

USER MANUAL

SM260A, SM262A SERIES

2U PRO SWITCHING SYSTEM

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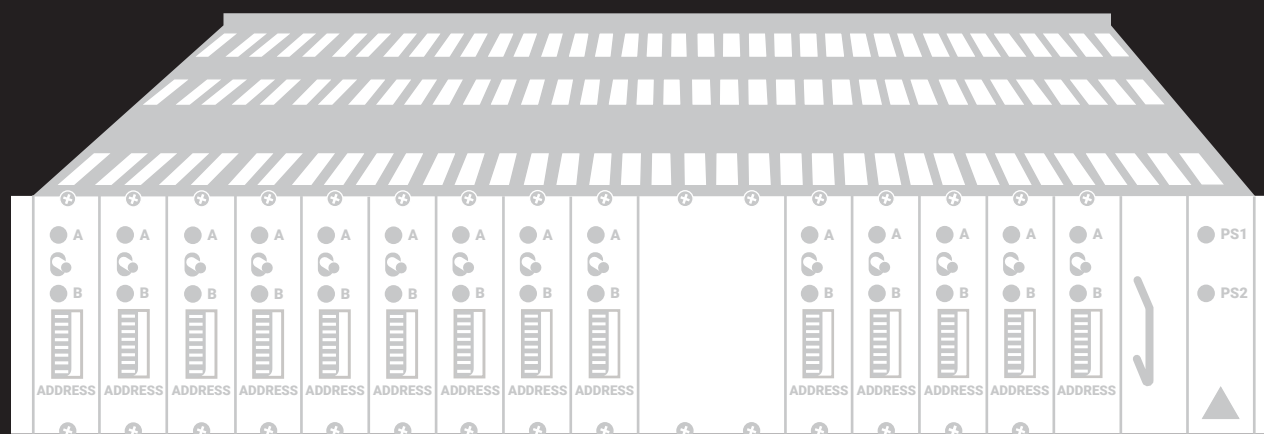


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CHAPTER 1: SPECIFICATIONS**TABLE 1-1. SPECIFICATIONS**

Connectors	<p>RJ-45 A/B SWITCH CARD – (3) RJ-45 connectors (8 or 10 pin depending on model);</p> <p>CAT6 RJ-45 A/B SWITCH CARD – (3) CAT6 RJ-45 connectors;</p> <p>FIBER OPTIC A/B SWITCH CARDS – (3) Duplex fiber optic SC or ST receptacles (FC and LC also available);</p> <p>DB9 A/B SWITCH CARD – (3) DB9 female connectors (male optional);</p> <p>DB15 A/B SWITCH CARD – (3) DB15 female connectors (male optional);</p> <p>DB25 A/B SWITCH CARD – (3) DB25 female connectors (male optional);</p> <p>DB25 SIGNAL MONITORING A/B SWITCH CARD – DB25 female (port C), DB25 male (ports A & B);</p> <p>F-TYPE A/B SWITCH CARD – (3) female F type connectors;</p> <p>CONTROLLER CARD – (1) RJ-45, (2) RJ-11;</p> <p>EXTERNAL POWER SUPPLY ADAPTER CARD – (2) two-pin Molex connectors, (2) two-position terminal blocks;</p> <p>INTERNAL AC POWER SUPPLY CARD – (1) IEC320 connector, (1) three-position terminal block;</p> <p>INTERNAL DC POWER SUPPLY CARD – (2) three-position terminal blocks</p>
Indicators	<p>A/B SWITCH CARDS – (2) LEDs, one for A, one for B;</p> <p>CONTROLLER CARD – (2) LEDs, one for power, one for status;</p> <p>EXTERNAL POWER SUPPLY ADAPTER CARD – (2) LEDs, one power indicator for each external power supply;</p> <p>INTERNAL AC or DC POWER SUPPLY CARD – (1) LED, power indicator;</p> <p>DB25 SIGNAL MONITORING A/B SWITCH CARD – (6) LEDs, A, B, TxD, RxD, RTS, DCD</p>
Switches	<p>A/B SWITCH CARDS – (1) momentary toggle switch, (1) 8-position DIP switch;</p> <p>CONTROLLER CARD – (1) momentary toggle switch, (1) 8-position DIP switch, (1) momentary push-button switch, and (1) key-lock switch;</p> <p>DB25 SIGNAL MONITORING A/B SWITCH CARD – (1) momentary toggle switch, (2) 8-position DIP switch</p>
Ethernet Management Interface (SNMP/Ethernet Controller Card only)	10BASE-T, Half-Duplex, does not support Auto MDI-X
Power	<p>RJ45 A/B SWITCH CARD – 12 VDC, 40 mA normal, additional 92 mA max while switching;</p> <p>CAT6 RJ45 A/B SWITCH CARD – 12 VDC, 40 mA normal, additional 92 mA max while switching;</p> <p>FIBER OPTIC A/B SWITCH CARD, PSEUDO NON-LATCHING – 12 VDC, 40 mA in A position, 120 mA max in B position, additional 13 mA max while switching;</p> <p>FIBER OPTIC A/B SWITCH CARD, NON-LATCHING – 12 VDC, 40 mA in A position, 133 mA max in B position;</p> <p>FIBER OPTIC A/B SWITCH CARD, LATCHING – 12 VDC, 40 mA normal, additional 80 mA max while switching;</p> <p>DB9 A/B SWITCH CARD – 12 VDC, 40 mA normal, additional 92 mA max while switching;</p> <p>DB15 A/B SWITCH CARD – 12 VDC, 40 mA normal, additional 147 mA max while switching;</p> <p>DB25 A/B SWITCH CARD – 12 VDC, 40 mA normal, additional 239 mA max while switching;</p> <p>RS-232/DB25 SIGNAL MONITORING A/B SWITCH CARD – 12 VDC, 40 mA normal, additional 239 mA max while switching;</p> <p>RS-530/DB25 SIGNAL MONITORING A/B SWITCH CARD – 12 VDC, 100 mA normal, additional 239 mA max while switching</p> <p>F-Type A/B SWITCH CARD, LATCHING – 12VDC, 40 mA normal, additional 52 mA max while switching;</p> <p>F-Type A/B SWITCH CARD, NON-LATCHING – 12VDC, 40 mA in A position, 92 mA max in B position;</p> <p>CONTROLLER CARD – 12 VDC, 100 mA normal, additional 250 mA with Ethernet module.</p> <p>The rack may be powered with either a (90 – 264 VAC, 47 – 63 Hz) internal AC supply card, or a (36 – 60 VDC) internal DC supply card, both of which provide 12 VDC, 4.2A max output. The rack may also be powered with one or two external (90 – 264 VAC, 47 – 63 Hz input, 12 VDC, 5A output) power supplies using the external power supply adapter card. Two or more power supplies may be used in a single rack for redundancy.</p>



CHAPTER 1: SPECIFICATIONS

TABLE 1-1 (CONTINUED). SPECIFICATIONS

Rack Size	RACK – 18 card slots, 3.5" H x 19" W x 12.5" D (including handles and connectors); RJ-45 A/B SWITCH CARD – one slot (0.937 inches wide); CAT6 RJ45 A/B SWITCH CARD – one slot (0.937 inches wide); FIBER OPTIC A/B SWITCH CARDS – one slot (0.937 inches wide); DB9 A/B SWITCH CARD – two slots (1.875 inches wide); DB15 A/B SWITCH CARD – three slots (2.812 inches wide); DB25 A/B SWITCH CARD – three slots (2.812 inches wide); DB25 SIGNAL MONITORING A/B SWITCH CARD – three slots (2.812 inches wide); F-TYPE A/B SWITCH CARD – one slot (0.937 inches wide); CONTROLLER CARD – one slot (0.937 inches wide); EXTERNAL POWER SUPPLY ADAPTER CARD - one slot (0.937 inches wide); INTERNAL AC or DC POWER SUPPLY CARD - two slots (1.875 inches wide)
Optical Wavelength	800 through 1600 nm (latching multimode models); 850 and 1310 nm (non-latching multimode models); 1310 and 1550 nm (single mode models)
Insertion Loss	2.0 dB maximum (multimode models); 1.5 dB maximum (single mode models)
Optical Isolation	35 dB minimum (multimode models); 55 dB minimum (single mode models)
Temperature	Operating: 32 to 104° F (0 to 40° C); Non-operating: +14 to +158° F (-10 to +70° C)
Humidity	Up to 80%, noncondensing
Altitude	40,000 ft. (maximum)



CHAPTER 2: OVERVIEW

The 2U Pro Switching System is a 2U 19" rack style chassis containing multiple A/B Switch Cards. Each switch card connects port A or port B to port C, through latching or non-latching telecommunication relays or fiber optic switch mechanisms. For models using latching mechanisms, the connection state will be maintained if power fails or is removed. Non-latching versions will revert to the port C to port A connection state when power is lost, and will remain in that state when power is restored until a new switch command is received. Pseudo Non-latching fiber optic switch cards fall back to the "Port C to Port A" connection when power fails or is removed. When power is re-applied, the optical switch in a pseudo non-latching fiber optic switch card will reconnect port C to the port (A or B) that was selected prior to the loss of power. The non-latching styles of fiber optic switch cards are often used when a fall-back or "failover" style of connection scheme is desired in the event of power failure.

The 2U rack has 18 slots and can accept any mix of switch cards, power supply cards, and one Controller Card (one required per chassis). Any type of card can be installed in any slot in the rack, allowing for maximum flexibility of cable routing etc. If a single slot power supply card is used, the rack can hold up to 16 A/B Switch Cards, and a Controller Card. Each A/B Switch Card can be individually switched, or the entire rack can be switched from the Controller Card. The Controller Card has a keyed switch to enable and disable manual switching (disables the front panel toggle switches on the Controller Card and on each switch card). The Controller Card has two RJ-11 ports that are used for serial communications to the rack, and also allow multiple racks to be daisy-chained together to create a single system that can be controlled by the first rack in the daisy chain. The Controller Card also provides remote switching capabilities via an RS-232 interface or using a +/- 12 VDC signal from a remote toggle switch.

The Controller Card consists of a front PC board assembly and a rear PC board assembly set, and is available in three different versions (RS-232, SNMP/Ethernet, and SNMP Expansion). The RS-232 version supports Rack and System Gang Switching using the manual toggle switches on the Controller Card and A/B Switch Cards, and supports RS-232 communications on the gang-in and gang-out connectors. The RS-232 Controller Card allows system level (all cards in all racks) switching with serial commands (see Section 5.1 for additional info). The SNMP/Ethernet capable version features an RS-232 terminal interface that can be used to control individual A/B switch cards, a rack of A/B switch cards, or system of daisy-chained racks, and to configure the Ethernet port parameters (see Section 7 for additional info). The Ethernet port allows the rack or system of daisy-chained racks (containing the SNMP Expansion Controller Card) to be controlled using SNMP commands, Telnet commands, or via a built-in html based web browser interface. There can only be one SNMP/Ethernet capable Controller Card in a daisy-chained system of racks, and it must be in the first rack in the system. If daisy-chaining one or more racks from an SNMP/Ethernet capable rack, the additional racks must have an SNMP Expansion Controller Card, which is compatible with the message format from the SNMP/Ethernet Controller Card.

The SNMP/Ethernet Controller Cards also support SNMP traps or syslog messages (user configurable) for various events and errors, and can send these alerts to as many as 16 different remote monitoring locations.

The SNMP/Ethernet Controller Cards have an intelligent automatic switching capability. This feature allows the switching system to be used to monitor a specific Ethernet network connection and to automatically switch all ports (performs a system switch operation) based on whether the monitored IP address responds to ICMP echo requests (responds to PINGs) or not. See Section 5.5 for additional details.

The DB25 Signal Monitoring switch cards are described in a separate manual.

CHAPTER 3: CONFIGURATION

3.1 A/B SWITCH CARD CONFIGURATION

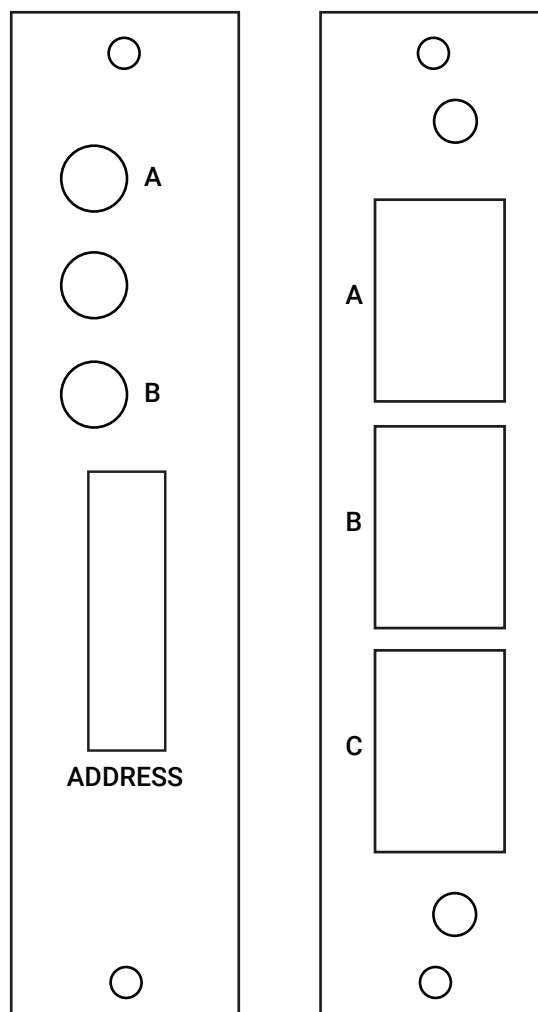


FIGURE 3-1. TYPICAL A/B SWITCH CARD FRONT AND REAR PANELS

Each A/B Switch Card has an 8-position DIP switch, used to set the card's address. Switch position 1 is the least significant bit, and position 8 is the most significant bit. Set each switch ON (as marked) for a '0', and OFF for a '1'. Card address 1 for example, would be DIP switch position 1 OFF, and positions 2-8 ON. Card addresses within a rack, or within a system of daisy-chained racks must be unique and one card **MUST** be addressed 1. Card address 0x00 is reserved and must not be used. A typical approach is to set rack 0x01, card addresses to 0x01 through 0x10 from left to right within the rack. In the second rack 0x02, set the card addresses to 0x11 through 0x20 and so on. The Controller Card communicates with the individual switch cards using a multi-drop scheme. If two A/B cards within the same rack or daisy-chained system of racks have the same address, both will try to respond at the same time, causing communication errors. Thus, the maximum number of A/B Switch Cards in a daisy-chained system of racks is limited to 255 switch cards.

CHAPTER 3: CONFIGURATION

3.2 CONTROLLER CARD REAR PC BOARD CONFIGURATION

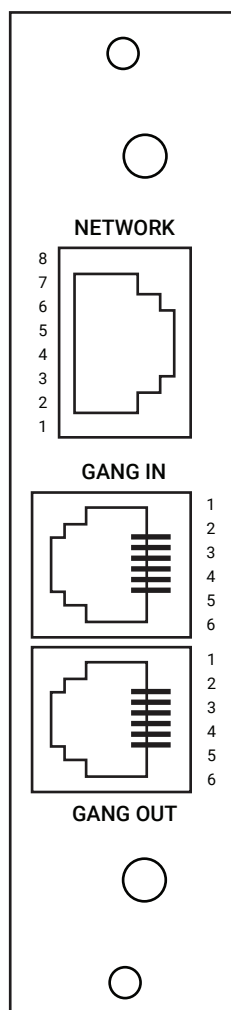


FIGURE 3-2. CONTROLLER CARD REAR PANEL OUTLINE

The Controller Card rear PC board assembly has two jumpers for shielding and grounding options. The two 3-position jumpers are positioned such that pin 1 is toward the card edge connector, and pin 3 is toward the RJ-11 connectors. Each 3-position jumper has a 2-position shunt, used to connect two of the three positions together.

TABLE 3-1. CONTROLLER CARD REAR PC BOARD JUMPER SETTINGS

JUMPER	W1	W2
RJ-45 Shield Connected to Frame Ground *	USB Type B connector	—
Open		
Power Supply Ground 100 Ohm Connection to Frame Ground *	—	Pin 1 to Pin 2 Pin 2 to Pin 3
Direct Connection to Frame Ground		

*Factory default positions

CHAPTER 3: CONFIGURATION

**TABLE 3-2. RJ-45 (OPTIONAL ETHERNET PORT)
PIN ASSIGNMENT**

PIN	SIGNAL NAME	SIGNAL DIRECTION
1	Transmit Pair	Output
2	Transmit Pair	Output
3	Receive Pair	Input
4	Receive Pair	Input

TABLE 3-3. RJ-11 GANG-IN PORT PIN ASSIGNMENT

PIN	SIGNAL NAME	SIGNAL DIRECTION
5	Signal Ground	Not applicable
4	Transmit Data / V+	Output/Output
3	Receive Data / V-	Input/Output
2	System Control (OPEN, +12, -12)	Input and Output

NOTE: The functions of pins 3 and 4, on the GANG-IN port, are set using jumpers on the front card. They can be configured as TXD and RXD for serial communication, or as V+ and V- to control the system control input with a remote toggle switch. The connections to V+ and V- are through 1 K ohm resistors. The System Control signal is used as an input and an output. As an Input signal, it is normally open. This input is driven to +12 VDC to switch the system to A, and is driven to -12 VDC to switch the system to B. As an output, this signal is driven to +10 VDC when the user initiates a system switch to A, and is driven to -10 VDC when the user initiates a system switch to B.

**TABLE 3-4. RJ-11 GANG-OUT PORT PIN
ASSIGNMENT**

PIN	SIGNAL NAME	SIGNAL DIRECTION
5	No connection	Not applicable
4	Transmit Data	Output
3	Receive Data	Input
2	Signal Ground	Not applicable

NOTE: A standard RJ-11 male/male crossover cable is required to connect from the gang-out port on one rack to the gang-in port on the next.



CHAPTER 3: CONFIGURATION

3.3 CONTROLLER CARD FRONT PC BOARD CONFIGURATION

The Controller Card front PC board has an 8-position DIP switch and four jumpers for user configurable options. The four 3-position jumpers are positioned such that pin 1 is toward the front panel, and pin 3 is toward the rear of the card. Each 3-position jumper has a 2-position shunt, used to connect two of the three positions together.

TABLE 3-5. CONTROLLER CARD FRONT PC BOARD JUMPER W1 AND W2 SETTINGS

JUMPER	W1	W2
Gang-In Pin 3 Connected to TXD * Connected to V+ through 1K	Pin 1 to Pin 2 Pin 2 to Pin 3	—
Gang-In Pin 4 Connected to RXD * Connected to V- through 1K	—	Pin 1 to Pin 2 Pin 2 to Pin 3

*Factory Default Setting

Jumpers W1 and W2 function as a pair to configure the gang-in port. Refer to Table 3-3 for the GANG-IN port pin assignment. Connect to TXD and RXD to support RS-232 serial communications, or connect to V+ and V- through 1 K ohm resistors to control the system control input with a remote toggle switch.

NOTE: The serial port is required for setup of the network parameters.

TABLE 3-6. CONTROLLER CARD FRONT PC BOARD JUMPER W4 AND W5 SETTINGS

JUMPER	W4	W5
Input Port Source Normal RS-232 * Optional SNMP/Ethernet version **	Pin 1 to Pin 2 Pin 2 to Pin 3	—
Input Port Source Normal RS-232 * Optional SNMP/Ethernet version **	—	Pin 1 to Pin 2 Pin 2 to Pin 3

* Factory Default Setting – RS-232 and SNMP Expansion versions

** Factory Default Setting – SNMP/Ethernet version

Jumpers W4 and W5 function as a pair to configure the input port source. It should not be necessary to change these jumpers from their factory set positions. These jumpers configure the source for communications to the internal processor on the Controller Card. If you have a Controller Card with an optional SNMP/Ethernet module installed, both jumpers should be set to connect pins 2 and 3. Otherwise, both jumpers should be set to connect pins 1 and 2 to allow the processor to communicate with the RS-232 signals from the GANG-IN port.

The 8-position DIP switch has a different function depending on the type of Controller Card. Refer to Table 3-7 for the RS-232 version only.

For the SNMP/Ethernet and SNMP Expansion Controller Cards, the 8-position DIP switch SW2 is used to define the Controller Card (or rack) address. Rack addresses within the system must be unique, but may be repeated in other systems. The rack address space and card address space are separate, i.e. racks and cards can have the same address. Address "00" must be left unused, and we recommend that the racks be assigned addresses "01" through "FF". If two racks within the same system have the same address, both will try to respond at the same time, causing communication errors. Switch position 1 is the least significant bit, and position 8 is the most significant bit. Set each switch ON (as marked) for a '0', and OFF for a '1'. Address 1 for example would be position 1 OFF, and positions 2-8 ON.

CHAPTER 3: CONFIGURATION

The SNMP/Ethernet Controller Cards can be supplied with special “universal” firmware that allows the Ethernet management interface to be enabled or disabled depending on the address DIP switch setting. When the rack address DIP switch is set to address “1” (binary 00000001), the Ethernet interface is enabled and the unit operates as a normal SNMP/Ethernet Controller Card. If the rack address DIP switch is set to address 2 or higher, the Ethernet interface is disabled and the unit operates like a SNMP Expansion Controller Cards, allowing it to be daisy-chain connected to the GANG-OUT port of another SNMP/Ethernet or SNMP Expansion Controller Card. Please contact Black Box for additional information regarding the universal firmware.

**TABLE 3-7. CONTROLLER CARD DIP SWITCH SETTINGS
(RS-232 VERSION ONLY)**

SWITCH	SW2-1	SW2-2	SW2-3	SW2-4	SW2-5	SW2-6
0	ON	ON	ON	ON	—	—
1	OFF	ON	ON	ON	—	—
2	ON	OFF	ON	ON	—	—
3	OFF	OFF	ON	ON	—	—
4	ON	ON	OFF	ON	—	—
5	OFF	ON	OFF	ON	—	—
6	ON	OFF	OFF	ON	—	—
7	OFF	OFF	OFF	ON	—	—
8	ON	ON	ON	OFF	—	—
9	OFF	ON	ON	OFF	—	—
:	ON	OFF	ON	OFF	—	—
;	OFF	OFF	ON	OFF	—	—
<	ON	ON	OFF	OFF	—	—
=	OFF	ON	OFF	OFF	—	—
>	ON	OFF	OFF	OFF	—	—
?	OFF*	OFF*	OFF*	OFF*	—	—
Security Code Enabled	—	—	—	—	ON	—
Security Code Disabled	—	—	—	—	OFF*	—
Safe Mode Enabled	—	—	—	—	—	ON
Safe Mode Disabled	—	—	—	—	—	OFF*

*Factory Default Setting

When the security code is enabled (SW2-5 set to ON), the selected security character must precede any serial commands received at the gang in port of the first rack in the system. The security code must be disabled on all following racks. Refer to Section 5.1 for a list of applicable serial commands.

Safe mode operation (SW2-6 set to ON) prevents switching commands from the gang-in port, allowing only status request commands. This provides a level of protection against corrupt or spurious data causing unintended switching in an application where only status is required of the gang-in port. Set safe mode OFF to allow A/B switching from the gang-in serial port. Safe mode must be disabled (OFF) on racks connected to the gang-out port of another rack, to allow system switching to occur (otherwise, system switching will be blocked from higher level racks).

DIP switch positions 7 and 8 are reserved for future development, and should be left in the OFF position.



CHAPTER 4: INSTALLATION

The A/B Switch Cards consist of a single card, which is inserted from the rear of the rack. The Controller Card consists of a front card and a rear card.

4.1 CONTROLLER CARD REAR PC BOARD INSTALLATION

STEP 1: Using the card guides, carefully slide the rear card into the rack, until it makes connection to the 8-position socket on the rack backplane.

STEP 2: Secure the rear card to the rack at the top and bottom of the card, using the screws provided.

STEP 3: Using a standard RJ-11 male/male crossover cable, connect the gang out from one rack to the gang in connector on the next if multiple racks are to be daisy-chained together. Repeat this step until all racks have been connected.

4.2 CONTROLLER CARD FRONT PC BOARD INSTALLATION

STEP 1: Using the card guides, carefully slide the front card into the rack, until it makes connection to the 36-position card edge connector on the rear card.

STEP 2: Secure the front card to the rack at the top and bottom of the card, using the screws provided.

4.3 A/B SWITCH CARD INSTALLATION

STEP 1: From the rear of the rack, using the card guides, carefully slide the card into the rack, until it makes connection to the 8-position socket on the rack backplane.

STEP 2: Secure the rear card to the rack at the top and bottom of the card, using the screws provided.

STEP 3: If not already in place, secure the front panel to the rack, using the screws provided.

CHAPTER 5: OPERATION

When power is applied to the Controller Card, the PWR LED should illuminate.

When power is applied to the A/B Switch Card, either the “A” LED or the “B” LED should illuminate to indicate the currently connected port.

When the Key-Lock switch on the Controller Card is OFF, the manual toggle switches on the Controller Card and all the A/B Switch Cards in the rack will be disabled.

NOTE: The rack may still switch in response to a command received on the RS-232 Gang-In port, or the Ethernet port.

When the Key-Lock switch on the Controller Card is ON, the manual toggle switches in the rack function normally.

The toggle switches on the A/B Switch Cards are used to switch only that card. Hold the switch in the “A” position to connect Port A to Port C. The “A” LED will illuminate when the switch operation has been completed. Release the switch when switching has finished. Hold the switch in the “B” position to connect Port B to Port C. The “B” LED will illuminate when the switch operation has been completed. Release the switch when switching has finished.

The toggle switch on the Controller Card is used to switch all cards in the rack, and is operated in the same fashion as the individual toggle switches on the A/B Switch Cards. To switch an entire system of daisy-chained racks, hold the “system” push-button while operating the toggle switch on the Controller Card.

The Controller Card STAT LED should blink under the following conditions:

- The front panel control switches are used to initiate a “rack” or “system” level switching operation.
- The Controller Card received a switch command on the RS232 Gang-In port or the Ethernet port.

5.1 RS-232 SERIAL SWITCHING

The RS-232 version of the Controller Card allows the user to remotely switch all of the cards in a rack or system of daisy-chained racks using the serial commands listed in Table 5-1. The SNMP/Ethernet version of the Controller Card does not support the one character serial commands listed in Table 5-1, but instead uses the enhanced console commands listed in Section 7 of this manual. Also note that the data rate of the Gang-In port increases to 9600 bps for the SNMP/Ethernet version of Controller Card. The SNMP Expansion Controller Card does not support the one character serial commands listed in Table 5-1, but will pass these commands through to the cards in the rack and to subsequent racks in the system.

TABLE 5-1. RS-232 SYSTEM SWITCHING COMMANDS (RS-232 VERSION OF CONTROLLER CARD)

COMMAND	DESCRIPTION
A <CR>	Switch system to A
B <CR>	Switch system to B
C <CR>	Request status

NOTES:

1. The RS-232 terminal device connected to the RS-232 version of Controller Card’s Gang-In port must be set to 2400 Baud, No Parity, 8 Data Bits, 1 Stop Bit. Connect using the supplied DB9 to RJ-11 adapter and RJ-11 to RJ-11 crossover cable.
2. The one-character commands above are CASE SENSITIVE, and must be followed by a carriage return. Refer to Table 3-7 for a list of optional “security” characters that may precede these commands.

NOTE: These RS-232 commands only allow control of the entire system, thus the status of all cards in the system should be the same. Therefore, only one card (address 0x01) in the first rack will respond to the “S” status command. If there is no card with address 0x01 in the first rack, there will be no response to the status command.



CHAPTER 5: OPERATION

5.2 SYSTEM SWITCHING USING THE GANG-IN SYSTEM CONTROL SIGNAL

The System Control signal is used as an input and an output. As an Input signal it is normally open. This input is driven to +12 VDC to switch the system to A, and is driven to -12 VDC to switch the system to B. The input circuit requires approximately 1 mA to operate properly.

As an output, this signal is driven to +10 VDC when the user initiates a system switch to A, and is driven to -10 VDC when the user initiates a system switch to B. To protect the output circuits, the output goes through a 1 K ohm resistor. Therefore, this output should not be used to drive a large load.

The gang-in connector normally accepts RS-232 input signals, but can be configured to supply +12 VDC and -12 VDC. Refer to Table 3-5 for jumper configuration information. These +12 VDC and -12 VDC outputs are provided through 1 K ohm resistors, and therefore should not be used to drive large loads. These outputs are provided to allow system switching, using only a remote contact. We recommend using a momentary toggle switch.

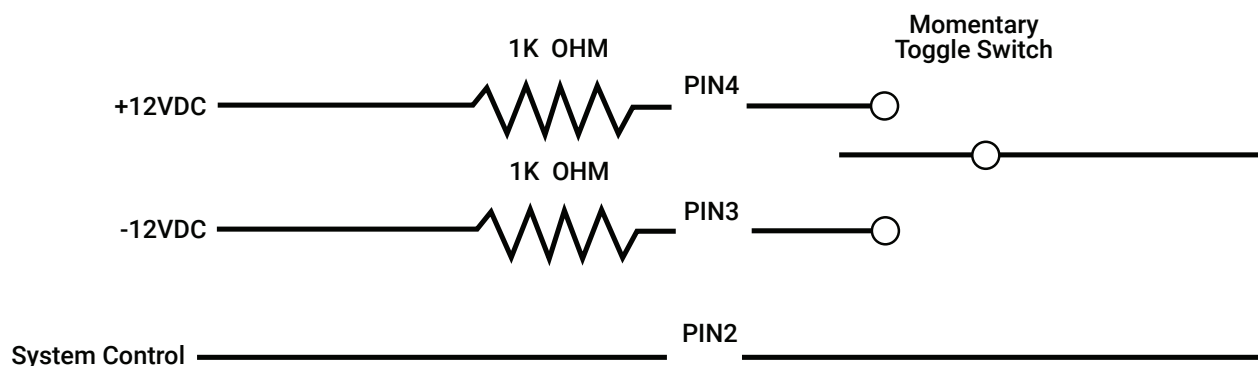


FIGURE 5-1. SYSTEM SWITCHING USING A REMOTE MOMENTARY TOGGLE SWITCH

5.3 RS-232 CONSOLE COMMANDS (FOR SNMP/ETHERNET CONTROLLER CARD)

This section is applicable to SNMP/Ethernet Controller Cards. The GANG-IN RS-232 interface on the SNMP/Ethernet Controller Card operates at 9600. The GANG OUT interface operates at 2400 bps. This allows the GANG OUT interface to connect to the GANG IN port on another rack (that does not have the Ethernet Module installed) so that multiple racks can be daisy-chain connected together. When daisy chaining multiple racks, only the first rack in the chain may have an Ethernet Module installed.

SNMP/Ethernet Controller Cards support an enhanced set of serial commands that are listed below and described in more detail in Section 7. To communicate with the internal Ethernet module, set your RS-232 terminal to 9600 baud, no parity, 8 data bits, and 1 stop bit. Connect this terminal to the GANG-IN RS232 interface on the SNMP/Ethernet Controller Card using the DB9 to RJ-11 adapter and RJ-11 crossover cable provided with the SNMP/Ethernet Controller Card.

When you apply power to the system, the Ethernet module runs a series of internal self tests and configuration steps. This takes approximately 5 seconds. After this process is complete you will see a sign-on message displayed on your serial console, similar to the following:

```
Network Agent Version 2.9X JUN 2018
Copyright (c) 2018
All rights reserved
System starting ...
Rack position A
Console ready
>
```

CHAPTER 5: OPERATION

At this point, the Ethernet module is now ready to receive RS-232 serial commands via the GANG IN connector. If you type “help” followed by the ENTER KEY, the list of available commands will be displayed as shown below. See Section 7 for a detailed description of each command.

CONSOLE COMMANDS:

```

GET          ALL (display all parameters)
GET          VERSION (display rack 1 software versions)
GET          VERSION N (display rack N software versions)
GET[SET]    SYSTEM [A/B] (control all system ports)
GET[SET]    RACK N [A/B] (control rack N ports)
GET[SET]    PORT N [A/B] (control port N)
GET         POWER N (display rack N power status)
GET[SET]    IPADDRESS [X.X.X.X]
GET[SET]    SUBNETMASK [X.X.X.X]
GET[SET]    GATEWAY [X.X.X.X]
GET[SET]    PINGREPLY [ON/OFF]
GET[SET]    SNMPENABLE [ON/OFF]
GET[SET]    READCOMMUNITYNAME [string]
GET[SET]    WRITECOMMUNITYNAME [string]
GET[SET]    WEBENABLE [ON/OFF]
GET[SET]    WEBPASSWORD [string]
GET[SET]    WEBTIMEOUT [N] (seconds)
GET[SET]    WEBPORT [N]
GET[SET]    TELNETENABLE [ON/OFF]
GET[SET]    TELNETPASSWORD [string]
GET[SET]    TELNETTIMEOUT [N] (seconds)
GET[SET]    TELNETPORT [N]
GET[SET]    MONITORIP [X.X.X.X] (0.0.0.0 to disable)
GET[SET]    MONITORMAC [X X X X X X] (X = HEX CHARS)
GET[SET]    MONITORMODE [FAILOVER/TOGGLE]
GET[SET]    MONITORDELAYCOUNT [N]
GET[SET]    MONITORINTERVAL [N] (1/10 seconds, 0 to disable)
GET[SET]    MONITORFAILCOUNT [N] (0 to disable)
GET[SET]    MONITOROKCOUNT [N] (0 = no auto recover)
GET[SET]    AUTHENTICATIONTRAP [ON/OFF]
GET[SET]    ALERTTYPE [TRAP/SYSLOG]
GET[SET]    ADMINIP N [X.X.X.X] (0.0.0.0 to disable an entry)
GET         ADMINIP (display all administrator IP addresses)
GET[SET]    MANAGER N [X.X.X.X] (0.0.0.0 to disable an entry)

```



CHAPTER 5: OPERATION

GET	MANAGER (display all SNMP managers)
PING	X.X.X.X (ICMP ECHO to remote host)
SAVE	save settings for next startup
RESET	restart (use after SAVE)
SET	DEFAULTS (restore default user settings, save required)

5.4 REMOTE ETHERNET MANAGEMENT (FOR SNMP/ETHERNET CONTROLLER CARD)

To use the Ethernet network port, you must set the IPADDRESS, SUBNETMASK and GATEWAY address of the internal Ethernet module before connecting to your network. See Section 7 for more details.

The internal Ethernet module allows remote management of the switching system via SNMP, Telnet, or web browser. The SNMP interface allows access to the MIB variables described in Section 9. SNMP is also used by SwitchCenter, the java based graphical user interface application provided with the SNMP/Ethernet Controller Card. The Telnet and web browser interfaces provide access to the console commands described in Section 7. Each of these remote management interfaces may be enabled or disabled.

The SAVE command is used to cause the internal Ethernet module to store the configuration parameters in non-volatile memory. If the Ethernet module is reset before performing a SAVE command, configuration changes will be lost.

5.5 AUTOMATIC SWITCHING (FOR SNMP/ETHERNET CONTROLLER CARD)

The SNMP/Ethernet Controller Card can be configured to automatically switch the connection state: all COMMON ports are connected to their respective A ports or all COMMON ports are connected to their respective B ports. To be able to perform the auto-switching functions, the internal Ethernet module issues ICMP echo request (PING) packets to a user-configurable IP address on the network.

The auto-switching function can be configured to operate in one of two modes. In FAILOVER mode (the default mode), the auto-switching function switches to the "failover" or "bypass" connection state (all COMMON ports are connected to their respective A ports) when PING responses are not received, and if configured to "auto recover" it switches to the "normal" connection state (all COMMON ports are connected to their respective B ports) when PING responses are received. In TOGGLE mode, the auto-switching function toggles the connection state from A to B or from B to A when PING responses are not received, and maintains the connection state (all COMMON ports are connected to their respective A ports or B ports) when PING responses are received. User configurable parameters control the auto-switching functions to allow the switch to be used in a variety of applications.

In FAILOVER mode, if the "normal" network path connections between the Ethernet module and the device being monitored go down for any reason, the Ethernet module will no longer be able to PING the specified IP address, and will then automatically switch from the "normal" connection state (all COMMON ports are connected to their respective B ports) to the "bypass" or "failover" connection state (all COMMON ports are connected to their respective A ports). Once the problems on the primary path have been identified and corrected, the user can issue a command to cause the rack to switch from the failover connection state back to the normal connection state. If auto recovery is enabled, the Ethernet module will automatically re-connect the normal path connections when it is again able to PING the user specified IP address. When using the auto recovery feature, it is important that the Ethernet network port on the rack be connected to the user's network so that the normal path is continuously being monitored even when the backup path has been selected; otherwise, the switching system could repeatedly switch (flap) back and forth between the failed primary path and the functioning backup path.

CHAPTER 5: OPERATION

In TOGGLE mode, if the “current” network path connections between the Ethernet module and the device being monitored go down for any reason, the Ethernet module will no longer be able to PING the specified IP address, and will then automatically switch to the “alternate” connection state, trying to restore successful PING responses. In this mode, the auto-switching function will toggle between all COMMON ports are connected to their respective A ports and all COMMON ports are connected to their respective B ports, until it receives responses to its PING requests. The rack will then remain in the current connection state (all COMMON ports are connected to their respective A ports or B ports), until the user issues a command to cause the rack to switch connections, or should the Ethernet module fail to receive PING responses. When in TOGGLE mode, it is important that the rack’s remote control Ethernet network port be connected to the user’s network so that the current path is being monitored.

When the auto switching feature is enabled, manual and remote switching can still be performed using the front panel toggle switch or by issuing serial or Ethernet commands, but this can affect the operation of the automatic switching feature. This is because the automatic switching feature is only aware of “system level” commands, i.e. “SET SYSTEM A”, “SET SYSTEM B”, and manual switching using the front panel toggle switch while holding in the “SYSTEM” pushbutton switch. If the user initiates any of these “system level” commands, the switching system will execute the command and the automatic switching feature will record the new connection state. The automatic switching feature will then continue to monitor the connection path to the selected IP address and will automatically switch connections as it normally would.

However, if the switching system receives a “SET RACK” command, or if the rack is switched using the front panel toggle switch without holding in the “SYSTEM” pushbutton switch, these commands will not be recorded by the automatic switching feature—it will be unaware that the switching system has changed connection states. Under certain conditions when in this state, the automatic switching feature will not automatically switch connection states as expected, because it “thinks” that it is already in the correct connection state. To recover from this condition, the user can either power cycle the SNMP/Ethernet Controller Card, issue a “RESET” command, or execute a “system level” command. Any of these actions will cause the automatic switching feature to record the current connection state of the switch, which then allows it to again operate normally.

Connection changes made using the “SET PORT” command also are not recorded by the automatic switching feature. Thus, under certain conditions, the automatic switching feature will not automatically switch connection states as described above when “rack level” commands are issued.

5.5.1 NETWORK CONNECTIONS FOR AUTO FAILOVER AND MANUAL RECOVERY (FAILOVER MODE) OR TOGGLE MODE

NOTE: The 2U Pro Switching System monitors the WAN connections by PINGing the far side router through the primary WAN link. in FAILOVER mode, if the primary WAN link fails, the SM260A auto switches to the backup WAN link. Auto recovery is disabled in this configuration to prevent flapping. In TOGGLE mode, if the selected WAN link fails, the rack will toggle between the primary and the backup WAN until a working link is established.

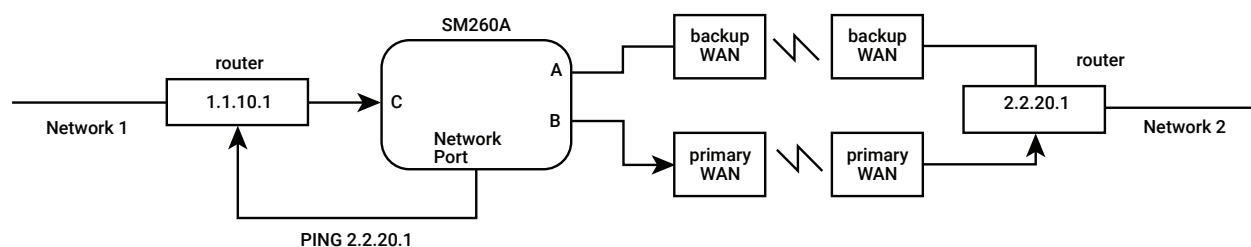


FIGURE 5-2. NETWORK CONNECTIONS FOR AUTO FAILOVER AND MANUAL RECOVERY (FAILOVER MODE) OR TOGGLE MODE

5.5.2 NETWORK CONNECTIONS FOR AUTO FAILOVER AND AUTO RECOVERY (FAILOVER MODE)

NOTE: The 2U Pro Switching System monitors the WAN connections by PINGing the far side router through the primary WAN link. If the primary WAN link fails, the SM260A switches to the backup WAN link. When the primary WAN link is available again, the rack auto switches back to the primary WAN path. This configuration will not function properly in TOGGLE mode, since the connection between the rack's remote control Network Port and the far side router is not affected by switching the C port connection state.

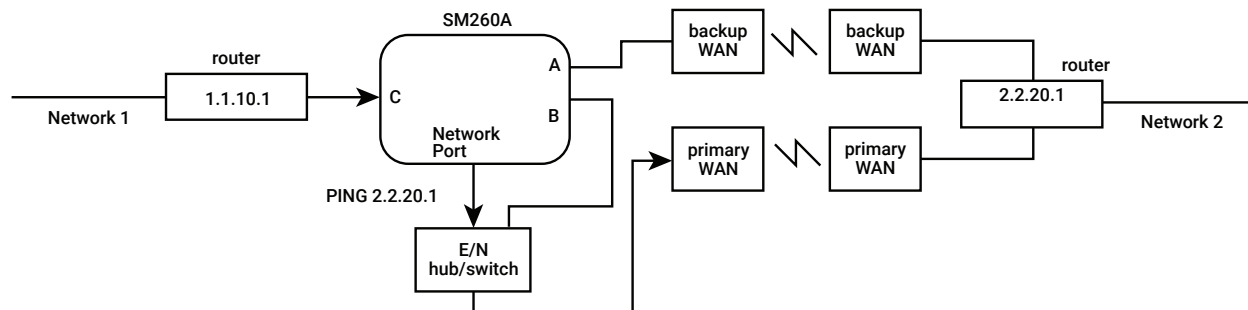


FIGURE 5-3. NETWORK CONNECTIONS FOR AUTO FAILOVER AND AUTO RECOVERY (FAILOVER MODE)

In most network environments, you can configure the Ethernet module to automatically determine the proper MAC address required for the PING packet. Enter the monitor ip address of the device to be monitored, and leave the monitor mac address parameter set to the default value 00 00 00 00 00 00. This causes the Ethernet module to issue an ARP request to determine the appropriate MAC address for the PING packet. To eliminate the ARP request, enter the monitor mac address as follows. If the monitored device is on the same subnet as the Ethernet module, set the monitor mac address to the MAC address of the monitored device. If the monitored device is on a different subnet than the Ethernet module, set the monitor mac address to the MAC address of the gateway router, so the gateway router can route the PING packet to the target device on a different subnet.

CHAPTER 6: NETWORK SETUP

To perform the initial setup of an SNMP/Ethernet version of Controller Card, you will need a serial terminal capable of 9600 baud, no parity, 8 data bits, and 1 stop bit. Connect this terminal to the GANG-IN port using the supplied DB9 to RJ-11 adapter and RJ-11 to RJ-11 crossover cable.

TABLE 6-1. DB9 TO RJ-11 ADAPTER PIN ASSIGNMENT

RJ-11 PIN	SIGNAL NAME	SIGNAL DIRECTION	DB9 PIN
3	Receive Data	To Terminal	2
4	Transmit Data	From Terminal	3
2	Ground	—	5

Apply power to the rack. The SNMP/Ethernet version of Controller Card requires about 5 seconds to boot up, while performing self tests and configuring.

After this process is complete you will see a sign-on message displayed on the serial console, i.e.

```
Network Agent Version 2.9X JUN 2018
```

```
Copyright (c) 2018
```

```
All rights reserved
```

```
System starting ...
```

```
Rack position A
```

```
Console ready
```

```
>
```

At this point, the Controller Card is ready for the low-level configurations necessary before you will be able to communicate with the network port using TCP/IP. You will need to enter an IP address, subnet mask, and gateway address, as well as read and write SNMP community names if using SNMP, a telnet password for telnet access, or a web password for browser access. These parameters must be saved into non-volatile memory, and then the system must be reset to allow it to reconfigure with the new settings. Any time one or more of these parameters is changed, they must be saved followed by a system reset. The following shows a typical setup session. Change the entered parameters to suit your application requirements. All the console level commands available are described in detail in Section 7.

```
>set ipaddress 192.168.1.200
```

```
IP Address: 192.168.1.200
```

```
>set subnetmask 255.255.255.0
```

```
Subnet Mask: 255.255.255.0
```

```
>set gateway 192.168.1.1
```

```
Gateway IP Address: 192.168.1.1
```

```
>set readcommunityname public
```

```
Read Community Name: public
```

```
>set writecommunityname private
```

```
Write Community Name: private
```



CHAPTER 6: NETWORK SETUP

```
>save
```

```
Saving user data, please wait.
```

```
Save complete.
```

```
>reset
```

```
resetting, please wait...
```

After the system reinitializes, you will again be greeted by the sign-on message as before. At this time, you can attach a 10BASE-T CAT5 cable between the Controller Card's Network port and an available port on your Ethernet hub or switch/router. The SNMP/Ethernet version of the Controller Card will now respond to telnet, SNMP and/or HTTP messages at the assigned IP address, depending on which options are enabled. Section 7 describes the commands that are available via the console prompt (telnet, web, or RS-232 interface). Section 8 describes the operation of the web browser interface, and Section 9 provides a MIB Path Summary that lists the supported SNMP variables and their functions.

CHAPTER 7: CONSOLE COMMANDS (SNMP/ENET CONTROL)

When the rack powers up, it will send a sign-on message followed by a prompt character ">" to your serial terminal device, set at 9600 baud, no parity, 8 data bits, and 1 stop bit. After each command is executed, the associated response from the rack will be issued, followed by a prompt character. For systems where the console port is being commanded by software, the software should wait for this prompt character before sending each and every command to the rack.

It is possible to switch one or all of the switch ports to the A or B connection state using the appropriate serial commands. It is also possible to query the position of any one of the switch ports in a particular rack using serial commands. The RS-232 serial interface is NOT affected by the position of the front panel keylock switch—it will act upon and respond to commands it receives even if the keylock switch is in the DISABLE position.

The following commands are available from the RS-232 console prompt of an SNMP/Ethernet version of the Controller Card. All commands are case-insensitive, although several variable parameters are case-sensitive (read/write community names, telnet and web password). All commands must be terminated with a carriage return (ASCII 13 or hex 0x0D) before they will be processed. GET, SET, SYSTEM, RACK, PORT, and ALL can all be abbreviated by the first letter of the command, allowing shorthand entry of switching commands.

GET ALL

Displays all parameters and settings. An example output is shown here.

```
System Status: X
IP Address: 192.168.1.30
MAC Address: 00 06 57 00 01 02
Subnet Mask: 255.255.255.0
Gateway IP Address: 192.168.1.1
PING Reply: Enabled
SNMP Enable: Enabled
Read Community Name: public
Write Community Name: private
Web Enable: Enabled
Web Password: mctech
Web Timeout: 300
Web Port: 80
Telnet Enable: Enabled
Telnet Password: dataman
Telnet Timeout: 80
Telnet Port: 23
Monitor IP Address: 0.0.0.0
Monitor MAC Address: 00 00 00 00 00 00
Monitor Interval: 10
Monitor Fail Count: 5
Monitor OK Count: 5
Monitor Delay Count: 0
Monitor Mode: FAILOVER
Authentication Trap: Disabled
Alert Type: TRAP
```



CHAPTER 7: CONSOLE COMMANDS (SNMP/ENET CONTROL)

Model 1: 2.9X JUN 2018, Rev. 50.CL

ADMIN IP Addresses:

SNMP Managers:

1: 192.168.1.113

2: 192.168.1.115

GET VERSION

Displays the software revision of the Ethernet module and firmware on the Controller Card in Rack 1.

Model 1: 2.9X JUN 2018, Rev. 50.CL

GET VERSION N

Displays the software revisions of the Ethernet module and firmware on the Controller Card in Rack N. If Rack N is not present, the Controller Card firmware will be shown as "no response".

Model 1: 2.9X JUN 2018, Rev. 50.CL

GET SYSTEM

This command is not supported in the 2U Pro Switching System. If this command is issued to the rack, it will respond with the following:

System Status: X

SET SYSTEM A[B]

Sets all of the A/B Switch Cards in the entire system (all connected racks) to position A or B.

GET RACK N

This command is not supported in the 2U Pro Switching System. If this command is issued to the rack, it will respond with the following:

Rack Status: XXXXXXXXXXXXXXXXXX

SET RACK N A[B]

Sets all of the A/B Switch Cards in the addressed rack N (1-255) to position A or B.

GET PORT N

Displays the status of switch card N (1-255). The response will be "Port Status: A", "Port Status: B", or "Port Status: no response" if there isn't a switch card present at address "N".

SET PORT N A[B]

Sets the addressed card N (1-255) to position A or B.

CHAPTER 7: CONSOLE COMMANDS (SNMP/ENET CONTROL)

GET POWER N

Displays the power supply status for rack N. If a single internal power supply card is used to power the rack, the response will be "Power Status: One Supply." If more than one power supply is used and ALL are operational, the response will be "Power Status: Two Supplies." If more than one power supply is used and ANY are not operating, the response will be "Power Status: One Supply Down."

SET IPADDRESS X.X.X.X

GET IPADDRESS

Set or display the current IP address of the Ethernet module. Any change will not become permanent until a SAVE and RESET operation sequence is performed.

SET SUBNETMASK X.X.X.X

GET SUBNETMASK

Set or display the current subnet mask of the Ethernet module. Any change will not become permanent until a SAVE and RESET operation sequence is performed.

SET GATEWAY X.X.X.X

GET GATEWAY

Set or display the gateway router's IP address. Any change will not become permanent until a SAVE and RESET operation sequence is performed.

SET PINGREPLY ON[OFF]

GET PINGREPLY

Set or display whether or not the Ethernet interface will respond to incoming PINGs (ICMP echo requests). Any change will not become permanent until a SAVE operation is performed.

SET SNMPENABLE ON[OFF]

GET SNMPENABLE

Set or display whether or not the SNMP interface is enabled. Any change will not become permanent until a SAVE operation is performed.

SET READCOMMUNITYNAME string

GET READCOMMUNITYNAME

SET WRITECOMMUNITYNAME string

GET WRITECOMMUNITYNAME

Set or display the current read or write community name as specified.

NOTE: In general, these are case-sensitive fields.

The password must be at least 1 char and no more than 8 chars in length. Any change will not become permanent until a SAVE and RESET operation sequence is performed.



CHAPTER 7: CONSOLE COMMANDS (SNMP/ENET CONTROL)

SET WEBENABLE ON[OFF]

GET WEBENABLE

Set or display the current state of web based access. The Ethernet module will not accept any HTTP requests when web enable is off. Any change will not become permanent until a SAVE and RESET operation sequence is performed.

SET WEBPASSWORD string

GET WEBPASSWORD

Set or display the current web password.

NOTE: This is a case-sensitive field.

The password must be at least one character and no more than 8 characters in length. Any change will not become permanent until a SAVE and RESET operation sequence is performed.

SET WEBTIMEOUT seconds

GET WEBTIMEOUT

Set or display the current web timeout in seconds. After a period of inactivity of this many seconds, the Ethernet module will request a login. Note that the web timeout cannot be disabled, it can however, be set arbitrarily large.

SET WEBPORT N

GET WEBPORT

Set or display the current web port number. Changing the web port number from the default can be used to provide an additional level of security. Any change will not become permanent until a SAVE and RESET operation sequence is performed.

SET TELNETENABLE ON[OFF]

GET TELNETENABLE

Set or display the current state of telnet based access. The Ethernet module will not accept any telnet requests when telnet enable is off. Any change will not become permanent until a SAVE and RESET operation sequence is performed.

SET TELNETPASSWORD string

GET TELNETPASSWORD

Set or display the current telnet password.

NOTE: This is a case-sensitive field.

The password must be at least one character and no more than 8 characters in length. Any change will not become permanent until a SAVE and RESET operation sequence is performed.

SET TELNETTIMEOUT seconds

GET TELNETTIMEOUT

Set or display the current telnet timeout in seconds. After a period of inactivity of this many seconds, the Ethernet module will disconnect any current telnet session.

NOTE: The telnet timeout cannot be disabled; it can however, be set arbitrarily large.

CHAPTER 7: CONSOLE COMMANDS (SNMP/ENET CONTROL)

SET TELNETPORT N

GET TELNETPORT

Set or display the current telnet port number. Changing the telnet port number from the default can be used to provide an additional level of security. Any change will not become permanent until a SAVE and RESET operation sequence is performed.

SET MONITORIP [X.X.X.X]

GET MONITORIP

Set or display the IP address of the device that the Ethernet module is to PING to determine the appropriate auto-switching action. Setting this to 0.0.0.0 disables the auto-switching function. Any change will not become permanent until a SAVE operation is performed. When the auto-switching function is enabled, the Ethernet module will send PING packets to the specified MONITORIP address and perform auto-switching actions dependent on the selected MONITORMODE and dependent on whether or not the PING responses are received.

SET MONITORMAC [X X X X X X]

GET MONITORMAC

Set or display the MAC (Ethernet) address of the device that the Ethernet module is to PING to determine the appropriate auto-switching action. This value is entered as a series of six HEX characters with spaces between each HEX character. If the MONITORMAC address is set to 00 00 00 00 00 00, the Ethernet module will automatically determine the proper MAC address required for the PING packet by issuing an ARP request. You can also manually set the MONITORMAC address. If monitoring connectivity to a device on the same subnet as the Ethernet module, set the MONITORMAC address parameters to the MAC address of the device being monitored. If monitoring connectivity to a device on a different subnet/network than the Ethernet module, set the MONITORMAC address parameter to the MAC address of the gateway router on the Ethernet module subnet. Any change will not become permanent until a SAVE operation is performed.

SET MONITORINTERVAL [N]

GET MONITORINTERVAL

Set or display the time interval between PINGs issued by the internal Ethernet module, measured in 100 msec increments. To issue PINGs every 1.5 seconds, set this value to 15. The valid range is 1 to 255 (0.1 seconds to 25.5 seconds). A value of 0 disables the auto-switching function. Any change will not become permanent until a SAVE operation is performed.

SET MONITORFAILCOUNT [N]

GET MONITORFAILCOUNT

Set or display the Monitor Fail Count. In FAILOVER mode, this is the number of successive PING attempts that must fail before the Switching System automatically switches to the "failover" or "bypass" connection state (all COMMON ports are connected to their respective A ports). The valid range is 1 to 255. A value of 0 disables the automatic switch/recovery function. In TOGGLE mode, this is the number of successive PING attempts that must fail before the Switching System automatically toggles the connection state (A to B, or B to A); see also Monitor Delay Count. Any change will not become permanent until a SAVE operation is performed.



CHAPTER 7: CONSOLE COMMANDS (SNMP/ENET CONTROL)

SET MONITOROKCOUNT [N]

GET MONITOROKCOUNT

Set or display the Monitor OK Count. This parameter is not used in TOGGLE mode. In FAILOVER mode, this is the number of successive PING attempts that must succeed before the Switching System automatically switches to the “normal” connection state (all COMMON ports are connected to their respective B ports). The valid range is 1 to 255. A value of 0 disables only the automatic recovery function—automatic switching will still operate if enabled. If auto recovery is disabled the user must manually switch back to the normal path via the front panel switch or by issuing a “SET SYSTEM B” command. Any change will not become permanent until a SAVE operation is performed.

SET MONITORDELAYCOUNT [N]

GET MONITORDELAYCOUNT

Set or display the Monitor Delay Count. This parameter is not used in FAILOVER mode. In TOGGLE mode, this is the number of successive PING attempts that are ignored after toggling the connection state. This can be thought of as a “blank-time” after a switching action to allow the new connection to be established. If the Monitor Delay Count is set to a non-zero value, and the new connection state is also “down”, the Ethernet module attempts to PING MONITORDELAYCOUNT (ignored) plus MONITORFAILCOUNT (failed) times before switching back to the original connection state. The valid range is 0 to 255. Any change will not become permanent until a SAVE operation is performed.

SET MONITORMODE [FAILOVER/TOGGLE]

GET MONITORMODE

Set or display the Monitor Mode. In FAILOVER mode, the auto-switching function switches to the “failover” connection state (all COMMON ports are connected to their respective A ports) when PING attempts fail, and if configured to auto-recover, switches to the “normal” connection state (all COMMON ports are connected to their respective B ports) when PING attempts succeed. In TOGGLE mode, the auto-switching function toggles the connection state (A to B, or B to A) when PING attempts fail, and maintains the connection state when PING attempts succeed. Any change will not become permanent until a SAVE operation is performed.

SET AUTHENTICATIONTRAP ON[OFF]

GET AUTHENTICATIONTRAP

Set or display the current state of authentication error traps. Authentication traps will be generated when this parameter is set to ON, and not when OFF.

NOTE: This setting only affects the trap generation, and not how the Ethernet module handles an authentication failure.

An authentication failure generally means that an SNMP access was attempted with an incorrect community name. Any change will not become permanent until a SAVE and RESET operation sequence is performed.

SET ALERTTYPE [TRAP/SYSLOG]

GET ALERTTYPE

Set or display the type of alert messages sent by the internal Ethernet module when certain events such as a change in switch state occur. The Ethernet module can be configured to issue either syslog messages, or SNMP traps.

NOTE: At least one IP address must be entered using the “SET MANAGER N X.X.X.X” command before either syslog messages or traps will be issued.

See Section 9 for a list of the traps supported by the Switching System, and see Section 10 for a list of the supported syslog messages.

CHAPTER 7: CONSOLE COMMANDS (SNMP/ENET CONTROL)

SET ADMINIP N X.X.X.X

Set administrator N (1-8) IP address. Up to 8 different administrator IP addresses can be entered. To remove an entry from the list, set the IP address to 0.0.0.0. If all 8 ADMIN IP addresses are 0.0.0.0 (no ADMIN IP addresses are configured) the internal Ethernet module will allow access from any IP address, subject to the existing password and enable flags for each interface. If one or more ADMIN IP addresses are non-zero, the internal Ethernet module will only process messages received from the configured (non-zero) ADMIN IP addresses. All other messages will be ignored. This ADMIN IP address filtering feature applies to the telnet, web browser and SNMP Ethernet interfaces and to the PING reply functions. The ADMIN IP address filtering does not affect outgoing PING and ARP messages so the Ethernet module is still able to monitor any IP address for the “auto-switch” features. The administrator IP addresses can be different than the manager IP addresses. Any change will not become permanent until a SAVE operation is performed.

GET ADMINIP N

Display the IP address of administrator N (1-8). If no value is entered for “N”, then all administrator IP addresses will be displayed.

ADMIN IP Addresses:

1: 192.168.1.113

2: 192.168.1.115

SET MANAGER N X.X.X.X

Set SNMP manager N (1-16) IP address. Up to 16 SNMP MANAGER IP addresses can be entered for destinations of trap messages. Trap messages will be sent to all enabled MANAGER IP addresses. To remove an entry from the list, set the IP address to 0.0.0.0.

GET MANAGER N

Display SNMP manager N (1-16) IP address.

GET MANAGER

Display all SNMP manager IP addresses.

SNMP Managers:

1: 192.168.1.113

2: 192.168.1.115

PING X.X.X.X

The internal Ethernet module issues a single ICMP echo request packet to the designated IP address. If a response is received, the Ethernet module will display the message “Reply from X.X.X.X”. If no response is received within 5 seconds, the Ethernet module will display the message “Request timed out”.

SAVE

Save settings for next startup. All settings are stored in NV memory and restored upon power on. Any changes will not become permanent until a SAVE and RESET operation sequence is performed.



CHAPTER 7: CONSOLE COMMANDS (SNMP/ENET CONTROL)

RESET

Causes the internal Ethernet module to reboot and reloads all parameters from stored settings. The Ethernet module takes about 10 seconds to reboot completely.

SET DEFAULTS

Restore user default settings. A SAVE operation is required to make the changes permanent.

?

HELP

Displays a list of commands.

CONSOLE COMMANDS:

```
GET          ALL (display all parameters)
GET          VERSION (display rack 1 software versions)
GET          VERSION N (display rack N software versions)
GET[SET]    SYSTEM [A/B] (control all system ports)
GET[SET]    RACK N [A/B] (control rack N ports)
GET[SET]    PORT N [A/B] (control port N)
GET          POWER N (display rack N power status)
GET[SET]    IPADDRESS [X.X.X.X]
GET[SET]    SUBNETMASK [X.X.X.X]
GET[SET]    GATEWAY [X.X.X.X]
GET[SET]    PINGREPLY [ON/OFF]
GET[SET]    SNMPENABLE [ON/OFF]
GET[SET]    READCOMMUNITYNAME [string]
GET[SET]    WRITECOMMUNITYNAME [string]
GET[SET]    WEBENABLE [ON/OFF]
GET[SET]    WEBPASSWORD [string]
GET[SET]    WEBTIMEOUT [N] (seconds)
GET[SET]    WEBPORT [N]
GET[SET]    TELNETENABLE [ON/OFF]
GET[SET]    TELNETPASSWORD [string]
GET[SET]    TELNETTIMEOUT [N] (seconds)
GET[SET]    TELNETPORT [N]
GET[SET]    MONITORIP [X.X.X.X] (0.0.0.0 to disable)
GET[SET]    MONITORMAC [X X X X X X] (X = HEX CHARS)
GET[SET]    MONITORMODE [FAILOVER/TOGGLE]
GET[SET]    MONITORDELAYCOUNT [N]
GET[SET]    MONITORINTERVAL [N] (1/10 seconds, 0 to disable)
```



CHAPTER 7: CONSOLE COMMANDS (SNMP/ENET CONTROL)

GET[SET]	MONITORFAILCOUNT [N] (0 to disable)
GET[SET]	MONITOROKCOUNT [N] (0 = no auto recover)
GET[SET]	AUTHENTICATIONTRAP [ON/OFF]
GET[SET]	ALERTTYPE [TRAP/SYSLOG]
GET[SET]	ADMINIP N [X.X.X.X] (0.0.0.0 to disable an entry)
GET	ADMINIP (display all administrator IP addresses)
GET[SET]	MANAGER N [X.X.X.X] (0.0.0.0 to disable an entry)
GET	MANAGER (display all SNMP managers)
PING	X.X.X.X (ICMP ECHO to remote host)
SAVE	save settings for next startup
RESET	restart (use after SAVE)
SET	sDEFAULTS (restore default user settings, save required)

NOTES:

- ♦ Commands can be entered in upper- or lower-case. Passwords are case-sensitive.
- ♦ All commands must be terminated with a carriage return (ASCII 13) or (hex 0x0D).



CHAPTER 8: WEB INTERFACE (SNMP/ENET CONTROL CARD)

The Ethernet module on the SNMP/Ethernet version of the Controller Card also allows access to the enhanced console commands listed in Section 7 through either a telnet connection or a web browser interface. When enabled (see SET WEBENABLE command), accessing the default page by typing the Controller Card's IP address in the address bar of your web browser will present the following page:



Web Interface Version 1.0
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Please logon:

Password:

FIGURE 8-1. LOGON SCREEN

NOTE: If using a pop-up blocker on your web browser, be sure to allow pop-ups from the IP address of the internal Ethernet module; otherwise, you could experience trouble receiving a response through the web interface.

After successfully entering the correct web password (see SET WEBPASSWORD command), you will get the command console page shown in Figure 8-2.

IMPORTANT: Do NOT click on the "submit" button or press the "enter" key on your keyboard multiple times. The web browser interface on the Ethernet module typically responds within a few seconds but may take as long as 5 to 10 seconds to process certain commands and return a response. Clicking on "submit" or hitting "enter" multiple times while the Ethernet module is processing a command can cause it to decide that the interface is not functioning properly. If this happens, the Ethernet module will become non-responsive until it receives a valid login request i.e. you must re-enter the Ethernet module's IP address in the address bar of your web browser, and then re-login when the logon screen appears.



Web Interface Version 1.0
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Command console:

Enter new command:

FIGURE 8-2. INITIAL COMMAND SCREEN

CHAPTER 8: WEB INTERFACE (SNMP/ENET CONTROL CARD)

At this point, you may enter any valid console command listed in Section 7 into the text box and click “Send Command” to execute. The following is an example result of the GET PORT 1 command.

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Command console:

Output from last command...

Port Status: A

Enter new command:

FIGURE 8-3. EXAMPLE COMMAND RESULTS SCREEN FOR GET PORT 1 COMMAND

The internal Ethernet module will allow only one telnet or web access session at a time. For this reason, the web timeout and telnet timeout parameters should be set to reasonable timeout values. To free up a session without waiting for the web timeout, click “Logoff”. Typing “quit” at the telnet prompt will similarly close a telnet session. Resetting the Ethernet module will also clear any existing web or telnet sessions.

CHAPTER 9: SNMP MIB PATH SUMMARY

NOTE: The MIB contains definitions that do not apply to every product in the 2U Pro Switching System family.

[internet] – 1.3.6.1

[private] – 1.3.6.1.4

[enterprises] – 1.3.6.1.4.1

[mctech] – 1.3.6.1.4.1.9477

[mctech] – 1.3.6.1.4.1.9477

Market Central, Inc. private enterprise number

[mcAgent] – 1.3.6.1.4.1.9477.1

Market Central, Inc. SNMP Agent

[abSwitchSystem] – 1.3.6.1.4.1.9477.1.4

A/B Switch System

[abSystemGangPort] – 1.3.6.1.4.1.9477.1.4.1

[abRackTable] – 1.3.6.1.4.1.9477.1.4.2

[abRackIndex] – 1.3.6.1.4.1.9477.1.4.2.1.1.RackIndex

[abRackGangPort] – 1.3.6.1.4.1.9477.1.4.2.1.2.RackIndex

[abRackKeyStat] – 1.3.6.1.4.1.9477.1.4.2.1.3.RackIndex

[abRackPowerStat] – 1.3.6.1.4.1.9477.1.4.2.1.4.RackIndex

[abRackSoftwareVersion] – 1.3.6.1.4.1.9477.1.4.2.1.5.RackIndex

[abRackName] – 1.3.6.1.4.1.9477.1.4.2.1.6.RackIndex

[abRackCards] – 1.3.6.1.4.1.9477.1.4.2.1.7.RackIndex

[abSwitchTable] – 1.3.6.1.4.1.9477.1.4.3

[abSwitchIndex] – 1.3.6.1.4.1.9477.1.4.3.1.1.SwitchIndex

[abSwitchPort] – 1.3.6.1.4.1.9477.1.4.3.1.2.SwitchIndex

[abSwitchSoftwareVersion] – 1.3.6.1.4.1.9477.1.4.3.1.3.SwitchIndex

[abSwitchName] – 1.3.6.1.4.1.9477.1.4.3.1.4.SwitchIndex

[mcIpRequester] – 1.3.6.1.4.1.9477.2

[mcTrapInfo] – 1.3.6.1.4.1.9477.3

[mcGenericTrap] – 1.3.6.1.4.1.9477.3.1

[mcSpecificTrap] – 1.3.6.1.4.1.9477.3.2



CHAPTER 9: SNMP MIB PATH SUMMARY

[mcManagerTable] – 1.3.6.1.4.1.9477.4

[mcManagerIndex] – 1.3.6.1.4.1.9477.4.1.1.ManagerIndex

[mcManagerIp] – 1.3.6.1.4.1.9477.4.1.2.ManagerIndex

Traps generated by the system

coldStart	generic trap 0
authenticationFailure	generic trap 4
abRackKeyLockChange	specific trap 1
abRackGangSwitchChange	specific trap 2
abSystemGangSwitchChange	specific trap 6
abRackPowerStatChange	specific trap 7
abSystemAutoSwitchChange	specific trap 8

9.1 A/B SWITCH SYSTEM SNMP VARIABLE DEFINITIONS

[abSystemGangPort] – 1.3.6.1.4.1.9477.1.4.1

A/B Switch System gang port. This variable is used to control all A/B Switch Cards in the system. A system may consist of up to 255 racks, each rack containing up to 16 A/B Switch Cards. It is write-only.

[abRackTable] – 1.3.6.1.4.1.9477.1.4.2

A/B Switch Rack variable table. This variable is not directly accessible.

[abRackIndex] – 1.3.6.1.4.1.9477.1.4.2.1.1.RackIndex

A/B Switch Controller “Rack” address. The A/B Switch Controller address is set via an eight position DIP switch on the card. Each A/B Switch Controller in the system MUST have a unique address, in the range of 0x01 to 0xFF hex. Address 0x00 is invalid, and must not be used. This is a read-only variable.

[abRackGangPort] – 1.3.6.1.4.1.9477.1.4.2.1.2.RackIndex

A/B Switch Rack gang port. This variable is used to control all A/B Switch Cards in a rack. A rack may contain up to 16 A/B Switch Cards. It is write-only.

[abRackKeyStat] – 1.3.6.1.4.1.9477.1.4.2.1.3.RackIndex

A/B Switch Rack Key-Lock Switch Status. This is a read-only variable. This variable can be used to determine if the Key-Lock Switch is in the OFF or ON position. The front panel switches in the rack are disabled when the Key-Lock Switch is in the OFF position. The A/B Switches will still respond to switch control signals and commands from the GANG-IN and GANG-OUT ports.



CHAPTER 9: SNMP MIB PATH SUMMARY

[abRackPowerStat] – 1.3.6.1.4.1.9477.1.4.2.1.4.RackIndex

A/B Switch Rack Power Status. This is a read-only variable.

The 2U A/B Switch controller rack may contain one or two power supplies. If one power supply is installed and operating, the Power Status will report "OneSupply". If two power supplies are installed and both are operating, the Power Status will report "TwoSupplies". If two power supplies are installed and one is off line, the Power Status will report "One Supply Down".

[abRackSoftwareVersion] – 1.3.6.1.4.1.9477.1.4.2.1.5.RackIndex

A/B Switch Controller Software Version. This is a read-only variable, and is limited to a maximum of 14 characters.

[abRackName] – 1.3.6.1.4.1.9477.1.4.2.1.6.RackIndex

A/B Switch Controller Identification String. The string is limited to a maximum of 14 characters.

[abRackCards] – 1.3.6.1.4.1.9477.1.4.2.1.7.RackIndex

A/B Switch Rack Card Status, one character for each of the sixteen cards in the rack. This variable is present for compatibility with other A/B switching systems. It is read-only and will respond "XXXXXXXXXXXXXXXXXX".

[abSwitchTable] – 1.3.6.1.4.1.9477.1.4.3

A/B Switch Rack variable table. This variable is not directly accessible.

[abSwitchIndex] – 1.3.6.1.4.1.9477.1.4.3.1.1.SwitchIndex

A/B Switch "Card" address.

On a 2U A/B Switch System, the switch card address is set via an eight-position DIP switch on the card. Each 2U A/B Switch card in the system MUST have a unique address, in the range of 0x01 to 0xFF hex. Address 0x00 is invalid, and must not be used. This is a read-only variable.

[abSwitchPort] – 1.3.6.1.4.1.9477.1.4.3.1.2.SwitchIndex

A/B Switch Card port. This variable is used to control the A/B Switch Card selected port. When set to A, the switch will connect port A to port C. When set to B, the switch will connect port B to port C. If the addressed A/B Switch Card is not present, you will not get a response.

[abSwitchSoftwareVersion] – 1.3.6.1.4.1.9477.1.4.3.1.3.SwitchIndex

A/B Switch Card Software Version. This is a read-only variable, and is limited to a maximum of 14 characters. On a 2U A/B Switch System, the A/B Switch cards have software. Therefore, this variable may be different, depending on the software version on each card.

[abSwitchName] – 1.3.6.1.4.1.9477.1.4.3.1.4.SwitchIndex

A/B Switch Card Identification String. The string is limited to a maximum of 14 characters.

[mcIpRequester] – 1.3.6.1.4.1.9477.2

The IP address of the remote entity that last accessed branch 1.3.6.1.4.1.9477.1. This variable can be used to identify the last IP address to access any mcAgent variable. It is returned in the authenticationFailure message.

CHAPTER 9: SNMP MIB PATH SUMMARY

[mpTrapInfo] – 1.3.6.1.4.1.9477.3

Group of trap information variables. This variable is not directly accessible.

[mcGenericTrap] – 1.3.6.1.4.1.9477.3.1

Indication of generic trap events. This variable is bit mapped such that bit 0 is trap 0, bit 1 is trap 1, etc. Write an integer with 1 in bit positions to clear particular trap indications. For example write 17 to clear traps 0 & 4.

[mcSpecificTrap] – 1.3.6.1.4.1.9477.3.2

Indication of specific trap events. This variable is bit mapped such that bit 1 is trap 1, bit 2 is trap 2, etc. Write an integer with 1 in bit positions to clear particular trap indications. For example, write 18 to clear traps 1 & 4.

[mcManagerTable] – 1.3.6.1.4.1.9477.4

Table for SNMP Manager IP addresses. This variable is not directly accessible.

[mcManagerIndex] – 1.3.6.1.4.1.9477.4.1.1.ManagerIndex

Index used to identify unique entries in the Manager IP address table.

[mcManagerIp] – 1.3.6.1.4.1.9477.4.1.2.ManagerIndex

SNMP Manager IP address. Destination IP address for TRAP or SYSLOG messages.

9.2 A/B SWITCH SYSTEM SNMP TRAP DEFINITIONS

All traps carry the sysObjectId (1.3.6.1.2.1.1.2) variable, whose value is 1.3.6.1.4.1.9477.1.

Coldstart – generic trap 0

This trap is sent during a power on initialization and reboot of the SNMP controller. It carries the sysDescr variable (1.3.6.1.2.1.1.1).

AuthenticationFailure – generic trap 4

This trap is sent as a result of an authentication failure in processing an SNMP request.

Generally, an authentication failure occurs as a result of an SNMP request with an invalid community name. It carries the mclpRequester variable.

abRackKeyLockChange – specific trap 1

This trap is sent when the key switch is changed on a rack. It carries the abRackKeyStat variable.

abRackGangSwitchChange – specific trap 2

This trap is sent when a rack gang switch occurs. It carries the abRackGangPort variable.

abSystemGangSwitchChange – specific trap 6

This trap is sent when a system gang switch occurs. It carries the abSystemGangPort variable.



CHAPTER 9: SNMP MIB PATH SUMMARY

abRackPowerStatChange – specific trap 7

This trap is sent when the rack power supply status changes. It carries the abRackPowerStat variable.

abSystemAutoSwitchChange – specific trap 8

This trap is sent when a system auto switch occurs. It carries the abSystemGangPort variable.

CHAPTER 10: SYSLOG MESSAGES

The internal Ethernet module can be configured to issue a syslog message rather than an SNMP trap when certain events occur. To configure the Ethernet module to issue syslog messages, you must use the "SET ALERTTYPE" command to select SYSLOG messages, and you need to specify the IP address(es) of the device(s) that will be receiving the syslog messages by using the "SET MANAGER N X.X.X.X" command (see Section 7 for details regarding these commands). Once these configuration parameters have been set, the Ethernet module will issue syslog messages for the following types of events:

- ♦ power up cold start, or restart using the RESET command
- ♦ SNMP authentication failure (access attempted using incorrect read or write community name)
- ♦ change in the state of the front panel keylock switch
- ♦ change in the state of the A/B switch ports in the rack caused by a user initiated "rack" command or the front panel toggle switch
- ♦ change in the state of the A/B switch ports in the rack caused by a user initiated "system" command or the front panel toggle switch
- ♦ change in the power ON/OFF state of either power input
- ♦ change in the state of the A/B switch ports due to the auto-switch function

The syslog messages issued by the Ethernet module conform where possible to the general recommendations as described in RFC 3164. The Ethernet module does not have a real-time clock, so each syslog message uses a default timestamp value of Jan 1 00:00:00. The device receiving the syslog messages will need to apply a timestamp or other identifier if this information is needed. The general format for each syslog message from the Ethernet module is as follows:

Jan 1 00:00:00 [Ethernet module IP address] Bypass Switch: [specific message based on the event that occurred]

Listed below is each type of syslog message that the Ethernet module can issue, followed by the actual syslog message that the Ethernet module will send.

power up cold start (or RESET command)

Jan 1 00:00:00 192.168.1.151 Bypass Switch: Switch has been reset.

SNMP authentication failure

Jan 1 00:00:00 192.168.1.151 Bypass Switch: SNMP authentication failure.

keylock switch change disabled to enabled

Jan 1 00:00:00 192.168.1.151 Bypass Switch: Keyswitch change to ON position.

keylock switch change enabled to disabled

Jan 1 00:00:00 192.168.1.151 Bypass Switch: Keyswitch change to OFF position.

system gang switch A to B via S S B command (or toggle switch)

Jan 1 00:00:00 192.168.1.151 Bypass Switch: System switch to B position.

system gang switch B to A via S S A command (or toggle switch)

Jan 1 00:00:00 192.168.1.151 Bypass Switch: System switch to A position.



CHAPTER 10: SYSLOG MESSAGES

rack gang switch A to B via S R 1 B command

Jan 1 00:00:00 192.168.1.151 Bypass Switch: Rack switch to B position.

rack gang switch B to A via S R 1 A command

Jan 1 00:00:00 192.168.1.151 Bypass Switch: Rack switch to A position.

applied power to PS1 (PS2 already powered up)

Jan 1 00:00:00 192.168.1.151 Bypass Switch: Power supply status changed to two supplies.

removed power from PS1 (PS2 still powered up)

Jan 1 00:00:00 192.168.1.151 Bypass Switch: Power supply status changed to one supply down.

removed power from PS2 (PS1 still powered up)

Jan 1 00:00:00 192.168.1.151 Bypass Switch: Power supply status changed to one supply down.

applied power to PS2 (PS1 already powered up)

Jan 1 00:00:00 192.168.1.151 Bypass Switch: Power supply status changed to two supplies.

auto switch B to A via auto-switch function

Jan 1 00:00:00 192.168.1.151 Bypass Switch: Automatic switch to A position.

auto switch A to B via auto-switch function

Jan 1 00:00:00 192.168.1.151 Bypass Switch: Automatic switch to B position.

APPENDIX A: REGULATORY INFORMATION

A.1 FCC STATEMENT

This equipment has been found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

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

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

All power supplies are certified to the relevant major international safety standards.



APPENDIX A: REGULATORY INFORMATION

A.2 NOM STATEMENT

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 debe ser situado fuera del alcance de fuentes de calor como radiadores, registros de calor, estufas u otros aparatos (incluyendo amplificadores) que producen calor.
11. El aparato eléctrico deberá ser conectado a una fuente de poder sólo del tipo descrito en el instructivo de operación, o como se indique en el aparato.
12. Precaución debe ser tomada de tal manera que la tierra física y la polarización del equipo no sea eliminada.
13. Los cables de la fuente de poder deben ser guiados de tal manera que no sean pisados ni pellizcados por objetos colocados sobre o contra ellos, poniendo particular atención a los contactos y receptáculos donde salen del aparato.
14. El equipo eléctrico debe ser limpiado únicamente de acuerdo a las recomendaciones del fabricante.
15. En caso de existir, una antena externa deberá ser localizada lejos de las líneas de energía.
16. El cable de corriente deberá ser desconectado del cuando el equipo no sea usado por un largo periodo de tiempo.
17. Cuidado debe ser tomado de tal manera que objetos líquidos no sean derramados sobre la cubierta u orificios de ventilación.
18. Servicio por personal calificado deberá ser provisto cuando:
 - A: El cable de poder o el contacto ha sido dañado; u
 - B: Objetos han caído o líquido ha sido derramado dentro del aparato; o
 - C: El aparato ha sido expuesto a la lluvia; o
 - D: El aparato parece no operar normalmente o muestra un cambio en su desempeño; o
 - E: El aparato ha sido tirado o su cubierta ha sido dañada.

APPENDIX B: DISCLAIMER/TRADEMARKS

B.1 DISCLAIMER

Black Box Corporation shall not be liable for damages of any kind, including, but not limited to, punitive, consequential or cost of cover damages, resulting from any errors in the product information or specifications set forth in this document and Black Box Corporation may revise this document at any time without notice.

B.2 TRADEMARKS USED IN THIS MANUAL

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NOTES

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