

User Manual

MIC-5401

Advanced Mezzanine Card
SAS/SATA Storage AMC

Trusted ePlatform Services



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4. Carefully pack the defective product, a fully-completed Repair and Replacement Order Card and a photocopy proof of purchase date (such as your sales receipt) in a shippable container. A product returned without proof of the purchase date is not eligible for warranty service.
5. Write the RMA number visibly on the outside of the package and ship it prepaid to your dealer.

Declaration of Conformity

CE

This product has passed the CE test for environmental specifications when shielded cables are used for external wiring. We recommend the use of shielded cables.

FCC Class B

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

FM

This equipment has passed the FM certification. According to the National Fire Protection Association, work sites are classified into different classes, divisions and groups, based on hazard considerations. This equipment is compliant with the specifications of Class I, Division 2, Groups A, B, C and D indoor hazards.

Technical Support and Assistance

1. Visit the Advantech web site at www.advantech.com/support where you can find the latest information about the product.
2. Contact your distributor, sales representative, or Advantech's customer service center for technical support if you need additional assistance. Please have the following information ready before you call:
 - Product name and serial number
 - Description of your peripheral attachments
 - Description of your software (operating system, version, application software, etc.)
 - A complete description of the problem
 - The exact wording of any error messages

Warnings, Cautions and Notes

Warning! Warnings indicate conditions, which if not observed can cause personal injury!



Caution! Cautions are included to help you avoid damaging hardware or losing data. e.g.



There is a danger of a new battery exploding if it is incorrectly installed. Do not attempt to recharge, force open, or heat the battery. Replace the battery only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.

Note! Notes provide optional additional information.



Document Feedback

To assist us in making improvements to this manual, we would welcome comments and constructive criticism. Please send all such - in writing - to: support@advan-tech.com

Packing List

Before setting up the system, check that the items listed below are included and in good condition. MIC-5401 SAS/SATA Storage Advanced Mezzanine Card

- Firmware update utility and user manual (PDF file) CD-ROM disc x1
- M3 x 4 countersink flat head screws x4
- Warranty certificate document x1

If any item does not accord with the table, please contact your dealer immediately.

Safety Instructions

1. Read these safety instructions carefully.
2. Keep this User Manual for later reference.
3. Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.
4. For plug-in equipment, the power outlet socket must be located near the equipment and must be easily accessible.
5. Keep this equipment away from humidity.
6. Put this equipment on a reliable surface during installation. Dropping it or letting it fall may cause damage.
7. The openings on the enclosure are for air convection. Protect the equipment from overheating. **DO NOT COVER THE OPENINGS.**
8. Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.
9. Position the power cord so that people cannot step on it. Do not place anything over the power cord.
10. All cautions and warnings on the equipment should be noted.
11. If the equipment is not used for a long time, disconnect it from the power source to avoid damage by transient overvoltage.
12. Never pour any liquid into an opening. This may cause fire or electrical shock.
13. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
14. If one of the following situations arises, get the equipment checked by service personnel:
 - The power cord or plug is damaged.
 - Liquid has penetrated into the equipment.
 - The equipment has been exposed to moisture.
 - The equipment does not work well, or you cannot get it to work according to the user's manual.
 - The equipment has been dropped and damaged.
 - The equipment has obvious signs of breakage.
15. **DO NOT LEAVE THIS EQUIPMENT IN AN ENVIRONMENT WHERE THE STORAGE TEMPERATURE MAY GO BELOW -20° C (-4° F) OR ABOVE 60° C (140° F). THIS COULD DAMAGE THE EQUIPMENT. THE EQUIPMENT SHOULD BE IN A CONTROLLED ENVIRONMENT.**
16. **CAUTION: DANGER OF EXPLOSION IF BATTERY IS INCORRECTLY REPLACED. REPLACE ONLY WITH THE SAME OR EQUIVALENT TYPE RECOMMENDED BY THE MANUFACTURER, DISCARD USED BATTERIES ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.**
17. The sound pressure level at the operator's position according to IEC 704-1:1982 is no more than 70 dB (A).

DISCLAIMER: This set of instructions is given according to IEC 704-1. Advantech disclaims all responsibility for the accuracy of any statements contained herein.


Safety Precaution - Static Electricity

Follow these simple precautions to protect yourself from harm and the products from damage.

- To avoid electrical shock, always disconnect the power from your PC chassis before you work on it. Don't touch any components on the CPU card or other cards while the PC is on.
- Disconnect power before making any configuration changes. The sudden rush of power as you connect a jumper or install a card may damage sensitive electronic components.

Product Configurations

Model Number	Front Panel
MIC-5401-0000E	Mid-size

- Note!**  1. AMC modules with pre-installed hard disk or solid state disk drives are available on request. Please contact Advantech sales representative for further detail.
2. Full size front panel is available on request.

We Appreciate Your Input

Please let us know of any aspect of this product, including the manual, which could use improvement or correction. We appreciate your valuable input in helping make our products better.

Glossary

AMC	Advanced Mezzanine Card
ATCA	Advanced Telecommunications Computing Architecture
CMC	Carrier Management Controller
HPM	Hardware Platform Management
IPMC	Intelligent Platform Management Controller
IPMI	Intelligent Platform Management Interface
LSB	Least Significant Byte
MCH	MicroTCA Carrier Hub
MMC	Module Management Controller
PICMG	PCI Industrial Computer Manufacturers Group
SAS	Serial Attached SCSI
SATA	Serial Advanced Technology Attachment
SCSI	Small Computer System Interface
SDR	Sensor Data Record
SSD	Solid State Drive

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Chapter 1

Product Overview

1.1 Introduction

The Advantech MIC-5401 is a single-width/mid-size Advanced Mezzanine Card (AMC) designed to support a 2.5" SAS or SATA hard disk drive to work as an enterprise storage module on an ATCA platform or in a MicroTCA shelf. The 2.5" hard disk drive is connected to the AMC port 2 (SAS and SATA) and port 3 (SAS only) according to the AMC.3 specification. Dual port SAS drives may be used on the MIC-5401 to increase the interface bandwidth for failover support between dual hosts in fault tolerant environments. Like all other standard AMC modules, an IPMI-based module management controller (MMC) is implemented on the MIC-5401 to serve as a communication interface with the Carrier Management Controller (CMC) on an ATCA platform, or with the CMC on the MicroTCA Carrier Hub (MCH) in a MicroTCA shelf. As a local IPMI controller on the AMC, it manages all hot-swap activities, E-keying, and hardware health monitoring such as voltages (12V, 5V, and management power 3.3V) and on-board temperatures (including hard disk drive ambient temperature). The MIC-5401's mechanical design is optimized for maximum shock and vibration resistance, and has a user- and service-friendly mounting process for the disk drive.

1.2 Logical Structure

So it may be equipped with a 2.5" Serial Attached SCSI (SAS) hard disk drive, the MIC-5401 provides an AMC connector to the ATCA blade or MicroTCA backplane and power supplies, and an AMC module management controller (MMC). The following figure shows the logical structure of the MIC-5401.

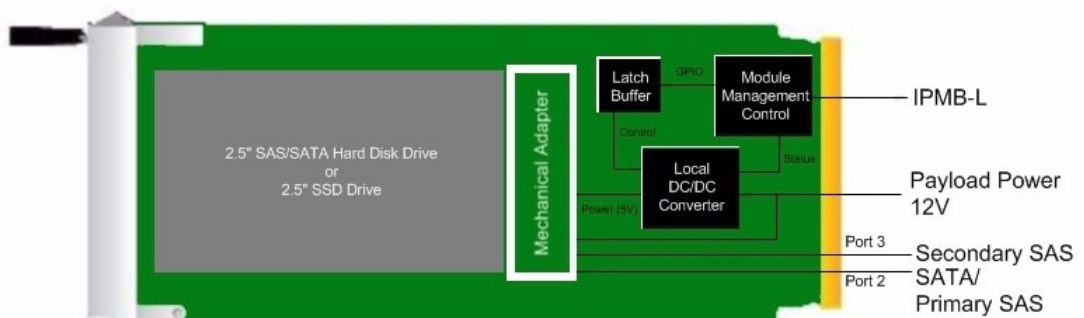


Figure 1.1 MIC-5401 Block Diagram

Chapter 2

Board Specifications

2.1 Technical Data

Table 2.1: Advantech MIC-5401 SAS/SATA Storage AMC Technical Data

AMC Module	Single width, mid-size form factor (full-size front panel available as an option)	
Storage Device Supported	2.5" SAS or SATA hard disk drives, or 2.5" SATA SSD (Solid State Drive)	
System Management	PICMG 3.0 R2.0, AMC.0 R2.0, and IPMI1.5 compliant	
	Redundant firmware image based on Pigeon Point System's solution supporting HPM.1 compliant upgrades and manual/automatic rollback	
Hardware Monitor	Power-on hour counter	
	Voltage: 12V, 5V, and 3.3V management power	
	Temperature: two on-board locations	
Watchdog	AMC compliant watchdog	
Thermal Sensor	LM75/DS75 (x2)	
Power Requirements	Management power: 3.3V \pm 10% (max. 100mA) Payload power: 12V \pm 5% (max. power consumption depends on used hard disk drive)	
Environmental Conditions	Temperature and humidity (operating)	GR-63-CORE, Issue 3, R4-7 (-5°C ~ 55°C; 5% ~ 95%RH)
	Temperature and humidity (non-operating)	GR-63-CORE, Issue 3, R4-7 (-40°C ~ 70°C; 95%RH)
	Altitude	GR-63-CORE, Issue 3, R4-8, R4-9, R4-10, R4-11, R4-12 (-60m ~ 4000m)
	Vibration (operating)	IEC 60068-2-64 (0.002G ² /Hz, 1Grms, 5~500 Hz)
	Vibration (non-operating)	IEC 60068-2-6 (2 G, 5 ~ 500 Hz, 1 Octave/min)
	Shock (operating)	IEC 60068-2-27 (half-Sine, 10 G, 11 ms)
	Shock (non-operating)	IEC 60068-2-27 (half-Sine, 30 G, 11 ms)
Regulatory	Conformance	UL94V0, FCC Class B, CE, RoHS & WEEE compliant
	NEBS Level 3	Designed for GR-63-CORE and GR-1089-CORE
Net Weight	125 grams (without hard disk drive)	
Compliance	Standards	PICMG 3.0 R2.0, AMC.0 R2.0, AMC.3 R1.0, IPMI1.5, and SCOPE Advanced MC Hardware Profile V1.0

Note! *The listed vibration and shock "G" levels for the operating mode is for the MIC-5401 equipped with a 2.5" SSD drive.*



2.2 Product Features

2.2.1 MMC

The MMC is a logical controller that monitors the health, status, voltages and temperature of the AMC module and stores the data to a local sensor data record (SDR). It forwards the AMC status and sensor data to the Carrier IPMC on an ATCA board or the Carrier Manager on a MCH which sends the data to the shelf manager of the ATCA system or the MicroTCA system, respectively. The MMC also maintains the AMC module's FRU information repository. The MMC on the MIC-5401 is built based on Pigeon Point Systems' (PPS) hardware/ software reference design kit for MMC.

2.2.1.1 ATmega128L Microprocessor

Atmel's ATmega128L is used as the micro controller for the MMC implementation on the MIC-5401. As a highly integrated micro controller that has on-chip Flash, EEPROM and SRAM memories, it contains an 8-bit AVR enhanced RISC architecture as its core. The peripheral functions of the ATmega128L used in the MMC design include the I2C controllers, 8-bit timer, watchdog timer (WDT), Analog-to-Digital Converter (ADC), and GPIO. They are responsible for the following:

- Implementing the IPMB-L interface as the communication channel between the MMC and the Carrier IPMC
- Monitoring sensor devices
- Implementing hot-swap functionality
- Controlling various reset types
- Maintaining SDR and FRU information

2.2.1.2 IPMB Implementation

The ATmega128L AVR core has a built-in I2C controller, which is connected to the IPMB-L interface on the AMC's edge connector. This interface provides the primary communication mechanism between the Carrier IPMC and the MMC.

2.2.1.3 Sensor Devices

Three types of sensor devices, thermal, voltage, and GPIO-based sensors, are used on the MMC.

Two LM75 thermal sensors are implemented on the PCB to monitor the temperatures of the air flowing across the AMC module and the HDD. When the MMC detects that a monitored temperature sensor crosses one or more thresholds in either direction, the MMC sends an IPMI temperature event message to the Carrier IPMC. The Carrier IPMC, or higher level management, uses this information to manage the cooling.

Four channels from an internal 10-bit ADC converter contained in the ATmega128L are used to monitor the following voltages:

- Payload input power (12V)
- Management power (3.3V)
- Payload backend power (12V)
- Payload backend power (5V)

A GPIO-based sensor is implemented in the MMC to detect any backend power failure by monitoring the 5V power good status of the PWM power controller on the AMC module.

Note! *Payload backend power refers to the 5V and 12V power input required by the SAS/SATA HDD.*



2.2.1.4 Module Hot Swap Sensor

The AMC module has hot swap capability, which enables the module to be inserted into or extracted from the carrier board without having to shut down the system, or allows the module to shut down (intentionally or un-intentionally) without bringing down the system. The MMC contains a Module Hot Swap sensor which proactively generates events to enable the Carrier IPMC to perform Hot Swap management for the AMC module. The following events are supported:

- AMC hot swap handle closed
- AMC hot swap handle opened
- AMC quiesced
- AMC backend power failure

Backend power failure is detected by monitoring the +12V and +5V backend power voltage levels.

2.2.1.5 Sensor Data Records (SDR)

The AMC module has local Sensor Data Records (SDR) for storing the above mentioned information (temperature, voltage, and hot swap state). In addition to sensor identification (type, name, unit, etc.), the SDR contains the configuration of the sensor parameters that specify sensor behavior, such as threshold, hysteresis, event generation capabilities, etc. Some of them can be configured through IPMI v1.5 commands. The SDR can be queried with device SDR commands. The MMC sends the AMC SDR event messages (e.g. AMC Module Hot Swap state) to the carrier manager which then sends the data to the shelf manager and the user can access it through the shelf manager or system manager.

Implemented module sensors are listed below.

Table 2.2: Sensor Data Records

Sensor No.	Sensor Name	Sensor Type	Voltage/Signal Monitored
0	Hot Swap	Discrete	Module Hot Swap
1	+12V Payload	Threshold	AMC +12V Payload power
2	+3.3V MP	Threshold	AMC +3.3V Management power
3	+12V Backend	Threshold	+12V Backend power
4	+5V Backend	Threshold	+5V Backend power
5	HDD Temp	Threshold	Temperature near HDD
6	MMC Temp	Threshold	Temperature near MMC
7	DC/DC Failure	Discrete	5V DC/DC Power Good
8	Version change	Discrete	MMC Firmware version change

Note!



Event messages from sensors 1, 3, 4 and 7 are automatically disabled when payload is off. This prevents generation of false events, but sensors are still active and their values can be read via the IPMI command: Get Sensor Reading .

2.2.1.6 Reset Types

Three types of logical resets are supported by the MMC.

- **Hard reset:** the MMC resets all internal and external data/states to default values (such as internal message rings, sensor thresholds, hysteresis and event enable masks, the states of the E-keying ports, and the state of the Blue LED and FRU LEDs). When the AVR MMC is powered on, the MMC firmware detects this condition and performs a hard reset of the AVR MMC. Another example is if the management power drops below some critical value, a brown-out reset of the AVR MMC occurs. When the management power returns to its normal value, the AVR MMC is brought out of reset. The MMC firmware detects the brown-out condition and performs a hard reset of the AVR MMC.
- **Cold reset:** the MMC resets all internal and external data/states to default values except for the overridden geographical address, overridden handle switch state, the states of E-keying controls, and the states of the blue LED and the FRU LEDs. One example for the cold reset scenario is if the watchdog timer of the AVR MMC expires, a watchdog reset of the AVR MMC occurs. The MMC firmware detects the watchdog reset condition and performs a cold reset of the AVR MMC. Another example is if the front panel reset button is pressed for a long period (>5s), the MMC will also execute a cold reset command. A cold reset can be also executed by an IPMI command.
- **Warm reset:** it is similar to the cold reset with additional preserved external data/states such as sensor threshold/hysteresis, sensor event masks, and sensor events. A warm reset can be also executed by an IPMI command.

2.2.1.7 Maintaining FRU Information

The FRU Data is maintained in the EEPROM memory of the ATmega128L AVR. The structure complies with IPMI FRU Information Storage Definition. The basic structure is shown below:

Table 2.3: FRU structure	
Common Header	The common header contains the offsets for each area within the FRU data storage. It will be automatically generated by the FRU compiler.
Internal Use Area	The internal use area is provided for storage of the MMC private, implementation-specific parameters that should not be changed or used for any other purposes.
Board Info Area	The board info area holds board relevant data, such as language code, manufacturing date/time, manufacturer, product name, serial number, part number, FRU programmer file ID, etc.
Product Info Area	The product info area holds product relevant data. It contains data partially identical to that in the board info area.
Multi Record Area	The multi record area contains several subsets. First, there are the AMC.0 required entries for E-Keying and system power budgeting. Next, there is an OEM record dedicated for use by customers (e.g. HDD Serial Number).

The PPS provides a special FRU compiler that converts a text file containing FRU information into a binary file that can be linked with the MMC firmware.

The AMC Point-to-Point Connectivity record is programmed in the Multi Record Info Area and describes the channel and link connectivity that is implemented on the MIC-5401 module. The record data must be consistent with the type of hard disk drive used (see table below).

Table 2.4: AMC Point-to-Point Connectivity Record vs. HDD Type


	SAS HDD	SATA HDD
AMC Channel 0	AMC Port 2	AMC Port 2
AMC Channel 1	AMC Port 3	N/A
AMC Link Type	AMC.3 Storage (0x07)	AMC.3 Storage (0x07)
AMC Link Type Extension	SAS/SATA (0x02)	SATA (0x01)
AMC Asymmetric Match	00b	01b (SATA server)
Link Grouping ID	0	0

The MMC checks this record after each hard reset (see SAS/SATA Mode Selection) and overwrites it if any problem is detected. As the SATA record is shorter than the SAS one, the dummy OEM record is stored immediately after SATA record as a placeholder. This empty record (Type ID = 0xC0, Length = 0x03, Manufacturer ID = 0x002839) should not be deleted; if it is, switching from SATA to SAS mode is not possible.

In addition, one OEM record (Type ID = 0xC8, Length = 0xFF, Manufacturer ID = 0x002839) dedicated for customer usage is implemented in the Multi Record Info Area. It provides up to 252 bytes of data that can be used for HDD Serial Number, for example.

2.2.2 Payload Function

The payload of the MIC-5401 is a 2.5" SAS HDD, SATA HDD, or SSD drive on the module. Its function is to provide storage in the ATCA or MicroTCA system. The MIC-5401 does not implement any payload interface, therefore communication between the payload and the MMC is not possible.

Note!  *The activation or de-activation of payload power for the module is under the full control of the shelf and carrier manager. The MMC just delivers event messages for the handle status and FRU data records for power budgeting and E-keying. It means that the payload will automatically power on or off when payload power comes in or turns off. The only exception is receiving the FRU Control (Cold Reset) IPMI command when the MMC resets the payload by backend power off/on cycling.*

2.2.3 Handle Switch

A handle switch is implemented to facilitate the insertion, locking, and extraction of the AMC module from the carrier board in addition to the state change of the hot swap micro-switch. When the handle is pushed towards the front panel by the user, the switch is toggled to confirm AMC insertion. On the other hand, when the handle is pulled away from the front panel, the micro-switch will resume its original position to indicate a request for AMC extraction to the Module Management Controller (MMC). The MMC sends a Module Hot Swap event message to the Carrier IPMC when the hot swap micro-switch changes state.

The handle switch type and location are designed according to the PICMG AMC.0 Rev2.0 specification.

2.2.4 Front Panel Indicators

The MIC-5401 supports three front panel LEDs (see Figure 2.1). Note that LED2 is used as HDD activity LED and is not controlled by the MMC.

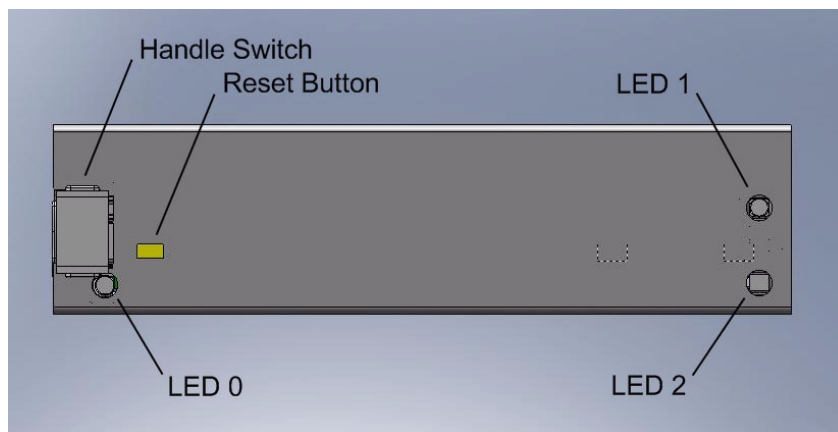


Figure 2.1 Front Panel

Table 2.5: Front Panel LEDs

LED	Color	Description
0	Blue	Hot swap indicator
1	Red	Out of service indicator
2	Green	HDD activity indicator

Blue LED: Carrier states are indicated by the module's Blue LED:

- solid on: FRU inactive
- long blink: FRU activation request / FRU activation in progress
- solid off: FRU active
- short blink: FRU deactivation request / FRU deactivation in progress

Red LED: Indicates failures or special states of the AMC module. Red LED is on when at least one of the following states occurs:

- Reset Button is pressed
- Backend power (+12V or +5V) fails
- Voltage or temperature critical threshold exceeded
- Fatal MMC error occurs (e.g. unrecoverable FRU record error)

Green LED: the real behavior depends on hard disk drive used and its mode (refer to HDD Activity Signal chapter for details).

2.2.5 Reset Button

There is a reset button on the front panel. When the button is pressed, the MMC will perform following actions:

- Turn on the red LED (OOS)
- If the button is released within 1s after the red LED turns on, the MMC will turn the LED off again and execute an FRU cold reset command (i.e. perform a payload reset by backend power off/on cycle).
- If the button is pressed for more than 5s, the MMC will turn the LED off again and execute a MMC cold reset command.

In addition, the reset button controls functionality of the Clear/Write HDD On-Time IPMI commands (they are disabled as long as the button is released to prevent accidental change of the time counter).

2.2.6 HDD On-Time Counter

The MMC provides an HDD on-time counter in order to keep track of time in continuous operation. This information is stored in the internal MMC EEPROM and it is updated every 15 minutes. This means that shorter time intervals are not recorded, and the on-time counter would be rather inaccurate in on/off operation.

However, it is not an issue in permanently powered systems where the primary purpose of the counter is MTBF evaluation.

The MMC provides three OEM IPMI commands that allow the user to manipulate the on-time information:

Read HDD On-Time can be used for reading the current state of the on-time counter:

Request:

- NetFn Code = 0x2E (OEM)
- Command Code = 0x01 (Read HDD On-Time)
- Data Byte 1 - 3 : Advantech IANA (LSB first, i.e. 0x39, 0x28, 0x00)

Response:

- NetFn Code = 0x2F (OEM)
- Command Code = 0x01 (Read HDD On-Time)
- Data Byte 1: Completion Code = 0x00 (Command Completed Normally)
- Data Byte 2 - 4 : Advantech IANA (LSB first, i.e. 0x39, 0x28, 0x00)
- Data Byte 5 - 8 : On-Time Counter value (LSB first) in units of 15 minutes

Clear HDD On-Time can be used for clearing the on-time counter. It is typically used only when a hard disk drive is replaced. The Reset Button must be held pressed during this command to assure that the erasure of the counter value is intentional.

Request:

- NetFn Code = 0x2E (OEM)
- Command Code = 0x02 (Clear HDD On-Time)
- Data Byte 1 - 3 : Advantech IANA (LSB first, i.e. 0x39, 0x28, 0x00)

Response:

- NetFn Code = 0x2F (OEM)
- Command Code = 0x02 (Clear HDD On-Time)
- Data Byte 1: Completion Code
- Data Byte 2 - 4 : Advantech IANA (LSB first, i.e. 0x39, 0x28, 0x00)

The Completion Code is 0x00 when command is completed normally, while it is 0xCB (i.e. Requested sensor, data or record not present) when Reset Button is not pressed).

Write HDD On-Time can be used for setting the current state of on-time counter. It is used only for special purposes (e.g. mounting of already used hard disk or setting the initial value after complete EEPROM erasing). The Reset Button must be held pressed during this command to avoid accidental changing of counter value.

Request:

- NetFn Code = 0x2E (OEM)
- Command Code = 0x03 (Write HDD On-Time)
- Data Byte 1 - 3 : Advantech IANA (LSB first, i.e. 0x39, 0x28, 0x00)
- Data Byte 4 - 7 : On-Time Counter value (LSB first) in units of 15 minutes

Response:

- NetFn Code = 0x2F (OEM)
- Command Code = 0x03 (Write HDD On-Time)
- Data Byte 1: Completion Code
- Data Byte 2 - 4 : Advantech IANA (LSB first, i.e. 0x39, 0x28, 0x00)



The Completion Code is 0x00 when command is completed normally, while it is 0xCB (i.e. Requested sensor, data or record not present) when Reset Button is not pressed or 0xCC (i.e. Invalid data field in Request) when value of MSB (request data byte 7) is non-zero.

2.3 Jumper and Switch

2.3.1 SAS/SATA Mode Selection

Depending on the type of HDD mounted on the MIC-5401, SW3 near the front end of the PCB (see Figure 2.2) needs to have the following setting.

Table 2.6: SW3 Settings

Default	SATA	
	On	
	SAS	
	Off	

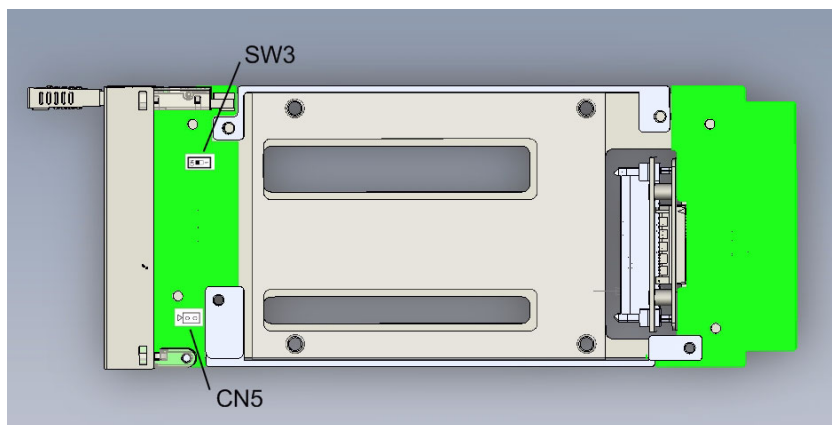
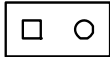



Figure 2.2 SW3 and CN5 Locations

2.3.2 Logical Ground and Chassis Ground

By default, the logical ground is separated from the chassis ground (EMI shielding and ESD stripe). However, they can be brought together by closing CN5.

Table 2.7: CN5 Settings

Default	Logical Ground Chassis Ground Separate	
	Open	
	Logical Ground Chassis Ground Connected	
	Closed	

2.4 AMC Connector Interface

The edge connector and its pin assignment on the MIC-5401 are compliant to the AMC base specification (AMC.0 Rev2.0) and the AMC specification for storage (AMC.3 Rev1.0). The use of the common options and fat pipe regions are outlined below:

Table 2.8: AMC Port Mapping

AMC Port #	Region	Implementation	Connected to (SAS HDD)	Connected to (SATA HDD)
0		unused		
1	Common options	unused		
2		SAS/SATA Port 0	Primary SAS port	SATA port
3		SAS/SATA Port 1	Secondary SAS port	unused
4-11	Fat pipe	unused		
12-15		unused		
16	Extended options	unused		
17-18		unused		
19-20		unused		
CLK1		unused		
CLK2	Clock	unused		
CLK3		unused		

Chapter 3

Hard Disk Drive Installation

The MIC-5401 is normally delivered without the hard disk drive in place. To install a 2.5" hard disk drive on the AMC module, follow the instructions described below.

Caution! To avoid ESD damages to the components on the AMC module or the connected system, always wear an ESD wrist strap when handling the units.



Note! Make sure there are four countersink flat-head screws (M3 x 4) in the product packaging. They are for fastening the hard disk drive to the MIC-5401 module.



3.1 Installing the Hard Disk Drive

1. Position the hard disk drive above the metal bracket on the primary side of the MIC-5401 AMC module, with the HDD gently tilted towards the SAS/SATA connector on the AMC PCB. (see Figure 3.1).

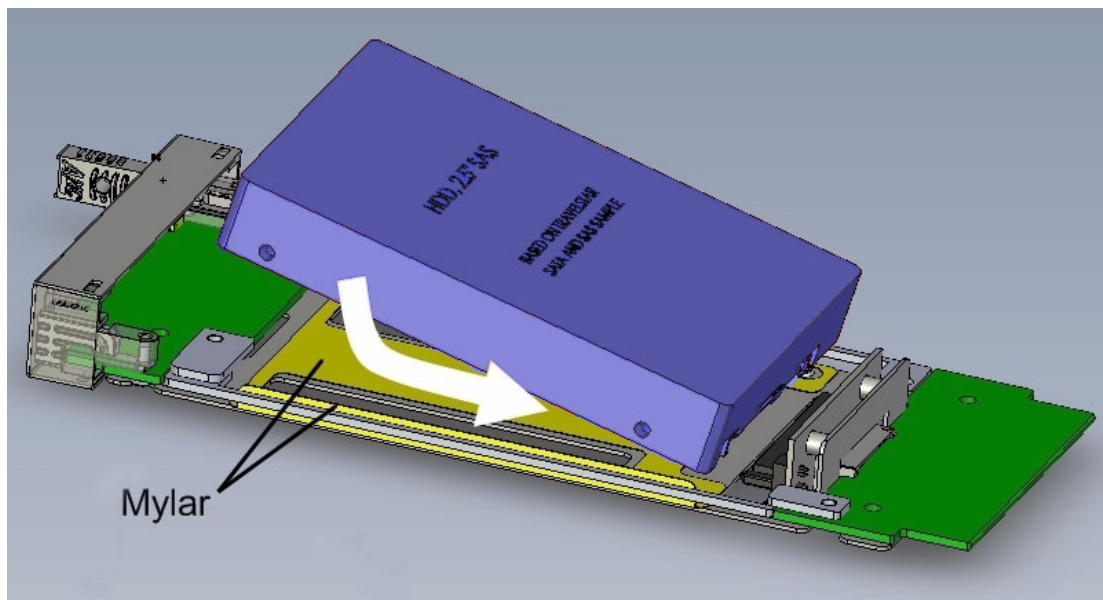


Figure 3.1 Aligning the HDD with the SAS/SATA connector

Note! The L-shaped Mylar sheet prevents electro-static discharge from the HDD to the metal bracket, and vice versa. Make sure both the bottom and the right hand sides of the HDD are in contact with the Mylar sheet.



2. Lower the HDD down to the bracket and gently advance it onto the SAS/SATA connector to full engagement (see Figure 3.2).

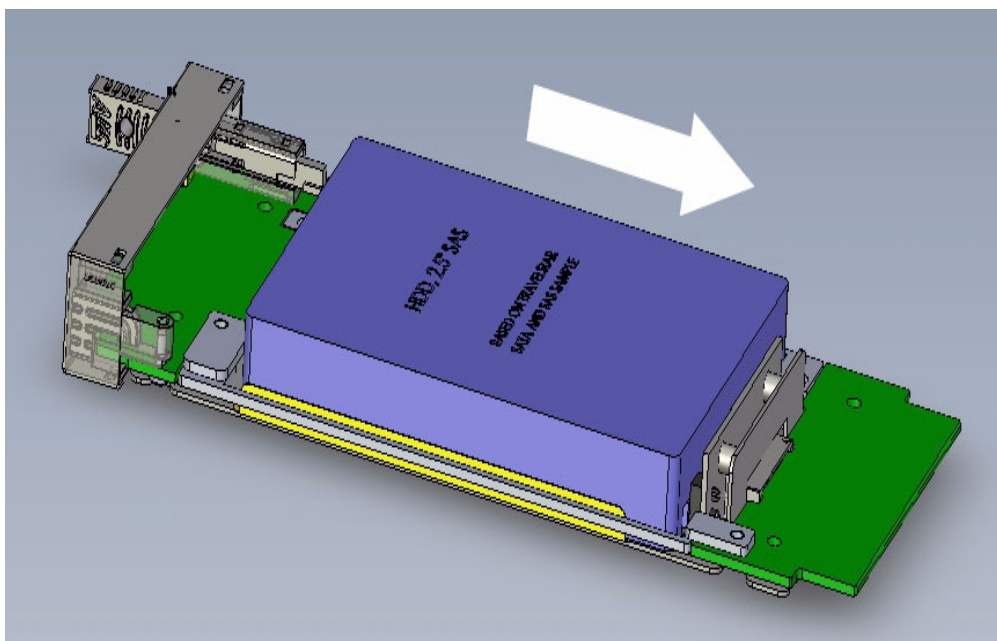


Figure 3.2 Engaging the HDD with the SAS/SATA connector

3. Use the four countersunk flat head screws (M3 x 4) to fasten the HDD to the metal bracket (see Figure 3.3). Tighten the screws so that their heads are flush with the bracket.

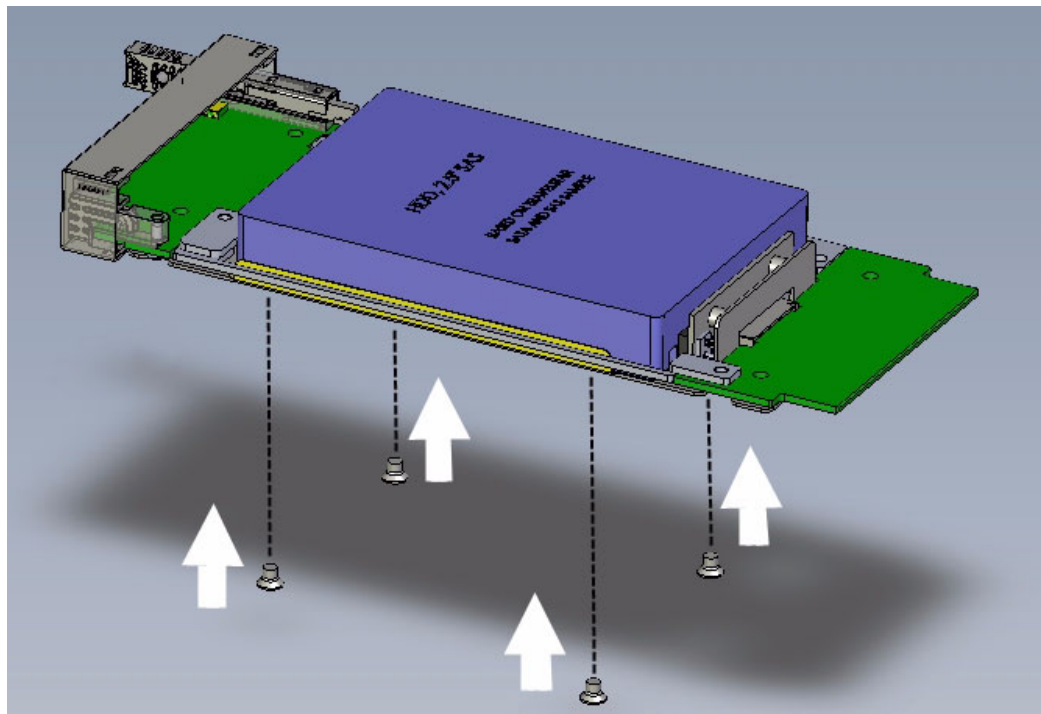


Figure 3.3 Attaching the HDD to the metal bracket

Note! Recommended torque value for tightening the screws = $4.2 \pm 0.5 \text{ kgf} \cdot \text{cm}$



-
4. Use switch SW3 to set the appropriate HDD type (refer to “SAS/SATA Mode Selection” on page 12).
 5. Install the MIC-5401 module in the AMC bay.
 6. Optional: Reset the HDD on-time counter via the Clear HDD On-Time command (This is recommended any time the hard disk drive is replaced).

Chapter 4

MMC Firmware Upgrade

4.1 HPM.1 Upgrade Support

The MMC firmware upgrade implementation is based on the HPM.1, IPM Controller Firmware Upgrade Specification, Revision 1.0. The MMC firmware supports three upgradeable components: the firmware, the FRU Info and the Boot Loader.

4.1.1 Firmware Component

The firmware component maintains two partitions in Flash. One is used as an active partition that firmware runs from, and the second partition is used as a backup. When the MMC firmware is to be upgraded, the backup partition is used for storing the upgraded version of the MMC firmware. In case of an unsuccessful firmware upgrade or a self test failure, the firmware component automatically rolls back to the old firmware version. The firmware component can also be manually rolled back to the old firmware using the HPM.1 Manual Firmware Rollback command.

Advantech will provide bug fixes, updates and new features through firmware component HPM.1 images.

4.1.2 FRU Info Component

The FRU Info component allows for upgrading the MIC-5401 FRU Information. This possibility is provided to facilitate firmware upgrades that involve changing the FRU Information. Due to this limited usage, the FRU Info component does not have its own revision property. When the Get Component Upgrade Properties command is used to query the revision of this component, the revision of the firmware component is returned. The FRU Info component is the only HPM.1 component that is located in EEPROM rather than Flash.

4.1.3 Boot Loader Component

Located at the end of the program memory (in the Boot Loader section) is a small software component called Boot Loader, which is responsible for several important tasks related to MMC boot and update processes. The Boot Loader HPM.1 component allows for upgrading the Boot Loader. However, there is no backup copy of the Boot Loader and if for any reason the Boot Loader upgrade procedure fails, the MMC firmware becomes non-functional after reboot and must be reprogrammed over JTAG or SPI. Therefore Advantech do not plan to release boot loader updates for end customers.

4.2 HPM.1 Upgrade Process Overview

The MMC upgrade procedure is managed by external software referred to as Upgrade Agent. The upgrade procedure includes the following stages:

1. **Preparation stage:** The target MMC is identified, and its compatibility with the Upgrade Agent and the Upgrade Image is validated.
2. **Upgrade stage:** A backup copy of the active MMC firmware is created, and the component image is uploaded and written into flash memory.
3. **Activation step:** The recently uploaded component is activated (this step can be deferred and performed later for the firmware component). During the activation process, the previous partition becomes the backup, and after rebooting the Boot Loader passes control to the upgraded firmware.

4.3 HPM.1 Upgrade with IPMItool

Although most HPM.1 compliant update tools are supposed to work with the Advantech MIC-5401, we recommend using the free IPMItool, available in both Windows and Linux versions.

The most convenient way to update is to use an Ethernet connection to a Shelf Manager. To access the MMC, the following parameters should be specified in the command line of the IPMItool utility:

```
ipmitool -I lan -H <ShIP> -T <IPMC> -B 0 -t <MMC> -b 7 -A <auth> hpm upgrade <img>
```

- `-I lan` instructs the IPMItool to use Ethernet for communications with the MMC.
- `-H <ShIP>` specifies the IP address of the Shelf Manager
- `-T <IPMC>` specifies the remote transit address (IPMB-0 address of the carrier IPMC) to which requests should be bridged by the Shelf Manager.
- `-B 0` specifies the remote transit channel (with 0 designating IPMB-0) to which requests should be bridged by the Shelf Manager.
- `-t <MMC>` specifies the remote target address (IPMB-L address of the MMC) to which requests should be bridged by the carrier IPMC.
- `-b 7` specifies the remote target channel (with 7 designating IPMB-L) to which requests should be bridged by the carrier IPMC.
- `-A <auth>` forces the IPMItool to use a specific authentication type (NONE, PASSWORD, MD2, MD5 or OEM), which must be supported by the Shelf Manager.
- `hpm upgrade ` performs upgrade with HPM.1 image

An example of complete command line is as follows:

```
ipmitool -I lan -H 192.168.16.17 -T 0x82 -B 0 -t 0x72 -b 7 -A NONE hpm upgrade hpm1fw.img
```

A previously uploaded component must be activated using the following command (it will return an error if no component has been downloaded before):

```
ipmitool -I lan -H <ShIP> -T <IPMC> -B 0 -t <MMC> -b 7 -A <auth> hpm activate
```

Note! *Update and activation stages can also be performed by issuing one command:*



```
ipmitool -I lan -H <ShIP> -T <IPMC> -B 0 -t <MMC> -b 7 -A <auth> hpm upgrade <img> activate
```

The firmware component can also be manually rolled back to the old firmware using the following command (it will return an error if no backup firmware partition is available):

```
ipmitool -I lan -H <ShIP> -T <IPMC> -B 0 -t <MMC> -b 7 -A <auth> hpm rollback
```

Please refer to IPMItool documentation for more details.

4.4 MMC Boot Process Overview

The MMC firmware boot process includes the following steps:

1. The Boot Loader reads the partition status byte and determines the active partition.
2. The Boot Loader calculates the checksum of the active firmware partition. If the checksum is not valid or if the active partition has a "boot failed" flag set up, the Boot Loader activates the backup firmware partition (if its checksum is valid).
3. The Boot Loader writes a partition status byte back to the EEPROM if necessary.
4. The Boot Loader passes control to the active firmware partition by calling its entry point.

Chapter 5

Known Limitations

5.1 HDD Activity Signal

Some manufacturers may not implement the HDD activity signal in their disk drive's connector pinout, P11. If such a disk drive is used on the MIC-5401, LED 2 on the AMC's front panel will not be on or blinking when the HDD is operating.

Consult your HDD's product manual for the definition of the connector pinout, P11. If it is reserved, there will be no indication for HDD activity on the AMC's front panel LED.

Appendix **A**

**IPMI/PICMG Command
Subset Supported by
the MMC**

A.1 IPMI/PICMG Command Subset Supported by the MMC

Command	Specification Ref.	NetFn	CMD
IPM Device "Global" Commands			
Get Device ID	IPMI 17.1	App	0x01
Cold Reset	IPMI 17.2	App	0x02
Warm Reset	IPMI 17.3	App	0x03
Broadcast "Get Device ID"	IPMI 17.9	App	0x01
Event Commands			
Set Event Receiver	IPMI 23.1	S/E	0x00
Get Event Receiver	IPMI 23.2	S/E	0x01
Platform Event Message	IPMI 23.3	S/E	0x02
Sensor Device Commands			
Get Device SDR Info	IPMI 29.2	S/E	0x20
Get Device SDR	IPMI 29.3	S/E	0x21
Reserve Device SDR Repository	IPMI 29.4	S/E	0x22
Get Sensor Reading Factors	IPMI 29.5	S/E	0x23
Set Sensor Hysteresis	IPMI 29.6	S/E	0x24
Get Sensor Hysteresis	IPMI 29.7	S/E	0x25
Set Sensor Threshold	IPMI 29.8	S/E	0x26
Get Sensor Threshold	IPMI 29.9	S/E	0x27
Set Sensor Event Enable	IPMI 29.10	S/E	0x28
Get Sensor Event Enable	IPMI 29.11	S/E	0x29
Get Sensor Event Status	IPMI 29.13	S/E	0x2B
Get Sensor Reading	IPMI 29.14	S/E	0x2D
Get Sensor Type	IPMI 29.16	S/E	0x2F
FRU Device Commands			
Get FRU Inventory Area Info	IPMI 28.1	Storage	0x10
Read FRU Data	IPMI 28.2	Storage	0x11
Write FRU Data	IPMI 28.3	Storage	0x12
AdvancedTCA Commands			
Get PICMG Properties	PICMG 3.0 3-9	PICMG	0x00
FRU Control	PICMG 3.0 3-22	PICMG	0x04
FRU Control Capabilities	PICMG 3.0 3-24	PICMG	0x1E
Get FRU LED Properties	PICMG 3.0 3-24	PICMG	0x05
Get LED Color Capabilities	PICMG 3.0 3-25	PICMG	0x06
Set FRU LED State	PICMG 3.0 3-26	PICMG	0x07
Get FRU LED State	PICMG 3.0 3-27	PICMG	0x08
Get Device Locator Record ID	AMC.0 3-47	PICMG	0x0D
AdvancedMC Commands			
Set AMC Port State	AMC.0 3-27	PICMG	0x19
Get AMC Port State	AMC.0 3-28	PICMG	0x1A
HPM.1 Commands			
Get Target Upgrade Capabilities	HPM.1 3-3	PICMG	0x2E
Get Component Properties	HPM.1 3-5	PICMG	0x2F
Abort Firmware Upgrade	HPM.1 3-15	PICMG	0x30

Initiate Upgrade Action	HPM.1 3-8	PICMG	0x31
Upload Firmware Block	HPM.1 3-9	PICMG	0x32
Finish Firmware Upload	HPM.1 3-10	PICMG	0x33
Activate Firmware	HPM.1 3-11	PICMG	0x35
Query Rollback Status	HPM.1 3-13	PICMG	0x37
Initiate Manual Rollback	HPM.1 3-14	PICMG	0x38
Advantech OEM Commands			
Read HDD On-Time	MIC-5401	OEM	0x01
Clear HDD On-Time	MIC-5401	OEM	0x02
Write HDD On-Time	MIC-5401	OEM	0x03

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