY. Serial mice cannot be adapted for use with the KEEMUX Px KVM switch.
- Serial ports on CPUs require the NTI VOPEX-IM9D for use with this switch.

## MATERIALS

### Materials Supplied with this kit:

- NTI KEEMUX Px KVM Switch (4,8,12,16,20,24, or 32 port)
- 120VAC or 240VAC at 50 or 60Hz-5VDC/2.0A AC Adapter
- Line cord, country specific
- CD with pdf file of this manual

### Materials *Not* Supplied, but **REQUIRED**:

Monitor, keyboard, and mouse interface cables ARE REQUIRED but not supplied.

- |            |   |                                    |
|------------|---|------------------------------------|
| • MONITOR  | - | VEXT-xx-MM for video interface     |
| • KEYBOARD | - | VKEXT-xx-MM for keyboard interface |
| • MOUSE    | - | VKEXT-xx-MM for mouse interface    |

### Optional:

- |                         |   |  |
|-------------------------|---|--|
| • KEYBOARD<br>and MOUSE | - | VVKINT-xx-MM "Y"-cable for keyboard <u>and</u> mouse interface |
|-------------------------|---|--|

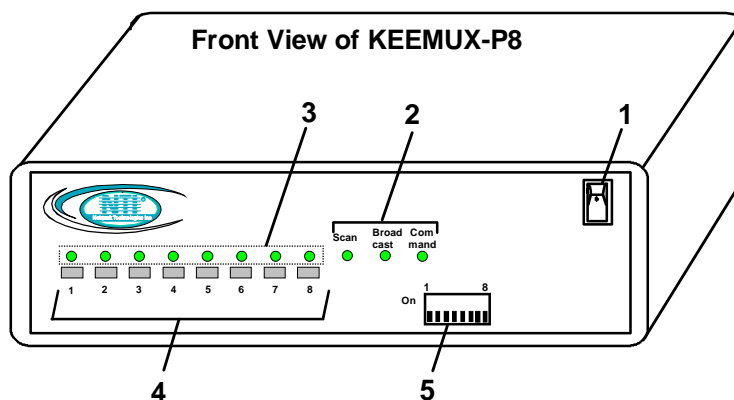
### Where:

xx is the length of the cable in feet

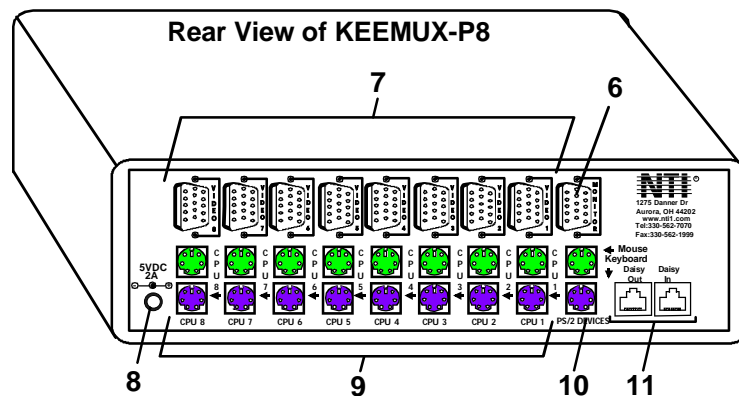
MM indicates male-to-male connector

All cables can be purchased from Network Technologies Inc by calling 800-RGB-TECH (800-742-8324) or (330)-562-7070.

## FEATURES AND FUNCTIONS



1. Power ON/OFF switch
2. Mode LEDs- for visual indication of switch mode status
3. CPU Status LEDs- for visual indication of connection between the user and a specific CPU.
4. CPU Select Switches- push to manually switch to a specific CPU
5. Dip-switches- for configuring keyboard type and cascaded switches
6. MONITOR- 15HD female connector- for connection of the user monitor
7. VIDEO x- 15HD female connectors- for connecting video cables from CPUs
8. 5VDC- 2.0A- connection jack for the AC adapter
9. CPU x- 6 pin miniDIN female connectors- for connection of device cable(s) from CPU(s)
10. PS/2 DEVICES- 6 pin miniDIN female connectors- for connection of user device(s) (keyboard/mouse)
11. DAISY In/Out- for attaching interface cables (REXT-SR-xx) between slave switches and the master switch



## INSTALLATION

### Prepare To Connect

1. Before connecting the KEEMUX to the CPUs, make sure all CPUs, the monitor, and the KEEMUX are turned OFF.



**WARNING! DAMAGE MAY OCCUR TO THE CPU IF POWER IS NOT DISCONNECTED BEFORE CONNECTING OR DISCONNECTING CABLES.**

2. The dip-switches on the front panel are configurable for several tasks. Switches 1-6 are used for cascading actions (see CASCADING on page 5) and switches 7 and 8 are for keyboard configuration. These keyboard configuration switches come pre-configured with both in the “OFF” position. Do not change these settings, as this will cause the PS/2 keyboard to not work.

**FYI:** Should switch 7 or 8 get changed to the “ON” position, it will be necessary to power-down the entire system (including CPUs), change the dip-switches back to the “OFF” position, and then power the system back up. If it is necessary to replace one PS/2 keyboard with another one, the keyboard can be hot-swapped without powering-down. Refer to Fig. 1 for instructions on proper keyboard dip-switch configuration.

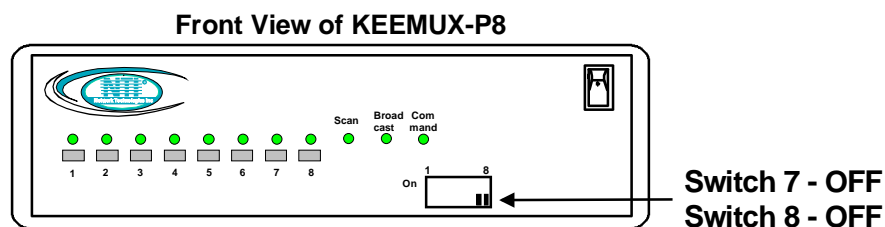


Figure 1- Keyboard dip-switch configuration

### Make Connections

1. Connect the monitor cable to the 15HD female port labeled “MONITOR” on the rear panel of the KEEMUX.

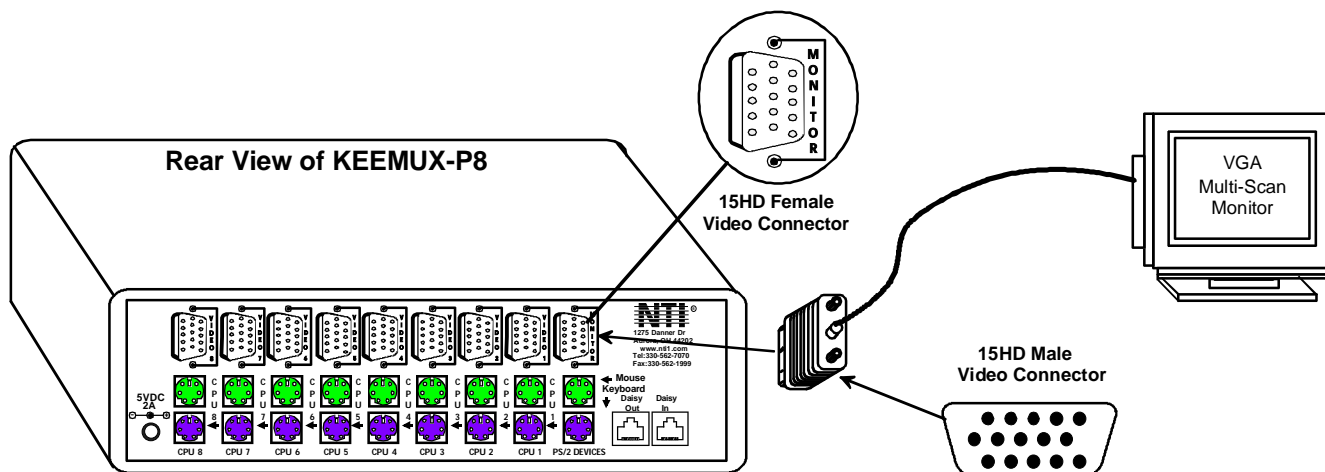


Figure 2- Connect the monitor to the KEEMUX

- Connect the keyboard cable to the 6 pin miniDIN female port labeled "KEYBOARD" on the rear panel of the switch. Connect the mouse cable to the 6 pin miniDIN female port labeled "MOUSE" on the rear panel of the KEEMUX.

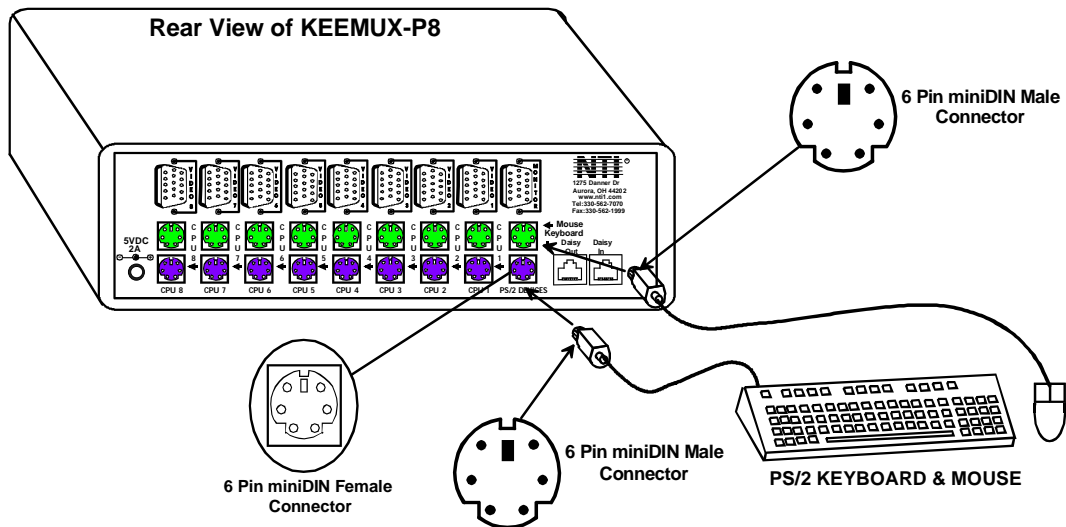
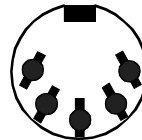


Figure 3- Connect the user keyboard and mouse

- Connect each CPU to the keyboard, monitor and mouse ports using VEXT-xx-MM for the monitor and VKEXT-xx-MM (2) for the mouse and keyboard— REQUIRED (not supplied). See Fig. 4.
  - Group the keyboard, monitor and mouse interface cables from each CPU.
  - Make sure that cables from the first CPU are connected to the VIDEO 1 and CPU 1 MOUSE and KEYBOARD connectors.
  - Cables from the second CPU should connect to the VIDEO 2 and CPU 2 MOUSE and KEYBOARD connectors...etc.

**NOTE: If an AT style keyboard connector is on a CPU, insert an adapter cable (ADP-5D6MD-R) between the CPU and VKEXT-xx-MM cable.**



AT Style Connector

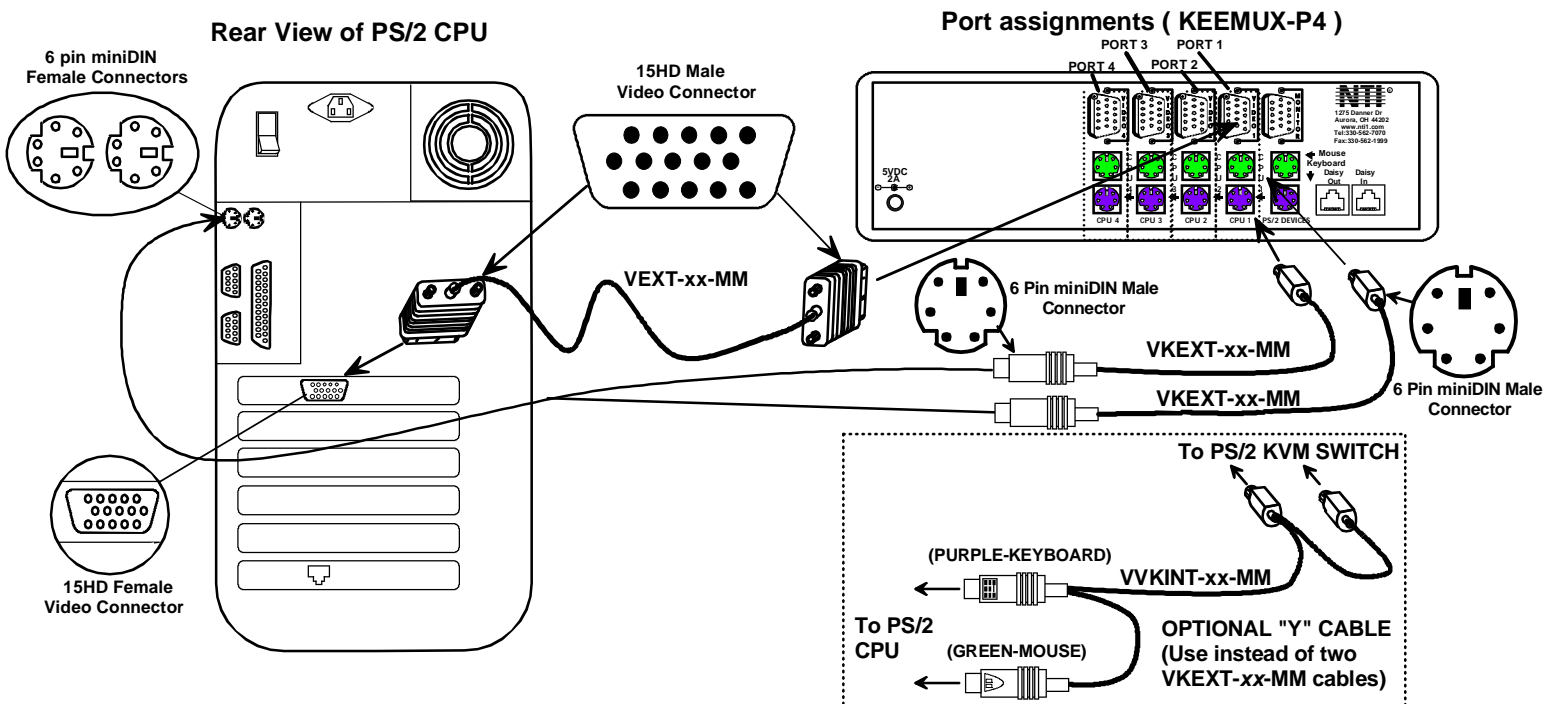


Figure 4- Connect a CPU to the KEEMUX



## Power Up

1. Turn the KEEMUX power ON first. The mode LEDs on the KEEMUX should flash twice.
2. Turn the monitor power ON.
3. Turn any or all of the CPUs ON.

**FYI:** Do not press any port buttons on the front panel until the PORT 1 LED on the front panel illuminates.

## CASCADING

The KEEMUX switch can be expanded to access up to 152 CPUs by cascading multiple units together, as illustrated below. The KEEMUX connected to the monitor and keyboard must be configured as the “master unit” (via dip-switches—see page 6). Any switches connected to the master unit must be configured as “slave units”. All KEEMUXs are fully configurable for this expansion method. The only additional hardware required is a set of keyboard, monitor, mouse, and RMT extension cables for each slave unit (see Fig. 5 below).

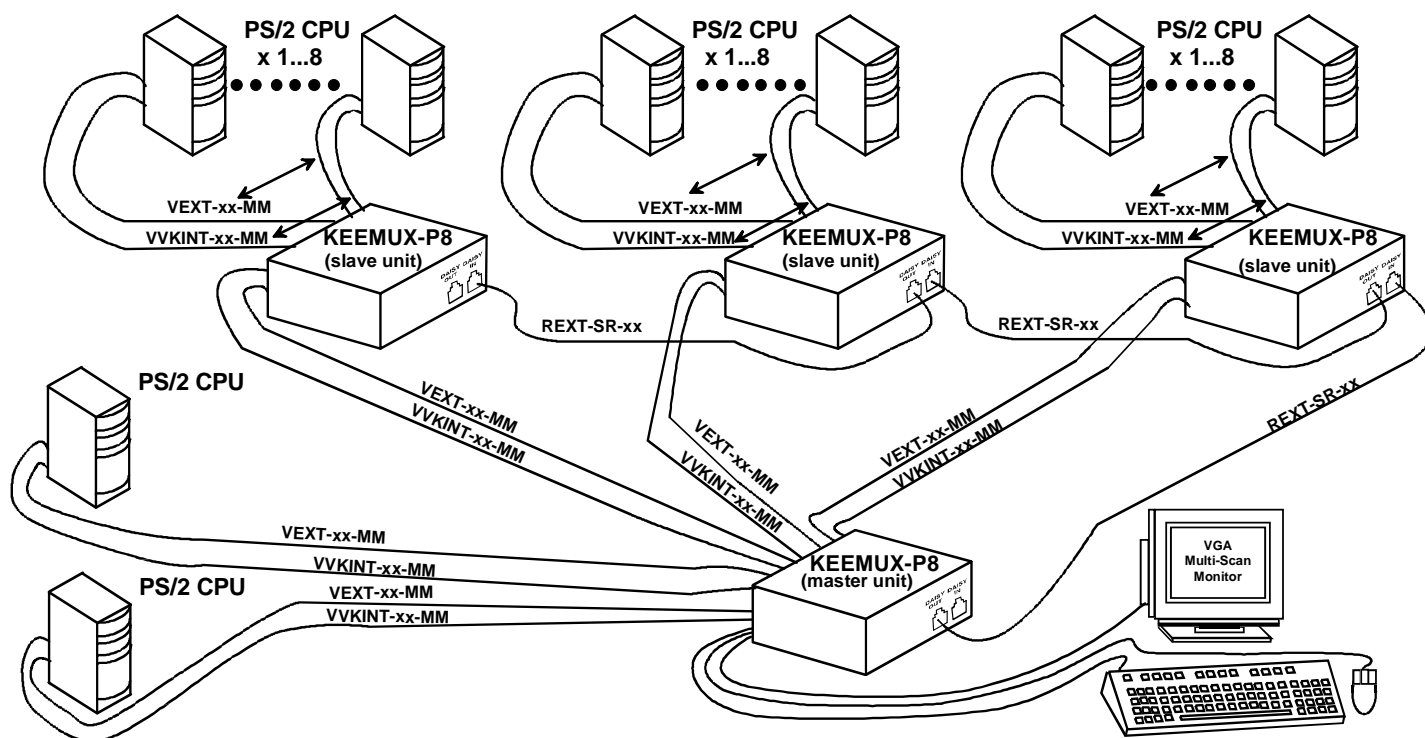


Figure 5- Cascaded configuration

## Limitations

- a. All the slave units must be the same size.
- b. Only 4, 8, or 16-port switches can be used as slave units.
- c. Up to 8 slave units may be connected to form a maximum system size of 152 ports (1 x 32 port master + 8 x 16 port slaves).
- d. Slave units must be added to the master unit in order (slave #1 to master's port 1, slave #2 to master's port 2, etc.).

**FYI:** Port 1 of the master unit (with a 4-port slave unit connected to it) will function and be controlled as ports 1-4 (1-8 for an 8-port slave, 1-16 for a 16-port, etc.). Port 2 of the master unit (with a second 4-port slave unit connected) will function and be controlled as port numbers 5-8 (9-16 for an 8-port slave, 17-32 for a 16-port slave, etc.). See Fig. 6 on page 6.

- e. All units must be powered OFF during configuration and interconnecting.

## Configuration

All 4, 8, and 16-port units are configured using the 8-position dip-switch (located on the front of each unit) according to tables 1 and 2 below.

### Front Panel Configuration Switches

Table 1 * (default settings)			
Switch	SW1	SW5	SW6
STAND-ALONE SWITCH	OFF*	OFF*	OFF*
SLAVE	ON	OFF	OFF
MASTER W/4-PORT SLAVES	OFF	OFF	ON
MASTER W/8-PORT SLAVES	OFF	ON	OFF
MASTER W/16-PORT SLAVES	OFF	ON	ON

Table 2 * (default settings) Master & Slave SW2-4 Settings				
SW2	SW3	SW4	Master with-	Slave Setting
OFF*	OFF*	OFF*	No Slave Attached	N/A
OFF	OFF	OFF	1 Slave attached	Slave Unit #1
OFF	OFF	ON	2 Slaves attached	Slave Unit #2
OFF	ON	OFF	3 Slaves attached	Slave Unit #3
OFF	ON	ON	4 Slaves attached	Slave Unit #4
ON	OFF	OFF	5 Slaves attached	Slave Unit #5
ON	OFF	ON	6 Slaves attached	Slave Unit #6
ON	ON	OFF	7 Slaves attached	Slave Unit #7
ON	ON	ON	8 Slaves attached	Slave Unit #8

#### About Table 2:

These switch settings are used by the slave(s) to establish its identity (i.e. location in the group) to the master.

On a master, the same switches are used to configure the master for how many slaves are attached to it.

## Cascaded Installation

- Attach all slaves consecutively to the master switch.
  - Perform steps 1 and 2 under INSTALLATION on page 4 for each slave unit.
  - Configure each switch as per the tables above under CONFIGURATION before proceeding.
  - With a VEXT-xx-MM cable, connect slave #1 monitor port to master's VIDEO 1 port.
  - With a VVKINT-xx-MM or (2) VKEXT-xx-MMs, connect slave #1's PS/2 DEVICES ports to the master's CPU1 KEYBOARD and MOUSE ports.
  - Repeat steps c and d for each additional slave unit, keeping in mind that each slave will connect to the next available master's port (i.e. slave #2 to master's VIDEO 2 and CPU 2 KEYBOARD and MOUSE, etc.). See Fig. 6 below.

If additional 4-PORT slaves are connected to VIDEO, PS/2 MOU CPU, & PS/2 KBD CPU ports 3 & 4, they will function and be controlled as CPU ports 9-12 and 13-16 respectively.

- OR -

If individual CPUs are connected to ports 3 & 4, they will function and be controlled as CPU ports 9 & 10 respectively.

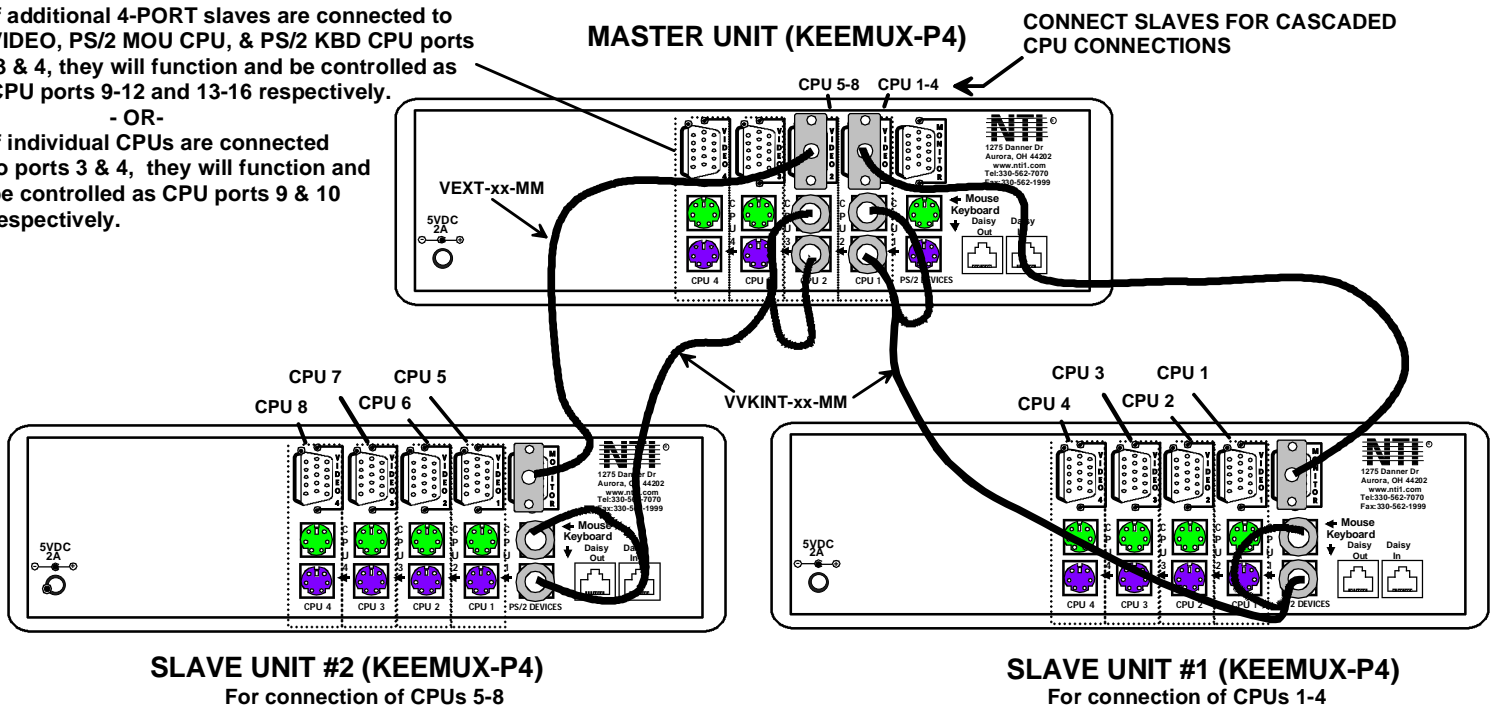


Figure 6- Cable connections for cascading

2. Connect Local CPUs to any remaining consecutive ports on the master as described under INSTALLATION on page 3.
3. Connect the RMT extension cables:
  - a. With an RMT extension cable (REXT-SR-xx), connect the master's "DAISY OUT" port to slave #1's "DAISY IN" port.
  - b. With another RMT extension cable, connect slave #1's "DAISY OUT" port to slave #2's "DAISY IN" port. (See Fig. 7 below.)
  - c. Apply additional RMT extension cables until all slave units are connected together.

**NOTE:** If switches are not being cascaded, then the "DAISY IN" and "DAISY OUT" ports will not be used.

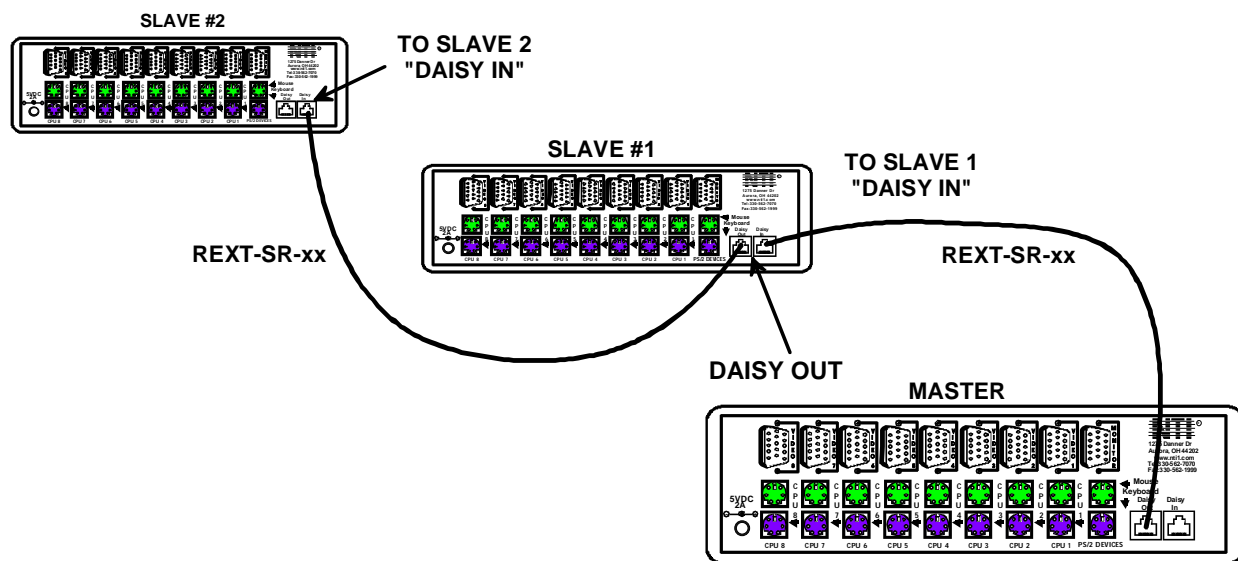


Figure 7- Connect remote extension cables between cascaded units

## USING THE NTI KEEMUX PS/2 KVM SWITCH

Control over the CPUs attached to the NTI KEEMUX is achieved through operation of the KEEMUX. Once the KEEMUX is properly connected, the KEEMUX will enable a connection to be made between the CPUs attached to its CPU x, and VIDEO x ports and the keyboard, monitor, and mouse attached to the PS/2 DEVICES and MONITOR ports. The LEDs on the control panel of the KEEMUX will illuminate depending on which port (and associated CPU) is being connected to the keyboard, monitor, and mouse. The choice of which CPU will be connected to the keyboard, monitor, and mouse is determined by controlling the KEEMUX either through the front control panel on the KEEMUX, by keyboard control, or by optional methods such as RS232 or an On Screen Display (OSD).

### Front Panel Control

There is a touch-switch and LED on the front panel of the KEEMUX for each connected CPU. Pressing any touch-switch on the front panel of the KEEMUX will connect the selected CPU to the keyboard, monitor, and mouse.

Holding down any front panel touch-switch for more than 2 seconds will cause the KEEMUX to cycle through all modes of operation: COMMAND, SCAN, BROADCAST, and NORMAL (described on pages 8 and 9). Three LEDs on the front panel indicate when these modes are enabled. Release the touch-switch when the desired mode is enabled. When no mode LEDs are illuminated the user is in Normal Mode controlling directly the CPU to which the user is connected through the KEEMUX.

## Keyboard Control

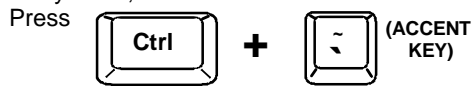
Keyboard control of the KEEMUX can be achieved using either of two methods:

- **Basic Command Mode**- operated strictly by using keyboard commands as instructed below. Basic Command Mode is only applicable if the OSD option is not built into the switch.
- **OSD Command Mode** (optional)- operated using the keyboard and mouse in conjunction with On Screen Display (OSD) menus superimposed onto the monitor. If OSD is built in, use the menus as instructed on page 12.

By pressing <Ctrl> + <~> (accent key), the user can enter Command Mode (either Basic, or OSD). Once in Command Mode, typing a series of commands will cause the KEEMUX to connect the user to any one CPU to which the KEEMUX is attached. Once finished, pressing the <Esc> key will exit Command Mode.

### Basic Command Mode

In order to control the KEEMUX with the keyboard, Command Mode must be enabled. To enter Command Mode from the keyboard:



**NOTE: IF THE OSD FEATURE HAS BEEN INSTALLED, PROCEED DIRECTLY TO “OSD CONTROL” ON PAGE 10. If not, continue with the instructions for controlling the KEEMUX as detailed below.**

When the COMMAND LED is illuminated, all 3 status lights on the keyboard will illuminate to indicate that Command Mode is enabled and the following functions are available: (**NOTE:** The user must exit Command Mode in order to type to a CPU. To exit Command Mode, press <Esc>.)

### Command Functions

Function:	Keystroke:
Increment Port <sup>1</sup>	or  (select the next higher port ex. 05 → 06)
Decrement Port <sup>1</sup>	or  (select the next lower port ex. 02 → 01)
Toggle Scan Mode ON and OFF	
Toggle Broadcast Mode ON and OFF	
Sets scan time-out period for each port.	-  -  -  (xxx from 002 to 255. ie. t 002 would set the time out period for 2 seconds)
Selects a specific port	-  -  (Pxx would be P01, P02, etc.)
Exit Command Mode	

#### KEY SYMBOLS LEGEND:

- or** PRESS EITHER KEY
- +** CHORDED SEQUENCE- PRESS CONSECUTIVELY  
AND KEEP KEYS PRESSED UNTIL ALL ARE PRESSED.
- PRESS CONSECUTIVELY

<sup>1</sup> If the SCAN LED is ON, pressing → or ← will cause the switch to select the next active port.

**NOTE: The “port” mentioned in the “Command Functions” above refers to the combination of the video (VIDEO x), mouse and keyboard (CPU x) of like numbers that a CPU is connected to (i.e. the CPU that is connected to VIDEO 1 and CPU 1 will be identified as Port 1 or P01). (See Fig. 8 on page 9.)**

## Port assignments ( KEEMUX-P4 )

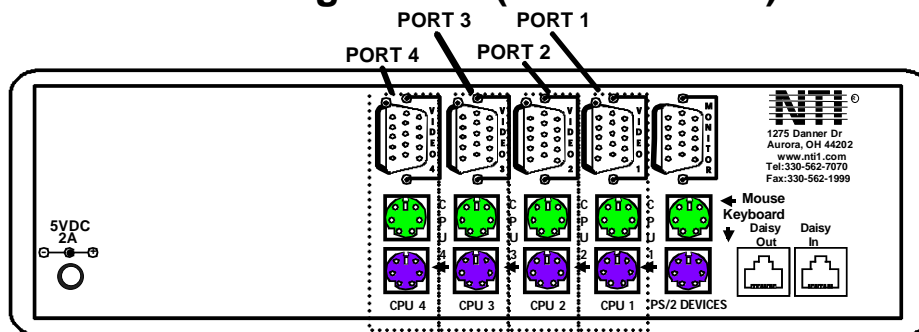


Figure 8- Connections grouped by port number

**Please note:** If the switches are being cascaded (such as that illustrated in Fig. 5 on page 5 under “Cascading”), make note of which port each of the CPUs is connected to on each slave and which port each slave is connected to on the master.

- The ports on the slave connected to the port 1 port on the master would be numbered 01-04 with multiple KEEMUX-P4s, the ports on the slave connected to port 2 would be numbered 05-08 (with multiple KEEMUX-P8s they would be 01-08, and 09-16, etc.)
- A connection to a CPU from the keyboard would be achieved by typing the appropriate port number. (See Fig. 6 on page 6.)
- No programming of the KEEMUX is necessary to achieve this control.
- When cascading, if not all of the ports are used on each slave attached to your system, THE PORT NUMBER(S) ASSOCIATED WITH THE UNUSED PORT(S) WILL NOT BE ACCESSIBLE when trying to control the switches connected to the system. (I.e. if ports 7 and 8 are not used on the first slave and an attempt is made to connect to ports 7 or 8 while in Command Mode, the KEEMUX will ignore the attempt. )

## Scan Mode

When in Scan Mode the KEEMUX scans each port with a CPU powered-ON. (The SCAN LED on the front panel will illuminate and remain ON while in Scan Mode.) The port with the CPU powered-ON remains active while in use. When the switch becomes idle for the configured time-out period (default time-out period is 5 seconds) the switch will connect to the next powered-ON CPU port. See Command Mode section above for configuring the scan time-out period.

**FYI:** The keyboard and mouse must remain idle for the full scan time-out period before the switch will connect to the next active port.

## Broadcast Mode

**(Use with extreme caution or commands intended for one CPU will be sent to all CPUs)**

Broadcast Mode allows the operator to send keystrokes to all active CPUs simultaneously. However, Broadcast Mode has some critical requirements.

- BROADCAST LED must be OFF when booting any attached CPUs.
- BROADCAST LED must be ON and COMMAND LED must be OFF for keystrokes to reach attached CPUs.

**Note:** The user must type somewhat slowly when in Broadcast Mode (less than 20 wpm) and cannot use the <Backspace> key.

## Normal Mode

When all of the KEEMUX mode LEDs are OFF the user is in Normal Mode, controlling the CPU to which the user is connected through the KEEMUX.

## OSD CONTROL

### (Optional)

OSD superimposes a menu system on the user's video screen with a list of all connected CPUs. OSD allows CPUs to be named (with up to 12-character names). OSD then allows selection of CPUs by that name. Connected CPUs can be listed by name or by port number. OSD Search Mode enables the user to type in the first few characters of the CPU's name and the OSD will locate it. Help screens assist with all OSD functions.

### Security Option

The security option of the OSD Control enables an administrator to control access to the CPU ports for each user. Up to 24 users can be created. These users have controlled access to any CPU. Only the administrator can activate or deactivate the security features. Security can be activated from the Maintenance Mode menu (page 16) with a successful administrator login for verification purposes. Furthermore, the administrator can set a maximum idle time value after which the current user will be logged out and the login screen displayed. This time out does not function while the OSD is active. The current security status, idle time out, and scan dwell time are all saved and will be restored whenever power to the switch is cycled OFF, then ON.

### Enabling the Security Feature

To enable the security feature the administrator must first enter Command Mode from the keyboard using the sequence <Ctrl> + <'> (accent key). The OSD menu will automatically appear on the monitor in addition to illuminating the Command Mode indicator LED on the KVM switch. This provides a visual way to control the KEEMUX using the keyboard, monitor, and mouse.

**The administrator**, when setting the KEEMUX up for the first time, may want to proceed directly to the ADMINISTRATION Mode by typing <CTRL> + <M>, then <A>, and then <Y>.

The factory settings are:

- **default user name = ADMINISTRATOR**
- **default password = ADMINISTRATOR**

**FYI: The user name for administrator cannot be changed from "ADMINISTRATOR"**

Once logged-in, follow the instructions on pages 11 and 12 for setting up users and changing the administrator password. Once the password is setup, if it is lost or forgotten, the administrator will have to contact NTI for assistance on clearing the password and set it up again. Within the ADMINISTRATION Mode the administrator can setup each of the users and the limitations of their use of the individual CPUs on the system.

**When a standard user powers up the system a security screen may appear as setup by the administrator.** The user will need to login to the system by following the instructions below for the USER LOGIN. If the user does not know the appropriate user name and password (setup by the administrator), contact the system administrator for this information. Once logged-in a user can follow the Command Functions described on page 15 to control the system of CPUs within the limitations as set by the administrator.

### User Login Mode

User Login Mode requires a user to login with a user name and password from the list created by the administrator. Access to the functions of the KEEMUX will not be allowed until a user has logged in.

#### Function:

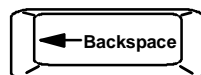
Adds a character to the user name/password

#### Keystroke:



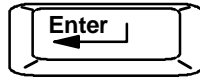
(Type any alphabetical or numeric character)

Removes previous character from the user name/password



**User Login Mode (Cont'd)****Function:**

Submit user name/password

**Keystroke:**

Exit User Login Mode and return to previous mode. This function is only available if security is not currently active.



*If the password submitted is incorrect, the user will not be able to proceed.*

*If the password submitted is correct, the user will proceed to the maintenance menu for additional feature options.*

## Additional Modes Available With Security

**NOTE:** The lists that follow are only available if the administrator is logged in.

### Administration Mode

Administration Mode allows the administrator to use the following functions:

**Function:****Keystroke:**

Change the administrator's password



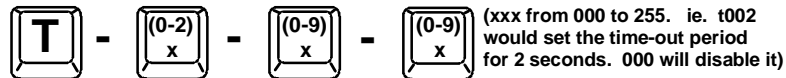
Enter User Name List Mode



Disable security



Selects the idle time in seconds



Exit Administration Mode and return to previous mode



### Administrator Password

To change the administrator password press <C> from the Administration Mode menu.

The administrator is able to change the administrator password as needed (see Fig. 9). Two edit fields are available, one for password, the other for verify password. The password can be up to 13 characters in length.

**Note:** The default password for the administrator is **ADMINISTRATOR**.



Figure 9- Administrator password change



**Function:****Keystroke:**

Add character to password string  
or verify password string



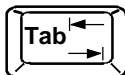
Delete previous character in  
edited string



Save new password.



Move to next field to be edited



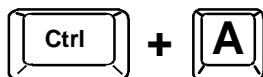
Return to Administration Mode

**User Name List**

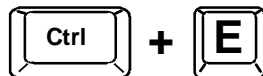
The User Name List displays the list of users and provides control for adding new users, changing or assigning user passwords, and changing access rights for any given user. User names may be up to 12 characters long, may not contain spaces, and are not case sensitive. Passwords may be up to 15 characters long, may not contain spaces, and are case sensitive.

**Function:****Keystroke:**

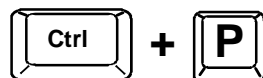
Edit the highlighted user's  
System Access rights



Enter Edit Mode to add/change/  
remove users



Change the highlighted user's  
password



Exit the User Name List and  
return to previous mode

**System Access List**

The System Access List displays a list of numbers representing the ports so the administrator can change access rights to the ports for the selected user. The user's name is displayed at the top of the access list. The mouse is used to change access rights by clicking on a given number to toggle a port's status. A user that has access to a port can connect to that port and control the CPU connected to that port when in Normal Mode.

**Function:****Keystroke:**

Save the changes to the access  
list and return to previous mode



Exit the System access list without  
saving and return to previous mode.





User Access Functions

Introduction

The OSD menu enables a user to name the CPUs connected to the KEEMUX and connect to them using that name from a single keyboard and mouse. The OSD is positioned on the user's monitor, displaying 8 CPU names at a time. The screen can be used for switching as well as editing the CPUs' names. Through the OSD menu, the user can control the KEEMUX to cycle through all modes of operation: COMMAND, SCAN, BROADCAST and NORMAL. LEDs on the front panel will illuminate to indicate when these modes are enabled.

OSD Command Mode

If the OSD option is installed, when entering the Command Mode from the keyboard using the <Ctrl> + <`> (accent key), the On Screen Display menu will automatically appear on the monitor in addition to illuminating the indicator LEDs on the KVM switch. This provides a visual way to control the KEEMUX using the keyboard, monitor, and mouse.

The list below describes the command functions available from the keyboard within the OSD mode of control after entering into Command Mode and while the COMMAND LED is illuminated:





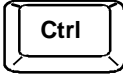

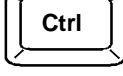

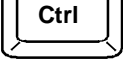







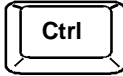





Function:	Keystroke:
Select the previous port	
Select the next port	
Enable/disable Scan Mode	 + 
Enable/disable Broadcast Mode	 + 
Enter Edit Mode	 + 
Enter Maintenance Mode	 + 
Display Help Menu (available with every control mode)	



Figure 10- Command Mode menu

Sets scan time-out on each port	 +  -  -  -  (xxx from 002 to 255. ie. t002 would set the time-out period for 2 seconds)
Selects a specific port	 +  -  -  (Pxx would be P01, P02, etc.)
Enters Search Mode and adds a character to search string and selects the CPU's name that matches best.	 (Type any alphabetical or numeric character)
Selects the first port on the switch	

**Note:** The user must exit Command Mode to type to a CPU.

To exit Command Mode, either hold down any touch-switch on the front panel for more than 2 seconds, OR press <ESC>.

**OSD Command Mode (Cont'd)****Function:****Keystroke:**

Selects the last port on the switch



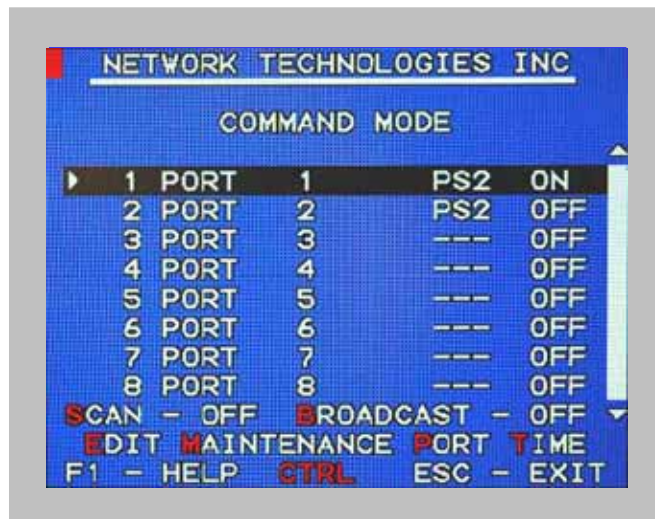
Switch to a selected port



Exit OSD Command Mode



The mouse can also be used to control Command Mode. The mouse cursor can be moved to the Scan, Help, and Exit fields where the user can then click on the left mouse button to perform that function. Ports listed on the screen can be selected by moving the cursor onto that port and clicking. Clicking twice on a selected port will switch to that port and exit Command Mode. To change the displayed ports on the screen simply click on the up and down arrows located to the right of the port names displayed.

**Figure 11- Press <Ctrl> for more functions****Scan Mode**

When in Scan Mode the switch scans to each port with a CPU powered-ON. (The SCAN LED on the front panel will illuminate and remain ON while in Scan Mode.) To enter Scan Mode press <Ctrl> + <S> from Command Mode. The port with the CPU powered-ON remains active while in use. When the switch becomes idle for the configured time-out period (default time-out period is 5 seconds) the switch will connect to the next powered-ON CPU port. See Command Mode section above for configuring the scan time-out period.

**NOTE: The keyboard and mouse must remain idle for the full scan time-out period before the switch will connect to the next active port.**

**Broadcast Mode**

**(Use with extreme caution or commands intended for one CPU will be sent to all CPUs)**

Broadcast Mode allows the operator to send keystrokes to all active CPUs simultaneously (even those CPUs the user cannot connect to due to lack of security access). To enter Broadcast Mode press <Ctrl> + <B> from Command Mode. Broadcast Mode is indicated by the illumination of the BROADCAST LED on the front panel. The BROADCAST LED will remain ON while in Broadcast Mode. However, Broadcast Mode has some critical requirements:

- BROADCAST LED must be OFF when booting any attached CPUs.
- BROADCAST LED must be ON and COMMAND LED must be OFF for keystrokes to reach attached CPUs.

**Normal Mode**

When all of the KEEMUX mode LEDs are OFF the user is in Normal Mode, controlling the CPU to which the user is connected through the KEEMUX.

**Edit Mode**

Edit Mode allows the user to modify the names of the CPUs connected to the switch. Names of CPUs can be up to 12 characters in length. To enter Edit Mode press <Ctrl> + <E> from Command Mode. When in Edit Mode, multiple keystroke combinations are not valid (<SHIFT>+<P>, <CTRL>+<P>, <ALT>+ <P>, and <P> will all type a "P" to the display - lower case letters cannot be typed). After changes have been made the user will be prompted by the menu to save the changes. Answer "Y" to save changes and answer "N" to continue using previously entered port names.









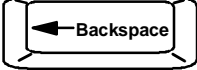
Function:	Keystroke:
Move cursor one position to the right	
Move cursor one position to the left	
Previous port	
Next port	
Selects the first port on the switch	
Selects the last port on the switch	
Toggles between insert and overstrike	 (The character either gets inserted and the remainder of the name gets shifted to the right, OR the current character gets overwritten.)
Erase current character	
Erase previous character	



Figure 12- Edit Mode screen

When finished making changes in Edit Mode, press <Enter> and a prompt will appear to press either <Y> to save the changes or <N> to continue making changes without saving the changes just made. If the <ESC> key is pressed instead of <Enter>, all changes made will be cancelled and the display will return to the previous menu.

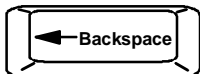
## Search Mode

**Search Mode** allows the user to enter and maneuver through a list of CPU names. As the user types, the best matching CPU name is selected. The list of CPUs may also be searched for a specific (or similar) name. From Command Mode, type any alphabetical or numeric character to enter Search Mode. The following commands are valid when the search option has been invoked from Command Mode.

### Function:

### Keystroke:

Erase previous character in search name



Move cursor one position to the right in search name



Move cursor one position to the left in search name



Select previous port



Select next port



Add a character to the search string and select the best matching CPU name



(Type any alphabetical or numeric character)

Exit Search Mode, return to Command Mode



Switch to selected port



Figure 13- Search Mode screen

## Maintenance Mode

Maintenance Mode allows a user to customize the On Screen Display to their requirements. To enter Maintenance Mode press <Ctrl> + <M> from Command Mode.

### Function:

### Keystroke:

Reset all of the port names



Toggle between numeric and alphabetic listing of ports



Move On Screen Display (OSD) window up on monitor



Move OSD window down on monitor



Move OSD window to the right



Move OSD window to the left



Figure 14- Maintenance Mode screen

**Maintenance Mode (Cont'd)****Function:****Keystroke:**

Make OSD window taller



Make OSD window shorter

Change user password.  
(Present only when a standard user is logged in.)

Log current user out and return to User Login Mode.

**Activate security features.**

Present only when security is available but not active.

**Enter Administration Mode.**

Option present only when administrator is logged in.

**NOTE:** If activating security features, the user will be prompted for a "Y" (yes) or "N" (no) to confirm the menu choice, at which point the user will be asked for a username and password before continuing. Only the administrator can activate the security features.

Save OSD window parameters for the port



Return to Command Mode

**Help Mode**

This mode displays a list of commands with a short explanation of their function. These lists are organized in pages for each mode (i.e. COMMAND, EDIT, SEARCH, and HELP). To enter Help Mode press <F1> from Command Mode. The following options allow the user to quickly obtain information on any command.

**Function:****Keystroke:**

View the previous page of help if available



View the next page of help if available



Exit HELP and return to previous mode



**RS232 CONTROL****(Optional)****RS232 Connections and Configuration****Remote Connection**

The RS232 Interface (optional) is designed to meet the RS232C standard and can be controlled from any CPU or other controller with an RS232 communications port. The pin-out for the DB-9 connector(s) on the unit is as follows:

**RS232 CONNECTOR (DB-9 FEMALE)**

PIN	SIGNAL	FUNCTION
1	CD	Carrier Detect
2	TXD	Transmit data (RXD at host)
3	RXD	Receive data (TXD at host)
4	DTR	Data terminal ready
5	GND	Signal ground
6	DSR	Data set ready
7	RTS	Request to send
8	CTS	Clear to send
9	-	No connection

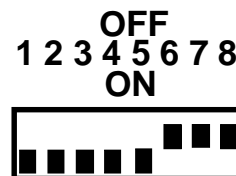
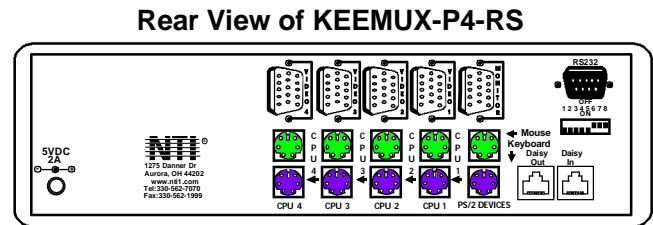
**Note: Security must be disabled or user access granted on the port(s) to be selected by RS-232 control.**

On the DB-9 female connector, pins 1 (DCD), 4 (DTR), and 6 (DSR) are shorted and pins 7 (RTS) and 8 (CTS) are shorted. Therefore, host handshaking is bypassed and TXD and RXD are the only active signals. A straight-through DB-9 serial cable (**not null modem- see specifications on page 26**) will work for most CPUs. To daisy chain multiple units, a Matrix Y-1 cable is used (see page 19) for each KEEMUX in the chain. The last unit in the chain should have DIP switch 1 ON (see table under "Unit Address and Loop Back" on page 19).

**Baud Rate**

The baud rate can be changed by powering down the unit, changing the 8 position RS232 dip switch on the rear of the KEEMUX, and then powering back up. This table shows how to set the baud rate.

DIP SWITCH			BAUD RATE
4	3	2	
OFF	OFF	OFF	300
OFF	OFF	ON	600
OFF	ON	OFF	1200
OFF	ON	ON	2400
ON	OFF	ON	9600
ON	ON	OFF	
ON	ON	ON	





## Unit Address and Loop Back

To allow multiple units to be controlled from a single CPU port, the RS232 control interface is designed to allow "daisy chaining" up to 15 units. By setting the appropriate RS232 dip switches, each unit can be given a unique address (1-15). Then the unit will only respond to commands on the bus if its address is embedded in the command. Use the table below to set the unit address.

DIP SWITCH				UNIT ADDRESS
8	7	6	5	
OFF	OFF	OFF	OFF	0 (not valid)
OFF	OFF	OFF	ON	1
OFF	OFF	ON	OFF	2
OFF	OFF	ON	ON	3
OFF	ON	OFF	OFF	4
OFF	ON	OFF	ON	5
OFF	ON	ON	OFF	6
OFF	ON	ON	ON	7
ON	OFF	OFF	OFF	8
ON	OFF	OFF	ON	9
ON	OFF	ON	OFF	10
ON	OFF	ON	ON	11
ON	ON	OFF	OFF	12
ON	ON	OFF	ON	13
ON	ON	ON	OFF	14
ON	ON	ON	ON	15

**Note:** In order to connect multiple KEEMUX units together a Matrix-Y-1 cable must be used. (See Fig. 15.) See Fig. 16 for the pinout of the Matrix-Y-1 cable. The Matrix-Y-1 cable is available from Network Technologies Inc.

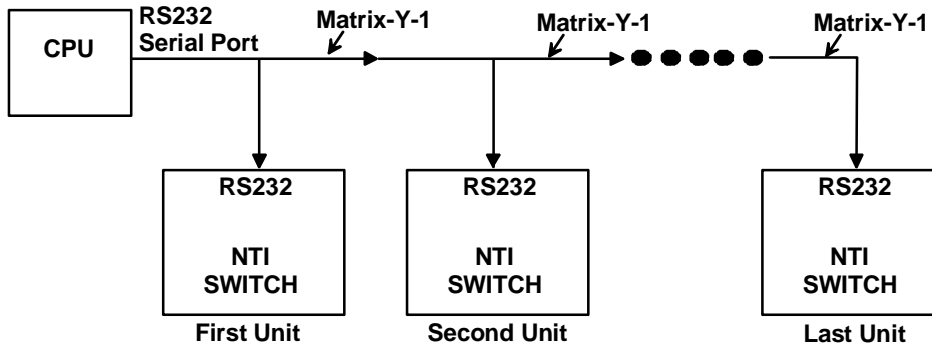


Figure 15- RS232 connection with Matrix-Y-1 cable

### Wiring Schematic of Matrix-Y-1 cable

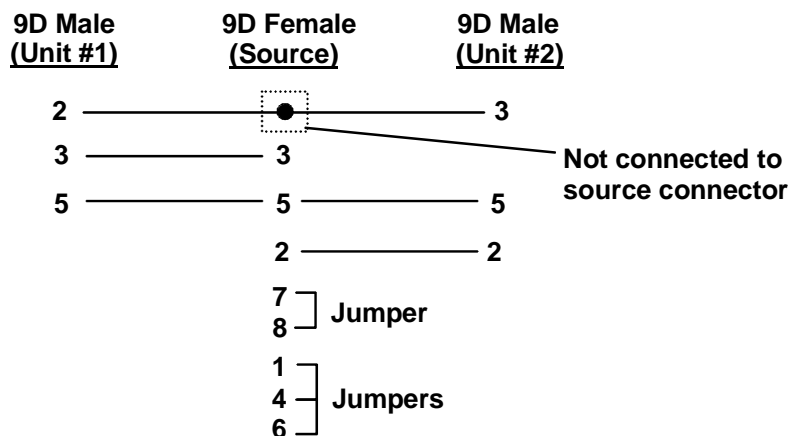


Figure 16- Pinout of Matrix-Y-1 cable

## Command Protocol

CPU controller commands supported by the unit are defined below. All commands should be terminated with a <CR> (carriage return). When a command is sent, the entire string is echoed back along with a response from the addressed unit. All characters in the command string should be upper case, and all numbers below 10 should have a leading 0 (ex: 1 = 01). As command strings are sent, the inner character delay cannot exceed 500 milliseconds.

**Note: To use this command protocol, the user is required to write a program that will send an entire command string all at once, not character by character. Programs that send one character at a time (such as HyperTerminal) cannot be used to control the KEEMUX. Alternatively, the user may use the Matrix Switcher's Control Program or SerTest to control the KEEMUX via RS232 (see page 21).**

### RS - reset unit(s) to default power-up configuration

FORMAT: RS AA<CR>  
 RS = "reset unit" command followed by at least one space  
 AA = unit address; if 00, all units on the bus will be reset and no response will be returned

RESPONSE: \*<CR> if command received and executed OK

**-OR-**

?<CR> if syntax or transmission error occurred

**Note: The RS command does not change the actual configuration.**

### CS - change single USER channel

FORMAT: CS AA,XX,YY<CR>  
 CS = "change single output" command followed by at least one space  
 AA = unit address  
 XX = input/CPU to connect  
 YY = output/USER to change

RESPONSE: \*<CR> (command received and executed OK)

**-OR-**

?<CR> (syntax or transmission error occurred)

### RO - read single USER channel

FORMAT: RO AA,XX<CR>  
 RO = "read output" command followed by at least one space  
 AA = unit address  
 XX = output/USER to read

RESPONSE: \*<CR> (command received and executed OK)

XX<CR> (XX = input/CPU connected)

**-OR-**

?<CR> (syntax or transmission error occurred)

### RU - read unit size

FORMAT: RU AA<CR>  
 RU = "read unit size" command followed by at least one space  
 AA = unit address

RESPONSE: \*<CR> (command received and executed OK)

XX,YY<CR> (XX = # of CPU's, YY = # of USERS)

**-OR-**

?<CR> (syntax or transmission error occurred)



## NTI Switch Control Program For Windows 9X, NT, 2000 And XP

The Matrix Switcher's Control Program is an easy and powerful graphical program that controls NTI switches through an RS232 interface. The NTI Switch Control Program is included on the CD packaged with the KEEMUX. The NTI Switch Control Program is downloaded by clicking on the link "Download NTI Switch Control Program" found on the webpage that opens when you insert the instruction manual CD into your CD ROM drive.

To install the NTI Switch Control Program after downloading

1. Locate the **Setup.exe** in the directory the program was downloaded to and double-click on it
2. Follow the instructions on the screen

The NTI Switch Control Program performs best on monitors set to a screen resolution of at least 800 X 600. Instruction for using the NTI Switch Control Program is available by opening "MSCP Help" in the "NTI" program group once the program has been installed and is open on the screen.

To open "MSCP Help" from the Windows desktop

1. Click on **START**
2. Click on **PROGRAMS**
3. Click on **NTI**
4. Click on **MSCP Help**

## SerTest- RS232 Interface Test Program

This software allows a user to test the functions of an NTI server switch, matrix switch or Multi-user/Multi-platform/Single-user switch RS232 interface. The SerTest program is automatically loaded when installing the MATRIX SWITCHER'S CONTROL PROGRAM as described above. The SerTest program, located in the NTI program group, generates a main menu with the 4 selections described below:

### Main Options

- Switch Operations                      - send commands to the unit.
- Ethernet Operations                  - set ethernet connection variables (not applicable to this model)
- Setup Options                          - set COM port, baud rate, and unit address
- About SerTest                          - display the program version

If Matrix Operations is selected, the following menu is displayed:

### **SWITCH OPERATIONS**

- 1) Reset Unit
  - send a reset command to the switch
  - the current unit address is displayed in parentheses
- 2) Reset All Units
  - send an internal reset command to all switches
- 3) Connect Output/User to an Input/CPU
  - connect an output to an input
- 4) Connect All Outputs/Users to an Input/CPU (not applicable to this model)
  - connect all outputs to an input
- 5) Connect Audio Output/User to an Input/CPU (only applicable to models with audio support)
  - connect an output to an input (Audio ports only)
- 6) Connect All Audio Outputs/Users to an Input/CPU (only applicable to models with audio support)
  - connect all outputs to an input (Audio ports only)
- 7) Change Mute Status for Audio Output/User (only applicable to models with audio support)
  - mute or un-mute the Audio port output

- 8) Change Volume for Audio Output/User (only applicable to models with audio support)
  - change Audio port output volume
- 9) Read Connection for Output/User
  - read what input is connected to the specified output
- a) Read Connection for Audio Output/User (only applicable to models with audio support)
  - read what input is connected to the specified output
- b) Read Mute Status and Volume for Audio Output/User (only applicable to models with audio support)
  - read the volume and the mute status of the specified output (Audio ports only)
- c) Read Unit Size
  - read the switch size (number of inputs and outputs)
- d) Read Unit Version/Revision String (not supported by this model)
  - read a string containing the switch version, type, and size
- e) Save I/O Connections into Unit Memory (not applicable to this model)
  - save the connections into switch memory bank
- f) Restore I/O Connections from Unit Memory (not applicable to this model)
  - restore the connections from switch memory bank
- g) Save All Units I/O Connections into Units Memory (not applicable to this model)
  - save the connections into switch memory bank, command for all switches
- h) Restore All Units I/O Connections from Units Memory (not applicable to this model)
  - restore the connections from switch memory bank, command for all switches
- i) Change All Units Baud Rate (9600/COM1)
  - change RS-232 Baud rate of all switches
  - the current baud rate and serial port are displayed in parentheses

#### **ETHERNET OPERATIONS (not applicable to this model)**

#### **SETUP OPTIONS**

- 1) select Com port current: (COM1:)
  - select PC serial port
  - the current PC serial port is displayed in parentheses
- 2) select Baud rate current: (9600)
  - select PC serial port baud rate
  - the current baud rate is displayed in parentheses
- 3) set unit Address current: (1)
  - select the unit address of the switch to be connected to by this program
  - the current address is displayed in parentheses

**For any selection that requires user input, the user is prompted. When commands are sent to the KEEMUX, the command string and KEEMUX responses are echoed to the screen. All commands generated by the program are formatted according to the information provided in sections above. If any transmission problems are detected, an error message is displayed.**

**Press <Esc> or <Enter> to back out to the main menu and press again to exit.**

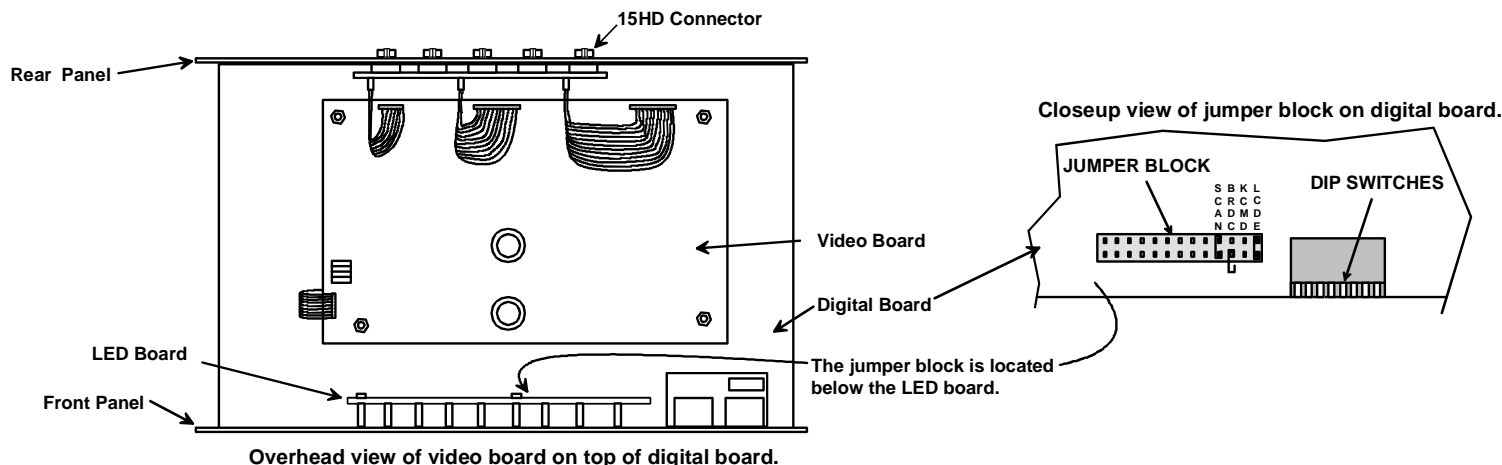
## **KEYBOARD MAPPING**

The keyboard configuration of each CPU is saved in the KEEMUX. For example, if the CPU attached to Port 4 had CAPS LOCK and NUM LOCK selected the last time that CPU was accessed, then they will automatically be set when Port 4 is accessed again.

## HOW TO DISABLE OPERATING MODES

The operating modes of the KEEMUX can be disabled if a user desires to do so. The Command Mode can be disabled which would also disable the Scan and Broadcast Modes, or, the Scan and/or Broadcast Modes can be individually disabled leaving the other features in Command Mode enabled.

To disable these operating modes, the user must get access to the jumper block. This block is located close to the dip-switches on the circuit board the keyboards plug into (called the digital board) inside the KEEMUX. (See Fig. 17.)



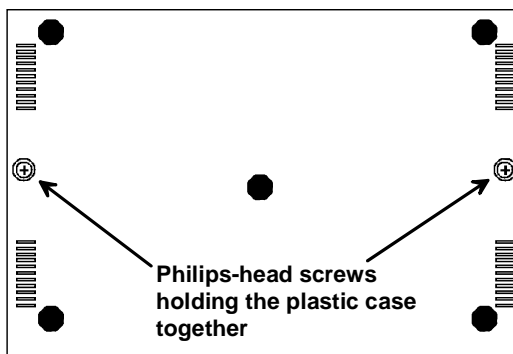
**Figure 17- Location of the jumper block**

If the unit is a rackmount style, the digital board is located directly beneath the cover of the unit, requiring the user to only remove the 10 screws from the cover to get access. With the cover removed, the jumper block will be easy to locate. Follow the instructions under "CONFIGURING THE JUMPER BLOCK" on page 24 to disable the desired mode(s).

If the unit is in a plastic case, the digital board is located on the bottom of the case, requiring the user to partially disassemble the unit to gain access to the jumper block.

### For models KEEMUX-Px in a plastic case:

1. Make sure the KEEMUX is completely disconnected from all CPU components. Be sure to unplug the KEEMUX from the electrical outlet.
2. Remove the two Philips-head screws from the underside of the KEEMUX and set the KEEMUX on a firm and flat surface, bottom down. (See Fig. 18.)



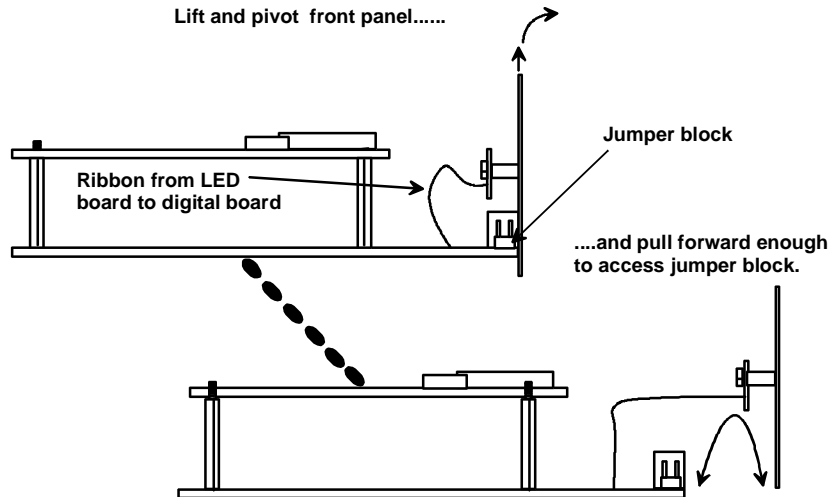
**View of bottom of plastic case**

**Figure 18- Remove screws to open case**

3. Remove the top half of the plastic case from the KEEMUX.

**NOTE:** Before proceeding, it is important to discharge any static charge you may be carrying by touching any large metal object (away from the KEEMUX).

- With it loosened, grasp firmly the front panel and slide the front panel up out of the slots in the plastic case that support it. Once clear of the case, pivot the assembly forward approximately 1", just enough to provide access to the jumper block. (See Fig. 19.) Be careful not to dislodge the connection of the ribbon connecting the front panel to the digital board. If it appears to become loose, be sure to reseat the connection before re-assembly. Now follow the instructions under "CONFIGURING THE JUMPER BLOCK" on page 24.



Pull front panel assembly far enough forward to provide access to jumper block.

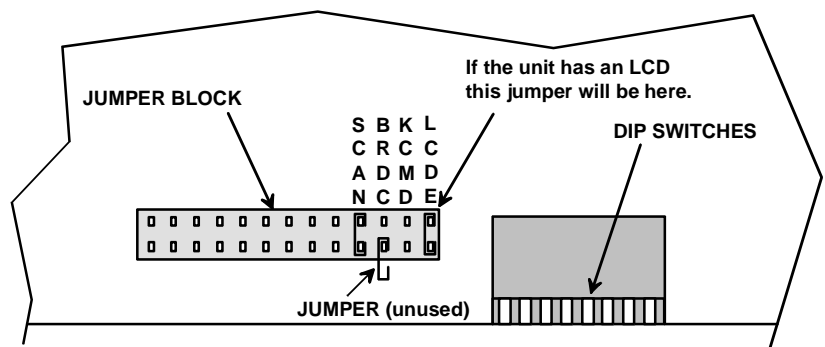
Figure 19- Clear the jumper block for configuration access

## Configuring The Jumper Block

Once the jumper block is exposed, apply a jumper across the appropriate pins to disable the desired mode(s) according to the chart below.

Pin Designation	Mode
KCMD	Command Mode*
BRDC	Broadcast Mode
SCAN	Scan Mode

\*Note: Putting a jumper across pins KCMD to disable Command Mode will also disable Broadcast and Scan Modes.



Drawing shows jumper across SCAN pins, disabling Scan Mode. Broadcast Mode is still enabled.

Figure 20- Place jumpers according to desired functionality

Once the desired jumpers are in place, reverse the disassembly process to re-assemble the KEEMUX. Be particularly careful to make sure all dip switches are in the OFF position (see Fig. 1 on page 3). Do not turn the power ON until the unit has been properly re-assembled.

## AUDIO SUPPORT

### (Optional)

Audio support provides the following additional features:

- Audio signals from the same CPU that keyboard, mouse, and video signals are from can be received by the user.
- Audio inputs accept any standard line level audio (1Vrms or 2.5Vp-p).
- Audio outputs are capable of driving an 8 Ohm speaker load with 200mW of continuous RMS power.

Audio signals are switched along with the keyboard, mouse and video signals using the buttons on the KEEMUX switch.

### Rear View of KEEMUX-P4-A

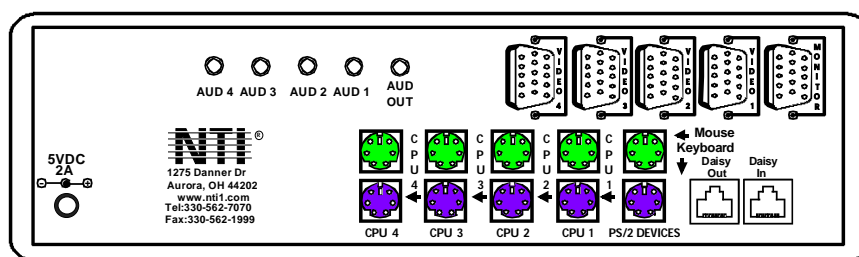


Figure 21- Control CPU audio with KEEMUX-P4-A

## DUAL VIDEO SUPPORT

### (Optional)

Dual Video support enables CPUs with two video outputs to be connected to the KEEMUX switch and two user monitors to be connected to view both sets of video signals. Both monitors must be of the type VGA multi-scan.

### Rear View of KEEMUX-P4-DV

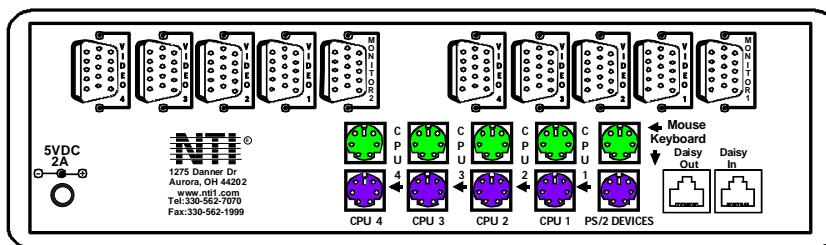
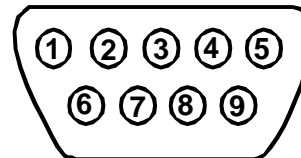


Figure 22- Connections for video cables on the KEEMUX-P4-DV

## SPECIFICATIONS FOR STRAIGHT-THROUGH RS232 SERIAL CABLE

### KEEMUX to PS2 CPU (9 PIN)

KEEMUX		Signal Direction	PS/2 CPU	
9 pin			9 pin	
Function	Pin #		Pin #	Function
RxD	3	←	3	TxD
TxD	2	→	2	RxD
CTS	7	←	7	RTS
RTS	8	→	8	CTS
DSR	4	←	4	DTR
DTR	6	→	6	DSR
SG	5	—	5	SG



**Mating Face  
of a 9D Male**

Terminals 7 and 8 are jumpered together and terminals 4 and 6 are jumpered together.

## TROUBLESHOOTING

If the KEEMUX is not working properly, please look for a solution in the list below:

**PROBLEM:** Keyboard Errors

**SOLUTION:** Check cable connections on each CPU and the switch.

**PROBLEM:** No Video

**SOLUTION:** Check cable connections on each CPU and the switch. Verify that keyboard, video, and mouse connect from each CPU to matching ports. After reconnecting, the CPU may need to be re-booted in order to sense the monitor connection.

**PROBLEM:** No Mouse Movement

**SOLUTION:** Check cable connections on each CPU and the switch. Verify that keyboard, video, and mouse connect from each CPU to matching ports. Verify that the mouse driver was loaded.

**PROBLEM:** No Keyboard Activity after running shutdown program on IBM PowerServer 220

**SOLUTION:**

1. Select a different port from the front panel buttons.
2. Turn power OFF to PowerServer 220.  
(either step above will enable keyboard)

**PROBLEM:** Monitor shuts down while working with OSD menu

**SOLUTION:** Disengage or increase time setting of CPU's monitor "sleep" mode from the BIOS and/or control panel display settings. (The CPU does not sense activity while in the OSD menu )

If a solution was not found in the list above, answers may be found in the Frequently Ask Questions (FAQs) section of our website at <http://www.nti1.com> or call us directly at **(800) 742-8324 (800-RGB-TECH)** or **(330) 562-7070** and we will be happy to assist in any way we can.

## WARRANTY INFORMATION

The warranty period on this product (parts and labor) is two (2) years from the date of purchase. Please contact Network Technologies Inc at **(800) 742-8324 (800-RGB-TECH)** or **(330) 562-7070** or visit our website at <http://www.networktechinc.com> for information regarding repairs and/or returns. A return authorization number is required for all repairs/returns.