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## Revision History

<table>
<thead>
<tr>
<th>Date</th>
<th>Version</th>
<th>Modifications</th>
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<tr>
<td>2016/01/15</td>
<td>1.0</td>
<td>First release</td>
</tr>
<tr>
<td>2016/07/29</td>
<td>1.1</td>
<td>Changes in CEB and DPB in pages 14, 15, 18, 24~28, 33, 35, 36, 39, 40, 44, 45,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>49~55, 59, 61, 63 and 64.</td>
</tr>
</tbody>
</table>
Information for Your Safety and Comfort

Safety Instructions

Read these instructions carefully. Keep this document for future reference. Follow all warnings and instructions marked on the product.

Turn Off the Product before Cleaning

Cut off all power sources from this product before cleaning. Do not use liquid cleaners or aerosol cleaners. Use a damp cloth for cleaning.

Warnings

• Do not use this product near water.

• Do not place this product on an unstable cart, stand or table. If the product falls, it could be seriously damaged.

• Slots and openings are provided for ventilation to ensure reliable operation of the product and to protect it from overheating. These openings must not be blocked or covered. The openings should never be blocked by placing the product on a bed, sofa, rug or other similar surface. This product should never be placed near or over a radiator or heat register, or in a built-in installation unless proper ventilation is provided.

• Never push objects of any kind into this product through cabinet slots as they may touch dangerous voltage points or short-out parts that could result in a fire or electric shock. Never spill liquid of any kind onto or into the product.
• To avoid damage of internal components, do not place the product on a vibrating surface.

Using Electrical Power

This product should be operated from the type of power indicated on the marking label. If you are not sure of the type of power available, consult your dealer or local power company.

Product Servicing

Do not attempt to service this product yourself, as opening or removing covers may expose you to dangerous voltage points or other risks. Refer all servicing to qualified service personnel.

When servicing the hot-swappable system fans while power is on, replace one system fan at a time to avoid system malfunction.

Use both hands to support this product when removing or installing it from the rack.
Remove this product from the rack, cut off the power and refer servicing to qualified service personnel when:

- liquid was spilled into the product
- the product was exposed to rain or water
- the product has been dropped or the case has been damaged
- the product exhibits a distinct change in performance, indicating a need for service
- the product does not operate normally after following the operating instructions

NOTE: Adjust only those controls that are covered by the operating instructions, since improper adjustment of other controls may result in damage and will often require extensive work by a qualified technician to restore the product to normal condition.
Disposal Instructions

Do not throw this electronic device into the trash when discarding. To minimize pollution and ensure utmost protection of the global environment, please recycle. For more information on the Waste from Electrical and Electronics Equipment (WEEE) regulations, please visit the local WEEE website.
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Preface

Wiwynn ST5110-75 has a storage capacity of seventy-five SAS hard drives in a 4U chassis and stands out from other JBOD storage systems with the highest storage density in the industry.

Introduction

Wiwynn ST5110-75 supports high availability with hot-plug hard drives and redundant cooling and power system.

With five separate drawers, Wiwynn ST5110-75 supports a total of seventy-five hard drives (fifteen HDDs for each drawer). The drawers can be flexibly configured as one combined zone or five independent zones to mix drive distribution within the same enclosure. This versatile design enhances both performance and capacity for diverse applications, Hadoop, virtualization, storage cluster, and many more.

About this Manual

The contents in this manual include:

Chapter 1 – contains the system specification, front and rear components, and the different system boards

Chapter 2 – shows how to install the system onto the rack

Chapter 3 – shows how to replace or upgrade system components

Chapter 4 – lists the expander features

Chapter 5 – shows the expander firmware update

Chapter 6 – lists the Wiwynn supported SES pages
Conventions

WARNING

Indicates the presence of a hazard that may result in serious personal injury if the **WARNING** is ignored.

CAUTION

Indicates the presence of a hazard that may cause minor personal injury or property damage if the **CAUTION** is ignored.
1. System Tour

1.1 System Specification

<table>
<thead>
<tr>
<th>Storage and I/O</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Expander</td>
<td>SAS12G Expander</td>
</tr>
<tr>
<td>Storage</td>
<td>Seventy-five 3.5&quot; hot-plug drive bays:</td>
</tr>
<tr>
<td></td>
<td>• Nearline SAS HDD (7.2K rpm)</td>
</tr>
<tr>
<td></td>
<td>• SATA HDD (7.2K rpm)</td>
</tr>
<tr>
<td></td>
<td>Five EXT mini-SAS HD 12G (SASx4) ports</td>
</tr>
<tr>
<td>Remote Management</td>
<td>SES, SMP</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Power Supply, Physical and Packaging Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply</td>
</tr>
<tr>
<td>Power Consumption</td>
</tr>
<tr>
<td>Form Factor</td>
</tr>
<tr>
<td>System Dimensions</td>
</tr>
<tr>
<td>Weight</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drawer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
</tr>
<tr>
<td>Dimensions</td>
</tr>
<tr>
<td>Weight</td>
</tr>
</tbody>
</table>
1.2 Front Panel

The illustration below shows the system front panel.

<table>
<thead>
<tr>
<th>No.</th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HDD LEDs</td>
</tr>
<tr>
<td>2</td>
<td>Drawer LEDs</td>
</tr>
<tr>
<td>3</td>
<td>Drawer Handle</td>
</tr>
<tr>
<td>4</td>
<td>Drawer Latch</td>
</tr>
<tr>
<td>5</td>
<td>Drawers (1 to 5)</td>
</tr>
</tbody>
</table>
1.3 Rear Panel

The illustration below shows the system rear panel.

<table>
<thead>
<tr>
<th>No</th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power Supply Units</td>
</tr>
<tr>
<td>2</td>
<td>System Fans</td>
</tr>
<tr>
<td>3</td>
<td>CEB (Chassis Expander Board) Module</td>
</tr>
</tbody>
</table>
### 1.3.1 CEB Module

![CEB Module components](image)

<table>
<thead>
<tr>
<th>No</th>
<th>Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mini SAS HD connector 1</td>
</tr>
<tr>
<td>2</td>
<td>Mini SAS HD connector 2-5</td>
</tr>
<tr>
<td>3</td>
<td>Enclosure status LED</td>
</tr>
<tr>
<td>4</td>
<td>UID LED</td>
</tr>
<tr>
<td>5</td>
<td>CEB power on/off switch</td>
</tr>
<tr>
<td>6</td>
<td>UID LED button</td>
</tr>
<tr>
<td>7</td>
<td>UART port</td>
</tr>
</tbody>
</table>
# 1.4 LED Indicator Status

## 1.4.1 Front LEDs (on LED Board)

<table>
<thead>
<tr>
<th>LEDs per Drawer</th>
<th>Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drawer LEDs (x5)</td>
<td>Green</td>
<td>Normal, drawer in</td>
</tr>
<tr>
<td></td>
<td>Orange</td>
<td>Drawer out</td>
</tr>
<tr>
<td>HDD LEDs (x15)</td>
<td>Blue</td>
<td>HDD connected</td>
</tr>
<tr>
<td></td>
<td>Red</td>
<td>HDD error</td>
</tr>
<tr>
<td></td>
<td>Off</td>
<td>No HDD</td>
</tr>
</tbody>
</table>

## 1.4.2 Rear LEDs (on CEB Board)

<table>
<thead>
<tr>
<th>LED</th>
<th>Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>UID</td>
<td>Off</td>
<td>Normal</td>
</tr>
<tr>
<td></td>
<td>Green</td>
<td>User control</td>
</tr>
<tr>
<td>Enclosure</td>
<td>Blue</td>
<td>System normal</td>
</tr>
<tr>
<td></td>
<td>Red</td>
<td>System error</td>
</tr>
</tbody>
</table>
1.5 Boards

1.5.1 Chassis Expander Board (CEB)

1.5.2 PSU Interposer Board
1.5.3 Mid-plane Board (MPB)

1.5.4 Drive Plane Board (DPB)

1.5.5 LED Board
2. Replacing the System

This system occupies 4U space. If this is your first time to install the system to the rack, please pay attention to the procedures below regarding safety concerns.

- **To remove or install the system, get others to help you. Do not attempt to replace the system by yourself.**

- **WARNING**
  Make sure the system is securely fixed to the rack. To avoid personal injury or damage to the system, you must adequately support the system rack during installation and removal.

- **WARNING**
  Only a certified service technician can do certain repairs. You should only perform troubleshooting and simple repairs, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Wiwynn is not covered by your warranty.

- **CAUTION**
  Before replacing the system, cut off all power sources supplied to the system. Ensure that all power cords are disconnected from the power sources.

- **NOTE:** Once power is supplied, the system runs automatically.
2.1 Installing the System to the Rack

To ensure personnel safety and avoid damaging the hard disk drives, it is recommended to install the system into the rack first before installing the hard disk drives.

CAUTION

Follow these steps to install the system to the rack:

1. Carefully insert the system into the rack until the side ear brackets are aligned with the rack posts.

2. Tighten the thumbscrews to secure the system to the rack.
2.2 Removing the System from the Rack

To ensure personnel safety and avoid damaging the hard disk drives, it is recommended to remove all hard disk drives first before removing the system from the rack.

CAUTION

Follow these steps to remove the system from the rack:

1. Loosen the thumbscrews.

2. Carefully pull out the system from the rack and place the system on a flat, rigid surface.
3. System Upgrades

Only a certified service technician can do certain upgrades or repairs. You should only perform troubleshooting and simple repairs, or as directed by the online or telephone service and support team. Damage due to servicing that is not authorized by Wiwynn is not covered by your warranty.

CAUTION

Before replacing or upgrading parts, cut off all power sources supplied to the system. Ensure that all power cords are disconnected from the power sources.

CAUTION

NOTE: The components shown in this chapter are for your reference only. Actual component may vary and may not reflect the appearance of the component.

3.1 Safety Instructions

Read these instructions carefully. Keep this document for future reference. Follow all warnings and instructions for your safety and to avoid damaging the system.

1. After pulling the system out of the rack for performing system upgrade, maintenance and debug, make sure to always place the system on a flat rigid surface.

2. For safety reasons, it is recommended to remove all hard disk drives before removing the drawer.

3. Use both hands to hold the drawer in the horizontal position when pulling it out or pushing it in to avoid damaging it.
4 **Caution**: The power in your system may have energy hazards, which can cause bodily harm. Unless you are instructed otherwise, only trained service technicians are authorized to remove the covers and access any of the components inside the system.

Remove the power before executing any of these items:
- Replacing the power cable
- Replacing any cable inside the system
- Replacing any board inside the system

### 3.2 Recommended Tools

In replacing components and parts, you will need the **following tools**:

- Philips screwdriver
- Flat screwdriver
- Torx screwdriver
3.3 Replacing the Hard Disk Drive

3.3.1 Removing the Hard Disk Drive

1. Press the drawer lever (1) and pull out the drawer (2) until the HDD compartment is completely out.

2. Pry open the HDD compartment cover.
3  Open the HDD compartment cover completely.

4  Pull out the hard disk drive.

5  Repeat step 4 to remove other hard disk drives.
3.3.2 Installing the Hard Disk Drive

1. Insert all hard disk drives into the compartment and make sure the HDD connectors are properly seated.

2. Close the HDD compartment.
3 Close the HDD compartment cover completely.

4 Push the drawer back into the chassis.
3.4 Replacing the LED Board

3.4.1 Removing the LED Board

1. Press the drawer lever (1) and pull out the drawer (2).

2. Remove the screws from the front and sides of the drawer.
3 Detach the drawer cover from the drawer.

4 Flip open the cable connector lid (1) and remove the cable (2).
5  Remove the screws securing the LED board to the drawer and remove the LED board from the drawer.
3.4.2 Installing the LED Board

1. Secure the LED board to the drawer using screws.

2. Insert the cable into the cable connector (1) and close the cable connector lid (2).
3 Attach the drawer cover to the drawer.

4 Use screws to secure the drawer cover to the drawer.
5  Push the drawer back into the chassis.
3.5 Replacing the Drawer

3.5.1 Removing the Drawer

1. Remove all hard disk drives from the drawer (see Removing the Hard Disk Drive on page 24).

2. Loosen the thumbscrews.

3. Pull out the system slowly until you see the drawer latches underneath the system chassis. Do not pull out the system completely.

To remove or install the system, get others to help you.
Do not attempt to remove the system by yourself.

WARNING
4 Pull out the drawer completely until you see the cables on the rear.

5 Use a flat-blade screwdriver to press the latch (1) and remove the Mini-SAS connector (2).
6 Use a flat-blade screwdriver to press the latch (1) and remove the power connector (2).

7 Open the cable clip to release the cables.
8 Use one arm to hold the pulled out drawer tightly. Pinch the drawer latches (underneath the system chassis) to release the drawer.

9 Pull out the drawer completely and place it on a flat, rigid surface.
3.5.2 Installing the Drawer

1. Insert the drawer into the chassis. Make sure the guide pins on the drawer fit into the rails on the chassis.

2. Push the drawer until the drawer latches (underneath the system chassis) are securely latched to the chassis.
3  Connect all the cables.

4  Close the cable clip to hold the cables in place.
5 Push the drawer until it is properly inserted into the chassis.

6 Install the hard disk drives back into the drawer (see Installing the Hard Disk Drive on page 26).

7 Push in the system until it is securely seated into the rail. Tighten the thumbscrews to secure the system to the rack.
3.6 Replacing the Drive Plane Board (DPB)

3.6.1 Removing the DPB

1. Remove the drawer (see Removing the Drawer on page 34).

2. Remove the screws from the front and sides of the drawer.

3. Detach the drawer cover from the drawer.
4 Flip open the LED board cable connector lid (1) and remove the cable (2).

5 Remove the screws securing the top drawer cover to the bottom cover.
6 Remove the screws from the drawer rear cover.

7 Remove the drawer top cover.

Make sure that you hold and lift the drawer top cover properly. **DO NOT** grasp the HDD compartment cover as it may swing open and cause you to drop the top cover.
8. Remove the drawer rear cover.

9. Disconnect the switch cable from the DPB.

10. Remove the screws securing the DPB to the drawer bottom cover.

11. Detach the DPB from the drawer bottom cover.
3.6.2 Installing the DPB

1. Use screws to secure the DPB to the drawer bottom cover.

2. Connect the switch cable to the DPB.

3. Install the drawer rear cover.
4. Install the drawer top cover.

Make sure that you hold the drawer top cover properly. **DO NOT** grasp the HDD compartment cover as it may swing open and cause you to drop the top cover.

5. Use screws to secure the drawer rear cover to the drawer.
6. Use screws to secure the top drawer cover to the bottom cover.

7. Insert the LED cable (1) and lock the cable connector lid (2).
8 Attach the drawer cover to the drawer.

9 Use screws to secure the drawer cover to the drawer.

10 Install the drawer (see Installing the Drawer on page 38).
3.7 Replacing the Fan Module

The fan modules are located on the system rear panel. If there is not enough space behind the rack to access the rear panel, first remove the system from the rack (see Removing the System from the Rack on page 21) before replacing the rear panel components.

3.7.1 Removing the Fan Module

1. Loosen the thumbscrew securing the fan module to the chassis.

2. Pull out the fan module and remove it from the chassis.
3. Repeat steps 2 and 3 to remove the other fan modules.

### 3.7.2 Installing the Fan Module

1. Insert the fan module into the chassis.

2. Secure the fan module to the chassis by tightening the thumbscrew.

3. Repeat steps 2 and 3 to install the other fan modules.

4. If necessary, install the system into the rack (see **Installing the System to the Rack** on page 20).
3.8 Replacing the Power Supply Unit (PSU)

The power supply units are located on the system rear panel. If there is not enough space behind the rack to access the rear panel, first remove the system from the rack (see Removing the System from the Rack on page 21) before replacing the rear panel components.

3.8.1 Removing the Power Supply Unit

1. Press the lever (1) and pull out the power supply unit (2).
3.8.2 Installing the Power Supply Unit

1. Insert the power supply unit and push until it is firmly latched into the chassis.

2. Repeat step 1 to install the other power supply unit.

3. If necessary, install the system into the rack (see Installing the System to the Rack on page 20).
3.9 Replacing the Chassis Expander Board (CEB) Module

The CEB modules are located on the system rear panel. If there is not enough space behind the rack to access the rear panel, first remove the system from the rack (see Removing the System from the Rack on page 21) before replacing the rear panel components.

3.9.1 Removing the CEB Module

1. Press both latches on to unlock.
2 Pry open the latches to release the CEB module from the chassis.

4 Pull out the CEB module.
3.9.2 Installing the CEB Module

1. Insert the CEB module.

2. Close the latches to lock the CEB module into the chassis.
3.10 Replacing the Chassis Expander Board (CEB)

3.10.1 Removing the CEB

1. Remove the CEB module (see Removing the CEB Module on page 53).

2. Remove the screws securing the CEB to the module bracket.
3 Remove the CEB from the module bracket.
3.10.2 Installing the CEB

1. Insert the CEB into the module bracket.

2. Use screws to secure the CEB to the module bracket.

3. Install the CEB module (see Installing the CEB Module on page 55).
3.11   Replacing the Rear Bracket

3.11.1   Removing the Rear Bracket

1. Remove the system from the rack (see Removing the System from the Rack on page 21).

2. Remove the system fans (see Removing the Fan Module on page 49).

3. Remove the power supply units (see Removing the Power Supply Unit on page 51).

4. Remove the CEB module (see Removing the CEB Module on page 53).

5. Loosen the thumbscrews and remove the blank CEB cover.
6 Remove the screws from the rear top cover and sides of the system.

7 Pry open the rear top cover (1) and remove it from the system (2).
8 Disconnect all the fan cables.

9 Disconnect all mini SAS HD and power cables.
10  Pull out the rear bracket from the system chassis.

3.11.2  Installing the Rear Bracket

1  Insert the rear bracket into the system chassis.
2 Connect all mini SAS and power cables.

3 Connect all fan cables.
4. Install the rear top cover.

5. Install the blank CEB cover and tighten the thumbscrews.
6. Use screws to secure the rear top cover and the rear bracket to the system chassis.

7. Install the CEB modules (see Installing the CEB Module on page 55).

8. Install the power supply units (see Installing the Power Supply Unit on page 52).

9. Install the system fans (see Installing the Fan Module on page 50).

10. Install the system into the rack (see Installing the System to the Rack on page 20).
3.12  Replacing the PSU Interposer Boards

3.12.1  Removing the PSU Interposer Boards

1. Remove the rear bracket (see Removing the Rear Bracket on page 59).

2. Remove the screws on both sides of the rear bracket.
3 Detach the interposer board connectors from the mid-plane board connectors. Lift and remove the upper rear bracket from the lower mid-plane board module.
4  Remove the screws securing the interposer boards.

5  Remove the interposer boards from the upper rear bracket.
3.12.2 Installing the PSU Interposer Boards

1. Use screws to secure the interposer boards to the upper rear bracket.
2. Position the upper rear bracket over the mid-plane board module. Align the interposer board connectors with the mid-plane board connectors. Make sure the connectors are properly fitted.
3 Use screws to secure the mid-plane board module to the upper rear bracket.

4 Install the rear bracket. (see Installing the Rear Bracket on page 62).

5 Install the system into the rack (see Installing the System to the Rack on page 20).
3.13 Replacing the Mid-Plane Board (MPB)

3.13.1 Removing the Mid-Plane Board

1 Remove the rear bracket (see Removing the Rear Bracket on page 59).

2 Remove the screws from both sides of the rear bracket.
3 Detach the interposer board connectors from the mid-plane board connectors. Lift and remove the upper rear bracket.

4 Loosen and remove the screws securing the mid-plane board to its bracket.

5 Remove the mid-plane board from its bracket.
3.13.2 Installing the Mid-Plane Board

1. Use screws to secure the mid-plane board to its bracket.

2. Position the upper rear bracket over the mid-plane board module. Align the interposer board connectors with the mid-plane board connectors. Make sure the connectors are properly fitted.
3  Use screws to secure the mid-plane board module to the upper rear bracket.

4  Install the rear bracket. (see Installing the Rear Bracket on page 62).

5  Install the system into the rack (see Installing the System to the Rack on page 20).
4. Expander Features

4.1 CEB Features

The CEB supports the following features:

- SAS protocol described in the Serial Attached SCSI – 3 (SAS-3) Standard
- Zoning for drive partitioning
- Expander crash detection
- Monitor current/voltage/temperature/fan speed sensors and access EEPROMs
- Fan power manual control
- Fault indicators for errors
- SES-3 for standard enclosure management for environmental monitoring
- EEPROM contents update for each FRU (Field Replaceable Unit) in MPB
- Enclosure event log
- Firmware in-system upgrade for each SAS expander
- Command line interface for diagnostics
4.2 DPB Features

The DPB supports the following features:

- SAS protocol described in the Serial Attached SCSI - 3 (SAS-3) Standard
- Zoning for drive partitioning
- Hard drive presence detection
- Tray pull-out detection
- Expander crash detection
- Individual hard drive power On/Off control
- Hard drive staggered spin-up
- Monitor current/voltage/temperature sensors, control HDD LED and access EEPROMs
- SAS hard drive SMART temperature monitoring
- Fan power manual control
- SES-3 for standard enclosure management for environmental monitoring
- EEPROM contents update for each FRU (Field Replaceable Unit) in DPB
- Enclosure event log
- In-band/out-band firmware upgrade for each SAS expander
- Command line interface for diagnostics
5. Expander Firmware Update

NOTE: Wiwynn customers can download XTools from Wiwynn or contact Avago directly for license in using or downloading XTools.

5.1 CEB 12G Expander Firmware Update

The CEB Expander requires the sas3xfw.fw and mfg.bin binary files to update the firmware via in-band SAS interface on the system. You need to login to the local OS (CentOS) through the data network. The Expander firmware update script uses Avago 12G XTools that support CentOS 6.x.

For example: CEB Expander SAS ID is 570e28402007d0ff

1. Key in this command to update the expander firmware:

   ```
   ./g3Xflash -i 570e28402007d0ff -y down fw sas3xfw.fw
   ```

   Wait for the flash process to finish.

2. Key in this command to update the expander configuration region:

   ```
   ./g3Xflash -i 570e28402007d0ff -y down mfg mfg.bin
   ```

   Wait for the flash process to finish.

3. Key in this command to reset the expander and apply the new expander firmware:

   ```
   ./g3Xflash -i 570e28402007d0ff -y reset exp
   ```

   Wait for at least one minute.
5.2 DPB 12G Expander Firmware Update

The DPB Expander requires the sas3xfw.fw and mfg.bin binary files to update the firmware via in-band SAS interface on the system. You need to login to the local OS (CentOS) through the data network. The expander firmware update script uses Avago 12G XTools that support CentOS 6.x.

For example: DPB Expander SAS ID is 570e28402007d0ff

1. Key in this command to update the expander firmware:

   ```bash
   ./g3Xflash -i 570e28402007d0ff -y down fw sas3xfw.fw
   ```

   Wait for the flash process to finish.

2. Key in this command to update the expander configuration region:

   ```bash
   ./g3Xflash -i 570e28402007d0ff -y down mfg mfg.bin
   ```

   Wait for the flash process to finish.

3. Key in this command to reset the expander and apply the new expander firmware:

   ```bash
   ./g3Xflash -i 570e28402007d0ff -y reset exp
   ```

   Wait for at least one minute.
6. Wiwynn Supported SES Pages

Wiwynn SAS Expander firmware follows SES (SCSI Enclosure Services) standard so that supported SES pages can be retrieved by opening source utility such as Linux sg_ses tool.

The following examples show you how to retrieve the status of some SES pages via Linux sg_ses tool.

6.1 CEB SES Pages

1. Get the status of SES page0

[root@localhost ~]# sg_ses -p 0 /dev/sg1
  wiwynn 4UCEB1 0798
Supported diagnostic pages:
  Supported Diagnostic Pages [sdp] [0x0]
  Configuration (SES) [cf] [0x1]
  Enclosure Status/Control (SES) [ec,es] [0x2]
  String In/Out (SES) [str] [0x4]
  Threshold In/Out (SES) [th] [0x5]
  Element Descriptor (SES) [ed] [0x7]
  Additional Element Status (SES-2) [aes] [0xa]
  Download Microcode (SES-2) [dm] [0xe]

2. Get the status of SES page1

[root@localhost ~]# sg_ses -p 1 /dev/sg1
  wiwynn 4UCEB1 0798
  Configuration diagnostic page:
    number of secondary subenclosures: 0
generation code: 0x0

closure descriptor list

Subenclosure identifier: 0 [primary]
relative ES process id: 1, number of ES processes: 1
number of type descriptor headers: 9
closure logical identifier (hex): 5f80f41feee0bf
closure vendor: wiwynn product: 4UCEB1 rev: 0702

vendor-specific data:
25 07 02 98 00 00 00 00

type descriptor header/text list

Element type: Array device slot, subenclosure id: 0
number of possible elements: 1
text: ArrayDevicesInSubEnclsr0

Element type: SAS connector, subenclosure id: 0
number of possible elements: 11
text: ConnectorsInSubEnclsr0

Element type: Power supply, subenclosure id: 0
number of possible elements: 2
text: PowerSensorsInSubEnclsr0

Element type: Cooling, subenclosure id: 0
number of possible elements: 18
text: CoolingElementInSubEnclsr0

Element type: Temperature sensor, subenclosure id: 0
number of possible elements: 32
text: TempSensorsInSubEnclsr0

Element type: Voltage sensor, subenclosure id: 0
number of possible elements: 48
text: VoltageSensorsInSubEnclsr0

Element type: Current sensor, subenclosure id: 0
number of possible elements: 8
text: CurrentSensorsInSubEnclsr0
Element type: Enclosure, subenclosure id: 0
number of possible elements: 1
text: EnclosureElementInSubEnclsr0
Element type: SAS expander, subenclosure id: 0
number of possible elements: 1
text: LSI SAS EXPANDER

3. Get the status of SES page 2

[root@localhost ~]# sg_ses -p 2 /dev/sg1
  wiwynn  4UCEB1    0798
  Primary enclosure logical identifier (hex): 5f80f41feeeee0bf
Enclosure Status diagnostic page:
  INVOP=0, INFO=1, NON-CRIT=1, CRIT=1, UNRECOV=0
generation code: 0x0
status descriptor list
Element type: Array device slot, subenclosure id: 0 [ti=0]
  Overall descriptor:
    Predicted failure=0, Disabled=0, Swap=0, status: Unsupported
    OK=0, Reserved device=0, Hot spare=0, Cons check=0
    In crit array=0, In failed array=0, Rebuild/remap=0, R/R abort=0
    App client bypass A=0, Do not remove=0, Enc bypass A=0, Enc bypass B=0
    Ready to insert=0, RMV=0, Ident=0, Report=0
    App client bypass B=0, Fault sensed=0, Fault reqstd=0, Device off=0
    Bypassed A=0, Bypassed B=0, Dev bypassed A=0, Dev bypassed B=0
Element 0 descriptor:
  Predicted failure=0, Disabled=0, Swap=0, status: Not installed
OK=0, Reserved device=0, Hot spare=0, Cons check=0
In crit array=0, In failed array=0, Rebuild/remap=0, R/R abort=0
App client bypass A=0, Do not remove=0, Enc bypass A=0, Enc bypass B=0
Ready to insert=0, RMV=0, Ident=0, Report=0
App client bypass B=0, Fault sensed=0, Fault reqstd=0, Device off=0
Bypassed A=0, Bypassed B=0, Dev bypassed A=0, Dev bypassed B=0

Element type: SAS connector, subenclosure id: 0 [ti=1]

Overall descriptor:
  Predicted failure=0, Disabled=0, Swap=0, status: Unsupported
  Ident=0, No information
  Connector physical link=0x0, Fail=0, OC=0

Element 0 descriptor:
  Predicted failure=0, Disabled=0, Swap=0, status: OK
  Ident=0, Mini SAS 4x receptacle (SFF-8088) [max 4 phys]
  Connector physical link=0xff, Fail=1, OC=0

Element 1 descriptor:
  Predicted failure=0, Disabled=0, Swap=0, status: OK
  Ident=0, Mini SAS 4x receptacle (SFF-8088) [max 4 phys]
  Connector physical link=0xff, Fail=1, OC=0

......

Element type: Power supply, subenclosure id: 0 [ti=2]

Overall descriptor:
  Predicted failure=0, Disabled=0, Swap=0, status: Unsupported
  Ident=0, DC overvoltage=0, DC undervoltage=0, DC overcurrent=0
  Hot swap=0, Fail=0, Requested on=0, Off=0, Overtmp fail=0
  Temperature warn=0, AC fail=0, DC fail=0

Element 0 descriptor:
  Predicted failure=0, Disabled=0, Swap=0, status: OK
Ident=1, DC overvoltage=0, DC undervoltage=0, DC overcurrent=0
Hot swap=0, Fail=0, Requested on=1, Off=0, Overtmp fail=0
Temperature warn=0, AC fail=1, DC fail=0

Element 1 descriptor:
Predicted failure=0, Disabled=0, Swap=0, status: Not available
Ident=1, DC overvoltage=0, DC undervoltage=0, DC overcurrent=0
Hot swap=0, Fail=1, Requested on=0, Off=1, Overtmp fail=0
Temperature warn=0, AC fail=1, DC fail=0

Element type: Cooling, subenclosure id: 0 [ti=3]

Overall descriptor:
Predicted failure=0, Disabled=0, Swap=0, status: Unsupported
Ident=0, Hot swap=0, Fail=0, Requested on=0, Off=0
Actual speed=0 rpm, Fan stopped

Element 0 descriptor:
Predicted failure=0, Disabled=0, Swap=0, status: OK
Ident=0, Hot swap=0, Fail=0, Requested on=0, Off=0
Actual speed=7180 rpm, Fan at second highest speed

Element 1 descriptor:
Predicted failure=0, Disabled=0, Swap=0, status: OK
Ident=0, Hot swap=0, Fail=0, Requested on=0, Off=0
Actual speed=6160 rpm, Fan at third highest speed

.....

Element type: Temperature sensor, subenclosure id: 0 [ti=4]

Overall descriptor:
Predicted failure=0, Disabled=0, Swap=0, status: Unsupported
Ident=0, Fail=0, OT failure=0, OT warning=0, UT failure=0
UT warning=0
Temperature: <reserved>
Element 0 descriptor:
Predicted failure=0, Disabled=0, Swap=0, status: OK
Ident=0, Fail=0, OT failure=0, OT warning=0, UT failure=0
UT warning=0
Temperature=49 C

Element 1 descriptor:
Predicted failure=0, Disabled=0, Swap=0, status: OK
Ident=0, Fail=0, OT failure=0, OT warning=0, UT failure=0
UT warning=0
Temperature=35 C

Element type: Voltage sensor, subenclosure id: 0 [ti=5]

Overall descriptor:
Predicted failure=0, Disabled=0, Swap=0, status: Unsupported
Ident=0, Fail=0, Warn Over=0, Warn Under=0, Crit Over=0
Crit Under=0
Voltage: 0.00 volts

Element 0 descriptor:
Predicted failure=0, Disabled=0, Swap=0, status: OK
Ident=0, Fail=0, Warn Over=0, Warn Under=0, Crit Over=0
Crit Under=0
Voltage: 11.97 volts

Element 1 descriptor:
Predicted failure=0, Disabled=0, Swap=0, status: OK
Ident=0, Fail=0, Warn Over=0, Warn Under=0, Crit Over=0
Crit Under=0
Voltage: 3.34 volts

.....
Element type: Current sensor, subenclosure id: 0 [ti=6]

Overall descriptor:

Predicted failure=0, Disabled=0, Swap=0, status: Unsupported
Ident=0, Fail=0, Warn Over=0, Crit Over=0
Current: 0.00 amps

Element 0 descriptor:

Predicted failure=0, Disabled=0, Swap=0, status: OK
Ident=0, Fail=0, Warn Over=0, Crit Over=0
Current: 1.51 amps

Element 1 descriptor:

Predicted failure=0, Disabled=0, Swap=0, status: OK
Ident=0, Fail=0, Warn Over=0, Crit Over=0
Current: 55.93 amps

Element type: Enclosure, subenclosure id: 0 [ti=7]

Overall descriptor:

Predicted failure=0, Disabled=0, Swap=0, status: Unsupported
Ident=0, Time until power cycle=0, Failure indication=0
Warning indication=0, Requested power off duration=0
Failure requested=0, Warning requested=0

Element 0 descriptor:

Predicted failure=0, Disabled=0, Swap=0, status: OK
Ident=0, Time until power cycle=0, Failure indication=0
Warning indication=0, Requested power off duration=0
Failure requested=0, Warning requested=0

Element type: SAS expander, subenclosure id: 0 [ti=8]

Overall descriptor:
Predicted failure=0, Disabled=0, Swap=0, status: Unsupported
Ident=0, Fail=0
Element 0 descriptor:
Predicted failure=0, Disabled=0, Swap=0, status: OK
Ident=0, Fail=0

4. Get the status of SES page 7

[root@localhost ~]# sg_ses -p 7 /dev/sg1
wiwynn 4UCEB1 0798

Primary enclosure logical identifier (hex): 5f80f41feeee0bf

Element Descirptor In diagnostic page:
generation code: 0x0
element descriptor list (grouped by type):
Element type: Array device slot, subenclosure id: 0 [ti=0]
Overall descriptor: ArrayDevicesInSubEnclsr0
Element 0 descriptor: ArrayDevice00
Element 1 descriptor: ArrayDevice01

Element type: SAS connector, subenclosure id: 0 [ti=1]
Overall descriptor: ConnectorsInSubEnclsr0
Element 0 descriptor: Connector00
Element 1 descriptor: Connector01

Element type: Power supply, subenclosure id: 0 [ti=2]
Overall descriptor: PowerSensorsInSubEnclsr0
Element 0 descriptor: PowerSupply_A
Element 1 descriptor: PowerSupply_B

Element type: Cooling, subenclosure id: 0 [ti=3]
Overall descriptor: CoolingElementInSubEnclsr0
Element 0 descriptor: Fan_1_Front
Element 1 descriptor: Fan_1_Rear

Element type: Temperature sensor, subenclosure id: 0 [ti=4]
Overall descriptor: TempSensorsInSubEnclsr0
Element 0 descriptor: CEB_EXP_Temp
Element 1 descriptor: PSU_Temperature_A_1

Element type: Voltage sensor, subenclosure id: 0 [ti=5]
Overall descriptor: VoltageSensorsInSubEnclsr0
Element 0 descriptor: CEB_Voltage_HotSwap_12V
Element 1 descriptor: CEB_Voltage_3.3V

Element type: Current sensor, subenclosure id: 0 [ti=6]
Overall descriptor: CurrentSensorsInSubEnclsr0
Element 0 descriptor: CEB_Current
Element 1 descriptor: PSU_Current_A

Element type: Enclosure, subenclosure id: 0 [ti=7]
Overall descriptor: EnclosureElementInSubEnclsr0
Element 0 descriptor: Mt.Rainier Enclosure
Element type: SAS expander, subenclosure id: 0 [ti=8]
Overall descriptor: LSI SAS EXPANDER
Element 0 descriptor: Left CEB Expander
5. Get the status of SES page 10

[root@localhost ~]# sg_ses -p 10 /dev/sg1

wiwynn 4UCEB1 0798

Primary enclosure logical identifier (hex): 5f80f41f0ee0bf

Additional element status diagnostic page:

generation code: 0x0

additional element status descriptor list

Element type: Array device slot, subenclosure id: 0 [ti=0]
Element index: 0 eioe=0
Transport protocol: SAS
number of phys: 1, not all phys: 0, device slot number: 0
phy index: 0
SAS device type: no SAS device attached
initiator port for:
target port for:
attached SAS address: 0x0
SAS address: 0x0
phy identifier: 0x0

Element type: SAS expander, subenclosure id: 0 [ti=8]
Element index: 121 eioe=0
Transport protocol: SAS
number of phys: 40
SAS address: 0x5f80f41f0ee0bf

[0] connector element index: 0, other element index: 0
[1] connector element index: 0

.....
6.2 DPB SES Pages

1. Get the status of SES page 0

```
[root@localhost ~]# sg_ses -p 0 /dev/sg17
wiwynn 4UDPB1 0798
```

Supported diagnostic pages:
- Supported Diagnostic Pages [sdp] [0x0]
- Configuration (SES) [cf] [0x1]
- Enclosure Status/Control (SES) [ec,es] [0x2]
- String In/Out (SES) [str] [0x4]
- Threshold In/Out (SES) [th] [0x5]
- Element Descriptor (SES) [ed] [0x7]
- Additional Element Status (SES-2) [aes] [0xa]
- Download Microcode (SES-2) [dm] [0xe]

2. Get the status of SES page 1

```
[root@localhost ~]# sg_ses -p 1 /dev/sg17
wiwynn 4UDPB1 0798
```

Configuration diagnostic page:
- number of secondary subenclosures: 0
- generation code: 0x0
- enclosure descriptor list
  - Subenclosure identifier: 0 [primary]
    - relative ES process id: 1, number of ES processes: 1
    - number of type descriptor headers: 7
    - enclosure logical identifier (hex): 5f80f411111110bf
    - enclosure vendor: wiwynn  product: 4UDPB1  rev: 0702
  - vendor-specific data:
26 07 02 98 00 00 00 00

type descriptor header/text list

Element type: Array device slot, subenclosure id: 0
  number of possible elements: 15
  text: ArrayDevicesInSubEnc1sr0

Element type: SAS connector, subenclosure id: 0
  number of possible elements: 19
  text: ConnectorsInSubEnc1sr0

Element type: Temperature sensor, subenclosure id: 0
  number of possible elements: 20
  text: TempSensorsInSubEnc1sr0

Element type: Voltage sensor, subenclosure id: 0
  number of possible elements: 7
  text: VoltageSensorsInSubEnc1sr0

Element type: Current sensor, subenclosure id: 0
  number of possible elements: 1
  text: CurrentSensorsInSubEnc1sr0

Element type: Enclosure, subenclosure id: 0
  number of possible elements: 1
  text: EnclosureElementInSubEnc1sr0

Element type: SAS expander, subenclosure id: 0
  number of possible elements: 1
  text: LSI SAS EXPANDER

3. Get the status of SES page2

[root@localhost ~]# sg_ses -p 2 /dev/sg17

wiwynn 4UDPB1 0798

Primary enclosure logical identifier (hex): 5f80f41111110bf
Enclosure Status diagnostic page:

INVOP=0, INFO=1, NON-CRIT=0, CRIT=0, UNRECOV=0

generation code: 0x0

status descriptor list

Element type: Array device slot, subenclosure id: 0 [ti=0]

Overall descriptor:

Predicted failure=0, Disabled=0, Swap=0, status: Unsupported
OK=0, Reserved device=0, Hot spare=0, Cons check=0
In crit array=0, In failed array=0, Rebuild/remap=0, R/R abort=0
App client bypass A=0, Do not remove=0, Enc bypass A=0, Enc bypass B=0
Ready to insert=0, RMV=0, Ident=0, Report=0
App client bypass B=0, Fault sensed=0, Fault reqstd=0, Device off=0
Bypassed A=0, Bypassed B=0, Dev bypassed A=0, Dev bypassed B=0

Element 0 descriptor:

Predicted failure=0, Disabled=0, Swap=0, status: OK
OK=0, Reserved device=0, Hot spare=0, Cons check=0
In crit array=0, In failed array=0, Rebuild/remap=0, R/R abort=0
App client bypass A=0, Do not remove=0, Enc bypass A=0, Enc bypass B=0
Ready to insert=0, RMV=0, Ident=0, Report=0
App client bypass B=0, Fault sensed=0, Fault reqstd=0, Device off=0
Bypassed A=0, Bypassed B=0, Dev bypassed A=0, Dev bypassed B=0

Element 1 descriptor:

Predicted failure=0, Disabled=0, Swap=0, status: OK
OK=0, Reserved device=0, Hot spare=0, Cons check=0
In crit array=0, In failed array=0, Rebuild/remap=0, R/R abort=0
App client bypass A=0, Do not remove=0, Enc bypass A=0, Enc bypass B=0
Ready to insert=0, RMV=0, Ident=0, Report=0
App client bypass B=0, Fault sensed=0, Fault reqstd=0, Device off=0
Bypassed A=0, Bypassed B=0, Dev bypassed A=0, Dev bypassed B=0
Element type: SAS connector, subenclosure id: 0 [ti=1]

Overall descriptor:
- Predicted failure=0, Disabled=0, Swap=0, status: Unsupported
- Ident=0, No information
- Connector physical link=0x0, Fail=0, OC=0

Element 0 descriptor:
- Predicted failure=0, Disabled=0, Swap=0, status: OK
- Ident=0, SAS Drive backplane receptacle (SFF-8482) [max 2 phys]
- Connector physical link=0x0, Fail=0, OC=0

Element 1 descriptor:
- Predicted failure=0, Disabled=0, Swap=0, status: OK
- Ident=0, SAS Drive backplane receptacle (SFF-8482) [max 2 phys]
- Connector physical link=0x0, Fail=0, OC=0

Element type: Temperature sensor, subenclosure id: 0 [ti=2]

Overall descriptor:
- Predicted failure=0, Disabled=0, Swap=0, status: Unsupported
- Ident=0, Fail=0, OT failure=0, OT warning=0, UT failure=0
- UT warning=0
- Temperature: <reserved>

Element 0 descriptor:
- Predicted failure=0, Disabled=0, Swap=0, status: OK
- Ident=0, Fail=0, OT failure=0, OT warning=0, UT failure=0
- UT warning=0
- Temperature=24 C

Element 1 descriptor:
Predicted failure=0, Disabled=0, Swap=0, status: OK
Ident=0, Fail=0, OT failure=0, OT warning=0, UT failure=0
UT warning=0
Temperature=23 C

.....

Element type: Voltage sensor, subenclosure id: 0 [ti=3]
Overall descriptor:
Predicted failure=0, Disabled=0, Swap=0, status: Unsupported
Ident=0, Fail=0, Warn Over=0, Warn Under=0, Crit Over=0
Crit Under=0
Voltage: 0.00 volts
Element 0 descriptor:
Predicted failure=0, Disabled=0, Swap=0, status: OK
Ident=0, Fail=0, Warn Over=0, Warn Under=0, Crit Over=0
Crit Under=0
Voltage: 11.86 volts
Element 1 descriptor:
Predicted failure=0, Disabled=0, Swap=0, status: OK
Ident=0, Fail=0, Warn Over=0, Warn Under=0, Crit Over=0
Crit Under=0
Voltage: 11.84 volts

.....

Element type: Current sensor, subenclosure id: 0 [ti=4]
Overall descriptor:
Predicted failure=0, Disabled=0, Swap=0, status: Unsupported
Ident=0, Fail=0, Warn Over=0, Crit Over=0
Current: 0.00 amps
Element 0 descriptor:
Predicted failure=0, Disabled=0, Swap=0, status: OK
Ident=0, Fail=0, Warn Over=0, Crit Over=0
Current: 9.10 amps

Element type: Enclosure, subenclosure id: 0 [ti=5]

Overall descriptor:
Predicted failure=0, Disabled=0, Swap=0, status: Unsupported
Ident=0, Time until power cycle=0, Failure indication=0
Warning indication=0, Requested power off duration=0
Failure requested=0, Warning requested=0

Element 0 descriptor:
Predicted failure=0, Disabled=0, Swap=0, status: OK
Ident=0, Time until power cycle=0, Failure indication=0
Warning indication=0, Requested power off duration=0
Failure requested=0, Warning requested=0

Element type: SAS expander, subenclosure id: 0 [ti=6]

Overall descriptor:
Predicted failure=0, Disabled=0, Swap=0, status: Unsupported
Ident=0, Fail=0

Element 0 descriptor:
Predicted failure=0, Disabled=0, Swap=0, status: OK
Ident=0, Fail=0

4. Get the status of SES page7

[root@localhost ~]# sg_ses -p 7 /dev/sg17
wiwynn 4UDPB1 0798

Primary enclosure logical identifier (hex): 5f80f41111110bf

Element Descriptor In diagnostic page:
generation code: 0x0

element descriptor list (grouped by type):

Element type: Array device slot, subenclosure id: 0 [ti=0]
Overall descriptor: ArrayDevicesInSubEnclsr0
Element 0 descriptor: ArrayDevice00
Element 1 descriptor: ArrayDevice01

....

Element type: SAS connector, subenclosure id: 0 [ti=1]
Overall descriptor: ConnectorsInSubEnclsr0
Element 0 descriptor: Connector00
Element 1 descriptor: Connector01

....

Element type: Temperature sensor, subenclosure id: 0 [ti=2]
Overall descriptor: TempSensorsInSubEnclsr0
Element 0 descriptor: DPB1_Front_1_Temp
Element 1 descriptor: DPB1_Front_2_Temp

....

Element type: Voltage sensor, subenclosure id: 0 [ti=3]
Overall descriptor: VoltageSensorsInSubEnclsr0
Element 0 descriptor: DPB1_Voltage_12V_HotSwap
Element 1 descriptor: DPB1_Voltage_12V_STBY

....

Element type: Current sensor, subenclosure id: 0 [ti=4]
Overall descriptor: CurrentSensorsInSubEnclsr0
Element 0 descriptor: DPB1_Current
Element type: Enclosure, subenclosure id: 0 [ti=5]
Overall descriptor: EnclosureInSubEnclsr0
Element 0 descriptor: Mt.Rainier Enclosure

Element type: SAS expander, subenclosure id: 0 [ti=6]
Overall descriptor: LSI SAS EXPANDER
Element 0 descriptor: DPB1 Expander

5. **Get the status of SES page10**

```
[root@localhost ~]# sg_ses -p 10 /dev/sg17
wiwynn 4UDPB1 0798
Primary enclosure logical identifier (hex): 5f80f411111110bf
```

Additional element status diagnostic page:

generation code: 0x0
additional element status descriptor list

Element type: Array device slot, subenclosure id: 0 [ti=0]

Element index: 0  eiioe=0
Transport protocol: SAS
number of phys: 1, not all phys: 0, device slot number: 0
phy index: 0
SAS device type: no SAS device attached
initiator port for:

target port for: SATA_device
attached SAS address: 0x5f80f411111110bf
SAS address: 0x5f80f41111111080
phy identifier: 0x0

Element index: 1  eiioe=0
Transport protocol: SAS
number of phys: 1, not all phys: 0, device slot number: 1
phy index: 0
SAS device type: no SAS device attached
initiator port for:
target port for: SATA_device
attached SAS address: 0x5f80f41111110bf
SAS address: 0x5f80f4111111081
phy identifier: 0x0

.....