Release Note for AIC HA401 Expander

September 25, 2019

Changelog

09/25/2019 (fw3A10_v1.12.10.6 + mfg3A10.0_HA401_v1.10.0.5) - Part Number (SEE-00121006_A01 + SEG-0010C005_A01)

Old Part Number SEE-00121005_A01 is replaced by SEE-00121006_A01.

Old Part Number SEG-0010C004_A01 is replaced by SEG-0010C005_A01.

1. Fix issue: fan stop at some speed code configured manually.

01/16/2019 (fw3A10_v1.12.10.5 + mfg3A10.0_HA401_v1.10.0.4) - Part Number (SEE-00121005_A01 + SEG-0010C004_A01)

Old Part Number SEE-00121004_A01 is replaced by SEE-00121005_A01.

1. Fix issue: SES page 0xA with zoning reports incorrect data.

12/13/2018 (fw3A10_v1.12.10.4 + mfg3A10.0_HA401_v1.10.0.4) - Part Number (SEE-00121004_A01 + SEG-0010C004_A01)

Old Part Number SEE-00121003_A01 is replaced by SEE-00121004_A01.

1. Support the status code of the overall element for Power Supply, Cooling, Temperature Sensor, and Enclosure.

10/01/2018 (fw3A10_v1.12.10.3 + mfg3A10.0_HA401_v1.10.0.4) - Part Number (SEE-00121003_A01 + SEG-0010C004_A01)

Old Part Number B98-00HA41E0121001 is replaced by SEE-00121003_A01.

Old Part Number B98-004BC0G010C003 is replaced by SEG-0010C004_A01.

1. Built with SDK 16
2. Support SES page 0x8B to enable/disable any individual disk's blue LED
3. Show the SAS address in the "Vendor Specific" field of the standard INQUIRY data

06/30/2017 (fw3A10_v1.12.10.1 + mfg3A10.0_HA401_v1.10.0.3) - Part Number (B98-00HA41E0121001 + B98-004BC0G010C003)

Old Part Number B98-004BC0G010C001 is replaced by B98-004BC0G010C003.

1. Official revision

06/27/2016 (fw3A10_HA401_debug_0627 + mfg3A10.0_HA401_debug_0627)

1. Support cooling speed threshold values
2. SES page 0x05 supports Cooling elements

02/22/2016 (fw3A10_v1.12.10.1 + mfg3A10.0_HA401_v1.10.0.1) - Part Number (B98-00HA41E0121001 + B98-004BC0G010C001)

2. Officially initial revision

02/01/2016 (fw3A10_HA401_debug_0201 + mfg3A10.0_HA401_debug_0104)

1. Support retrying Backplane chassis number reading while failed to get it during initialization

01/19/2016 (fw3A10_HA401_debug_0119 + mfg3A10.0_HA401_debug_0104)

1. Bug fix: loading incorrect PHY signal strength setting because of swapping canister slot ID on the firmware “fw3A10_HA401_debug_0901”

01/18/2016 (fw3A10_HA401_debug_0104 + mfg3A10.0_HA401_debug_0104)

1. Swap two terminology items in HA401 SES Specification: “primary canister” and “secondary canister”

01/04/2016 (fw3A10_HA401_debug_0104 + mfg3A10.0_HA401_debug_0104)

1. Extend the length of the chassis number on SES page 82h from 30 bytes to 247 bytes

09/18/2015 (fw3A10_HA401_debug_0918 + mfg3A10.0_HA401_debug_0804)

1. Support powering off and +5V standby power cycling either canister

09/10/2015 (fw3A10_HA401_debug_0910 + mfg3A10.0_HA401_debug_0804)

1. Erase SES Enclosure Info Configuration Page (0xEE04) on the persistent region of the flash

09/01/2015 (fw3A10_HA401_debug_0901 + mfg3A10.0_HA401_debug_0804)

1. Swap canister slot ID
   ID 1: primary canister (the lower canister or Canister-B)
   ID 0: secondary canister (the upper canister or Canister-A)

1. SES Pages

- 00h – List of supported diagnostic pages
- 01h – SES configuration
- 02h – SES enclosure control / enclosure status
- 04h – SES string out / string in
- 05h – SES threshold out / threshold in
- 07h – SES element descriptor
- 0Ah – SES additional element
- 0Eh – SES download microcode control / SES download microcode status
- 80h - Vendor specific diagnostic out / diagnostic in
- 82h – Vendor specific chassis number out / chassis number in
- 8Bh – Vendor specific disk blue LED out / disk blue LED in

2. Implementation on SES Pages

2.1. SES string out / string in

2.1.1. SES string out

It can be used to control the following items.

- Change UUID
- Change temperature sensor settings on Backplane - T1 and T2
- Change two canister status LED
- Change Expander SAS address
- Reset I2C on local Bridge PIC, Backplane PIC, and all Backplane I2C slaves including PMBus
- Hard reset local Bridge PIC
- Force local Bridge PIC to stay in bootloader mode
- Hard reset Backplane PIC
- Force Backplane PIC to stay in bootloader mode
- Reset local Expander
- Reset remote Expander
- Configure Backplane PIC setting for Backplane bezel LED state and motherboard power-off mode for the enclosure power button

- Configure Backplane PIC power for powering off and +5V standby power cycling either canister

String out format

Byte0 ~ Byte7	Change Expander SAS address No change – all 0x0 The change will take effect after expander reset.
Byte8 ~ Byte11	Temperature0 parameters (in Celsius): T1, T2, warning threshold, critical threshold No change – all 0x0 The change will take effect after expander reset.
Byte12 ~ Byte15	Temperature1 parameters (in Celsius): T1, T2, warning threshold, critical threshold No change – all 0x0 The change will take effect after expander reset.
Byte16 ~ Byte19	Temperature2 parameters (in Celsius): T1, T2, warning threshold, critical threshold No change – all 0x0 The change will take effect after expander reset.
Byte20 ~ Byte20	Secondary canister status LED – Blue No change – 0xFF, Not control LED – 0x0, LED on – 0x1, LED off – 0x2, LED slow blink – 0x3, LED fast blink – 0x4 LED slow blink and LED fast blink might look similar due to the scheduling priority
Byte21 ~ Byte21	Secondary canister status LED – Red No change – 0xFF, Not control LED – 0x0, LED on – 0x1, LED off – 0x2, LED slow blink – 0x3, LED fast blink – 0x4 LED slow blink and LED fast blink might look similar due to the scheduling priority
Byte22 ~ Byte22	Primary canister status LED – Blue No change – 0xFF, Not control LED – 0x0, LED on – 0x1, LED off – 0x2, LED slow blink – 0x3, LED fast blink – 0x4 LED slow blink and LED fast blink might look similar due to the scheduling priority
Byte23 ~ Byte23	Primary canister status LED – Red No change – 0xFF, Not control LED – 0x0, LED on – 0x1, LED off – 0x2, LED slow blink – 0x3, LED fast blink – 0x4

	LED slow blink and LED fast blink might look similar due to the scheduling priority
Byte24 ~ Byte39	Change UUID (Byte0 ~ Byte15 on Backplane EEPROM with I2C address: 0xA0) No change – all 0x0
Byte40 ~ Byte40	Reset I2C No change – 0x0, Reset – 0x1
Byte41 ~ Byte41	Reset Backplane PIC No change – 0x0, Reset – 0x1
Byte42 ~ Byte42	Force to stay in Backplane PIC bootloader It triggers “Reset I2C” also. No change – 0x0, Bootloader – 0x1
Byte43 ~ Byte43	Reset local Bridge PIC No change – 0x0, Reset – 0x1
Byte44 ~ Byte44	Force to stay in local Bridge PIC bootloader It triggers “Reset I2C” also. No change – 0x0, Bootloader – 0x1
Byte45 ~ Byte45	Reset remote Expander No change – 0x0, Reset – 0x1
Byte46 ~ Byte46	Reset local Expander No change – 0x0, Reset – 0x1
Byte47 ~ Byte47	Configure Backplane PIC setting No change – 0xFF Power button on force motherboard power-off mode – Bit1 = 0 Power button on non-force motherboard power-off mode – Bit1 = 1 Turn on AC loss feature – Bit2 = 0 Turn off AC loss feature – Bit2 = 1 Custom bezel solid on – Bit7 = 0 and Bit6 = 0 Custom bezel slow blinking – Bit7 = 0 and Bit6 = 1 Custom bezel fast blinking – Bit7 = 1 and Bit6 = 0 Custom bezel solid off – Bit7 = 1 and Bit6 = 1
Byte48 ~ Byte48	Configure Backplane PIC power No change – 0x0 Power off the lower canister – Bit7 = 1 Power off the upper canister – Bit6 = 1 +5V standby power cycle the lower canister – Bit5 = 1 +5V standby power cycle the upper canister – Bit4 = 1

	+5V standby power cycle duration – Bit3 ~ Bit0 (it ranges between 0.5 second and 8 seconds)

2.1.2. SES string in

It can provide status of the following items.

- Expander firmware revision
- Expander manufacture configuration revision
- Local Bridge PIC firmware revision
- Backplane PIC firmware revision
- Backplane UUID
- Canister slot id
- Two canister power state in Backplane PIC
- Two canister power status in Backplane PIC
- Two canister present status in Backplane PIC
- Synchronous GPIO status for the other Bridge PIC
- UART status for the other Bridge PIC
- Local Bridge PIC data valid indicator
- Local Bridge PIC healthy state
- Backplane PIC healthy state
- Backplane PIC setting for Backplane bezel LED state and motherboard power-off mode for the enclosure power button
- Unreadable Backplane I2C slave
- Temperature sensor settings on Backplane - T1 and T2
- Two canister status LED
- Expander SAS address

String in format

Byte0 ~ Byte7	Expander SAS address
Byte8 ~ Byte11	Expander firmware revision
Byte12 ~ Byte15	Expander manufacture configuration revision
Byte16 ~ Byte19	Temperature0 parameters (in Celsius): T1, T2, warning threshold, critical threshold Each parameter is 0xFF while reading failure.
Byte20 ~ Byte23	Temperature1 parameters (in Celsius): T1, T2, warning threshold, critical threshold Each parameter is 0xFF while reading failure.

Byte24 ~ Byte27	Temperature2 parameters (in Celsius): T1, T2, warning threshold, critical threshold Each parameter is 0xFF while reading failure.
Byte28 ~ Byte28	Canister slot id 1: secondary canister (the lower canister or Canister-B) 0: primary canister (the upper canister or Canister-A)
Byte29 ~ Byte29	Local Bridge PIC healthy Healthy – 0x1, Not healthy – 0x0
Byte30 ~ Byte30	Local Bridge PIC data valid indicator Valid – 0x1, Invalid – 0x0
Byte31 ~ Byte31	Backplane PIC setting Reading failure – 0xFF Power button on force motherboard power-off mode – Bit1 = 0 (default) Power button on non-force motherboard power-off mode – Bit1 = 1 Turn on AC loss feature – Bit2 = 0 Turn off AC loss feature – Bit2 = 1 (default) Custom bezel solid on – Bit7 = 0 and Bit6 = 0 (default) Custom bezel slow blinking – Bit7 = 0 and Bit6 = 1 Custom bezel fast blinking – Bit7 = 1 and Bit6 = 0 Custom bezel solid off – Bit7 = 1 and Bit6 = 1
Byte32 ~ Byte32	Unreadable Backplane I2C slave Reading failure – 0xFF, None – 0x0, Temperature0 – 0x1, Temperature1 – 0x2, Temperature2 – 0x3, PCA9555_chip0_port0 – 0x4 or 0x5, PCA9555_chip0_port1 – 0x6 or 0x7, PCA9555_chip1_port0 – 0x8 or 0x9, PCA9555_chip1_port1 – 0xA or 0xB, EEPROM – 0xC, Backplane PIC – 0xD
Byte33 ~ Byte33	Sync GPIO healthy Reading failure – 0xFF, Healthy – 0x1, Not healthy – 0x0
Byte34 ~ Byte34	UART healthy Reading failure – 0xFF, Healthy – 0x1, Not healthy – 0x0
Byte35 ~ Byte35	Backplane PIC healthy Reading failure – 0xFF, Healthy – 0x1, Not healthy – 0x0
Byte36 ~ Byte36	Secondary canister status LED – Blue Reading failure – 0xFF

	Bit7 ~ Bit4 for the status: LED on – 0x1, LED off – 0x2 Bit3 ~ Bit0 for the setting: Not control LED – 0x0, LED on – 0x1, LED off – 0x2, LED slow blink – 0x3, LED fast blink – 0x4 LED slow blink and LED fast blink might look similar due to the scheduling priority
Byte37 ~ Byte37	Secondary canister status LED – Red Reading failure – 0xFF Bit7 ~ Bit4 for the status: LED on – 0x1, LED off – 0x2 Bit3 ~ Bit0 for the setting: Not control LED – 0x0, LED on – 0x1, LED off – 0x2, LED slow blink – 0x3, LED fast blink – 0x4 LED slow blink and LED fast blink might look similar due to the scheduling priority
Byte38 ~ Byte38	Primary canister status LED – Blue Reading failure – 0xFF Bit7 ~ Bit4 for the status: LED on – 0x1, LED off – 0x2 Bit3 ~ Bit0 for the setting: Not control LED – 0x0, LED on – 0x1, LED off – 0x2, LED slow blink – 0x3, LED fast blink – 0x4 LED slow blink and LED fast blink might look similar due to the scheduling priority
Byte39 ~ Byte39	Primary canister status LED – Red Reading failure – 0xFF Bit7 ~ Bit4 for the status: LED on – 0x1, LED off – 0x2 Bit3 ~ Bit0 for the setting: Not control LED – 0x0, LED on – 0x1, LED off – 0x2,

	LED slow blink – 0x3, LED fast blink – 0x4 LED slow blink and LED fast blink might look similar due to the scheduling priority
Byte40 ~ Byte40	Secondary canister present status Reading failure – 0xFF, Not present – 0x0, Present – 0x1
Byte41 ~ Byte41	Primary canister present status Reading failure – 0xFF, Not present – 0x0, Present – 0x1
Byte42 ~ Byte42	Secondary canister power status Reading failure – 0xFF, Power off – 0x0, Power on – 0x1
Byte43 ~ Byte43	Primary canister power status Reading failure – 0xFF, Power off – 0x0, Power on – 0x1
Byte44 ~ Byte44	Secondary canister power state Reading failure – 0xFF, Clean state – 0x0 Canister not present – 0x1, Canister present and off – 0x2 Canister present and on – 0x3 Canister present but failed to power on – 0x4
Byte45 ~ Byte45	Primary canister power state Reading failure – 0xFF, Clean state – 0x0 Canister not present – 0x1, Canister present and off – 0x2 Canister present and on – 0x3 Canister present but failed to power on – 0x4
Byte46 ~ Byte61	Backplane UUID (Byte0 ~ Byte15 on Backplane EEPROM with I2C address: 0xA0)
Byte62 ~ Byte63	Reserved
Byte64 ~ Byte66	Backplane PIC firmware revision
Byte67 ~ Byte69	Bridge PIC firmware revision

2.2. SES threshold out / threshold in

It includes only Temperature Sensor and Cooling 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. Vendor specific diagnostic out / diagnostic in

2.3.1. Vendor specific out / vendor specific in for I2C access on Backplane

It supports the following commands. Each "Send I2C access command" should be followed by a "Get I2C result". While issuing another "Send I2C access command" after sending a "Send I2C access command", you would get error reported. After sending a "Send I2C access command", a "Cancel I2C access command" should be issued before sending another "Send I2C access command".

(A) Send I2C access command (the vendor specific out)

(B) Get I2C result (the vendor specific in)

(C) Cancel I2C access command (the vendor specific out)

There are two Vendor specific in formats and two Vendor specific out formats.

Vendor specific in format-1

Byte0 ~ Byte0	Return code for success – 0x0
Byte1 ~ Byte1	read length in bytes
Byte(1+1)~Byte(1+1)	read data-1
…	…
Byte(1+N)~Byte(1+N)	read data-N N can be up to 128

Vendor specific in format-2

Byte0 ~ Byte0	Return code for failure local Bridge PIC failed to read from/write to the target device via I2C – 0x1 local Bridge PIC memory allocation failure – 0x2 Invalid data from local Bridge PIC – 0x3 Expander failed to read from local Bridge PIC via I2C excluding data timeout – 0x4 Expander memory allocation failure – 0x5 No I2C read command sent – 0x6 Data timeout from local Bridge PIC – 0x7

Vendor specific out format-1

Byte0 ~ Byte0	Send I2C access command – 0x0
Byte1 ~ Byte1	I2C slave address
Byte2 ~ Byte2	read length in bytes
Byte3 ~ Byte3	write length in bytes
Byte(3+1)~Byte(3+1)	write data-1
…	…
Byte(3+N)~Byte(3+N)	write data-N N can be up to 128

Vendor specific out format-2

Byte0 ~ Byte0	Cancel I2C access command – 0x1

Example:

Take PMBus for example. The I2C address of the PMBus power module is 0xB2. We try to read the input voltage of the power module. In the specification of the power module, the input voltage is output with a 2-byte format after being written one command byte "0x88" via I2C. The following data (read length = 2 and write length = 1) will be sent via the vendor specific out page.

00 B2 02 01 88

After the vendor specific out page, you can issue the vendor specific in page to get the following data. It's a successful command (0x00), two data bytes (0x02), and the output data (0x63 and 0xeb).

00 02 63 eb

2.3.2. I2C error / reset statistic

It supports up to 108-byte reading data for I2C error statistic and I2C interface reset count. Each I2C error count consists of 2 consecutive bytes repositioned for Little-endian machines (the low byte first, then the high byte).

Vendor specific in format-1

Byte0 ~ Byte0	Return code for success – 0x0
Byte1 ~ Byte1	0x6C
Byte(1+1)~Byte(1+1)	read data-1
…	…
Byte(1+N)~Byte(1+N)	read data-N N is 108

The 5 error counts (writeI2C, readI2C, dataFormat, dataComparison, and dataTimeout monitored by Expander) consist of the first 10 bytes. The 5 error counts monitored by Expander are described below.

(A) writeI2C: Fail to write I2C

(B) readI2C: Fail to read I2C

(C) dataFormat: Data format read from local Bridge PIC is incorrect

(D) dataComparison: Read local Bridge PIC twice, and compare both data

(E) dataTimeout: Data timeout from local Bridge PIC

The following 90 bytes monitored by Bridge PIC are divided by 9 groups (10 bytes each group). The 5 error counts (BusArbitration, MasterHardware, SlaveResponse, MemoryAllocation, and DataComparison) consist of each 10-byte group. The 9 groups are listed below in order.

Group 1: Backplane temperature sensor 0

Group 2: Backplane temperature sensor 1

Group 3: Backplane temperature sensor 2

Group 4: Backplane PCA9555-0

Group 5: Backplane PCA9555-1

Group 6: Backplane EEPROM

Group 7: Backplane PIC

Group 8: Backplane PMBus

Group 9: IPMB (from Bridge PIC I2C master to Motherboard IPMB I2C slave)

The 5 error counts monitored by Bridge PIC are described below.

(A) BusArbitration: It's nothing to do with the sync GPIO. The error is raised while Bridge PIC fails to start I2C sequence due to the I2C bus signal.

(B) MasterHardware: Error for the I2C master interface like the abnormal interface status after starting I2C sequence, interface transmitter never ready, …

(C) SlaveResponse: Can't get proper response from the I2C slave

(D) MemoryAllocation: Bridge PIC fails to allocate memory for processing I2C access

(E) DataComparison: Read the same I2C slave device twice, and compare both data

The last 8 bytes monitored by Bridge PIC are 4 interface reset counts (I2C master for Backplane, I2C slave for Expander, I2C master for local IPMB, and I2C slave for

remote IPMB).

Vendor specific out format-1

Byte0 ~ Byte0	Send I2C access command – 0x0
Byte1 ~ Byte1	0x0
Byte2 ~ Byte2	0x6C
Byte3 ~ Byte3	0x0

Example:

To read I2C error statistic and I2C interface reset count, issue the vendor specific out page with the following data.

00 00 6C 00

After the vendor specific out page, you can issue the vendor specific in page to get the following data. It's a successful command (0x00), 108 data bytes (0x6c), and the output data.

00 6c 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00

2.4. Vendor specific chassis number out / chassis number in

The chassis number is kept on Byte256 ~ Byte511 of the EEPROM on the chassis backplane. The I2C address of the backplane EEPROM is 0xA0. The length of the chassis number is not more than 247 bytes.

The chassis number is the unit serial number in the VPD (Vital Product Data) page fetched with a SCSI INQUIRY command.

2.4.1. Vendor specific chassis number out

In order to update the chassis number on the backplane EEPROM, the length of the chassis number must be 1 ~ 247 bytes. To invalidate the chassis number, the length should be applied with 0.

Chassis number (0 ~ 247 bytes)

2.4.2. Vendor specific chassis number in

Byte0 ~ Byte0	Valid data: 0x0, invalid data: 0x1
Chassis number or none	Chassis number (1 ~ 247 bytes) for valid data, none for invalid data

2.5. Vendor specific disk blue LED out / disk blue LED in

2.5.1. Vendor specific disk blue LED out

Byte0 ~ Byte0	PHY number in hexadecimal for the disk
Byte1 ~ Byte1	0x00 to disable the disk blue LED, and 0x01 to enable the disk blue LED

2.5.2. Vendor specific disk blue LED in

48 bytes reported represent the statuses of the 48 PHY's. The status of the disk PHY is either 0x00 or 0x01, the other PHY's report 0xFF. The status "0x00" means that the disk blue LED is disabled, and the status "0x01" means the disk blue LED is enabled.

3. SES Elements

- 02h - Power Supply
  Number of possible elements: 2
- 03h - Cooling (it is not supported while the number of elements is 0)
  Number of possible elements: 0, 8, or 16 (it depends on the jumper setting of Bridge board)
- 04h - Temperature Sensor
  Number of possible elements: 3
- 0Eh - Enclosure
  Number of possible elements: 1
- 17h - Array Device
  Number of possible elements: 24

4. Implementation on SES Elements

Only the fields highlighted in green are supported.

4.1. Power Supply Element

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				

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 CRITICAL: FAIL bit is set due to one or more failure condition UNKNOWN: Can't get information from Bridge MCU
FAIL	A failure condition is detected
AC FAIL	A failure condition is detected
DC FAIL	A failure condition is detected

4.2. Cooling Element

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.

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: Everything is Ok NON-CRITICAL: If either warning limit is exceeded CRITICAL: If either failure limit is exceeded UNKNOWN: Can’t get information from Bridge MCU
IDENT	Applicable only for Cooling element 0 and Cooling element 8 0: Enable the smart fan function 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	000b: Stopped. Current RPM = 0 001b: Lowest speed. 0 < Current RPM ≦ 5000 010b: Second lowest speed. 5000 < Current RPM ≦ 7000 011b: Third lowest speed. 7000 < Current RPM ≦ 9000 100b: Intermediate speed. 9000 < Current RPM ≦ 11000 101b: Third highest speed. 11000 < Current RPM ≦ 13000 110b: Second highest speed. 13000 < Current RPM ≦ 15000

	111b: Highest speed. 15000 < Current RPM

4.3. Temperature Sensor Element

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							

4.3.1. 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 NON-CRITICAL: If either warning limit is exceeded CRITICAL: If either failure limit is exceeded UNKNOWN: Can't get information from Bridge MCU
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

4.4. Enclosure Element

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.

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

4.5. Array Device Element

4.5.1. 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.

4.5.2. 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 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

5. SES Element Control Functions

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.

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

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.

5.3. How to manually change fan speed for local or remote 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 fan speed for local or remote 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 fan speed. Only the Cooling element 0 (for local) and the Cooling element 8 (for remote) support this feature.

REQUESTED SPEED CODE

Code	Description
000b	Leave fan at current speed
001b	Set cooling mechanism to lowest speed
010b	Set cooling mechanism to second lowest speed
011b	Set cooling mechanism to third lowest speed
100b	Set cooling mechanism to intermediate speed
101b	Set cooling mechanism to third highest speed
110b	Set cooling mechanism to second highest speed
111b	Set cooling mechanism to highest speed

5.4. How to identify the enclosure on the custom bezel

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 "RQST IDENT" is defined in the bit7, byte1 of the "Enclosure control element" in the SES specification. Setting the bit makes the custom bezel fast blink,

and clearing the bit makes the custom bezel solid on.

6. Online Firmware Update

6.1. Expander firmware and MFG update

(1) Use the open source sg3_utils to perform firmware and MFG update via inband SAS. The sg3_utils is supported by Windows and Linux.

(2) Use LSI g3Xtools, “g3Xflash” to reset the expander chip to activate the new firmware and MFG. via inband SAS.

6.2. PIC firmware update

(1) Force local Bridge PIC to stay in the bootloader mode by sending the “String Out” page.

(2) Use Microchip PIC32 Bootloader Application – PIC32UBL to update firmware, and then run the new firmware. Microchip PIC32UBL is only supported by Windows. Users can develop PIC32 Bootloader Application for Linux based on Microchip PIC32UBL source.

7. Temperature sensor and cooling connector locations

Bridge Board			
Cooling 6/7	Cooling 4/5	Cooling 2/3	Cooling 0/1
Backplane Board			
Temp Sensor-2	Temp Sensor-0		Temp Sensor-1
Drive Bay			
24 Disk Drives			