

Areca Expander Box

ARC-8026 SAS Expander Box

USER'S Manual

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FCC Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

Manufacturer's Declaration for CE Certification

We confirm ARC-8026 SAS expander box has been tested and found comply with the requirements set up in the council directive on the approximation of the law of member state relating to the EMC Directive 2004/108/EC. For the evaluation regarding to the electromagnetic compatibility, the following standards were applied:

EN 55022: 2006, Class B
EN 61000-3-2: 2006
EN 61000-3-3: 1995+A1: 2001+A2: 2005

EN 55024:1998+A1:2001=A2:2003
IEC61000-4-2: 2001
IEC61000-4-3: 2006
IEC61000-4-4: 2004
IEC61000-4-5: 2005
IEC61000-4-6: 2006
IEC61000-4-8: 2001
IEC61000-4-11: 2004

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1. Introduction

1.1 Overview

The Areca SAS expander module ARC-8026 is based on the LSI 36-port LSISAS2x36 expander IC, SAS-2 chip which features 36 x 6Gb/s ports and 6G/3G multiplexing, SAS 2.0 zoning, self-configuration, table-to-table routing, and an integrated PPC processor for SES-2 and enclosure management support. The ARC-8026 expander board features three 6Gb/s SAS 4x SFF-8088 ports; one host and two for expansion to additional JBOD enclosures. It is designed to fit into a stand-alone box and can be installed in a 5.25" mounting shell. The Areca SAS expander box is ideal for enclosure customers that want to support up to 24 channels 6Gb/s and 3Gb/s SAS/SATA JBOD function units using low-cost SFF-8087 SAS cables. The expander box can be daisy-chained additional enclosures to provide more disk connection. It has been fully tested and qualified with 6Gb/s and 3Gb/s Areca external SAS/Fibre/iSCSI/PCIe to SAS RAID controller, SAS RAID adapters and HBAs.

The expander box contains an embedded expander manager that can access via in-band SES-2 over SMP protocol and out-of-band RS-232 port. The Areca expander firmware and EPLD has implemented the SES-2 protocol and disk activity map to SGPIO based indicator LEDs. For backplane without SGPIO supporting, the expander box also provides two kinds of alternative LED cable header to support the individual fault/activity status indicator for those backplanes. In addition to meet different enclosure, ARC-8026 expander box has implemented autonomous enclosure management of two power supplies status connectors, four fan monitor/speed control connectors through the SES-2 protocol. Firmware and configuration data including vendor identification strings can be customized or tuned for each customer.

1.2 Technical Specifications

Enclosure Controller Modules

- Expander Board: 1 modules
- Sensors: 1 sensor per expander board

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Controller External Connectors

SAS Connectors

- 1 SAS “IN” connector for connection to the host
- 2 SAS “OUT” connector for expansion to next JBOD enclosure

Drives

SAS Hot-Plug Hard Drives

- Up to 12/16/24 6.0 Gb/s SAS hard drives at speed of 10K or 15K rpm

SATA Hot-Plug Hard Drives

- Up to 12/16/24 6.0 Gb/s SATA hard drives at speeds of 7.2K or 10K rpm

Internal Connectors

- 3/4/6 SFF-8087 min-SAS connectors
- 1 x 6-pin PCI-E power connector
- 4 x 3-pin fan connector
- 2 x 2-pin power status connector
- 1 x 6-pin LCD connector

Serial Connector (per Expander Board)

- 1 x 6-pin UART RJ-11 connector (for expander box manager only)

LED Indicators

Internal fault/activity header

- 12/16/24 2.54mm activity and fault header

External SAS Port LED Indicators

- Expander two one-color LED status indicators for each SAS port, one for SAS port link and one for the activity status

Physical

- 41(H) x 145(W) x 200(D) mm

Environmental

Temperature

- Operating 10° to 40°C
- Storage -40° to 70°C

Relative Humidity

- Operating 10% to 80% (non-condensing)
- Storage 5% to 95% (non-condensing)

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2. Hardware Installation

This section describes the procedures for installing the cable solution external ARC-8026 expander box.

2.1 Before Your Begin Installation

Thanks for purchasing the cable solution external ARC-8026 SAS expander as your data storage subsystem. This user manual gives simple step-by-step instructions for installing and configuring the SAS expander box. To ensure personal safety and to protect your equipment and data, reading the following information package list carefully before you begin installing.

Package Contents

Open the package carefully, and make sure that none of the items listed below are missing.

The ARC-8026 expander box kit may have included the following items in the shipping package:

- ARC-8026 expander box with LCD module
- 1 x RJ11 to RS-232 DB9 cable
- 1 x User manual
- 8 x drive mounting screws (4 screws for each side)
- Adapter convert two 4 pin peripheral power cables into a PCI-E power cable

If any item is missing or damaged, please contact your local resellers for service.

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2.2 Board Layout & Outline

The ARC-8026 expander box can support a family included 3/4/6 internal SFF-8087 ports with additional 3 external SFF-8088 ports. This section provides the board layout and connector/jumper for the SAS expander box.

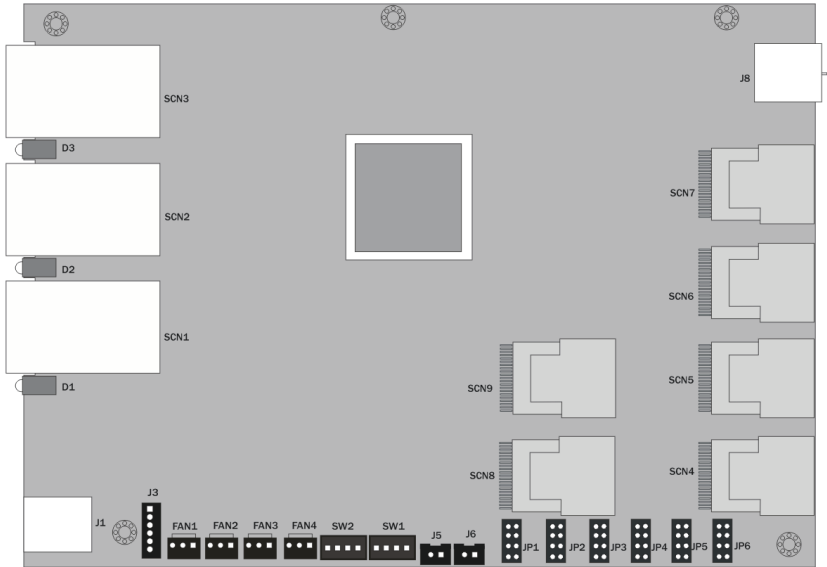


Figure 2-1, ARC-8026 expander box

Connector	Description	Type
1. (SCN3)	6Gb/s SAS Expander In/Out (CH2)	SFF-8088
2. (SCN2)	6Gb/s SAS Expander In (CH1)	SFF-8088
3. (SCN1)	6Gb/s SAS Expander Out (CH0)	SFF-8088
4. (D3)	LED for Expander In/Out Link and Access	Bi-color DIP
5. (D2)	LED for Expander In Link and Access	Bi-color DIP
6. (D1)	LED for Expander Out Link and Access	Bi-color DIP
7. (J1)	RS232 for Expander Configuration	RJ11 Connector
8. (J3)	LCD Connector	6-Pin Controller Header
9. (FAN1)	Fan1 with RPM Sense	3-Pin Connector
10. (FAN2)	Fan2 with RPM Sense	3-Pin Connector

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11. (FAN3)	Fan3 with RPM Sense	3-Pin Connector																		
12. (FAN4)	Fan4 with RPM Sense	3-Pin Connector																		
13. (SW2)	<div>Fan/Power Detective Control Function<table><tr><td>SW2(2)</td><td>PW_FLT1 STATUS</td></tr><tr><td>ON</td><td>ENABLE</td></tr><tr><td>OFF</td><td>DISABLE</td></tr></table><table><tr><td>SW2(3)</td><td>PW_FLT2 STATUS</td></tr><tr><td>ON</td><td>ENABLE</td></tr><tr><td>OFF</td><td>DISABLE</td></tr></table><table><tr><td>SW2(4)</td><td>FAN CONTROL</td></tr><tr><td>ON</td><td>ENABLE</td></tr><tr><td>OFF</td><td>DISABLE</td></tr></table></div>	SW2(2)	PW_FLT1 STATUS	ON	ENABLE	OFF	DISABLE	SW2(3)	PW_FLT2 STATUS	ON	ENABLE	OFF	DISABLE	SW2(4)	FAN CONTROL	ON	ENABLE	OFF	DISABLE	<div>Micro DIP-Switch</div> <div>ENABLE: Monitor function enable.</div> <div>DISABLE: Monitor function disable.</div>
SW2(2)	PW_FLT1 STATUS																			
ON	ENABLE																			
OFF	DISABLE																			
SW2(3)	PW_FLT2 STATUS																			
ON	ENABLE																			
OFF	DISABLE																			
SW2(4)	FAN CONTROL																			
ON	ENABLE																			
OFF	DISABLE																			
14. (SW1)	<div>Fan1-Fan4 Input Definition<table><tr><td>SW1(1-4)</td><td>FAN_NO.</td></tr><tr><td>OFF OFF OFF OFF</td><td>0</td></tr><tr><td>ON OFF OFF OFF</td><td>1 (Fan1)</td></tr><tr><td>ON ON OFF OFF</td><td>2 (Fan1~Fan2)</td></tr><tr><td>ON ON ON OFF</td><td>3 (Fan1~Fan3)</td></tr><tr><td>ON ON ON ON</td><td>4 (Fan1~Fan4)</td></tr></table></div>	SW1(1-4)	FAN_NO.	OFF OFF OFF OFF	0	ON OFF OFF OFF	1 (Fan1)	ON ON OFF OFF	2 (Fan1~Fan2)	ON ON ON OFF	3 (Fan1~Fan3)	ON ON ON ON	4 (Fan1~Fan4)	<div>Micro DIP-Switch</div>						
SW1(1-4)	FAN_NO.																			
OFF OFF OFF OFF	0																			
ON OFF OFF OFF	1 (Fan1)																			
ON ON OFF OFF	2 (Fan1~Fan2)																			
ON ON ON OFF	3 (Fan1~Fan3)																			
ON ON ON ON	4 (Fan1~Fan4)																			
15. (J5)	Power 1 Status Input	2-Pin Header																		
16. (J6)	Power 2 Status Input	2-Pin Header																		
17. (JP1)	Individual Activity LED Header for 6Gb/s SAS 1-8 Ports	8-Pin Header																		
18. (JP2)	Individual Activity LED Header for 6Gb/s SAS 9-16 Ports	8-Pin Header																		
19. (JP3)	Individual Activity LED Header for 6Gb/s SAS17-24 Ports	8-Pin Header																		
20. (JP4)	Individual Fault LED Header for 6Gb/s SAS 1-8 Ports	8-Pin Header																		
21. (JP5)	Individual Fault LED Header for 6Gb/s SAS 9-16 Ports	8-Pin Header																		
22. (JP6)	Individual Fault LED Header for 6Gb/s SAS 17-24 Ports	8-Pin Header																		
23. (SCN4)	6Gb/s SAS 1-4 Ports (Internal)	SFF-8087																		
24. (SCN5)	6Gb/s SAS 5-8 Ports (Internal)	SFF-8087																		

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25. (SCN6)	6Gb/s SAS 9-12 Ports (Internal)	SFF-8087
26. (SCN7)	6Gb/s SAS 13-16 Ports (Internal)	SFF-8087
27. (SCN8)	6Gb/s SAS 17-20 Ports (Internal)	SFF-8087
28. (SCN9)	6Gb/s SAS 21-24 Ports (Internal)	SFF-8087
29. (J8)	PCIE Power Connector	6-Pin Connector

Table 2-1, ARC-8026 expander box connectors

Note:

• Fan Headers (FAN1~FAN4)

The box has four 4 3-pin fan headers which can control and detect the fan speed. Each header can only connect to one fan. You can directly connect the enclosure cooling fan to those 3-pin header. Controller hardware monitor can check the RPM status of the cooling fans and show those fan status on the controller's hardware information based on the SW1 micro switch definition (Fan1-Fan4). SW2 (3) micro dip-switch is used to control the fan monitor function. Current limitation of each fan header is 6A.

• Power Status Input Headers (J5 and J6)

Power status 2-pin input headers monitors enclosure two power supply status output pin based on the SW2 (1 and 2) micro dip-switch.

Pin definition for J5 and J6.

Pin 1: GND

Pin 2: Single Input; Low: power fail, High: power ok

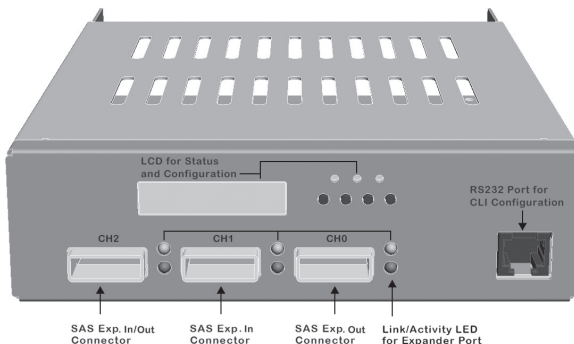


Figure 2-2, Front view of ARC-8026 expander box

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The following describes the ARC-8026 expander box link/activity LED.

SAS Host Port LED	Status
Link LED (Green light)	When host port link LED is illuminated for 1 second and turns off for 3 seconds that indicates the one link has connected. When host port Link LED is illuminated for 2 seconds and turns off for 2 seconds that indicates the two links have connected. When host port Link LED is illuminated for 4 seconds that indicates the four links have connected.
Activity LED (Blue light)	When activity LED is illuminated that indicates the SAS host accesses to the ARC-8026 expander box.

2.3 Installation

The ARC-8026 expander box housed in a 5¼-inch half-height canister with a removable LCD module, a host channel, two expander and a RS-232 CLI port controller. The expander controller is provided for customers who want to use the exiting SAS/SATA enclosure. It is designed to fit into one 5¼-inch half-height drive bays located in a server chassis or storage case. Standard mounting holes are located on both sides of the controller canister. These mounting holes accept commonly available No. 6-32 coarse-thread screws. Use the following instructions below to install the ARC-8026 expander box.

Step 1. Power the Enclosure Off

Turn off the enclosure and remove the AC power cord. Remove the enclosure's cover. For the instructions, please see the enclosure documentation.

Step 2. Unpack ARC-8026 Expander Box

Unpack and remove the ARC-8026 expander box from the package. Inspect it carefully, if anything is missing or damaged, contact your local dealer.

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Step 3. Mounting ARC-8026 Expander Box into the Enclosure

Remove the enclosure cover and find a 5.25 inch CD-ROM wide place to fasten the ARC-8026 expander box in the external enclosure. The expander box requires one 5.25" half-height drive bay.

Step 4. Connecting Expander Controller Power

The ARC-8026 series expander box supports 6 pin PCI-E power connector from PCB version 1.0. If your power supply doesn't have a 6 pin PCI-E power cable then you can use the adapter to convert two 4 pin peripheral power cables into a PCI-E power cable. If you use an adapter then be sure to plug the 4 pin peripheral power connectors into separate power cables coming from the power supply.

Step 5. Install the LED Cable (option)

Please check the method which controls fault LED on the backplane. If the backplane supports SGPIO feature, ignore the individual fault LED cable connection. The preferred I/O connector for server backplanes is the Min SAS 4i (SFF-8087) internal connector. This connector has eight signal pins to support four SAS/SATA drives and six pins for the SGPIO (Serial General Purpose Input/Output) side-band signals. The SGPIO bus is used for efficient fault/activity LED management and for sensing drive locate status. See SFF 8485 for the specification of the SGPIO bus. For backplane without SGPIO supporting, Please refer to section step 5-1. LED cables for fault/activity LED cable installation.

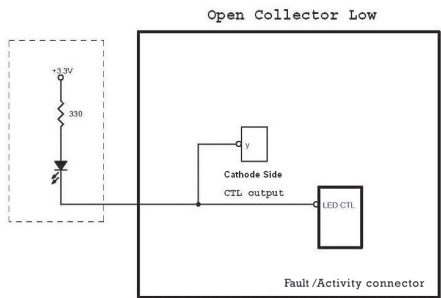
Step 5-1. Install and Re-check Fault LED Cable Connections (option)

Make sure that the proper failed drive channel information is displayed by the fault LEDs. An improper fault LED cable connection will tell the user to "Hot Swap" the wrong drive. This can result in removing the wrong disk (one that is functioning properly) from the controller. This can result in failure and loss of system data.

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The following electronics schematic is the SAS expander logical of fault/activity header. The signal for each pin is cathode (-) side.

The following diagrams and descriptions describe each type of connector.

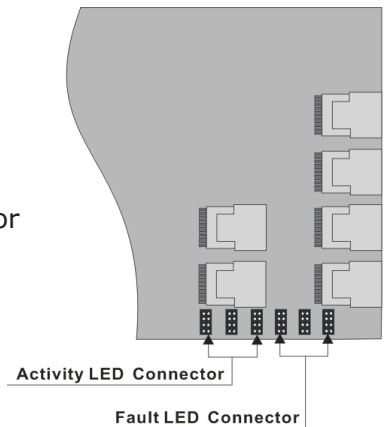


Note:

Cables for the individual drive LEDs may come with a drive cage, or you may need to purchase them.

Connect the cables for the drive activity LEDs and fault LEDs between the backplane of the cage and the respective connector on the ARC-8026 expander box header. The following table describes the activity/fault LED.

Figure 2-3, ARC-8026
12/16/24 expander box
activity/fault LED connector



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LED	Normal Status	Problem Indication
Activity LED	When the activity LED is illuminated, there is I/O activity on that disk drive. When the LED is dark, there is no activity on that disk drive.	N/A
Fault LED	<p>When the fault LED is solid illuminated, there is no disk present and When the fault LED is off, that disk is present and status is normal.</p> <p>Some controllers support the "Identify Drive" function. When the "Identify Drive" is selected, the selected drive fault LED will blank.</p>	<p>When the fault LED is slow blinking (2 times/sec), that indicate disk drive has failed and should be hot-swapped immediately.</p> <p>When the activity LED is illuminated and fault LED is fast blinking (10 times/sec) that indicate there is rebuilding activity on the disk drive.</p>

Step 6. Connecting SFF-8087 Cable to Backplane

The ARC-8026 expander box supports 3/4/6 SFF-8087 connectors on the back side. User uses suitable cable (depends on the backplane) to connect the expander box connector to the enclosure backplane.

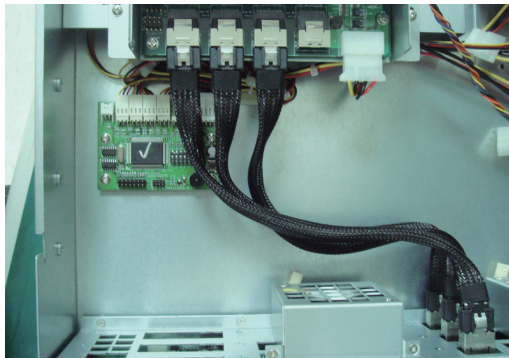


Figure 2-4, Connect ARC-8026 and backplane

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Step 7. Install the Enclosure Top Cover

Check the installation thoroughly, reinstall the enclosure cover, and reconnect the power cord cables.

Step 8. Loading Drive to the Drive Tray

You can connect the SAS/SATA drives to the controller through direct cable and backplane solutions. In the direct connection, SAS/SATA drives are directly connected to SAS PHY port with SAS/SATA cables. The SAS expander module can support up to 12/16/24 PHY internal ports and 12 PHY external ports. Remove the front bezel from the computer chassis and install the cages or SAS/SATA drives in the computer chassis. Loading drives to the drive tray if cages are installed. Be sure that the power is connected to the individual drives or cage.

In the backplane solution, SAS/SATA drives are directly connected to SAS system backplane. The number of SAS/SATA drives is limited to the number of slots available on the backplane. Your ARC-8026 expander box supports up to 12/16/24 SAS or SATA 6.0-Gb/s drives, each one contained in its individual drive carrier. Each drive is hot-pluggable, allowing you to remove and insert drives without shutting down your ARC-8026 expander enclosure. Install the drives to 12-bays ARC-8026 expander enclosure as shown in figure 2-6.

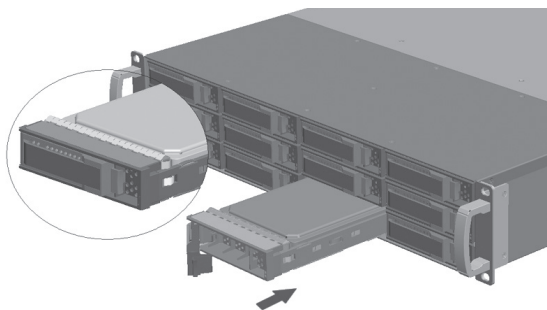


Figure 2-5, Install the drives to 12-bays ARC-8026 expander enclosure

Step 9. Connect to Host Interface

Once the ARC-8026 expander box has finished the configuration (option), then you can connect it to a host interface. The enclosure can be connected to a host interface which may a host adapter or RAID controller through the SFF-8088 SAS cable. By installing host adapter port and ARC-8026 expander box using the correct external cables which may be included in your enclosure kits. Then connect ARC-8026 expander box and host adapter port as shown below:

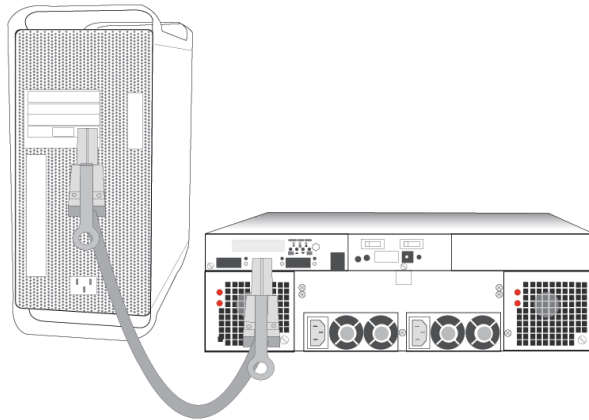


Figure 2-6, Connect ARC-8026 expander Box and host port adapter

Step 10. Connecting Expander Box's RS-232 Port (option)

The ARC-8026 expander box's system functions can be managed via a PC running a VT-100 terminal emulation program, or a VT-100 compatible terminal. The provided internal cable converts the RS-232C signals from the RJ11 into the one 9-pin D-Sub male connector.

Step 11. Add More Expander Boxes (option)

ARC-8026 expander box can run in one of two modes:

- Normal Mode
- Zone Mode

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You must select either mode using the CLI utility and restart the ARC-8026 expander enclosure again. The manufacture is default on the Normal Mode. Changing the mode while the ARC-8026 expander box is on. This will not affect expander operation until the ARC-8026 expander enclosure is rebooted.

In normal mode, a SAS host can communicate with up to 24 drives in the 24 bay enclosure via a single ARC-8026 expander box. ARC-8026 SAS expander box is a device that contain expander ports. Expander ports may support being attached to SAS initiator ports, SAS and/or SATA target ports, and to other expander ports. The SAS RAID controller or host adapter can support daisy-chain how many enclosures which depend on the RAID controller or the host adapter firmware. The following figure shows how to connect the external Min SAS cable from the SAS RAID controller that has external ports to the ARC-8026 expander box enclosures.

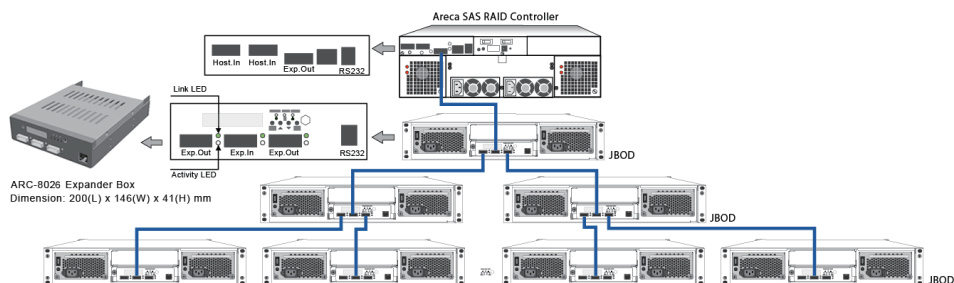
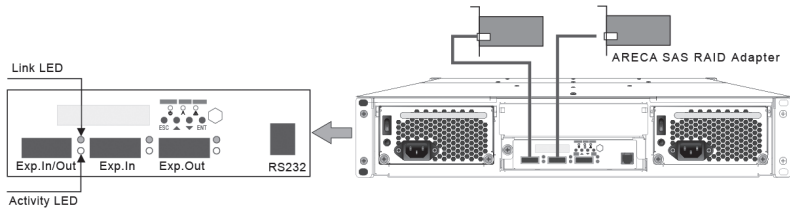


Figure 2-7, SAS expander connect to a drive box or drive enclosure

In zone mode, the SAS expander box can be split into up to 8 virtual groups. Each group drive channels and external cable connectors are assigned by CLI GROUP command. The following figure is shown the SAS expander box which has split into 2 virtual groups. Each group drive channels are controlled by individual host adapter using SAS CH1 and SAS CH2.



Note:

1. Please refer to chapter 4.3 CLI features of GROUP command which is used to associate the external port and the devices/phys slot.
2. Turn on the expander enclosure first to make sure the SAS RAID controller or SAS host adapter recognizes the drives in the enclosure.

Step 12. Connect the Power

Connect the power cord to a grounded electrical outlet and to the expander enclosure power. Turn on the power switch at the rear of the enclosure.

Step 13. Configure ARC-8026 Expander Box

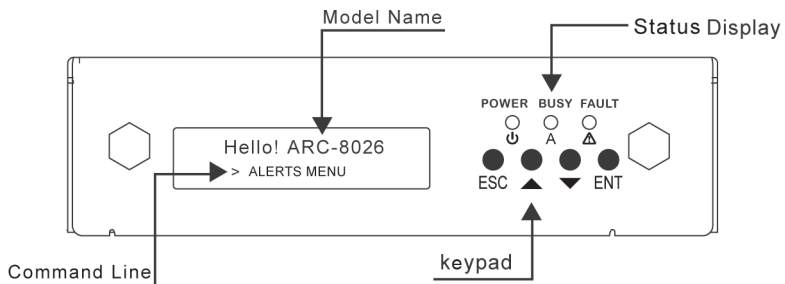
The ARC-8026 expander box is normally delivered with LCD pre-installed. Your ARC-8026 expander box can be managed by using the LCD with keypad or a serial device (terminal emulation).

- Method 1: LCD Panel with Keypad

You can use LCD front panel and keypad function to simply manage the ARC-8026 expander box. The LCD status panel also informs you of the expander's current system functions at a glance. The LCD provides a system of screens with areas for information, status indication, or menus. The LCD screen displays up to two lines at a time of menu items or other information.

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Please refer to Chapter 3 LCD Configuration Manager.
The initial screen is shown as following:



- Method 2: RS-232 Port

The ARC-8026 expander box's system functions can also be managed via a VT-100 compatible terminal or a PC running a VT-100 terminal emulation program. You can attach a serial (Character-Based) terminal or server com port to the ARC-8026 expander box for accessing the text-based setup menu. Please refer to Chapter 4 CLI Manager.

3. LCD Configuration Manager

The SAS expander box LCD configuration utility is a character-based utility that you can run after powering the unit. Use LCD configuration utility to see and configure:

- Alerts Menu,
- Voltage,
- Set Link,
- Set Alarm,
- Set Password,
- Save Config, and
- System Reset

The LCD display front panel function keys are the primary user interface for the SAS expander box. Except for the "Firmware update", all configurations can also be performed through this interface.

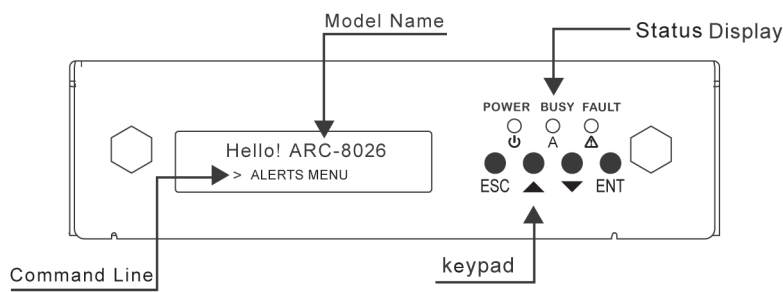
3.1 Using Local Front Panel Touch-Control Keypad

The front panel keypad and liquid crystal display (LCD) is the primary user interface for the SAS expander box. All configuration and management of the expander controller and its properly connected disk arrays can be performed from this interface. The front panel keypad and LCD is connected to the ARC-8026 SAS expander box to access the built-in configuration that resides in the SAS expander box's firmware.

The LCD provides a system of screens with areas for information, status indication, or menus. The LCD screen displays up to two lines at a time of menu items or other information.

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The initial screen is shown as following:



Function Key Definitions:

The four function keys at the right of the front panel perform the following functions:

Key	Function
Up Arrow	Use to scroll the cursor Upward / Rightward
Down Arrow	Use to scroll the cursor Downward / Leftward
ENT Key	Submit selected icon function (Confirm a selected item)
ESC Key	Return to previous screen (Exit a selection configuration)

There are a variety of failure conditions that cause the ARC-8026 expander box monitoring LED to light. Below table provides a summary of the front panel LED.

Panel LED	Normal Status	Problem Indication
Power LED	Bright green	This LED does not light up after power switched on
Busy LED (Host Access)	Blink green during host computer accessing the expander box	LED never flickers
Fault LED	Unlit	Solid red

3.2 Navigation Map of the LCD

The password option allows user to set or clear the SAS expander box's password protection feature. Once the password has been set, the user can only monitor and configure the SAS expander box by providing the correct password. The password is used to protect the SAS expander box from unauthorized entry. The SAS expander box will check the password only when entering the main menu from the initial screen. The SAS expander box will automatically go back to the initial screen when it does not receive any command in 5 minutes. The SAS expander box's password is default setting at 0000 by the manufacture.

The following flow is an expansion of LCM setup option items hierarchical menu.

LCM setup option items hierarchical menu:

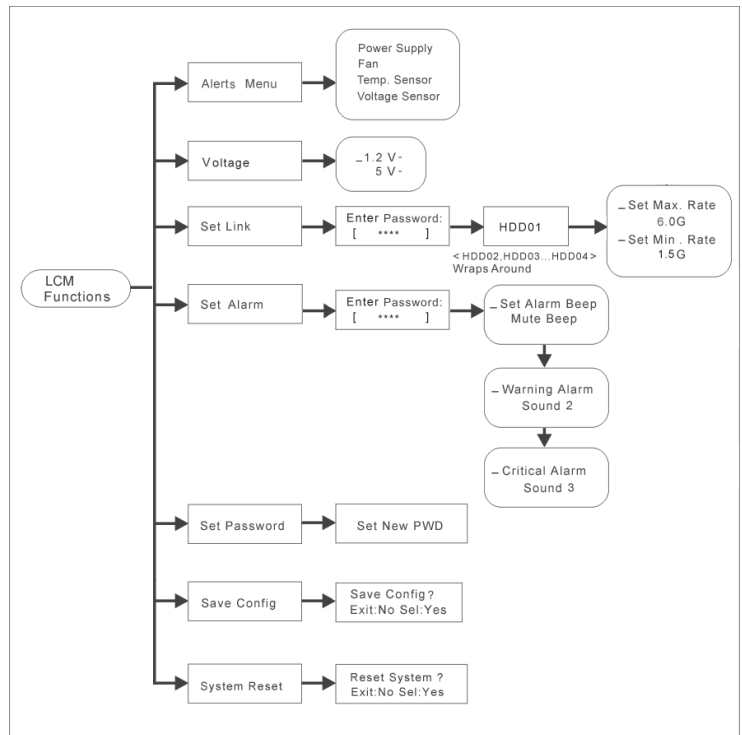


Figure 3.2-1

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● Alerts Menu

Show which device that fail to work, its sub-items could be "Power Supply", "Fan", "Temp. Sensor" and "Voltage Sensor".

● Voltage

Show enclosure chip voltage in status data, represent in V.

The sub-items are shown as below:

1.2V- , the expander box voltage is 1.2V

5V- , the expander box voltage is 5V

For the setup item, the LCM key represent:

Up key to enter the 0 - 9 data.

Down key to enter "a" - "z" and "A" - "Z" data.

Enter key to confirm the input or ready to update a sub-item data.

Esc/Exit key to go back to the main selection.

● Set Link

Set HDD devices maximum/minimum link speed rate. the value could be 6.0G, 3.0G or 1.5G each of HDD devices link speed will have the sub-items are shown as below:

_Set Max. Rate

6.0G

_Set Min. Rate

1.5G

● Set Alarm

Set enclosure buzzer warning/critical error beep style or mute the current beep. The value could be "Sound 1", "Sound 2", "Sound 3", "Sound 4" and "Sound Disabled". Sound 1 to 4 means different frequency sound. Sound disabled means disable the sound beep. The sub-items are shown below:

_Set Alarm Beep

Mute beep

Warning Alarm

_Sound 2

_Critical Alarm

Sound 3

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- **Set Password**

Change the enclosure LCM/UART CLI password. The sub-item is " Set New PWD".

- **Save Config**

Save all the updated option value into non-volatile memory area.

- **System Reset**

Reboot the system.

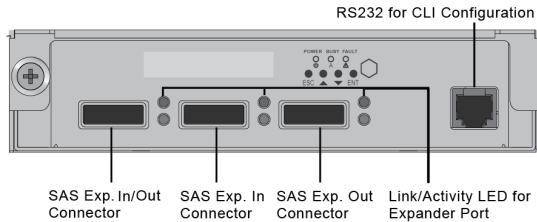
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4. CLI Manager

This Command Line Interface (CLI) is provided for you to manage the Areca ARC-8026 series 12/16/24 SAS expander system functions. The CLI is useful in environments where a graphical user interface (GUI) is not available.

• Locations of RS-232C Port

The ARC-8026 expander box uses the RJ11 port as the serial port interface. Please use the cable included on the shipping box to configure the expander controller.



• Establishing the Connection for the RS-232 Port

The CLI function can be done by using an ANSI/VT-100 compatible terminal emulation program. You must complete the appropriate installation procedure before proceeding with the CLI function. Whichever terminal emulation program is used must support the 1K XMODEM file transfer protocol.

The serial port on the ARC-8026 box's bracket can be used in VT100 mode. The provided interface cable converts the RS232 signal of the RJ11 connector on the SAS expander controller into a 9-pin D-Sub male connector. The firmware-based terminal SAS expander management interface can access the expander through this RS-232 port. You can attach a VT-100 compatible terminal or a PC running a VT-100 terminal emulation program to the serial port for accessing the text-based setup menu.

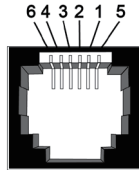
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4.1 Expander RS-232C Port Pin Assignment

To ensure proper communications between the SAS expander box and the VT-100 Terminal Emulation, Please configure the VT100 terminal emulation settings to the values shown below:

Terminal requirement	
Connection	Null-modem cable
Baud Rate	115,200
Data bits	8
Stop	1
Flow Control	None

The controller RJ11 connector pin assignments are defined as below.

Pin Assignment				
Pin	Definition	Pin	Definition	
1	RTS (RS232)	4	GND	
2	RXD (RS232)	5	GND	
3	TXD (RS232)	6	GND	

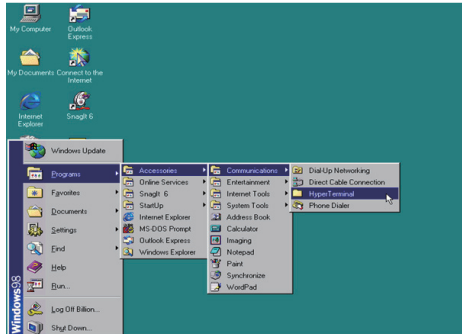
4.2 Start-up VT100 Screen

By connecting a VT100 compatible terminal, or a PC operating in an equivalent terminal emulation mode, all CLI administration functions can be exercised from the VT100 terminal.

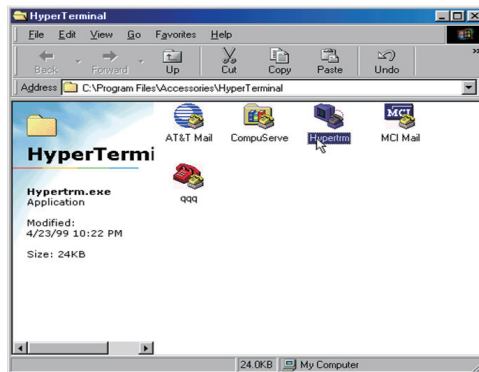
There are a wide variety of Terminal Emulation packages, but for the most part they should be very similar. The following setup procedure is an example Setup VT100 Terminal in Windows XP system using Hyper Terminal use Version 3.0 or higher.

Step 1. Open the "Taskbar Start"/"Programs"/"Accessories"/"Communications"/"Hyper Terminal". (Hyper Terminal requires version 3.0 or higher).

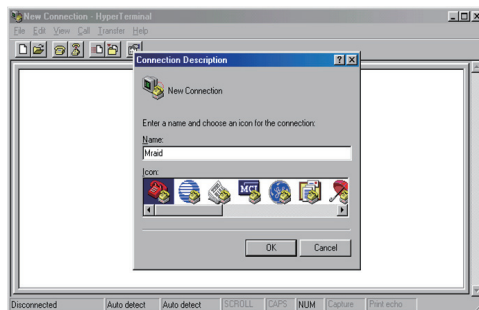
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Step 2. Open "HYPERTRM.EXE".

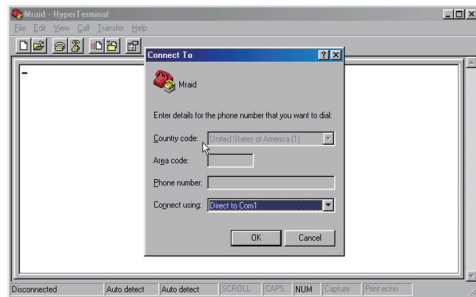


Step 3. Enter a name you prefer and then click "OK".



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Step 4. Select an appropriate connecting port and then click "OK".



Step 5. Configure the port parameter settings and then click "OK".

Bits per second: 115200

Data bits: 8

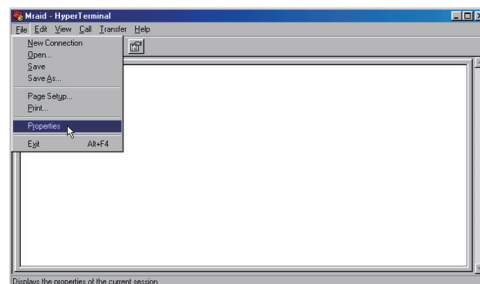
Parity: None

Stop bits: 1

Flow control: None

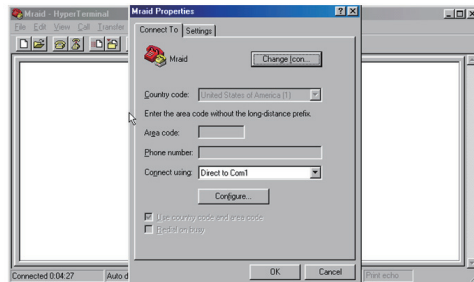


Step 6. Open the file menu and select "Properties".

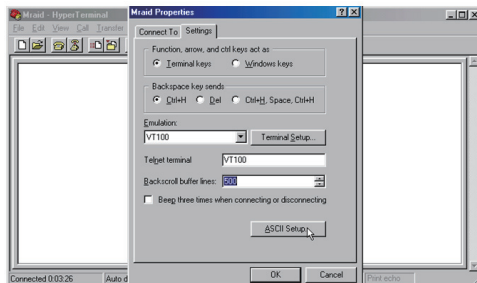


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Step 7. Configure the "Connect To" setting.



Step 8. Configure the "Settings" items and then click "OK".
Function, arrow and ctrl keys act as: Terminal Keys
Backspace key sends: Ctrl+H
Emulation: VT100
Telnet terminal: VT100
Back scroll buffer lines: 500



4.3 CLI Command

This section provides detail information about the SAS expander-box's CLI function. All the commands please type in lower case.

● **HELP Command**

This command provides an on-line table of contents, providing brief descriptions of the help sub-commands. You can use the <CLI> help to get detail information about the CLI commands summary.

Syntax

CLI>help[Enter]

Example:

CLI>help

pass	- Set Password
lo	- Logout CLI Shell
link	- Link Rate Control
th	- Temperature Control
group	- Set the PHY Group
sys	- System Information
bu	- Alarm Control
fan	- Fan Speed Control
spin	- Drive SpinUp Control
st	- Store System Setting
lsd	- List Devices Status
showlogs	- Show the Current Logs
fld	- File Download
counters reset(optional)	-Display/Reset all phy counters
sasaddr	-Display expander SAS address

● **PASS Command**

The pass command allows user to set or clear the expander box password protection feature. Once the password has been set, the user can only monitor and access the expander box setting by providing the correct password. The password can accept max.

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8 chars and min. 4 chars. The manufacture default password is "0000".

Syntax

CLI>pass [Enter]

Example:

CLI>pass

Old Password:****

New Password:****

Verify New Password:****

Password Changed But Not Save Permanently!

Note, use CLI command "st" to keep permanently.

● **LO Command**

To exit the selected expander box CLI shell, use the lo command.

Syntax

CLI> lo [Enter]

Example:

CLI>lo

Password:

● **LINK Command**

The link command allows you to set the operate device link rate that has been connected on expander controllers. Typical parameters include: Max and Min disk speed connected the SAS expander box.

Syntax

CLI>link [Index Max Min] [Enter]

Index: Slot Index

Max, Min: speed code, 8 means 1.5G, 9 means 3.0G and 10 means 6.0G

PS. Pls. Save Config. & Reboot To Take Effect

CLI>st

Example:

CLI>link

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ArrayDevice Element (0x17):

=====						
NAME	PHY	NLR	MAX	MIN	TYPE	ADDRESS
SLOT 01	0	3.0G	10	8	SAS	5000C500-0D2002D1
SLOT 02	1		10	8		
SLOT 03	2		10	8		
SLOT 04	3	1.5G	10	8	SATA	5001B469-84965C03
SLOT 05	4		10	8		
SLOT 06	5		10	8		
SLOT 07	6	6.0G	10	8	SAS	5000C500-17C8FD25
SLOT 08	7		10	8		
SLOT 09	8		10	8		
SLOT 10	9		10	8		
SLOT 11	10		10	8		
SLOT 12	11		10	8		

//Set the slot 0x6 max. speed to 1.5G

CLI >link 6 9 8

CLI >link

ArrayDevice Element (0x17):

=====						
NAME	PHY	NLR	MAX	MIN	TYPE	ADDRESS
SLOT 01	0	3.0G	10	8	SAS	5000C500-0D2002D1
SLOT 02	1		10	8		
SLOT 03	2		10	8		
SLOT 04	3	1.5G	10	8	SATA	5001B469-84965C03
SLOT 05	4		10	8		
SLOT 06	5		10	8		
SLOT 07	6	6.0G	9	8	SAS	5000C500-17C8FD25
SLOT 08	7		10	8		
SLOT 09	8		10	8		
SLOT 10	9		10	8		
SLOT 11	10		10	8		
SLOT 12	11		10	8		

CLI>st

CLI>

Reboot to take effect.

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CLI >link

ArrayDevice Element (0x17):

```
=====
```

NAME	PHY	NLR	MAX	MIN	TYPE	ADDRESS
SLOT 01	0	3.0G	10	8	SAS	5000C500-0D2002D1
SLOT 02	1		10	8		
SLOT 03	2		10	8		
SLOT 04	3	1.5G	10	8	SATA	5001B469-84965C03
SLOT 05	4		10	8		
SLOT 06	5		10	8		
SLOT 07	6	3.0G	9	8	SAS	5000C500-17C8FD25
SLOT 08	7		10	8		
SLOT 09	8		10	8		
SLOT 10	9		10	8		
SLOT 11	10		10	8		
SLOT 12	11		10	8		

• TH Command

The th command allows you to set the operate device temperature warning limit. Typical parameters include: High-Warn and Low-Warn are warning temperature in Celsius.

Syntax

CLI> th Index High-Warn Low-Warn

Example:

CLI>th

Temperature Element (0x04):

```
=====
```

NAME	ID	CT(°C)	HTW	LTW	OTWarn
ENC. Temp	01	30	60	5	No
Chip Temp	02	64	85	5	No
Slot01 Temp	03	31	60	5	No
Slot02 Temp	04	32	60	5	No
Slot03 Temp	05	30	60	5	No
Slot04 Temp	06	31	60	5	No
Slot05 Temp	07	36	60	5	No
Slot06 Temp	08	32	60	5	No
Slot07 Temp	09	32	60	5	No

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Slot08 Temp	10	35	60	5	No
Slot09 Temp	11	34	60	5	No
Slot10 Temp	12	32	60	5	No
Slot11 Temp	13	32	60	5	No
Slot12 Temp	14	33	60	5	No

CLI>th 2 79 0

Temperature Element (0x04):

```
=====
```

NAME	ID	CT(°C)	HTW	LTW	OTWarn
ENC. Temp	01	30	60	5	No
Chip Temp	02	64	79	0	No
Slot01 Temp	03	31	60	5	No
Slot02 Temp	04	32	60	5	No
Slot03 Temp	05	30	60	5	No
Slot04 Temp	06	31	60	5	No
Slot05 Temp	07	36	60	5	No
Slot06 Temp	08	32	60	5	No
Slot07 Temp	09	32	60	5	No
Slot08 Temp	10	35	60	5	No
Slot09 Temp	11	34	60	5	No
Slot10 Temp	12	32	60	5	No
Slot11 Temp	13	32	60	5	No
Slot12 Temp	14	33	60	5	No

CLI>st

CLI>

Reboot to take effect.

CLI>th

Temperature Element (0x04):

```
=====
```

NAME	ID	CT(°C)	HTW	LTW	OTWarn
ENC. Temp	01	30	60	5	No
Chip Temp	02	64	79	0	No
Slot01 Temp	03	31	60	5	No
Slot02 Temp	04	32	60	5	No
Slot03 Temp	05	30	60	5	No
Slot04 Temp	06	31	60	5	No
Slot05 Temp	07	36	60	5	No
Slot06 Temp	08	32	60	5	No
Slot07 Temp	09	32	60	5	No

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Slot08 Temp	10	35	60	5	No
Slot09 Temp	11	34	60	5	No
Slot10 Temp	12	32	60	5	No
Slot11 Temp	13	32	60	5	No
Slot12 Temp	14	33	60	5	No

● GROUP Command

The group command is used to associate the external port with the devices/phys as one zone group. The three external cable ports and all devices/phys slots will default associate with one zone group.

Syntax

```
gr {dev GroupNo[1..] {ci, cj, ck,..} Start-Index(D) End-Index(D)
}
gr {off | [t10 off] }
dev          : use drive slot index
GroupNo      : groupno start from 1, max 8 groups ci, cj, ck,..:
external cable connector. i, j, k,.. is the index which range from 0
to 3. According to view from connector side, index start from
right to left or top to bottom. The cable c0, c1, or c2 is view
from right to left or start from top to bottom.
Start-Index  : Start slot index of zone range, [1.. max drive]
End-Index    : End slot index of zone range, [1.. max drive]
off          : clear the zone group setting.
t10 off      : turn T10 mode off.
```

Example:

```
CLI>gr
Current PHY Group Mode: T10
Group-1: C0, C1, C2, Slot: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12,
13, 14, 15, 16
Value: 0x00000000FFFFFFFF
```

```
//Set the cable0 and slot 1 to slot 6 as group 1
CLI>gr dev 1 c0 1 6
```

```
New PHY Group Mode: T10
Group-1: C0, Slot: 1, 2, 3, 4, 5, 6
```

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Value: 0x000000000000FFC00

Current PHY Group Mode: T10

Group-1: C0, C1, C2 Slot: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

Value: 0x00000000FFFFFFFF

//Set the cable1 and cable2 and slot 7 to slot 16 as group 2

CLI>gr dev 2 c1, c2 7 16

New PHY Group Mode: T10

Group-1: C0, Slot: 1, 2, 3, 4, 5, 6

Value: 0x000000000000FFC00

Group-2: C1, C2, Slot: 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

Value: 0x00000000FF003FF

Current PHY Group Mode: T10

Group-1: C0, C1, C2 Slot: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

Value: 0x00000000FFFFFFFF

CLI>st

Power Cycle to reboot

CLI>gr

Current PHY Group Mode: T10

Group-1: C0, Slot: 1, 2, 3, 4, 5, 6

Value: 0x000000000000FFC00

Group-2: C1, C2, Slot: 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

Value: 0x00000000FF003FF

//Clear the Zone group Setting

CLI>gr off

New PHY Group Mode: T10

Group-1: C0, C1, C2 Slot: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16

Value: 0x00000000FFFFFFFF

Current PHY Group Mode: T10

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Group-1: C0, Slot: 1, 2, 3, 4, 5, 6
Value: 0x000000000000FFC00
Group-2: C1, C2, Slot: 7, 8, 9, 10, 11, 12, 13, 14, 15, 16
Value: 0x0000000000FF003FF

● SYS Command

The sys command is used to view the expander's information. Typical information includes: vendor, model name, serial/unit number, expander port number, product revision, chip name/chip revision, customer code, manufacture data revision and work time.

Syntax

CLI>sys [Enter]

Example:

CLI>sys

```
=====
=====
Hardware Revision Information:-
=====
=====
```

```
Vendor ID           : Areca Technology Co Ltd. Taiwan, R.O.C
Model ID            : ARC-8026
Serial No.          : 00000000000000000
Unit Serial No.     :
Expander SAS Address : 0x5001B46984965C3F
Product Revision    : 0
Expander Chip ID     : 0x0221 (Ports : 28)
Expander Chip Revision : B3
Customer Code       : 0x36
Manufacturer Data Revision : 0xB2
Working Time        : Day00000-01:48:14
```

```
=====
=====
Firmware Revision Information:-
=====
=====
```

Active Firmware: Active Image

Boot Image:

Revision: 6.01.00.68 06/30/10

Firmware Family: 1 Fast Boot: No Image Address: 0x14000000

Active Image:

Revision: 6.01.00.68 06/30/10

Firmware Family: 1 Fast Boot: No Image Address: 0x14080000

Backup Image:

Revision: 6.01.00.68 06/30/10

Firmware Family: 1 Fast Boot: No Image Address: 0x14100000

• BU Command

The BU command allows you to control the buzzer attributes that have been controlled by SAS expander H/W. There are four sound levels defined by the expander H/W.

The default warning is sound level 2 and critical: sound level 3.

Syntax

CLI>BU [Warning Critical] [MUTE] [Enter]

Example:

CLI>BU

Buzzer Attribute:

Warning Beep: Sound 2

Critical Beep: Sound 3

CLI>BU 0x1 0x3

CLI>BU

Buzzer Attribute:

Warning Beep: Sound 1

Critical Beep: Sound 3

CLI>

When expander alarm with buzzer, you can temporarily mute it with the following command. The buzzer still can be activated by the next different event.

CLI>BU MUTE

When expander alarm with buzzer, you can disable it completely by command "bu 0 0". If you would like to enable beeper, the

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command for default settings will be "bu 2 3".

● FAN Command

The fan command allows you to set the operate fan speed. Typical parameters include: LowestSpeed and WarningSpeed are fan speed in speed code from level 1 to 7.

The LowestSpeed is the speed code that fan operate in normal state, and the WarningSpeed is the speed code that fan operate in warning state; like as detect a device in over-temperature.

Syntax

CLI> fan LowestSpeed WarningSpeed

Example:

CLI>fan

Cooling Element (0x03):

```
=====
                        SPEED
NAME      CODE  RPM  STATUS
Fan 01      2   3690   OK
Fan 02      2   4090   OK
Fan 03      2   3650   OK
Fan 04      2   4050   OK
```

Current FAN Speed Attribute:

Lowest SpeedCode: 2

Warning SpeedCode: 5

CLI>fan 3 7

New FAN Speed Attribute:

Lowest SpeedCode: 3

Warning SpeedCode: 7

Current FAN Speed Attribute:

Lowest SpeedCode: 2

Warning SpeedCode: 5

CLI>st

CLI>

Reboot to take effect.

CLI>fan

Cooling Element (0x03):

```
=====
                SPEED
NAME      CODE  RPM  STATUS
Fan 01      3   4140   OK
Fan 02      3   4630   OK
Fan 03      3   4140   OK
Fan 04      3   4490   OK
```

Current FAN Speed Attribute:

Lowest SpeedCode: 3

Warning SpeedCode: 7

Fan internal command for different fan speed type:

fan -t [high | normal | low | vlow]

high : 6000 - 10000 rpm

normal : 1800 - 7000 rpm

low : 1000 - 2000 rpm

vlow : below 1000 rpm

the above is a rough value, user can set different to fit the fan speed type.

Default is normal.

● SPIN Command

The spin command defines the mode of staggering SATA drive spin-up function connected on the expander box. This command gives expander box the ability to spin up the disk drives sequentially or in groups, allowing the drives to come ready at the optimum time without straining the system power supply. Staggering drive spin-up in a multiple drive environment also avoids the extra cost of a power supply designed to meet short-term startup power demand as well as:

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Syntax

CLI> spin [Delay(D)[ms] Num(D)]

Expander issues the spin up the drives by [Num] drives with [Delay] ms.

Example1:

CLI>spin

Current SpinUp Attribute:

Drive Number: 1

Delay: 1024 ms

CLI>spin 512 3

New SpinUp Attribute:

Drive Number: 3

Delay: 512 ms

Current SpinUp Attribute:

Drive Number: 1

Delay: 1024 ms

● ST Command

The st command stores system configurations in flash. Since all the revised parameter setting is temporarily stored in the working RAM, the ST command saves those parameters permanently in flash ROM.

Syntax

CLI> st

Example:

CLI> st

CLI>

● LSD Command

The lsd command is use for show the element devices status in the expander controller. With parameter, this command only show the select device status.

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Syntax

CLI> lsd [hdd | temp | volt | pwr | con | ..]

Show SES elements information:

ArrayDevice Element (0x17):

=====						
NAME	PHY	NLR	MAX	MIN	TYPE	ADDRESS
SLOT 01	0	3.0G	10	8	SAS	5000C500-0D2002D1
SLOT 02	1		10	8		
SLOT 03	2		10	8		
SLOT 04	3	1.5G	10	8	SATA	5001B469-84965C03
SLOT 05	4		10	8		
SLOT 06	5		10	8		
SLOT 07	6	6.0G	10	8	SAS	5000C500-17C8FD25
SLOT 08	7		10	8		
SLOT 09	8		10	8		
SLOT 10	9		10	8		
SLOT 11	10		10	8		
SLOT 12	11		10	8		

Connector Element (0x19):

=====					
NAME	PHY	NLR	TYPE	STATUS	
Connector00	16		02		
Connector00	17		02		
Connector00	18		02		
Connector00	19		02		
Connector01	20	6.0G	02	Connected	
Connector01	21	6.0G	02	Connected	
Connector01	22	6.0G	02	Connected	
Connector01	23	6.0G	02	Connected	
Connector02	24		02		
Connector02	25		02		
Connector02	26		02		
Connector02	27		02		

Cooling Element (0x03):

=====			
SPEED			
NAME	CODE	RPM	STATUS
Fan 01	5	2100	OK
Fan 02	5	2200	OK

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Fan 03 Not-Installed
Fan 04 Not-Installed
Temperature Element (0x04):

=====					
NAME	ID	CT(^C)	HTW	LTW	OTWarn
ENC. Temp	01	32	60	5	No
Chip Temp	02	42	85	5	No

Voltage Element (0x12):

=====					
NAME	VOLT(V)	OVLMT	UVLMT	STATUS	
1V	0.99	1.07	0.94	None	
5V	4.96	5.32	4.63	None	

PowerSupply Element (0x02):

=====	
NAME	STATUS
PowerSupply01	OK
PowerSupply02	OK

AudibleAlarm Element (0x06):

=====		
NAME	STATUS	ALMSTATE
Audible-Alarm	Normal	0
CLI>		

● SHOWLOGS Command

The showlogs command allows you to display system event notifications that have been generated event by the SAS expander box.

Syntax

CLI>showlogs [DisplayMode(hex, detail, default)]

Example:

CLI>showlogs

00000000-00000000:PLATFORM:Firmware initialization started

Day000000-00:00:00 ENCLOSURE-Fan 01 Failed

● FDL Command

The box has added the expander firmware update through the CLI on the external RS-232 port. Before you process the firmware update, There are two block regions that you can update expander microcode on SAS expander box.

(1)CODE region - for FW file : sas2xfwXXXX.fw

(2)MFGB region - for Data file : mfgdat6gYYYY.rom

To update the expander controller firmware, follow the procedure below:

Syntax: all the commands please type in lower case
CLI>fdl { code | mfgb } offset[Enter]

Then use XModem/(Checksum) protocol transmit file to update ROM Region

The following procedures is used to update firmware through the RS-232:

- A. Open any UART communication tools like HypeTerminal(115200,n,8,1).
- B. Press any key on HyperTerminal window, the window will show "CLI>" prompt.
- C. Type help will show help screen.
- D. One command to update firmware. Step as follow,
- E. Issue download & update command under "CLI>".
CLI>fdl code 0
Please Use XModem Protocol for File Transmission.
Use Q Or q to quit Download before starting XModem.
<-----expander prompt for ready to receive file to update.
- F. Then under HyperTerminal program, use the pull down menu item transfer "Send" -> send files when dialog box prompt, choose "Xmodem" and the file in the directory then press "send".
 - (1). If the expander receive the file under the timeout limit (60s), the process starts.
 - (2). If time out, please retry the step E again.
- G. You can also cancel the program step by type 'q'.
- H. If transfer OK, the transfered data is updated. Cold-start expander (Power cycle again) to take effect.

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Example:

Update procedure, use Xmodem to transfer, refer to "fdl" command for detail operation.

```
CLI> fdl { code | mfgb } offset[Enter]
```

Use HyperTerminal or TeraTerm utility with Xmodem mode to transfer and update files.

If transfer OK, the transfered data is updated. Cold-start expander (Power cycle again) to take effect.

The following firmware and data are available in the following filename format.

(1)FW file (CODE) : sas2xfwXXXX.fw

(2)Data file (MFGB) : mfgdat6gYYYYY.rom

Update SAS expander firmware:

```
CLI> fdl code 0
```

Use HyperTerminal or TeraTerm utility with Xmodem mode to transfer sas2xfwXXXX.fw.

If transfer OK, the transfered data is updated. Cold-start expander (Power cycle again) to take effect.

Update SAS expander data file:

```
CLI>fdl mfgb 0
```

Use HyperTerminal or TeraTerm utility with Xmodem mode to transfer mfgdat6gYYYYY.rom.

If transfer OK, the transfered data is updated. Cold-start expander (Power cycle again) to take effect.

● Counters Reset Command

Display/Reset all phy counters counters reset(optional)

```
CLI>counters reset
```

Phy counters successfully reset.

```
CLI>counters
```

```
Phy Layer Error Counters=====
```

```
===== InvWrdCnt ==DispErrCnt ==LossSyncCnt ==RstSeqFailCnt=
```

```
Phy 00   0x00000000   0x00000000   0x00000000   0x00000000
```

```
Phy 01   0x00000000   0x00000000   0x00000000   0x00000000
```

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Phy 02	0x00000000	0x00000000	0x00000000	0x00000000
Phy 03	0x00000000	0x00000000	0x00000000	0x00000000
Phy 04	0x00000000	0x00000000	0x00000000	0x00000000
Phy 05	0x00000000	0x00000000	0x00000000	0x00000000
Phy 06	0x00000000	0x00000000	0x00000000	0x00000000
Phy 07	0x00000000	0x00000000	0x00000000	0x00000000
Phy 08	0x00000000	0x00000000	0x00000000	0x00000000
Phy 09	0x00000000	0x00000000	0x00000000	0x00000000
Phy 10	0x00000000	0x00000000	0x00000000	0x00000000
Phy 11	0x00000000	0x00000000	0x00000000	0x00000000
Phy 12	0x00000000	0x00000000	0x00000000	0x00000000
Phy 13	0x00000000	0x00000000	0x00000000	0x00000000
Phy 14	0x00000000	0x00000000	0x00000000	0x00000000
Phy 15	0x00000000	0x00000000	0x00000000	0x00000000
Phy 16	0x00000000	0x00000000	0x00000000	0x00000000
Phy 17	0x00000000	0x00000000	0x00000000	0x00000000
Phy 18	0x00000000	0x00000000	0x00000000	0x00000000
Phy 19	0x00000000	0x00000000	0x00000000	0x00000000
Phy 20	0x00000000	0x00000000	0x00000000	0x00000000
Phy 21	0x00000000	0x00000000	0x00000000	0x00000000
Phy 22	0x00000000	0x00000000	0x00000000	0x00000000
Phy 23	0x00000000	0x00000000	0x00000000	0x00000000
Phy 24	0x00000000	0x00000000	0x00000000	0x00000000
Phy 25	0x00000000	0x00000000	0x00000000	0x00000000
Phy 26	0x00000000	0x00000000	0x00000000	0x00000000
Phy 27	0x00000000	0x00000000	0x00000000	0x00000000

Link Layer Event Counters
Phy Event Counter Not Configured.
Generic Broadcast Counter
Broadcast Counter Not Configured.
Generic Broadcast Counter
Broadcast Counter Not Configured.

● Sasaddr Command

CLI>sasaddr

Expander New SAS Address: 0x5001B4690400083F
Expander Current SAS Address:
EXP Port SAS Address: 0x5001B4690400083F

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SXP Port SAS Address: 0x5001B4690400083D
STP Port SAS Address: Disabled

Version History

Revision	Page	Description
1.1	p.9	Revised Fan Headers (J11~J14) description
1.1	p.11	Revised step 4 description