

AIC[®]

BMC

Update FRU Guide

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Document Release History

Release Date	Version	Update Content
2025/11/17	1.0	Initial release for using the "ipmitool fru edit" and raw command to update the FRU.
2025/11/27	1.1	Updated the "Notes and Recommendations" section of "5.2 Edit FRU Field in FRU.bin".
2025/11/28	1.2	1. Added some permissions description to Chapter "2. Requirements". 2. Added Chapter "7. Batch Writing FRU Data via Linux Script" 3. Added Chapter "8. Warranty Notice"

1. Introduction

This document provides guidance on how to update and manage Field Replaceable Unit (FRU) data within the BMC firmware environment.

It explains the relationship between FRU.bin, EEPROM, and the IPMI OEM commands used to synchronize FRU data between temporary and permanent storage.

The procedures in this guide are intended for developers, factory engineers, and advanced users who need to modify or verify FRU information on AIC platforms.

2. Requirements

Before performing any FRU update, ensure the following prerequisites are met:

- **BMC access** (via SSH, serial console, or local command line).
- **BMC administrator privileges.**
- **ipmitool** installed on your host or target system. Use ipmitool **v1.8.19** or later.
- **FRU_Write_Password** (**AIC_Factory** or **AIC_Customer** permission).
 - **The FRU_Write_Password is confidential. It must be requested from AIC via email.**
 - **AIC_Factory** permission: Full write access (all FRU fields).
 - **AIC_Customer** permission: Restricted write access (excluding Chassis Serial Number and Board Serial Number).

3. How to Download ipmitool

For Linux

You can install ipmitool using the package manager of your distribution:

Ubuntu / Debian:

```
$ sudo apt update  
$ sudo apt install ipmitool
```

CentOS / RHEL:

```
$ sudo yum install ipmitool
```

For Windows:

Search the internet for compiled ipmitool executables. For example:

<https://www.dannynieuwenhuis.nl/download-windows-ipmitool-exe-version-1-8-19/>

<https://www.ieisystem.com/qa/tool/14632.html>

4. FRU / EEPROM Design Overview

4.1 Data Storage Design

- The **EEPROM** stores all permanent FRU field data.
- The **FRU.bin** file serves as a *temporary working copy* that exists in the BMC runtime.

4.2 Data Flow

1. At BMC Boot:

- The BMC copies all FRU data from EEPROM into FRU.bin.
- FRU.bin is used for all runtime operations and is stored in temporary storage.
- FRU.bin will be lost after a power cycle or full shutdown.

2. During BMC Operation:

- When executing `ipmitool fru edit` commands, all modifications are applied **only to FRU.bin**.
- EEPROM remains unchanged at this stage.

3. To Make Changes Persistent:

- You must explicitly execute the IPMI OEM command **Secure_Write_FRU**. This command writes the updated FRU.bin contents back into the EEPROM.
- After this step, the modified FRU fields become **permanent** and will survive BMC resets.

4. After BMC Reset:

- Upon reboot, the BMC again loads FRU.bin from EEPROM.
- The previously updated data is now reloaded and reflected in the system.

4.3 Summary Diagram

Phase	Source	Target	Description
Boot	EEPROM	FRU.bin	Copy EEPROM data to temporary working file
Runtime	FRU.bin	—	ipmitool fru edit : modifies this temporary working file
Commit	FRU.bin	EEPROM	IPMI OEM command Secure_Write_FRU : Writes FRU.bin to EEPROM
Reboot	EEPROM	FRU.bin	Reloads persistent data into runtime memory

Note:

1. All runtime FRU edits are *volatile* until explicitly committed to EEPROM using the IPMI OEM command **Secure_Write_FRU**.

5. Command Overview

5.1 View FRU Information (Standard IPMI FRU Commands)

Displays all FRU field data currently stored in **FRU.bin** (temporary working file).

This command is **read-only** and does not modify FRU content.

Command Syntax:

```
$ ipmitool -I lanplus -H <BMC_IP> -U <BMC_USER> -P <BMC_PASSWORD> fru print  
[FRU_ID]
```

Example Output:

```
D:\Tools\ipmitool-v1.8.18>ipmitool -I lanplus -H 192.168.121.57 -U admin -P admin123 fru print  
FRU Device Description : Builtin FRU Device (ID 0)  
Chassis Type          : Rack Mount Chassis  
Chassis Part Number   : XP1-S201SU03D01  
Chassis Serial        : 515-24120500300003  
Board Mfg Date        : Tue Nov 5 18:10:00 2024  
Board Mfg             : AIC  
Board Product         : SIRIUS  
Board Serial          : BMB-DPG0000AC01  
Board Part Number     : 11444-2444-00004  
Product Manufacturer  : AIC  
Product Name          : SB201-SU  
Product Part Number   : XP1-S201SU03D01  
Product Version       : 01  
Product Serial        : 515-24120500300003  
Product Asset Tag     : 01
```

5.2 Edit FRU Field in FRU.bin (Standard IPMI FRU Commands)

This command edits a specific FRU field stored in **FRU.bin** (not in EEPROM).

Changes are temporary – they will be lost after a BMC reset unless committed to EEPROM using the OEM command **Secure_Write_FRU**.

Command Syntax:

```
$ ipmitool -I lanplus -H <BMC_IP> -U <BMC_USER> -P <BMC_PASSWORD> fru edit  
<FRU_ID> field <SECTION> <FIELD_INDEX> <NEW_STRING>
```

Notes and Recommendations:

1. <NEW_STRING> Maximum Length (24 bytes)

Each FRU field supports a maximum of **24 bytes**. If the field exceeds this limit, writing to EEPROM will fail.

2. <NEW_STRING> Minimum String Length Requirement (≥ 2 Bytes, No Empty Strings)

Type Code 3 (11b) fields require **at least 2 bytes** if data is present.

Per the IPMI FRU specification, a zero-length field is interpreted as not present, and the BMC removes the field from the FRU structure.

Empty strings ("") produce zero-length fields, which the BMC interprets as not present, causing:

- Missing FRU fields in `ipmitool fru print`
- BIOS/Redfish parsing errors
- Factory or RMA validation issues

Recommendation:

Do not use empty strings. When a “blank” value is required, write at least two characters, such as " " (two spaces) or "--", to ensure compatibility with Type Code 3 (11b) requirements.

3. Known issues with ipmitool

Editing strings of different lengths may trigger **FRU Area offset incorrect**.

Recommendation: Always write all fields <NEW_STRING> as **fixed 24-byte strings** for reliable `ipmitool fru edit` operation.

4. Restricted Fields (Do Not Modify)

Customers **must not overwrite** the following FRU fields, as doing so may void product warranty or impact RMA (Return Material Authorization) eligibility.

- Board Serial Number
- Chassis Serial Number

Parameter Explanation:

Parameter	Description
<BMC_IP>	IP address of the target BMC.
<BMC_USER>	Username for IPMI authentication.
<BMC_PASSWORD>	Password for the specified BMC user account.
<FRU_ID>	FRU Device ID. 0: Mainboard FRU
<SECTION>	Section shorthand: c: Chassis Info b: Board Info p: Product Info
<FIELD_INDEX>	Field index (0-based, per section)
<NEW_STRING>	New string value (2 ~ 24 bytes)

Field Mapping Reference:

This section provides the mapping between ipmitool fru edit command parameters and the actual FRU field names defined in the IPMI FRU specification.

<SECTION>	<FIELD_INDEX>	FRU Field Name
c	0	Chassis Part Number
c	1	Chassis Serial Number
b	0	Board Manufacturer
b	1	Board Product Name
b	2	Board Serial Number
b	3	Board Part Number
p	0	Product Manufacturer
p	1	Product Name
p	2	Product Part Number
p	3	Product Version
p	4	Product Serial Number
p	5	Product Asset Tag

Example:

Update Chassis Part Number(**field c 0**) = "CPN-123"

```
$ ipmitool -I lanplus -H 192.168.121.57 -U admin -P admin123 fru edit 0 field c 0 "CPN-123"
```

5.3 Edit Manufacturing Date Field in FRU.bin (IPMI OEM Commands)

Standard IPMI FRU Commands does not support modifying the **Board Manufacturing Date (Mfg Date Time)** field.

This OEM command updates the **Board Manufacturing Date (Mfg Date Time)** field in **FRU.bin**.

Set_FRU_Mfg_Date Command Syntax:

```
$ ipmitool -I lanplus -H <BMC_IP> -U <BMC_USER> -P <BMC_PASSWORD> raw 0x3A 0xF0 <FRU_ID> <MFG_DATE_BYTE0> <MFG_DATE_BYTE1> <MFG_DATE_BYTE2>
```

Notes:

- This command updates **FRU.bin only** (not EEPROM).
- **MFG_DATE (Board Manufacturer Date)** is 3-byte "minutes since 1/1/96 UTC" format, per IPMI FRU spec.
- To make the update persistent, you must later execute the IPMI OEM command **Secure_Write_FRU**.
- For background information, refer to *FRU/EEPROM Design Overview* section.

Special Note on Board Manufacturer Date:

1. Format is 3 bytes, little-endian (LSB first).
2. Unit: Minutes since base date: 1996-01-01 00:00:00 UTC.
3. Maximum representable timestamp: 2027-11-24 20:15 UTC
4. Handling of Out-of-Range Dates:
 - The sender **MUST** check whether the provided timestamp exceeds the maximum supported time (2027-11-24 20:15 UTC).
 - If the time is after this maximum, the field value **MUST** be written as 0x00 0x00 0x00, which is interpreted as "unspecified" per IPMI FRU specification.

11. Board Info Area Format

Table 11-1, BOARD INFO AREA

field length	field
1	Board Area Format Version 7:4 - reserved, write as 0000b 3:0 - format version number = 1h for this specification.
1	Board Area Length (in multiples of 8 bytes)
1	Language Code (See section 15)
3	Mfg. Date / Time Number of minutes from 0:00 hrs 1/1/96. LSbyte first (little endian) 00_00_00h = unspecified.
1	Board Manufacturer type/length byte
P	Board Manufacturer bytes
1	Board Product Name type/length byte
Q	Board Product Name bytes
1	Board Serial Number type/length byte*
N	Board Serial Number bytes*
1	Board Part Number type/length byte
M	Board Part Number bytes
1	FRU File ID type/length byte*
R	FRU File ID bytes* The FRU File version field is a pre-defined field provided as a manufacturing aid for verifying the file that was used during manufacture or field update to load the FRU information. The content is manufacturer-specific. This field is also provided in the Product Info area. Either or both fields may be 'null'.
xx	Additional custom Mfg. Info fields. Defined by manufacturing. Each field must be preceded by a type/length byte
1	C1h (type/length byte encoded to indicate no more info fields).
Y	00h - any remaining unused space
1	Board Area Checksum (zero checksum)

* These areas are always encoded as if the Language Code were English.

Example Calculation:

- Epoch time of 1996-01-01 00:00:00 UTC = 820454400 seconds
- Epoch time of 2024-05-24 01:57:00 UTC = 1716515820 seconds
- $(1716515820 - 820454400) / 60 = \mathbf{14934357 \text{ minutes} = 0xE3E155}$

Example:

```
$ ipmitool -H 192.168.121.57 -U admin -P admin123 -I lanplus raw 0x3A 0xF0 0x00 0x55 0xE1 0xE3
```

Explanation:

- **raw 0x3A 0xF0**: Use IPMI OEM command **Set_FRU_Mfg_Date**
- **0x00**: Mainboard FRU (FRU Device ID)
- **0x55 0xE1 0xE3**: Manufacturing Date (LSB first)

5.4 Commit FRU.bin to EEPROM (IPMI OEM Commands)

This OEM command writes all FRU data from **FRU.bin** back to **EEPROM** to make modifications permanent.

It requires a valid **FRU_Write_Password** and supports two permission levels:

- **AIC_Factory**: Full write access (all FRU fields).
- **AIC_Customer**: Restricted write access (excluding Chassis Serial Number and Board Serial Number).

The **FRU_Write_Password** is confidential. It must be requested from AIC via email.

Secure_Write_FRU Command Syntax:

```
$ ipmitool -I lanplus -H <BMC_IP> -U <BMC_USER> -P <BMC_PASSWORD> raw 0x3A  
0xF1 <FRU_ID> <FRU_Write_Password BYTES...>
```

Notes:

- After five consecutive invalid password attempts, the command is disabled until the next BMC restart.
- Completion codes follow the IPMI specification:
 - 0x00: Success
 - 0xC4: Out of space (FRU field > 24 bytes)
 - 0xCC: Invalid data field (wrong password)
 - 0xC9: Parameter out of range (invalid length)
 - 0xD5: Operation not supported (too many password failures)
 - 0xFF: Unspecified error
- For information on how FRU, FRU.bin, and EEPROM interact, please refer to *FRU/EEPROM Design Overview* section.

6. View/Edit FRU Examples

6.1 View FRU Information

```
$ ipmitool -I lanplus -H 192.168.121.57 -U admin -P admin123 fru print
```

```
D:\Tools\ipmitool-v1.8.18>ipmitool -I lanplus -H 192.168.121.57 -U admin -P admin123 fru print
FRU Device Description : Builtin FRU Device (ID 0)
Chassis Type          : Rack Mount Chassis
Chassis Part Number   : XP1-S201SU03D01
Chassis Serial        : 515-24120500300003
Board Mfg Date        : Tue Nov  5 18:10:00 2024
Board Mfg              : AIC
Board Product          : SIRIUS
Board Serial           : BMB-DPG0000AC01
Board Part Number      : 11444-2444-00004
Product Manufacturer   : AIC
Product Name           : SB201-SU
Product Part Number    : XP1-S201SU03D01
Product Version        : 01
Product Serial         : 515-24120500300003
Product Asset Tag      : 01
```

6.2 Edit FRU field in FRU.bin

6.2.1 Chassis Information

```
# Chassis Part Number (c 0) = "CPN-123"
```

```
$ ipmitool -I lanplus -H 192.168.121.57 -U admin -P admin123 fru edit 0 field c 0 "CPN-123"
```

```
# Chassis Serial Number (c 1) = "CSN-123"
```

```
$ ipmitool -I lanplus -H 192.168.121.57 -U admin -P admin123 fru edit 0 field c 1 "CSN-123"
```

6.2.2 Board Information

```
# Board Manufacturer (b 0) = "BM-123"
```

```
$ ipmitool -I lanplus -H 192.168.121.57 -U admin -P admin123 fru edit 0 field b 0 "BM-123"
```

```
# Board Product Name (b 1) = "BP-123"
```

```
$ ipmitool -I lanplus -H 192.168.121.57 -U admin -P admin123 fru edit 0 field b 1 "BP-123"
```

```
# Board Serial Number (b 2) = "BSN-123"
```

```
$ ipmitool -I lanplus -H 192.168.121.57 -U admin -P admin123 fru edit 0 field b 2 "BSN-123"
```

```
# Board Part Number (b 3) = "BPN-123"
```

```
$ ipmitool -I lanplus -H 192.168.121.57 -U admin -P admin123 fru edit 0 field b 3 "BPN-123"
```

Set_FRU_Mfg_Date Command(raw 0x3A 0xF0),

Board Mfg Date = 5/24/2024 01:57:00 (0x55 0xE1 0xE3)

```
$ ipmitool -I lanplus -H 192.168.121.57 -U admin -P admin123 raw 0x3A 0xF0 0x00 0x55 0xE1 0xE3
```

6.2.3 Product Information

Product Manufacturer (p 0) = "PM-123"

```
$ ipmitool -I lanplus -H 192.168.121.57 -U admin -P admin123 fru edit 0 field p 0 "PM-123"
```

Product Name (p 1) = "PN-123"

```
$ ipmitool -I lanplus -H 192.168.121.57 -U admin -P admin123 fru edit 0 field p 1 "PN-123"
```

Product Part Number (p 2) = "PPN-123"

```
$ ipmitool -I lanplus -H 192.168.121.57 -U admin -P admin123 fru edit 0 field p 2 "PPN-123"
```

Product Version (p 3) = "PV-123"

```
$ ipmitool -I lanplus -H 192.168.121.57 -U admin -P admin123 fru edit 0 field p 3 "PV-123"
```

Product Serial Number (p 4) = "PSN-123"

```
$ ipmitool -I lanplus -H 192.168.121.57 -U admin -P admin123 fru edit 0 field p 4 "PSN-123"
```

Product Asset Tag (p 5) = "PAT-123"

```
$ ipmitool -I lanplus -H 192.168.121.57 -U admin -P admin123 fru edit 0 field p 5 "PAT-123"
```

6.3 Commit FRU.bin to EEPROM

Secure_Write_FRU(raw 0x3A 0xF1) command, FRU_Write_Password = "1234"

```
$ ipmitool -I lanplus -H 192.168.121.57 -U admin -P admin123 raw 0x3A 0xF1 0x00 0x31 0x32 0x33 0x34
```

7. Batch Writing FRU Data via Linux Script

7.1 Editing the FRU Configuration File

Before writing to FRU, open `fru_info_factory.conf` or `fru_info_customer.conf`, and modify the field values as needed.

Each field follows a `key: "value"` format. Only valid keys are processed.

Customers should not overwrite the following FRU fields, as it affects product warranty and RMA (Return Material Authorization) eligibility.

- Board Serial Number
- Chassis Serial Number

The AIC_Customer permission **<FRU_Write_Password>** does not have permission to write to "Board Serial Number" and "Chassis Serial Number" fields.

Only the AIC_Factory permission **<FRU_Write_Password>** allows modification of these protected fields.

```
*FRU_ID*
FRU ID: "0"

*Board*
Manufacturer: "AIC"
Product Name: "SIRIUS"
Part Number: "BMB-DPG0000AC01"
Serial Number: "11444-2444-00004"
Manufacturer Date Time: "2024-11-05 10:10"

*Chassis*
Part Number: "XP1-S201SU03D01"
Serial Number: "515-24120500300003"

*Product*
Manufacturer: "AIC"
Product Name: "SB201-SU"
Part Number: "XP1-S201SU03D01"
Version: "01"
Serial Number: "515-24120500300003"
AssetTag: "01"
```

7.2 Run the script to write to the FRU data

```
# Write FRU data using configuration file. Only show the execution results.
$ ./write_fru.sh <BMC_IP> <BMC_Username> <BMC_Password>
<FRU_Write_Password> <FRU_INFO.CONF>

# Show verbose field-by-field write log
$ ./write_fru.sh <BMC_IP> <BMC_Username> <BMC_Password>
<FRU_Write_Password> <FRU_INFO.CONF> -v

# Show help
$ ./write_fru.sh -h
```

Behavior:

- Parses and writes each field from **<FRU_INFO.CONF>**
- Stops immediately on any error
- Outputs a final result: **PASS** or **FAIL**

Note:

1. The **<FRU_Write_Password>** is confidential and must be requested from AIC via email.
2. Security Restriction: After five consecutive failures using an incorrect **<FRU_Write_Password>**, the BMC firmware will disable the IPMI OEM command **Secure_Write_FRU**. A full BMC reset is required to re-enable access.
3. Regarding **<FRU_INFO.CONF>**,
 - For AIC customers, use AIC_Customer permission **<FRU_Write_Password>** and **fru_info_customer.conf**
 - For AIC factory, use AIC_Factory permission **<FRU_Write_Password>** and **fru_info_factory.conf**
4. **<FRU_INFO.CONF>** must follow the correct format and field names.
5. All FRU fields (Besides MfgDate) in this script are written using fixed 24 bytes length strings to avoid issues when using "ipmitool fru edit".
6. Board Manufacturer Date Time Format & Limitation
 - The value must follow the format: "YYYY-MM-DD HH:MM" (24-hour UTC format).
 - Internally, this field is encoded as a 3-byte little-endian integer, representing the number of minutes since 1996-01-01 00:00 UTC.
 - Dates before 1996 will result in an error and abort the write process.
 - The maximum representable date is 2027-11-24 20:15 UTC.
 - If the provided date exceeds this limit, the script will:

- Replace the value with **0x00 0x00 0x00**, which is interpreted as "Unspecified" or "Mon Jan 1 00:00:00 1996" by IPMI tools

Note: Due to IPMI's 3-byte format limitation for Manufacturer Date Time, dates beyond late 2027 cannot be precisely encoded. Setting the field to "unspecified" ensures forward compatibility without causing data corruption or invalid date displays in tools like `ipmitool fru print`.

Example:

1. Help

```
jethro@bmc3-server:~/Update_FRU$ ./write_fru.sh -h
Usage: ./write_fru.sh <BMC_IP> <BMC_Username> <BMC_Password> <FRU_Write_Password> <FRU_INFO.CONF> [-v]
      ./write_fru.sh -h

Options:
  -h, --help      Show this help message
  -v, --verbose   Show per-field write log

Examples:
  Basic usage:
    ./write_fru.sh 192.168.1.100 bmc_user bmc_pw fru_pw fru_info_customer.conf

  Verbose:
    ./write_fru.sh 192.168.1.100 bmc_user bmc_pw fru_pw fru_info_customer.conf -v
```

2. Write FRU data using configuration file

```
jethro@bmc3-server:~/Update_FRU$ ./write_fru.sh 192.168.121.57 admin admin123 [REDACTED] fru_info_factory.conf
Start writing FRU ID: 0
[✓] FRU Write Result: PASS
```

3. Show verbose field-by-field write log

```
jethro@bmc3-server:~/Update_FRU$ ./write_fru.sh 192.168.121.57 admin admin123 [REDACTED] fru_info_factory.conf -v
Start writing FRU ID: 0
Writing [Board.Manufacturer] ⇒ "AIC" (b 0)
Writing [Board.Product Name] ⇒ "SIRIUS" (b 1)
Writing [Board.Part Number] ⇒ "BMB-DPG0000AC01" (b 2)
Writing [Board.Serial Number] ⇒ "11444-2444-00004" (b 3)
Writing [Board.Manufacturer Date Time] ⇒ "0x62 0x83 0xE7" via raw 0x3c 0xf0
Writing [Chassis.Part Number] ⇒ "XP1-S201SU03D01" (c 0)
Writing [Chassis.Serial Number] ⇒ "515-24120500300003" (c 1)
Writing [Product.Manufacturer] ⇒ "AIC" (p 0)
Writing [Product.Product Name] ⇒ "SB201-SU" (p 1)
Writing [Product.Part Number] ⇒ "XP1-S201SU03D01" (p 2)
Writing [Product.Version] ⇒ "01" (p 3)
Writing [Product.Serial Number] ⇒ "515-24120500300003" (p 4)
Writing [Product.AssetTag] ⇒ "01" (p 5)
Committing FRU.bin to EEPROM...
[✓] FRU Write Result: PASS
```

4. Using wrong <FRU_Write_Password>

```
jethro@bmc3-server:~/Update_FRU$ ./write_fru.sh 192.168.121.57 admin admin123 test_pw fru_info_factory.conf
Start writing FRU ID: 0
x Error: ipmitool command failed: ipmitool -H 192.168.121.57 -I lanplus -U admin -P admin123 raw 0x3A 0xF1 0 0x74 0x65 0x73 0x74 0x5F 0x70 0x77
x Failed to write FRU.bin to EEPROM. Your password may be incorrect.
x FRU Write Result: FAIL
```

8. Warranty Notice

Customers should not overwrite the following FRU fields:

- Board Serial Number
- Chassis Serial Number

These fields are pre-programmed at the factory and uniquely identify the hardware for warranty and service tracking.

If **Customers** manually modify or overwrite either of these fields, AIC will not provide product warranty or accept RMA (Return Merchandise Authorization) requests.