# Release Note for AIC SAS 12G 4U60_SE Expander

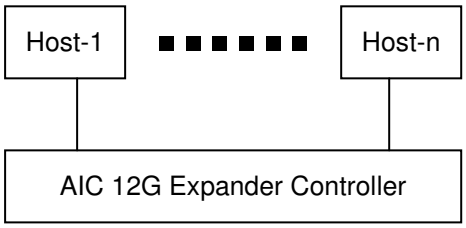
May 29, 2018

## Changelog

05/29/2018 (FW 1.12.41.51 + MFG 1.41.0.51 + FW 1.12.42.51 + MFG 1.42.0.51) - Part Number (SEE-00124151_A01 + SEG-0041C051_A01 + SEE-00124251_A01 + SEG-0042C051_A01)

1. Initial revision

## 1. Support Multiple Host/Path Access




To have multiple host/path access support (the host number can be up to the number of wide ports on each AIC 12G Expander Controller), only the following drives are supported for shared access:

(A) SAS drive / Nearline SAS drive

(B) SATA drive with an interposer which provides SATA-to-SAS conversion

Locating a drive via any HBA utility is not supported. Users should send standard SES command to the enclosure (4U60 Hub) to locate a drive.

### 1.1 Unsupported Feature

(A) Enclosure logical identifier can be changed.

(B) Locating a drive via any HBA utility. Users should send standard SES command to locate a drive.

(C) The management software MegaRAID Storage Manager with LSI 6G RAID Card is not supported.

## 2. SES Inband Features

2.1. SES Pages

00h - List of supported diagnostic pages

01h - SES configuration

02h - SES enclosure control / enclosure status

04h – SES String In

05h – SES Threshold Out / In

07h - SES element descriptor

0Ah - SES additional element

0Eh - SES download microcode control / SES download microcode status

83h – SES Vendor specific page : Canister Number

2.2. SES Elements

02h - Power Supply

03h - Cooling

04h - Temperature Sensor

0Eh - Enclosure

12h - Voltage

17h - Array Device

2.3 Implementation on SES Pages

2.3.1 SES String In Page

Get PMBUS information with String In Page.

**String In Format**

| BYTE/BIT | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | I2C congestion status (0: no congestion, 1: congestion or failure) | | | | | | | |
| 1 | PSU Module1 STATUS_WORD | | | | | | | |
| 2 | | | | | | | | |
| 3 | PSU Module2 STATUS_WORD | | | | | | | |
| 4 | | | | | | | | |

| | |
|---|---|
| 5~14 | Reserved (0xFF) |

2.3.2 SES Threshold Out / In

It includes only Temperature Sensor and Voltage Sensor elements.

**Threshold control element format**

| BYTE/BIT | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | REQUESTED HIGH CRITICAL THRESHOLD | | | | | | | |
| 1 | REQUESTED HIGH WARNING THRESHOLD | | | | | | | |
| 2 | REQUESTED LOW WARNING THRESHOLD | | | | | | | |
| 3 | REQUESTED LOW CRITICAL THRESHOLD | | | | | | | |

**Threshold status element format**

| BYTE/BIT | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | HIGH CRITICAL THRESHOLD | | | | | | | |
| 1 | HIGH WARNING THRESHOLD | | | | | | | |
| 2 | LOW WARNING THRESHOLD | | | | | | | |
| 3 | LOW CRITICAL THRESHOLD | | | | | | | |

2.3.3 SES Vendor specific page: Canister Number ( page code 83h) Out / In

The length N of canister number can be 0~30 bytes. If no canister number is entered (N=0), then canister number is restored to default: 0x20 0x20 0x20 0x20 0x20 0x20 0x20 0x20 (8 spaces in ASCII).

**Canister Number control format**

| BYTE/BIT | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0~N | Canister Number | | | | | | | |

If no canister number is found, return Status = 1 (failed) only, else return Status=0 (success) followed by canister number.

**Canister Number status format**

| BYTE/BIT | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | Status (0: success, 1: failed) | | | | | | | |
| 1~N | Canister Number | | | | | | | |

| | |
|---|---|
| (if success) | |

## 2.4. Implementation on SES Elements

Only the fields highlighted in green are supported.

### 2.4.1. Power Supply Element

#### 2.4.1.1. Power Supply Control Element

| BYTE/BIT | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | COMMON CONTROL | | | | | | | |
| | SELECT | PRDFAIL | DISABLE | RST SWAP | Reserved | | | |
| 1 | RQST IDENT | Reserved | | | | | | |
| 2 | Reserved | | | | | | | |
| 3 | Reserved | RQST FAIL | RQST ON | Reserved | | | | |

| Field | Value |
|---|---|
| RQST ON | Please refer to section “SES Element Control Functions” for details. |

#### 2.4.1.2. Power Supply Status Element

| BYTE/BIT | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | COMMON STATUS | | | | | | | |
| | Reserved | PRDFAIL | DISABLED | SWAP | ELEMENT STATUS CODE | | | |
| 1 | IDENT | Reserved | | | | | | |
| 2 | Reserved | | | | DC OVER VOLTAGE | DC UNDER VOLTAGE | DC OVER CURRENT | Reserved |
| 3 | HOT SWAP | FAIL | RQSTED ON | OFF | OVERTMP FAIL | TEMP WARN | AC FAIL | DC FAIL |

| Field | Value |
|---|---|
| ELEMENT STATUS CODE | OK: No failure or warning conditions detected<br>CRITICAL: FAIL bit is set due to one or more failure condition |
| FAIL | A failure condition is detected |
| RQSTED ON | 1: On<br>0: Off |
| OFF | 1: Off |

| | |
|---|---|
| | 0: On |
| AC FAIL | A failure condition is detected |
| DC FAIL | A failure condition is detected |

2.4.2. Cooling Element

2.4.2.1. Cooling Control Element

| BYTE/BIT | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | COMMON CONTROL | | | | | | | |
| | SELECT | PRDFAIL | DISABLE | RST SWAP | Reserved | | | |
| 1 | RQST IDENT | Reserved | | | | | | |
| 2 | Reserved | | | | | | | |
| 3 | Reserved | RQST FAIL | RQST ON | Reserved | | REQUESTED SPEED CODE | | |

| Field | Value |
|---|---|
| RQST IDENT | Please refer to section “SES Element Control Functions” for details. |
| REQUESTED SPEED CODE | Please refer to section “SES Element Control Functions” for details. |

2.4.2.2. Cooling Status Element

| BYTE/BIT | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | COMMON STATUS | | | | | | | |
| | Reserved | PRDFAIL | DISABLED | SWAP | ELEMENT STATUS CODE | | | |
| 1 | IDENT | Reserved | | | | ACTUAL FAN SPEED (MSB) | | |
| 2 | ACTUAL FAN SPEED (LSB) | | | | | | | |
| 3 | HOT SWAP | FAIL | RQSTED ON | OFF | Reserved | ACTUAL SPEED CODE | | |

| Field | Value |
|---|---|
| ELEMENT STATUS CODE | OK: Actual fan speed > 0<br>CRITICAL: The fan RPM can’t be detected or equal to 0. |
| IDENT | Applicable only for Cooling element 0<br>0: Enable the smart fan function<br>1: Disable the smart fan function |
| ACTUAL FAN SPEED | Current fan RPM |
| FAIL | The fan RPM can’t be detected or equal to 0. |

| | |
|---|---|
| ACTUAL SPEED CODE | Speed code level bases on current fan RPM. |

2.4.3. Temperature Sensor Element

2.4.3.1. Temperature Sensor Control Element

| BYTE/BIT | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | COMMON CONTROL | | | | | | | |
| | SELECT | PRDFAIL | DISABLE | RST SWAP | Reserved | | | |
| 1 | RQST IDENT | RQST FAIL | Reserved | | | | | |
| 2 | Reserved | | | | | | | |
| 3 | Reserved | | | | | | | |

2.4.3.2. Temperature Sensor Status Element

| BYTE/BIT | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | COMMON STATUS | | | | | | | |
| | Reserved | PRDFAIL | DISABLED | SWAP | ELEMENT STATUS CODE | | | |
| 1 | IDENT | FAIL | Reserved | | | | | |
| 2 | TEMPERATURE | | | | | | | |
| 3 | Reserved | | | | OT FAILURE | OT WARNING | UT FAILURE | UT WARNING |

| Field | Value |
|---|---|
| ELEMENT STATUS CODE | OK: Everything is Ok<br>NON-CRITICAL: If either warning limit is exceeded<br>CRITICAL: If either failure limit is exceeded |
| FAIL | A warning or failure condition is detected |
| TEMPERATURE | Temperature reading |
| OT FAILURE | Temperature has exceeded the failure high threshold value |
| OT WARNING | Temperature has exceeded the warning high threshold value |
| UT FAILURE | Temperature is below the failure low threshold value |
| UT WARNING | Temperature is below the warning low threshold value |

2.4.4. Enclosure Element

2.4.4.1. Enclosure Control Element

| BYTE/BIT | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | COMMON CONTROL | | | | | | | |
| | SELECT | PRDFAIL | DISABLE | RST SWAP | Reserved | | | |
| 1 | RQST IDENT | Reserved | | | | | | |
| 2 | POWER CYCLE REQUEST | POWER CYCLE DELAY | | | | | | |
| 3 | POWER OFF DURATION | | | | | | REQUEST FAILURE | REQUEST WARNING |

| Field | Value |
|---|---|
| RQST IDENT | Please refer to section “SES Element Control Functions” for details. |
| REQUEST FAILURE | Please refer to section “SES Element Control Functions” for details. |
| REQUEST WARNING | Please refer to section “SES Element Control Functions” for details. |

2.4.4.2. Enclosure Status Element

| BYTE/BIT | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | COMMON STATUS | | | | | | | |
| | Reserved | PRDFAIL | DISABLED | SWAP | ELEMENT STATUS CODE | | | |
| 1 | IDENT | Reserved | | | | | | |
| 2 | TIME UNTIL POWER CYCLE | | | | | | FAILURE INDICATION | WARNING INDICATION |
| 3 | REQUEST POWER OFF DURATION | | | | | | FAILURE REQUESTED | WARNING REQUESTED |

| Field | Value |
|---|---|
| ELEMENT STATUS CODE | OK |
| IDENT | 0: Identify LED of Hub is OFF<br>1: Identify LED of Hub is solid ON |
| FAILURE REQUESTED | Set by the REQUEST FAILURE on Enclosure Control Element |
| WARNING REQUESTED | Set by the REQUEST WARNING on Enclosure Control Element |

2.4.5. Voltage Element

2.4.5.1. Voltage Control Element

| BYTE/BIT | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | COMMON CONTROL | | | | | | | |
| | SELECT | PRDFAIL | DISABLE | RST SWAP | Reserved | | | |
| 1 | RQST IDENT | RQST FAIL | Reserved | | | | | |
| 2 | Reserved | | | | | | | |
| 3 | Reserved | | | | | | | |

2.4.5.2. Voltage Status Element

| BYTE/BIT | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | COMMON STATUS | | | | | | | |
| | Reserved | PRDFAIL | DISABLED | SWAP | ELEMENT STATUS CODE | | | |
| 1 | IDENT | FAIL | Reserved | | WARN OVER | WARN UNDER | CRIT OVER | CRIT UNDER |
| 2 | VOLTAGE | | | | | | | |
| 3 | | | | | | | | |

| Field | Value |
|---|---|
| ELEMENT STATUS CODE | OK: Everything is Ok<br>NON-CRITICAL: If either warning limit is exceeded<br>CRITICAL: If either failure limit is exceeded |
| FAIL | A warning or failure condition is detected |
| WARN OVER | Voltage has exceeded the warning high threshold value |
| WARN UNDER | Voltage is below the warning low threshold value |
| CRIT OVER | Voltage has exceeded the failure high threshold value |
| CRIT UNDER | Voltage is below the failure low threshold value |
| VOLTAGE | Voltage reading |

2.4.6. Array Device Element

2.4.6.1. Array Device Control Element

| BYTE/BIT | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | COMMON CONTROL | | | | | | | |
| | SELECT | PRDFAIL | DISABLE | RST SWAP | Reserved | | | |
| 1 | RQST OK | RQST RSVD DEVICE | RQST HOT SPARE | RQST CONS CHECK | RQST IN CRIT ARRAY | RQST IN FAILED ARRAY | RQST REBULD/ REMAP | RQST R/R ABORT |
| 2 | RQST ACTIVE | DO NOT REMOVE | Reserved | RQST MISSING | RQST INSERT | RQST REMOVE | RQST IDENT | Reserved |
| 3 | Reserved | | RQST FAULT | DEVICE OFF | ENABLE BYP A | ENABLE BYP B | Reserved | |

| Field | Value |
|---|---|
| PRDFAIL | Please refer to section “SES Element Control Functions” for details. |
| RQST OK | Please refer to section “SES Element Control Functions” for details. |
| RQST RSVD DEVICE | Please refer to section “SES Element Control Functions” for details. |
| RQST HOT SPARE | Please refer to section “SES Element Control Functions” for details. |
| RQST CONS CHECK | Please refer to section “SES Element Control Functions” for details. |
| RQST IN CRIT ARRAY | Please refer to section “SES Element Control Functions” for details. |
| RQST IN FAILED ARRAY | Please refer to section “SES Element Control Functions” for details. |
| RQST REBUILD/REMAP | Please refer to section “SES Element Control Functions” for details. |
| RQST R/R ABORT | Please refer to section “SES Element Control Functions” for details. |
| RQST ACTIVE | Please refer to section “SES Element Control Functions” for details. |
| DO NOT REMOVE | Please refer to section “SES Element Control Functions” for details. |
| RQST MISSING | Please refer to section “SES Element Control Functions” for details. |
| RQST INSERT | Please refer to section “SES Element Control Functions” for details. |

| | |
|---|---|
| RQST REMOVE | Please refer to section “SES Element Control Functions” for details. |
| RQST IDENT | Please refer to section “SES Element Control Functions” for details. |
| RQST FAULT | Please refer to section “SES Element Control Functions” for details. |
| DEVICE OFF | Please refer to section “SES Element Control Functions” for details. |

2.4.6.2. Array Device Status Element

| BYTE/BIT | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | COMMON STATUS | | | | | | | |
| | Reserved | PRDFAIL | DISABLED | SWAP | ELEMENT STATUS CODE | | | |
| 1 | OK | RSVD DEVICE | HOT SPARE | CONS CHK | IN CRIT ARRAY | IN FAILED ARRAY | REBUILD/ REMAP | R/R ABORT |
| 2 | APP CLIENT BYPASSED A | DO NOT REMOVE | ENCLOSURE BYPASSED A | ENCLOSURE BYPASSED B | READY TO INSERT | RMV | IDENT | REPORT |
| 3 | APP CLIENT BYPASSED B | FAULT SENSED | FAULT REQSTD | DEVICE OFF | BYPASSED A | BYPASSED B | DEVICE BYPASSED A | DEVICE BYPASSED B |

| Field | Value |
|---|---|
| PRDFAIL | Set by the PRDFAIL on Array Device Control Element |
| ELEMENT STATUS CODE | OK: A drive is detected in the slot<br>NOT INSTALLED: No drive is installed in the slot |
| OK | Set by the RQST OK on Array Device Control Element |
| RSVD DEVICE | Set by the RQST RSVD DEVICE on Array Device Control Element |
| HOT SPARE | Set by the RQST HOT SPARE on Array Device Control Element |
| CONS CHK | Set by the RQST CONS CHECK on Array Device Control Element |
| IN CRIT ARRAY | Set by the RQST IN CRIT ARRAY on Array Device Control Element |
| IN FAILED ARRAY | Set by the RQST IN FAILED ARRAY on Array Device Control Element |
| REBUILD/REMAP | Set by the RQST REBUILD/REMAP on Array Device Control |

| | |
|---|---|
| | Element |
| R/R ABORT | Set by the RQST R/R ABORT on Array Device Control Element |
| DO NOT REMOVE | Set by the DO NOT REMOVE on Array Device Control Element |
| READY TO INSERT | Set by the RQST INSERT on Array Device Control Element |
| RMV | Set by the RQST REMOVE on Array Device Control Element |
| IDENT | Set by the RQST IDENT on Array Device Control Element |
| FAULT REQSTD | Set by the RQST FAULT on Array Device Control Element |
| DEVICE OFF | Set by the DEVICE OFF on Array Device Control Element |

2.5. SES Element Control Functions

2.5.1. LED indicators (blue and red) associated with an attached disk drive

**Array Device Slot control element**

| BYTE/BIT | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | COMMON CONTROL | | | | | | | |
| | SELECT | PRDFAIL | DISABLE | RST SWAP | Reserved | | | |
| 1 | RQST OK | RQST RSVD DEVICE | RQST HOT SPARE | RQST CONS CHECK | RQST IN CRIT ARRAY | RQST IN FAILED ARRAY | RQST REBULD/ REMAP | RQST R/R ABORT |
| 2 | RQST ACTIVE | DO NOT REMOVE | Reserved | RQST MISSING | RQST INSERT | RQST REMOVE | RQST IDENT | Reserved |
| 3 | Reserved | | RQST FAULT | DEVICE OFF | ENABLE BYP A | ENABLE BYP B | Reserved | |

The default behavior for blue LED is "LED is on when the disk is not busy, and off when the disk is executing a command". When the "RQST IDENT" bit is set, the blue LED overwrites its default behavior with a slow blink while the red LED is off. The blue LED is set "Activity" for not overwriting its default behavior.

The behavior “Fast Blink” is “LED is blinking at 2Hz frequency”.

The behavior “Slow Blink” is “LED is blinking at 0.5Hz frequency”.

The behavior “ON”/”OFF” is “LED is solid ON/OFF without blinking”.

| Slot Control Bit | Blue LED | Red LED |
|---|---|---|
| RQST OK | Activity | OFF |
| RQST RSVD DEVICE | Activity | OFF |
| RQST HOT SPARE | Activity | OFF |
| RQST CONS CHECK | Activity | Fast Blink |

| | | |
|---|---|---|
| RQST IN CRIT ARRAY | Activity | Slow Blink |
| RQST IN FAILED ARRAY | Activity | Slow Blink |
| RQST REBUILD/REMAP | Activity | Fast Blink |
| RQST R/R ABORT | Activity | Slow Blink |
| RQST ACTIVE | Activity | OFF |
| DO NOT REMOVE | Activity | OFF |
| RQST MISSING | ON | ON |
| RQST INSERT | Activity | Slow Blink |
| RQST REMOVE | Activity | Slow Blink |
| RQST IDENT | Slow Blink | OFF |
| RQST FAULT | ON | ON |
| DEVICE OFF | OFF | OFF |
| PRDFAIL | Activity | Slow Blink |

2.5.2. How to turn on/off the power of a drive slot

**Array Device Slot control element**

| **BYTE/BIT** | **7** | **6** | **5** | **4** | **3** | **2** | **1** | **0** |
|---|---|---|---|---|---|---|---|---|
| 0 | COMMON CONTROL | | | | | | | |
| | SELECT | PRDFAIL | DISABLE | RST SWAP | Reserved | | | |
| 1 | RQST OK | RQST RSVD DEVICE | RQST HOT SPARE | RQST CONS CHECK | RQST IN CRIT ARRAY | RQST IN FAILED ARRAY | RQST REBULD/ REMAP | RQST R/R ABORT |
| 2 | RQST ACTIVE | DO NOT REMOVE | Reserved | RQST MISSING | RQST INSERT | RQST REMOVE | RQST IDENT | Reserved |
| 3 | Reserved | | RQST FAULT | DEVICE OFF | ENABLE BYP A | ENABLE BYP B | Reserved | |

The "DEVICE OFF" for a drive slot is defined in the bit4, byte3 of the "Array Device Slot control element" in the SES specification. Set the bit to turn off a slot power, and vice versa. We use the software package "sg3_utils" on Linux for example, and have a SAS HBA and a cable to connect your host with the expander.

(A) Show the device for AIC Expander Controller (canister)

```
$ sg_map -i

/dev/sg2    AIC 12G     4U60: Hub    0c29
```

(B) Get the current state of a slot power. The "Device off=0" means the slot power is on.

$ sg_ses --page=2 /dev/sg2

Element 0 descriptor:

App client bypass B=0, Fault sensed=0, Fault reqstd=0, Device off=0

(C) Get the descriptor of a slot power

$ sg_ses --page=7 /dev/sg2

Element 0 descriptor: Disk001

(D) Turn off a slot power

$ sg_ses --descriptor=Disk001 --set=3:4:1 /dev/sg2

(E) Turn on a slot power

$ sg_ses --descriptor=Disk001 --clear=3:4:1 /dev/sg2

2.5.3. How to power off/on all disk drives on a disk backplane manually

**Power Supply control element**

| BYTE/BIT | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | COMMON CONTROL | | | | | | | |
| | SELECT | PRDFAIL | DISABLE | RST SWAP | Reserved | | | |
| 1 | RQST IDENT | Reserved | | | | | | |
| 2 | Reserved | | | | | | | |
| 3 | Reserved | RQST FAIL | RQST ON | Reserved | | | | |

The "RQST ON" for Power Supply is defined in the bit5, byte3 of the "Power Supply control element" in the SES specification. Clear the bit on Power Supply Element “DiskPowerSupply” to power off all disk drives. Set the bit on Power Supply Element “DiskPowerSupply” to power on all disk drives. We use the software package "sg3_utils" on Linux for example, and have a SAS HBA and a cable to connect your host with the expander.

(A) Show the device for AIC Expander Controller (canister) on a disk backplane

$ sg_map -i

/dev/sg2  AIC 12G  4U60: Hub  0c29

(B) Power off all disk drives on the disk backplane

$ sg_ses --descriptor=DiskPowerSupply --clear=3:5:1 /dev/sg2

(C) Power on all disk drives on the disk backplane

$ sg_ses --descriptor=DiskPowerSupply --set=3:5:1 /dev/sg2

2.5.4. How to power off the entire enclosure

**Power Supply control element**

| BYTE/BIT | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | COMMON CONTROL | | | | | | | |
| | SELECT | PRDFAIL | DISABLE | RST SWAP | Reserved | | | |
| 1 | RQST IDENT | Reserved | | | | | | |
| 2 | Reserved | | | | | | | |
| 3 | Reserved | RQST FAIL | RQST ON | Reserved | | | | |

The "RQST ON" for Power Supply is defined in the bit5, byte3 of the "Power Supply control element" in the SES specification. Clear the bit on Power Supply Element “PowerSupply01” or “PowerSupply02” to power off the entire enclosure. We use the software package "sg3_utils" on Linux for example, and have a SAS HBA and a cable to connect your host with the expander.

(A) Show the device for AIC Expander Controller (canister)

$ sg_map -i

/dev/sg2  AIC 12G  4U60: Hub  0c29

(B) Power off the entire enclosure

$ sg_ses --descriptor=PowerSupply00 --clear=3:5:1 /dev/sg2

2.5.5. How to identify the enclosure

**Enclosure control element**

| BYTE/BIT | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | COMMON CONTROL | | | | | | | |
| | SELECT | PRDFAIL | DISABLE | RST SWAP | Reserved | | | |
| 1 | RQST IDENT | Reserved | | | | | | |
| 2 | POWER CYCLE REQUEST | POWER CYCLE DELAY | | | | | | |
| 3 | POWER OFF DURATION | | | | | | REQUEST FAILURE | REQUEST WARNING |

When the identify LED of Hub is off, the identity is disabled. When solid on, the identity is enabled. The "RQST IDENT" for Enclosure is defined in the bit7, byte1 of the "Enclosure control element" in the SES specification. Set the bit to enable the identity. Clear the bit to disable the identity. We use the software package "sg3_utils" on Linux for example, and have a SAS HBA and a cable to connect your host with the expander.

(A) Show the device for AIC Expander Controller (canister)

```
$ sg_map -i

/dev/sg2    AIC 12G      4U60: Hub         0c29
```

(B) Enable the identity

```
$ sg_ses --descriptor=EnclosureElement00 --set=1:7:1 /dev/sg2
```

(C) Disable the identity

```
$ sg_ses --descriptor=EnclosureElement00 --clear=1:7:1 /dev/sg2
```

2.5.6. How to enable/disable the enclosure alarm by your software

**Enclosure control element**

| BYTE/BIT | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | COMMON CONTROL | | | | | | | |
| | SELECT | PRDFAIL | DISABLE | RST SWAP | Reserved | | | |
| 1 | RQST IDENT | Reserved | | | | | | |
| 2 | POWER CYCLE REQUEST | POWER CYCLE DELAY | | | | | | |
| 3 | POWER OFF DURATION | | | | | | REQUEST FAILURE | REQUEST WARNING |

The system alarm LED is used for the enclosure alarm and power alarm. The "REQUEST

FAILURE" and “REQUEST WARNING” for Enclosure are defined in the bit1, byte3 and bit0, byte3 of the "Enclosure control element" in the SES specification. Setting either bit can enable the enclosure alarm. Clearing both bits disables the enclosure alarm. We use the software package "sg3_utils" on Linux for example, and have a SAS HBA and a cable to connect your host with the expander.

(A) Show the device for AIC Expander Controller (canister)

$ sg_map -i

/dev/sg2  AIC 12G  4U60: Hub  0c29

(B) Enable the enclosure alarm

$ sg_ses --descriptor=EnclosureElement00 --set=3:1:1 /dev/sg2

or

$ sg_ses --descriptor=EnclosureElement00 --set=3:0:1 /dev/sg2

(C) Disable the enclosure alarm

$ sg_ses --descriptor=EnclosureElement00 --clear=3:1:1 /dev/sg2

and

$ sg_ses --descriptor=EnclosureElement00 --clear=3:0:1 /dev/sg2

2.5.7. How to manually change PWM (fan speed) for all Cooling elements

**Cooling control element**

| BYTE/BIT | 7 | 6 | 5 | 4 | 3 | 2 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|
| 0 | COMMON CONTROL | | | | | | | |
| | SELECT | PRDFAIL | DISABLE | RST SWAP | Reserved | | | |
| 1 | RQST IDENT | Reserved | | | | | | |
| 2 | Reserved | | | | | | | |
| 3 | Reserved | RQST FAIL | RQST ON | Reserved | | REQUESTED SPEED CODE | | |

The "RQST IDENT" for Cooling is defined in the bit7, byte1 and the "REQUESTED SPEED CODE" is defined in the bit2 ~ 0, byte3 of the "Cooling control element" in the SES specification. Set "RQST IDENT" bit to disable the smart fan function, and then change PWM or fan speed for all Cooling elements by setting the "REQUESTED SPEED CODE" bits. Clear "RQST IDENT" bit to enable the smart fan function again. Please disable the smart fan function before changing PWM or fan speed. Only Cooling element 0 supports this feature. We use the software package "sg3_utils" on Linux for example, and have a SAS HBA and a cable

to connect your host with the expander.

(A) Show the device for AIC Expander Controller (canister)

$ sg_map -i

/dev/sg2  AIC 12G  4U60: Hub  0c29

(B) Set "RQST IDENT" of Cooling element 0 to disable the smart fan function

$ sg_ses --descriptor=CoolingElement00 --set=1:7:1 /dev/sg2

(C) Set "REQUESTED SPEED CODE" of Cooling element 0 to change PWM or fan speed for all Cooling elements. Set "REQUESTED SPEED CODE"=7 (100% PWM) for example.

$ sg_ses --descriptor=CoolingElement00 --set 3:2:3=7 /dev/sg2

| REQUESTED SPEED CODE | PWM |
|---|---|
| 7 | 100% |
| 6 | 90% |
| 5 | 80% |
| 4 | 70% |
| 3 | 60% |
| 2 | 50% |
| 1 | 40% |
| 0 | Leave at current speed |

## 3. Serial Command Line Interface Functions

The RS232 setting - baud rate: 38400 bps, data bits: 8, parity: none, stop bits: 1, flow control: none

### 3.1. How to enable/disable T10 zoning

The default T10 zoning configuration is off.

(A) Check the current zoning state

cmd> phyzone state

Zoning is OFF

(B) Enable zoning

cmd> phyzone on

(C) Disable zoning

cmd> phyzone off

3.2. How to configure T10 zoning

After enabling T10 zoning, 5 predefined groups are Group1, Group8, Group9, Group10, Group11. Each PHY should be in one of the 5 groups, and all PHYs in a wide port should be in the same group. Each PHY in Group1 can access any PHY in other groups, and vice versa. Each PHY in Group8 cannot access any PHY in Group9, and vice versa.

The command syntax is "phyzone phy_index group". The following example shows how to setup one drive accessed only by the first port and another drive accessed only by the second port.

The configuration for the example is

(A) PHY20- PHY23 for the first wide port of HUB

(B) PHY16- PHY19 for the second wide port of HUB

(C) PHY20 – PHY21 for drives on EDGE

Step 1: Read the current group for PHY16 of HUB

cmd> phyzone 16

Phy 16 for Zone Group 1

Step 2: Assign the second port (PHY16 – PHY19) of HUB for Group9

cmd> phyzone 16 9

cmd> phyzone 17 9

cmd> phyzone 18 9

cmd> phyzone 19 9

Step 3: Assign the first port (PHY20 – PHY23) of HUB for Group8

cmd> phyzone 20 8

cmd> phyzone 21 8

cmd> phyzone 22 8

cmd> phyzone 23 8

Step 4: Assign the drive on PHY20 of EDGE to be accessed only by the first port of HUB instead of the second port

cmd> phyzone 20 8

Step 5: Assign the drive on PHY21 of EDGE to be accessed only by the second port of HUB instead of the first port

cmd> phyzone 21 9

Step 6: Reset HUB and EDGE for taking effect with the new settings

cmd> reset

3.3. How to get all revisions in AIC SAS 12G Expander

(A) Expander firmware revision

cmd> rev

(B) Expander configuration revision

cmd> showmfg

(C) MCU firmware revision or sensor information (MCU firmware revision is reported by Hub only)

cmd> sensor

3.4. How to configure temperature sensor (HUB only)

Four temperature settings in Celsius are T1, T2, warning threshold, and alarm (critical) threshold. The T1, T2 and alarm (critical) threshold are applied to the smart fan function.

(A) Get the current temperature settings

cmd> temperature

Temperature in Celsius (t1=20 C, t2=55 C, warning=50 C, alarm=55 C)

(B) Set temperature with new T1=18 C, T2=52 C, warning threshold=48 C, and alarm threshold=54 C. The new setting will take effect after reset.

cmd> temperature 18 52 48 54

cmd> reset

(C) We also take expander temperature into consideration, and the temperature parameters for expander are non-changeable. Expander temperature parameters: T1=40, T2=86 (max 115*0.75), and no warning and alarm. The smart fan function will use the highest PWM output which is calculated from system and expander temperature parameters.

3.5. How to configure enclosure address

(A) Get the current enclosure address

```
cmd> enclosure_addr
Enclosure Address: 0x500605B0000272BF
```

(B) Set the enclosure address with 0x500605B0000272BF. The new setting will take effect after reset.

```
cmd> enclosure_addr 500605B0000272BF
cmd> reset
```

3.6. How to configure standby timer for all disk drives (EDGE only)

This feature is applicable for SAS/SATA drives. Standby timer is in units of minutes. Setting standby timer with 0 minute disables this feature.

(A) Get current standby timer

```
cmd> standby_timer
Standby Timer : 0 minutes
```

(B) Set the standby timer with 10 minutes. The new setting will take effect after reset.

```
cmd> standby_timer 10
cmd> reset
```

3.7. How to configure wide port checker

This feature is applicable for SAS drives instead of SATA drives. If there is no connection with any active SAS initiator by checking all wide ports, AIC Expander Controller stops all attached SAS drives to save power consumption of SAS drives. Otherwise, AIC Expander Controller starts all attached SAS drives to provide drive access service to any active SAS initiator. The same setting should be applied to HUB and EDGE.

(A) Get the current state of wide port checker

cmd> check_wide_port
Checking wide port is OFF

(B) Enable checking wide port. The new setting will take effect after reset.

cmd> check_wide_port on
cmd> reset

(C) Disable checking wide port. The new setting will take effect after reset.

cmd> check_wide_port off
cmd> reset

3.8. How to power off/on all disk drives automatically

This feature is applicable for SAS/SATA drives. If there is no connection with any active SAS initiator by checking all wide ports, AIC Expander Controller powers off all attached SAS/SATA drives to save power consumption. Otherwise, AIC Expander Controller powers on all attached SAS/SATA drives to provide drive access service to any active SAS initiator. The same setting should be applied to HUB and EDGE.

cmd> check_wide_port standby
cmd> reset

3.9. How to configure EDFB (EDGE only)

The default EDFB configuration is off.

(A) Check the current configuration

cmd> edfb
EDFB is OFF

(B) Enable EDFB

cmd> edfb on

(C) Disable EDFB

cmd> edfb off

3.10. How to configure power setting (Hub only)

This feature is for restoring on AC power loss. Three supported options are "keep off", "keep on", and "keep last state". The default setting is "keep off".

(A) Get the current power setting

cmd> power_setting

Power setting: keep off

(B) Set "keep off"

cmd> power_setting keep_off

(C) Set "keep on"

cmd> power_setting keep_on

(D) Set "keep last state"

cmd> power_setting keep_last_state

3.11. How to configure zone count

Remove the SAS cable between the HBA/RAID card and the 4U60 before configuring zone count. Power the 4U60 off after configuring zone count. Power on the 4U60, and then insert the SAS cable.

Three zone configurations supported are one zone, two zones, and three zones. The default configuration is one zone of which T10 zoning configuration is disabled. T10 zoning configuration of the other configurations (two zones and three zones) is enabled. All COM ports for HUB and EDGE should be applied with the same configuration.

(A) Get current zone count

cmd> zonecount

Zone Count 1

(B) Set zone count = 2

cmd> zonecount 2

Succeeded to set zone count 2

(C) Predefined zones follow

(C-1) When Zone Count = 1, T10 zoning is disabled.

HUB:

| Zone # | 1 |
|---|---|

| | |
|---|---|
| Wideport | 1, 2, 3 |

EDGE:

| | |
|---|---|
| Zone # | 1 |
| Slot | 1~60 |

(C-2) When Zone Count = 2, T10 zoning is enabled.

No disk could be seen if we connect HBA/RAID card with port 3 of HUB

HUB:

| | | | |
|---|---|---|---|
| Zone # | 1 | 2 | Other |
| Wideport | 1 | 2 | 3 |

EDGE:

| | | |
|---|---|---|
| Zone # | 1 | 2 |
| Slot | 1~30 | 31~60 |

(C-3) When Zone Count = 3, T10 zoning is enabled.

HUB:

| | | | |
|---|---|---|---|
| Zone # | 1 | 2 | 3 |
| Wideport | 1 | 2 | 3 |

EDGE:

| | | | |
|---|---|---|---|
| Zone # | 1 | 2 | 3 |
| Slot | 1~5,<br>16~20,<br>31~35,<br>46~50 | 6~10,<br>21~25,<br>36~40,<br>51~55 | 11~15,<br>26~30,<br>41~45,<br>56~60 |