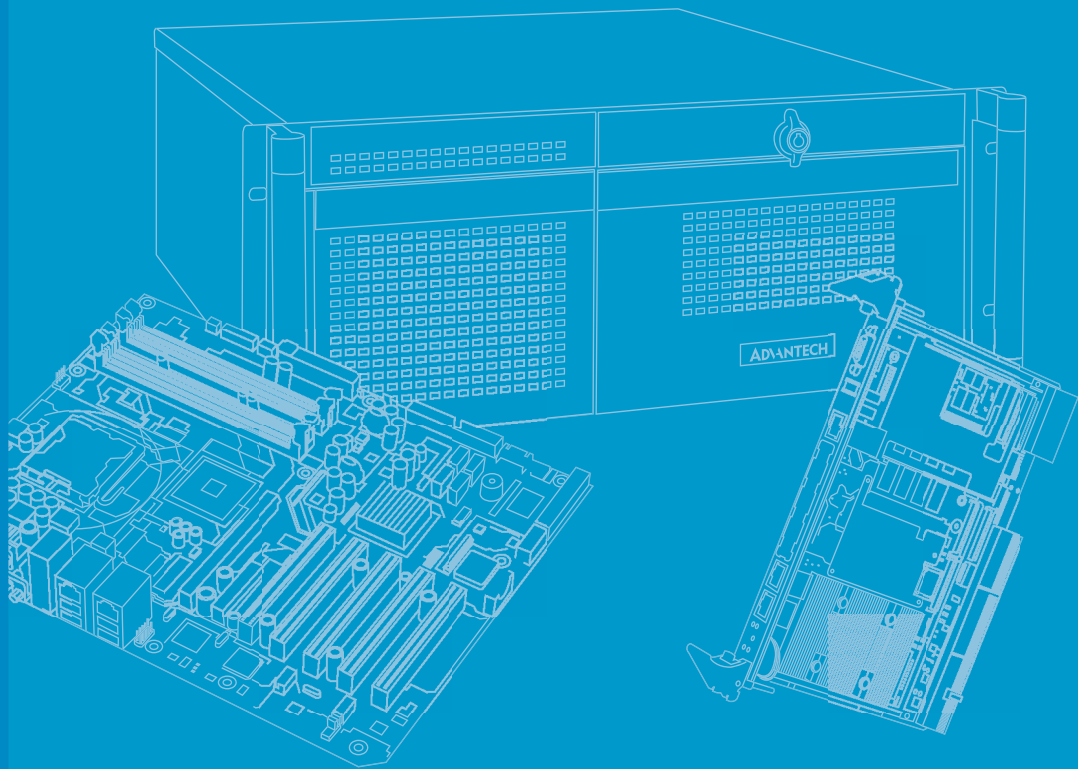




# User Manual

## MIC-715-OX

**Ruggedized AI Inference System  
Based on NVIDIA® Jetson Orin  
NX**

強固型 AI 推理系統，搭配  
NVIDIA® Jetson Orin NX  
強固型 AI 推理系統，搭配  
NVIDIA® Jetson Orin NX

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*Enabling an Intelligent Planet*

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Part No./ 料号 / 料號 2002071500 Edition 2

Printed in Taiwan

September 2024

## Product Warranty (2 Years) / 产品质量保证（两年） / 產品品質保證（兩年）

Advantech warrants the original purchaser that each of its products will be free from defects in materials and workmanship for two years from the date of purchase.

This warranty does not apply to any products that have been repaired or altered by persons other than repair personnel authorized by Advantech, or products that have been subject to misuse, abuse, accident, or improper installation. Advantech assumes no liability under the terms of this warranty as a consequence of such events.

Because of Advantech's high quality-control standards and rigorous testing, most customers never need to use our repair service. If an Advantech product is defective, it will be repaired or replaced free of charge during the warranty period. For out-of-warranty repairs, customers will be billed according to the cost of replacement materials, service time, and freight. Please consult your dealer for more details.

If you believe your product is defective, follow the steps outlined below.

1. Collect all the information about the problem encountered. (For example, CPU speed, Advantech products used, other hardware and software used, etc.) Note anything abnormal and list any onscreen messages displayed when the problem occurs.
2. Call your dealer and describe the problem. Please have your manual, product, and any helpful information readily available.
3. If your product is diagnosed as defective, obtain a return merchandise authorization (RMA) number from your dealer. This allows us to process your return more quickly.
4. Carefully pack the defective product, a completed Repair and Replacement Order Card, and a proof of purchase date (such as a photocopy of your sales receipt) into a shippable container. Products returned without a proof of purchase date are not eligible for warranty service.
5. Write the RMA number clearly on the outside of the package and ship the package prepaid to your dealer.

从购买之日起，研华为原购买商提供两年的产品质量保证。但对那些未经授权的维修人员维修过的产品并不进行质量保证。研华对于不正确的使用、灾难、错误安装产生的问题有免责权利。

如果研华产品出现故障，在质保期内我们提供免费维修或更换服务。对于出保产品，我们将会酌情收取材料费、人工服务费用。请联系您的销售人员了解详细情况。

如果您认为您购买的产品出现了故障，请遵循以下步骤：

1. 收集您所遇到的问题的信息（例如，CPU 主频、使用的研华产品及其它软件、硬件等）。请注意屏幕上出现的任何不正常信息显示。
2. 打电话给您的供货商，描述故障问题。请借助手册，产品和任何有帮助的信息。
3. 如果您的产品被诊断发生故障，请从您的供货商那里获得 RMA (Return Material Authorization) 序列号。这可以让我们尽快的进行故障产品的回收。
4. 请仔细的包装故障产品，并在包装中附上完整的售后服务卡片和购买日期证明（如销售发票）。我们对无法提供购买日期证明的产品不提供质量保证服务。
5. 把相关的 RMA 序列号写在外包装上，并将其运送给销售人员。

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如果研華產品出現故障，在保固期內我們提供免費維修或更換服務。對於保固外產品，我們將會酌收材料費、人工服務費用。請聯繫您的銷售人員瞭解詳細情況。

如果您認為您購買的產品出現了故障，請遵循以下步驟：

1. 收集您所遇到的問題的資訊（例如，CPU 頻率、使用的研華產品及其它軟體、硬體等）。請注意螢幕上出現的任何不正常資訊顯示。
2. 打電話給您的供應商，描述故障問題。請參考手冊，產品和任何有幫助的資訊。
3. 如果您的產品被診斷發生故障，請從您的供應商那裏獲得 RMA (Return Material Authorization) 序號。這可以讓我們儘快的進行故障產品的回收。
4. 請仔細的包裝故障產品，並在包裝中附上完整的售後服務卡片和購買日期證明（如銷售發票）。我們對無法提供購買日期證明的產品不提供保固服務。
5. 把相關的 RMA 序號寫在外包裝上，並將其運送給銷售人員。

## Declaration of Conformity / 符合性声明 / 符合性聲明

### FCC Class A

This equipment has been tested and found to comply with the limits for a Class A 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 this event, users are required to correct the interference at their own expense.

### FCC A 级

注意：根据 FCC 规则第 15 款，本设备已经过检测并被判定符合 A 级数字设备标准。这些限制旨在为商业环境下的系统操作提供合理保护，使其免受有害干扰。本设备会产生、耗费和发射无线电频率能量，如果没有按照手册说明正确安装和使用，可能会对无线电通讯造成有害干扰。此时，用户需自行解决干扰问题。

### FCC A 級

注意：根據 FCC 規則第 15 款，本設備已經過檢測並被判定符合 A 級數位設備標準。這些限制旨在為商業環境下的系統操作提供合理保護，使其免受有害干擾。本設備會產生、耗費和發射無線電頻率能量，如果沒有按照手冊說明正確安裝和使用，可能會對無線電通訊造成有害干擾。此時，用戶需自行解決干擾問題。

## Packing List / 包装清单 / 包裝清單

Before system installation, check that the items listed below are included and in good condition. If any item does not accord with the list, contact your dealer immediately.

- MIC-715-OX4A1
- 1 x User manual (download)
- 1 x China RoHS
- 1 x Micro USB cable
- 1 x Waterproof 6-pin cable
- 2 x Mini PCIe screw + 1 x M.2 screw

安裝之前，用戶需確認包裝中含有下面所列各項。

- MIC-715-OX4A1
- 1 x China RoHS 文件
- 1 x 用戶手冊（在線下載）
- 1 x Micro USB 線材
- 1 x 防水 6-pin 電源線
- 2 x Mini PCIe 螺絲 + 1 x M.2 螺絲

安裝之前，用戶需確認包裝中含有下面所列各項。

- MIC-715-OX4A1
- 1 x China RoHS
- 1 x 使用手冊（線上下載）
- 1 x Micro USB 線
- 1 x 防水 6-pin 電源線
- 2 x Mini PCIe 螺絲 + 1 x M.2 螺絲

## Product Information / 产品信息 / 產品資訊

For more information on this and other Advantech products, please visit our website at:

<http://www.advantech.com>

For technical support and service, please visit our support website for MIC-715-OX at:

[https://www.advantech.com/zh-tw/products/965e4edbf98-429e-89ed-9a0a8435a7be/mic-715-ox/mod\\_97a36574-38e0-40f4-9a80-560bba9413eb](https://www.advantech.com/zh-tw/products/965e4edbf98-429e-89ed-9a0a8435a7be/mic-715-ox/mod_97a36574-38e0-40f4-9a80-560bba9413eb)

Register your products on our website and get 2 months extra warranty for free at:

<http://www.register.advantech.com>

如需本产品或研华其它产品的更多信息，请访问我们的网站：

<http://www.advantech.com>

如需技术支持与服务，请访问 AI 的技术支持网站：

[https://www.advantech.com/zh-tw/products/965e4edbf98-429e-89ed-9a0a8435a7be/mic-715-ox/mod\\_97a36574-38e0-40f4-9a80-560bba9413eb](https://www.advantech.com/zh-tw/products/965e4edbf98-429e-89ed-9a0a8435a7be/mic-715-ox/mod_97a36574-38e0-40f4-9a80-560bba9413eb)

请在网站上注册您的产品并免费获取 2 个月的延长质保：

<http://www.register.advantech.com>

如需本產品或研華其它產品的更多資訊，請訪問我們的網站：

<http://www.advantech.com>

如需技術支援與服務，請訪問 MIC-720AI 的技術支援網站：

[https://www.advantech.com/zh-tw/products/965e4edbf98-429e-89ed-9a0a8435a7be/mic-715-ox/mod\\_97a36574-38e0-40f4-9a80-560bba9413eb](https://www.advantech.com/zh-tw/products/965e4edbf98-429e-89ed-9a0a8435a7be/mic-715-ox/mod_97a36574-38e0-40f4-9a80-560bba9413eb)

請在網站上註冊您的產品並免費獲取得 2 個月的延長保固：

<http://www.register.advantech.com>

## Safety Instructions / 安全指示

1. Read these safety instructions carefully.
2. Retain this user manual for future reference.
3. Disconnect the equipment from all power outlets before cleaning. Use only a damp cloth for cleaning. Do not use liquid or spray detergents.
4. For pluggable equipment, the power outlet socket must be located near the equipment and easily accessible.
5. Protect the equipment from humidity.
6. Place the equipment on a reliable surface during installation. Dropping or letting the equipment 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. Ensure that the voltage of the power source is correct before connecting the equipment to a power outlet.
9. Position the power cord away from high-traffic areas. 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 from transient overvoltage.
12. Never pour 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 any of the following occurs, have the equipment checked by service personnel:
  - The power cord or plug is damaged.
  - Liquid has penetrated the equipment.
  - The equipment has been exposed to moisture.
  - The equipment is malfunctioning, or does not operate according to the user manual.
  - The equipment has been dropped and damaged.
  - The equipment shows obvious signs of breakage.

**DISCLAIMER:** These instructions are provided according to IEC 704-1 standards. Advantech disclaims all responsibility for the accuracy of any statements contained herein.

1. 请仔细阅读此安全操作说明。
2. 请妥善保存此用户手册供日后参考。
3. 用湿抹布清洗设备前，请从插座拔下电源线。请不要使用液体或去污喷雾剂清洗设备。
4. 对于使用电源线的设备，设备周围必须有容易接触到的电源插座。
5. 请不要在潮湿环境中使用设备。
6. 请在安装前确保设备放置在可靠的平面上，意外跌落可能会导致设备损坏。
7. 设备外壳的开口是用于空气对流，从而防止设备过热。**请不要覆盖这些开口。**
8. 当您连接设备到电源插座上前，请确认电源插座的电压是否符合要求。
9. 请将电源线布置在人们不易绊到的位置，并不要在电源线上覆盖任何杂物。
10. 请注意设备上的所有警告标识。
11. 如果长时间不使用设备，请将其同电源插座断开，避免设备被超标的电压波动损坏。
12. 请不要让任何液体流入通风口，以免引起火灾或者短路。



13. 请不要自行打开设备。为了确保您的安全，请由经过认证的工程师来打开设备。
14. 如遇下列情况，请由专业人员来维修：
  - 电源线或者插头损坏；
  - 设备内部有液体流入；
  - 设备曾暴露在过于潮湿的环境中使用；
  - 设备无法正常工作，或您无法通过用户手册来使其正常工作；
  - 设备跌落或者损坏；
  - 设备有明显的外观破损。

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1. 請仔細閱讀此安全操作說明。
2. 請妥善保存此用戶手冊供日後參考。
3. 用濕抹布清洗設備前，請從插座拔下電源線。請不要使用液體或去污噴霧劑清洗設備。
4. 對於使用電源線的設備，設備周圍必須有容易接觸到的電源插座。
5. 請不要在潮濕環境中使用設備。
6. 請在安裝前確保設備放置在可靠的平面上，意外跌落可能會導致設備損壞。
7. 設備外殼的開口是用於空氣對流，從而防止設備過熱。請不要覆蓋這些開口。
8. 當您連接設備到電源插座上前，請確認電源插座的電壓是否符合要求。
9. 請將電源線佈置在人們不易絆到的位置，並不要在電源線上覆蓋任何雜物。
10. 請注意設備上的所有警告標識。
11. 如果長時間不使用設備，請將其同電源插座斷開，避免設備被超標的電壓波動損壞。
12. 請不要讓任何液體流入通風口，以免引起火災或者短路。
13. 請不要自行打開設備。為了確保您的安全，請由經過認證的工程師來打開設備。
14. 如遇下列情况，請由專業人員來維修：
  - 電源線或者插頭損壞；
  - 設備內部有液體流入；
  - 設備曾暴露在過於潮濕的環境中使用；
  - 設備無法正常工作，或您無法通過用戶手冊來使其正常工作；
  - 設備跌落或者損壞；
  - 設備有明顯的外觀破損。

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**警告使用者：**這是甲類資料產品，在居住的環境中使用時，可能會造成射頻干擾，在這種情況下，使用者會被要求採取某些適當的對策。

この装置は、クラス A 情報技術装置です。この装置を家庭環境で使用する  
と電波妨害を引き起こすことがあります。この場合には使用者が適切な対策  
を講ずるよう要求されることがあります。 VCCI-A

電腦配置了由電池供電的即時時鐘電路，如果電池更換不正確，將有爆炸的危險，因此只可以使用製造商推薦的同一種或者同等型號的電池進行替換。請按照製造商的指示處理舊電池。

消費者若使用電源適配器供電，則應購買配套使用獲得CCC認證並滿足標準要求的電源適配器。



## Safety Precautions – Static Electricity / 安全措施 – 静电防护 / 安全措施 – 靜電防護

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

- To avoid electrical shock, always disconnect the power from the PC chassis before manual handling. Do not touch any components on the CPU card or other cards while the PC is powered on.

为了保护您和您的设备免受伤害或损坏，请遵照以下安全措施：

- 操作设备之前，请务必断开机箱电源，以防触电。不可在电源接通时接触卡上的任何元件。

為了保護您和您的設備免受傷害或損壞，請遵照以下安全措施：

- 操作設備之前，請務必斷開主機殼電源，以防觸電。不可在電源接通時接觸板上的任何元件。

### CAUTION:

There is danger of explosion if the 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 and avoid the situations described below.

- Replacement of a battery with an incorrect type that can defeat a safeguard
- Disposal of a battery into fire or a hot oven, or mechanically crushing or cutting of a battery, that can result in an explosion.
- Leaving a battery in an extremely high temperature surrounding environment that can result in an explosion or the leakage of flammable liquid or gas.
- A battery subjected to extremely low air pressure that may result in an explosion or the leakage of flammable liquid or gas.

### ATTENTION:

Danger d'explosion si la batterie est remplacée de manière incorrecte. Remplacez uniquement avec le même type ou un type équivalent recommandé par le fabricant. Jetez les piles usagées conformément aux instructions du fabricant.

- Le remplacement d'une PILE par une pile de type incorrect peut neutraliser un SYSTÈME DE SÉCURITÉ.
- La mise au rebut d'une PILE dans le feu ou dans un four chaud, ou par écrasement ou découpe, peut entraîner une EXPLOSION.
- L'exposition d'une PILE à un environnement présentant une température extrêmement élevée peut entraîner une EXPLOSION ou une fuite de liquide ou de gaz inflammable.
- L'exposition d'une PILE à une pression d'air extrêmement faible peut entraîner une EXPLOSION ou une fuite de liquide ou de gaz inflammable.



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# Chapter 1

General Introduction

概述

產品資訊

## 1.1 Introduction / 产品简介 / 產品簡介

The MIC-715-OX is embedded with a NVIDIA Jetson Orin NX, featuring a compact 275 x 220 x 80 mm, 4.5 kg, fanless design. The MIC-715-OX has a high tolerance in harsh environments with a wide operating temperature range of -25 to 60°C. The MIC-715-OX uses an M12 connector, featuring an IP67 rating for water and dust resistance. In order to manage the secure connection under vibration, all the I/O connectors are lockable.

MIC-715-OX 嵌入了 NVIDIA Jetson Orin NX，採用緊湊型無風扇設計，尺寸為 275 x 220 x 80 mm 和 4.5 kg。MIC-715-OX 在惡劣環境下具有高耐受性，工作溫度範圍從 -25° C 到 60° C。MIC-715-OX 使用 M12 連接器，具有 IP67 防水防塵等級。為了在振動下管理安全連接，所有 I/O 連接器都是可鎖定的。

MIC-715-OX 嵌入了 NVIDIA Jetson Orin NX，採用緊湊型無風扇設計，尺寸為 275 x 220 x 80 mm 和 4.5 kg。MIC-715-OX 在惡劣環境下具有高耐受性，工作溫度範圍從 -25° C 到 60° C。MIC-715-OX 使用 M12 連接器，具有 IP67 防水防塵等級。為了在振動下管理安全連接，所有 I/O 連接器都是可鎖定的。

## 1.2 Product Features / 产品特性 / 產品特性

### 1.2.1 Key Features / 主要特性

#### Processor System - Jetson Orin NX

- CPU: Arm® Cortex A78AE v8.2 64-bit CPU, 8 cores (max operating frequency: 2 GHz)
- Ampere GPU: 1024 CUDA cores, 32 tensor cores, up to 100 TOPS (INT8), max. operating frequency: 918 MHz
- Memory: 16GB LPDDR5
- Storage: M.2 SSD

#### Ethernet

- 6 x Gigabit Ethernet (10/100/1000 Mbps), supports 4 x PoE ports, IEEE 802.3af compliant

#### Peripheral I/O

- 1 x HDMI (max. resolution 3840 x 2160 @ 60Hz. Waterproof connector, unmatching)
- 2 x USB 3.0 (waterproof connector, unmatching)
- 2 x CAN (Interface: M12 A-coded, 5-pin male)
- 2 x Full-size Mini PCIe with one SIM slot support
- 1 x M.2 3052 B-Key + 1 x M.2 2280 M-Key (NVMe, PCIe x1)
- 1 x OTG Micro USB (internal)
- 1 x Micro SD card slot

#### 处理器系统 -Jetson Orin NX

- CPU: Arm® Cortex A78AE v8.2 64-bit CPU, 8 Cores (Max. Operating Frequency: 2 GHz)
- Ampere GPU: 1024 CUDA Core, 32 Tensor Cores, Performance up to 100 TOPS (INT8) Max. operating frequency: 918 MHz
- Memory: 16GB LPDDR5



- Storage: With additional M.2 SSD

#### 网络:

- 6 x Gigabit Ethernet (10/100/1000 Mbps), support 4 x PoE ports, IEEE 802.3af compliant

#### I/O 界面:

- 1 x HDMI (Max. resolution 3840 x 2160 @ 60Hz. Waterproof connector, unmatching)
- 2 x USB 3.0 (waterproof connector, unmatching)
- 1 x USB 2.0 (内部)
- 2 x CAN (Interface: M12 A-coded, 5-pin male)
- 1 x RS-232/RS-422/RS-485
- 2 x Full-size Mini PCIe with one SIM slot support
- 1 x M.2 3052 B-Key + 1 x M.2 2280 M-Key (NVMe, PCIe x1)
- 1 x OTG microUSB (内部)
- 1 x Reset 按钮 / 1 x Recovery 按钮
- 1 x Micro SD 卡槽

#### 處理器系統 - Jetson Orin NX

- CPU: Arm® Cortex A78AE v8.2 64-bit CPU, 8 Cores (Max. Operating Frequency: 2 GHz)
- Ampere GPU: 1024 CUDA Core, 32 Tensor Cores, Performance up to 100 TOPS (INT8) Max. operating frequency: 918 MHz
- Memory: 16GB LPDDR5
- Storage: With additional M.2 SSD

#### 網路:

- 6 x Gigabit Ethernet (10/100/1000 Mbps), support 4 x PoE ports, IEEE 802.3af compliant

#### I/O 介面:

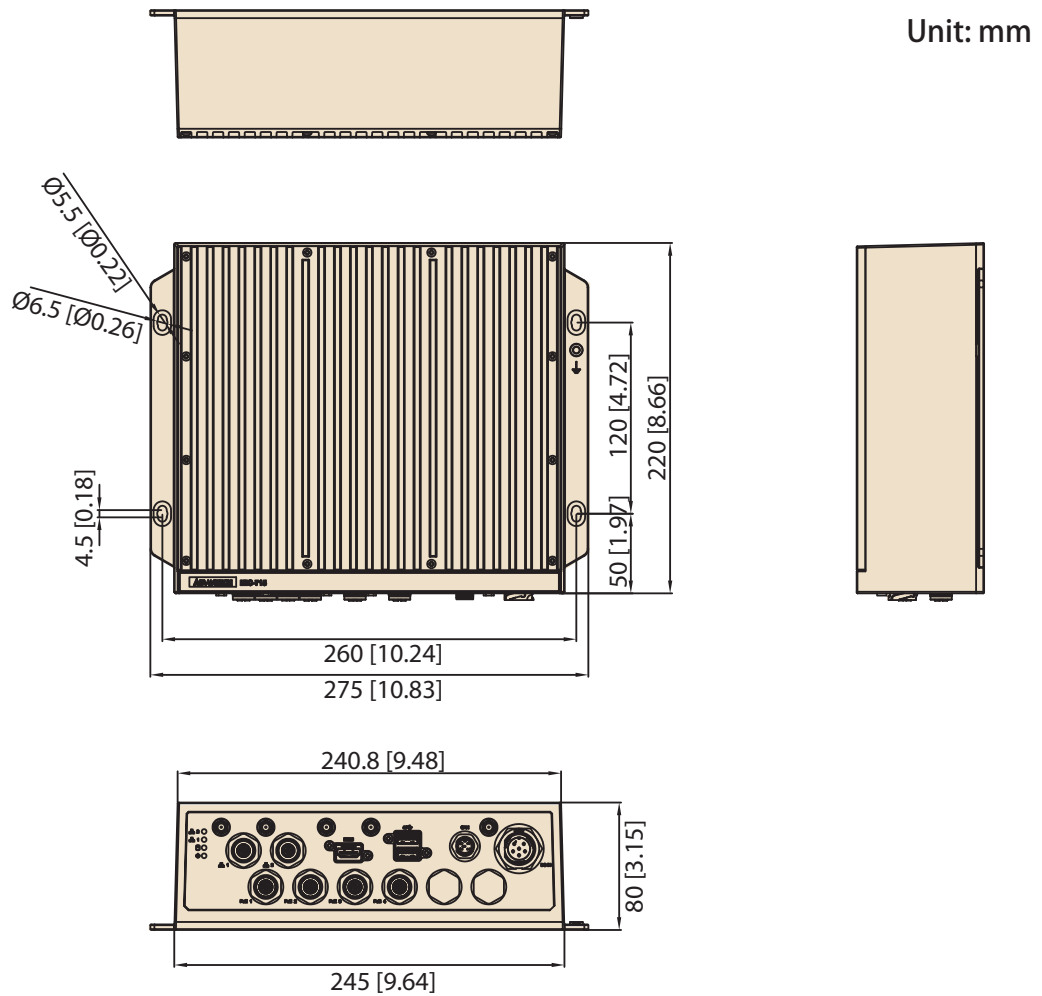
- 1 x HDMI (Max. resolution 3840 x 2160 @ 60Hz. Waterproof connector, unmatching)
- 2 x USB 3.0 (waterproof connector, unmatching)
- 1 x USB 2.0 (内部)
- 2 x CAN (Interface: M12 A-coded, 5-pin male)
- 1 x RS-232/RS-422/RS-485
- 2 x Full-size Mini PCIe with one SIM slot support  
\*MIC-715-0X 系列產品 Mini PCIe 相關模組並無搭配販售，須由消費者自行選擇安裝。請依照產品規格書上標示之規格選購。
- 1 x M.2 3052 B-Key + 1 x M.2 2280 M-Key (NVMe, PCIe x1)  
\*MIC-715-0X 系列產品 M.2 SSD 並無搭配販售，須由消費者自行選擇安裝組成系統電腦方可使用。請依照產品規格書上標示之規格選購。
- 1 x OTG microUSB (内部)
- 1 x Reset 按钮 / 1 x Recovery 按钮
- 1 x Micro SD 卡槽

## 1.3 Mechanical Specifications / 机械规格 / 機械規格

- **Dimensions:** 220 x 245 x 79 mm (8.66 x 9.65 x 3.11 in)
- **Reference Weight:** 4.5 kg

- 尺寸: 220 x 245 x 79 mm (8.66 x 9.65 x 3.11 in)
- 参考重量: 4.5 kg

- 尺寸: 220 x 245 x 79 mm (8.66 x 9.65 x 3.11 in)
- 参考重量: 4.5 kg



## 1.4 Electrical Specifications / 电源规格 / 電源規格

- **Power supply type:** AT, 12/24 V<sub>DC</sub> (12-6 A)
- **Power type:** M16, 6-pin male
- **电源类型:** AT, 12/24 V<sub>DC</sub> (12-6 A)
- **电源型式:** M16, 6-pin male
- **電源類型:** AT, 12/24 V<sub>DC</sub> (12-6 A)
- **電源型式:** M16, 6-pin male

## 1.5 Environmental Specifications / 环境规格 / 環境規格

- **Operating temperature:** -20 ~ 60°C (-4 ~ 140°F)
- **Operating humidity:** 95% @ 40°C (non-condensing)
- **Storage temperature:** -40 ~ 85°C (-40 ~ 185°F)
- **Storage humidity:** 60°C @ 95% RH Non-condensing
- **工作温度:** -20 ~ +60° C (-4 ~ 140° F)
- **工作湿度:** 95% @ 40° C (非凝結)
- **儲存温度:** -40~85° C (-40~185° F)
- **儲存湿度:** 60° C @ 95% RH, 非凝結  
\* 安全认证评估工作温度最高 50° C
- **工作溫度:** -20 ~ +60° C (-4 ~ 140° F)
- **工作濕度:** 95% @ 40° C (非凝結)
- **儲存溫度:** -40~85° C (-40~185° F)
- **儲存濕度:** 60° C @ 95% RH, 非凝結  
\* 安全認證評估工作溫度最高 50° C



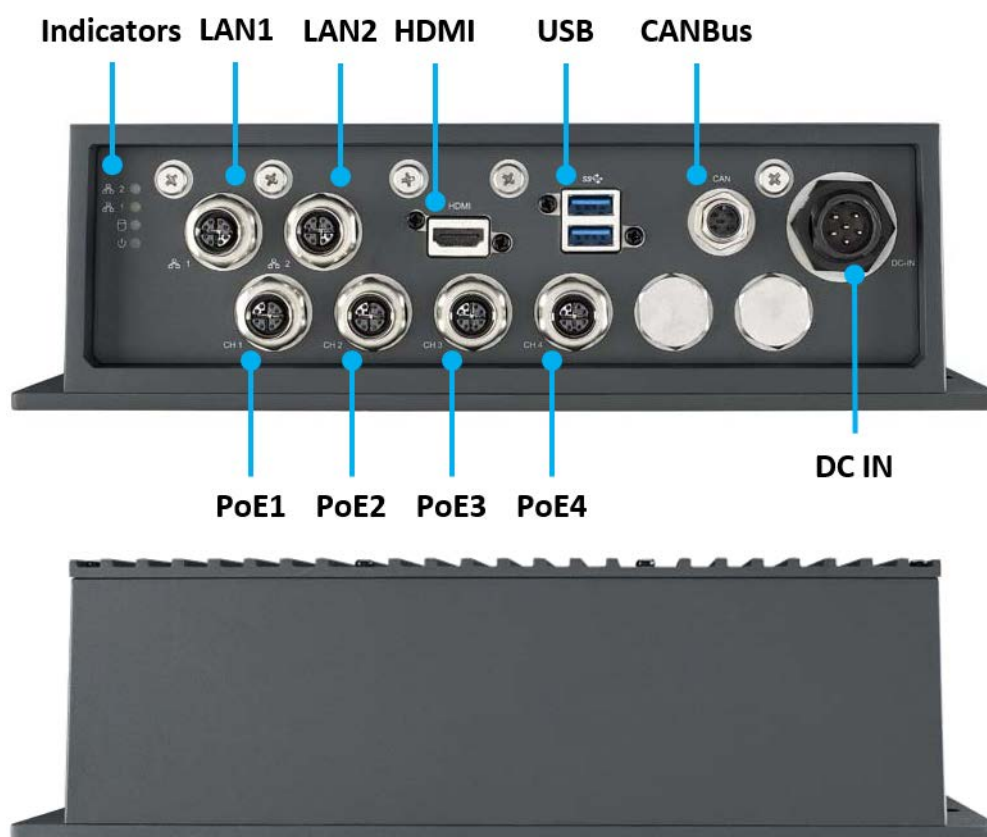
# Chapter 2

H/W Installation

硬件安裝

硬體安裝

## 2.1 I/O Overview / I/O 概观 / I/O 概觀



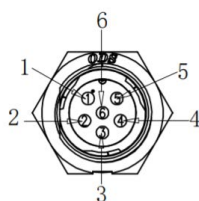
## 2.2 Connectors / 接口 / 介面

### 2.2.1 M16 Power Connector / 电源端口 / 电源埠

MIC-715-OX comes with an M16 power connector on the front side of the device.

MIC-715-OX 在本机前面板提供一组 M16 电源端口。

MIC-715-OX 在本機前面板提供一組 M16 電源埠。



| Pin | Function        |
|-----|-----------------|
| 1   | +Vin            |
| 2   | +Vin            |
| 3   | IGNITION        |
| 4   | -Vin            |
| 5   | -Vin            |
| 6   | Power_ON Switch |

### 2.2.2 4-CH M12 PoE LAN Ports

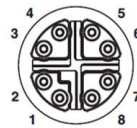
The MIC-715-OX comes with 4-channel M12 PoE LAN ports on the front side of the device.

MIC-715-OX 在本机前面板提供 4 路 M12 型式的 PoE 网络端口。

MIC-715-OX 在本機前面板提供 4 路 M12 型式的 PoE 網路連接埠。



M12 X-Coding Female, 8 poles



| Pin | Function    |
|-----|-------------|
| 1   | MDI0+ (DC+) |
| 2   | MDI0- (DC+) |
| 3   | MDI1+ (DC-) |
| 4   | MDI1- (DC-) |
| 5   | MDI3+       |
| 6   | MDI3-       |
| 7   | MDI2-       |
| 8   | MDI2+       |

### 2.2.3 CAN Bus / 控制器局域网络 / 控制器區域網路

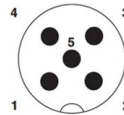
The MIC-715-OX comes with one CAN bus port on the front side of the device.

MIC-715-OX 在本机前面板提供 1 组 CAN bus 端口。

MIC-715-OX 在本機前面板提供 1 组 CAN bus 連接埠。



M12 A-coding Male, 5 poles



| Pin | Function |
|-----|----------|
| 1   | CAN2_H   |
| 2   | CAN2_L   |
| 3   | GND      |
| 4   | CAN1_H   |
| 5   | CAN1_L   |

\*No pins for V+ and V-

### 2.2.4 M12 Ethernet (LAN) port/M12 网络端口/M12 網路連接埠

The MIC-715-OX comes with 2 x M12 LAN ports in the front side of the device.

MIC-715-OX 在本机前面板提供两组 M12 网络端口。

MIC-715-OX 在本機前面板提供兩組 M12 網路連接埠。





M12 X-Coding Female, 8 poles



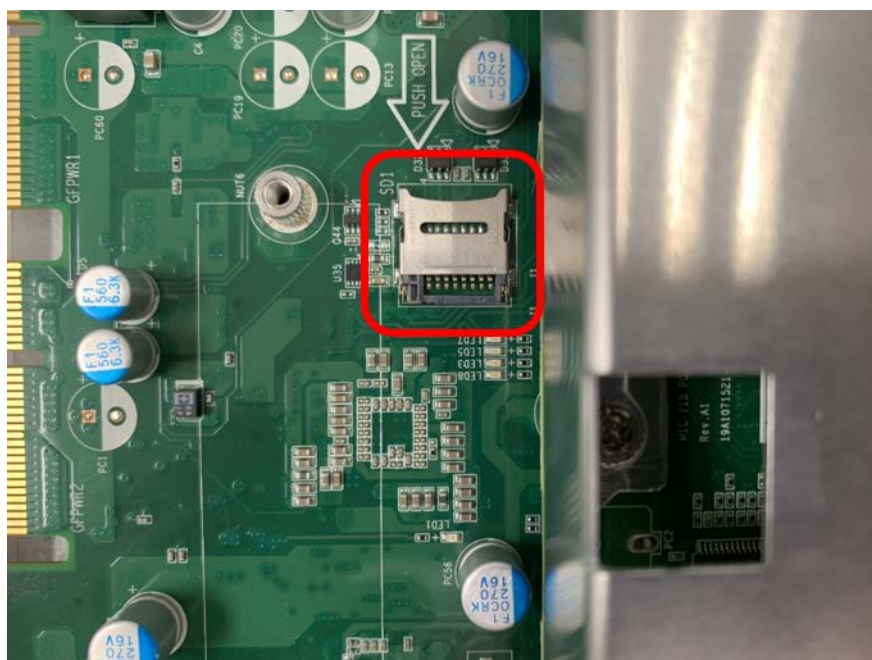
| Pin | Function |
|-----|----------|
| 1   | MDI0+    |
| 2   | MDI0-    |
| 3   | MDI1+    |
| 4   | MDI1-    |
| 5   | MDI3+    |
| 6   | MDI3-    |
| 7   | MDI2-    |
| 8   | MDI2+    |

### 2.2.5 Internal Micro SD Slot / 内部 Micro SD 端口 / 内部 Micro SD 埠

The MIC-715-OX supports one internal Micro SD slot.

MIC-715-OX 在本机内部提供一组 microSD 埠。

MIC-715-OX 在本機內部提供一組 microSD 埠。

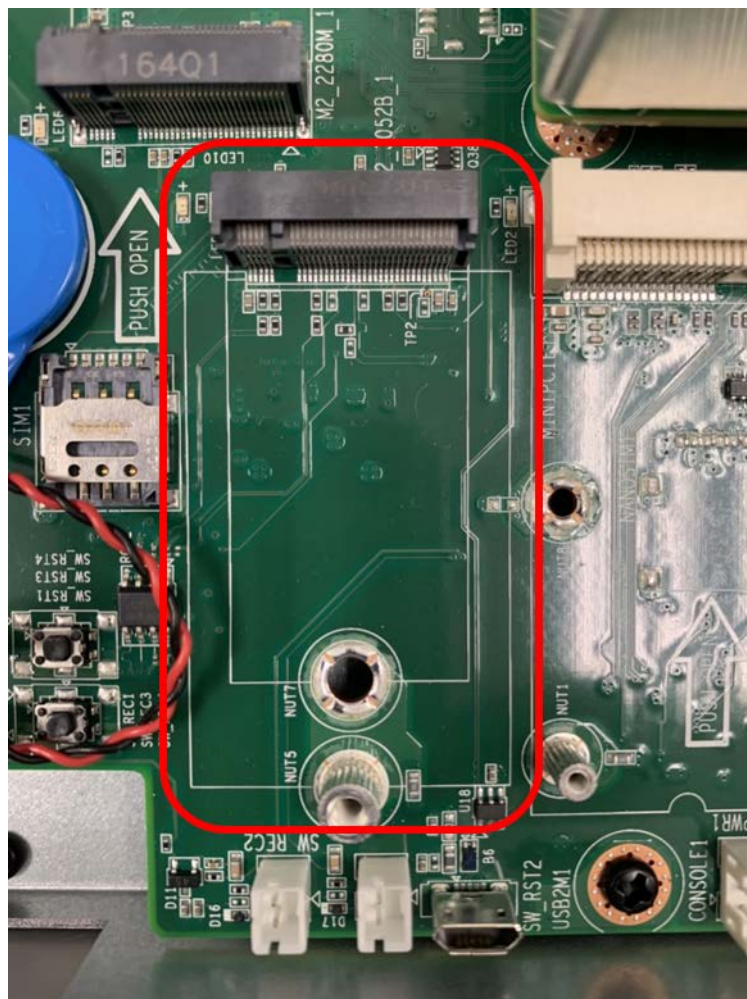


### 2.2.6 M.2 3052 Port / M.2 3052 端口 / M.2 3052 埠

The MIC-715-OX provides 1 x M.2 3052 B-Key slot internally.

MIC-715-OX 在本机内部提供 1 组 M.2 3052 B-Key 端口。

MIC-715-OX 在本機內部提供 1 組 M.2 3052 B-Key 連接埠。

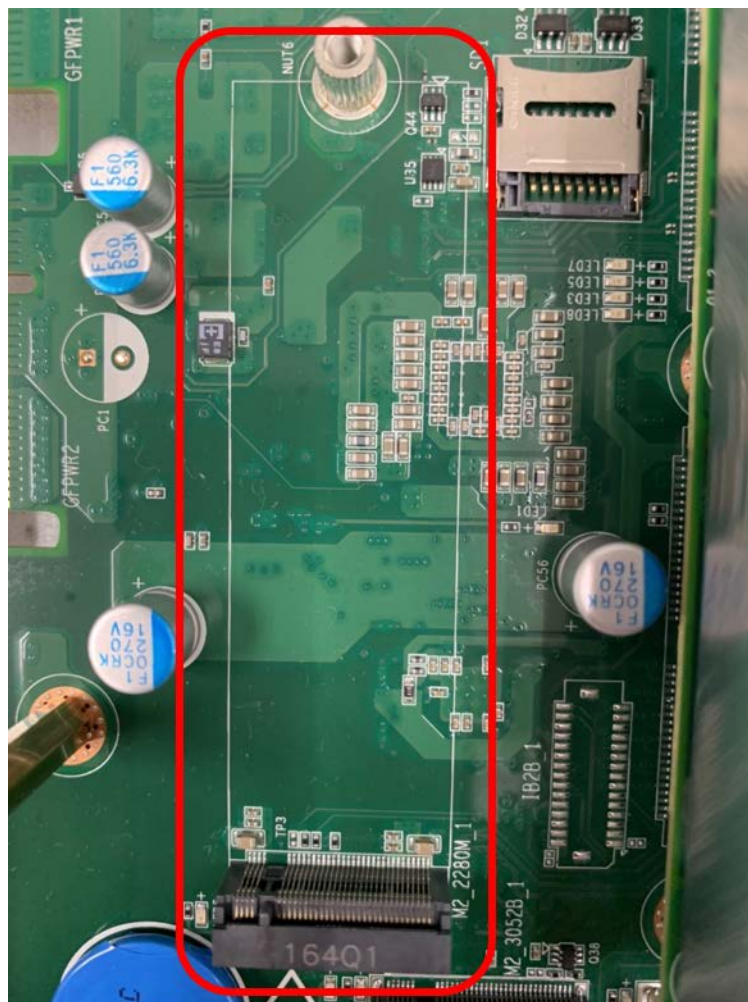


### 2.2.7 M.2 2280 Port / M.2 2280 端口 / M.2 2280 埠

MIC-715-OX provides 1 x M.2 2290 M-Key (NVMe, PCIe x1) slot internally.

MIC-715-OX 在本機內部提供 1 組 M.2 2280 M-Key (NVMe, PCIe x1) 端口。

MIC-715-OX 在本機內部提供 1 組 M.2 2280 M-Key (NVMe, PCIe x1) 連接埠。



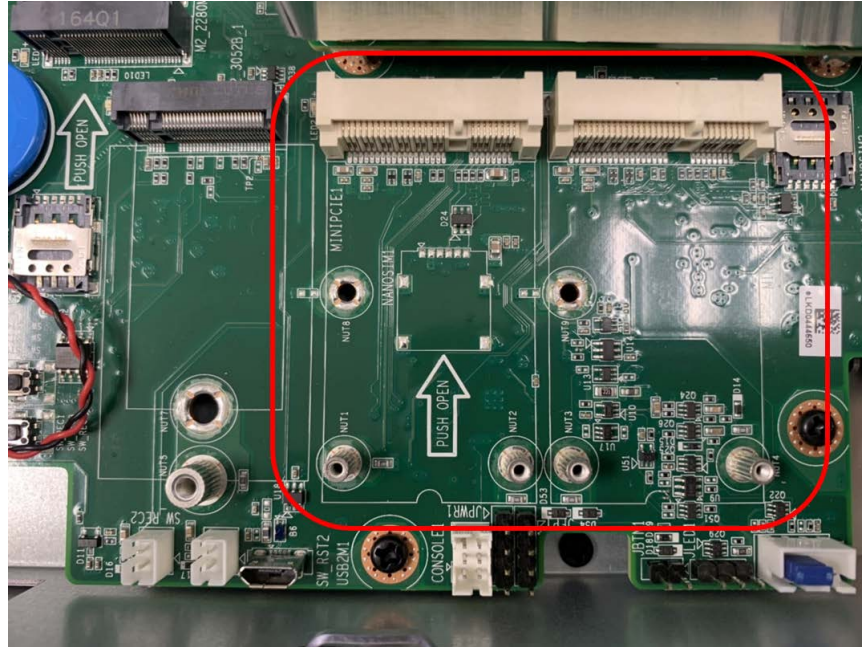


## 2.2.8 Mini PCIe Port / Mini PCIe 端口 / Mini PCIe 埠

The MIC-715-OX supports 2 x internal Mini PCIe ports.

MIC-715-OX 在本机内部提供 2 组 mini-PCIe 端口。

MIC-715-OX 在本機內部提供 2 組 mini-PCIe 連接埠。



## 2.3 USB Recovery Mode / USB 更新模式/USB 更新模式

To update your MIC-715-OX, you must navigate to “Force USB Recovery Mode.” When in Force USB Recovery Mode, you can update system software and write partition configuration to the device.

1. Please prepare one HOST PC (for more HOST PC detail, please refer to software update SOP)
2. Before flashing the MIC-715-OX, turn MIC-715-OX into **Force Recovery Mode** manually.
  - (a) Shut down the MIC-715-OX.
  - (b) Connect the HOST PC and MIC-715-OX with an internal micro USB cable.
  - (c) Press and hold the internal SW\_REC1 button.
  - (d) Press the SW\_RST1 button.
  - (e) After 5 seconds release the SW\_REC1 button.

Make sure the MIC-715-OX is successfully recognized by the HOST PC:

Type command: lsusb in HOST PC. If you see: NVIDIA Corp., it means the MIC-715-OX is in recovery mode.

\* *Root password of MIC-715-OX: MIC-715-OX*

如果需要更新 MIC-715-OX，你必须要让 MIC-715-OX 进入 USB 更新模式。在 USB 更新模式下，你可以更新系统的软件以及将系统写入相关的参数设定。

1. 请准备一台 HOST 系统。（关于 Host 系统的细节，请参阅软件更新指南）
2. 在更新 MIC-715-OX 之前，你必须手动让 MIC-715-OX 进入 USB 更新模式。
  - (a) 请将 MIC-715-OX 关机。
  - (b) 透过 Micro USB 线材连接 HOST 系统与 MIC-715-OX 内部的 Micro USB 端口。

- (c) 按住机器内部 SW\_REC1 按钮
- (d) 单击机器内部 SW\_RST1 按钮
- (e) 5 秒钟后放开 SW\_REC1 按钮

确定 MIC-715-0X 有正确被 HOST PC 认到：

请在HOST PC输入：lsusb

如果能够看到 NVIDIA Corp.，则表示 MIC-715-0X 已经在 recovery mode

\*MIC-715-0X 系统 root 密码：MIC-715-0X

如果需要更新 MIC-715-0X，你必須要讓 MIC-715-0X 進入 USB 更新模式。在 USB 更新模式下，你可以更新系統的軟體以及將系統寫入相關的參數設定。

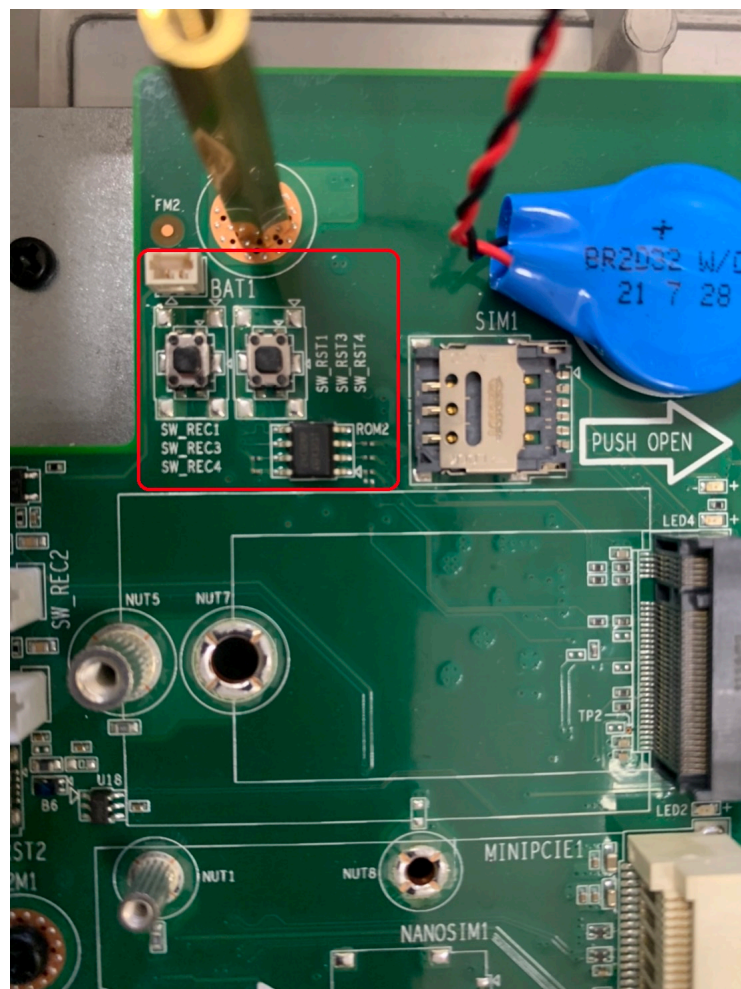
1. 請準備一台 HOST 系統。（關於 Host 系統的細節，請參閱軟體更新指南）
2. 在更新 MIC-715-0X 之前，你必須手動讓 MIC-715-0X 進入 USB 更新模式。
  - (a) 請將 MIC-715-0X 關機。
  - (b) 透過 Micro USB 線材連接 HOST 系統與 MIC-715-0X 內部的 Micro USB 埠
  - (c) 按住機器內部 SW\_REC1 按鈕
  - (d) 按一下機器內部 SW\_RST1 按鈕
  - (e) 5 秒鐘後放開 REC\_SW1 按鈕

確定 MIC-715-0X 有正確被 HOST PC 認到：

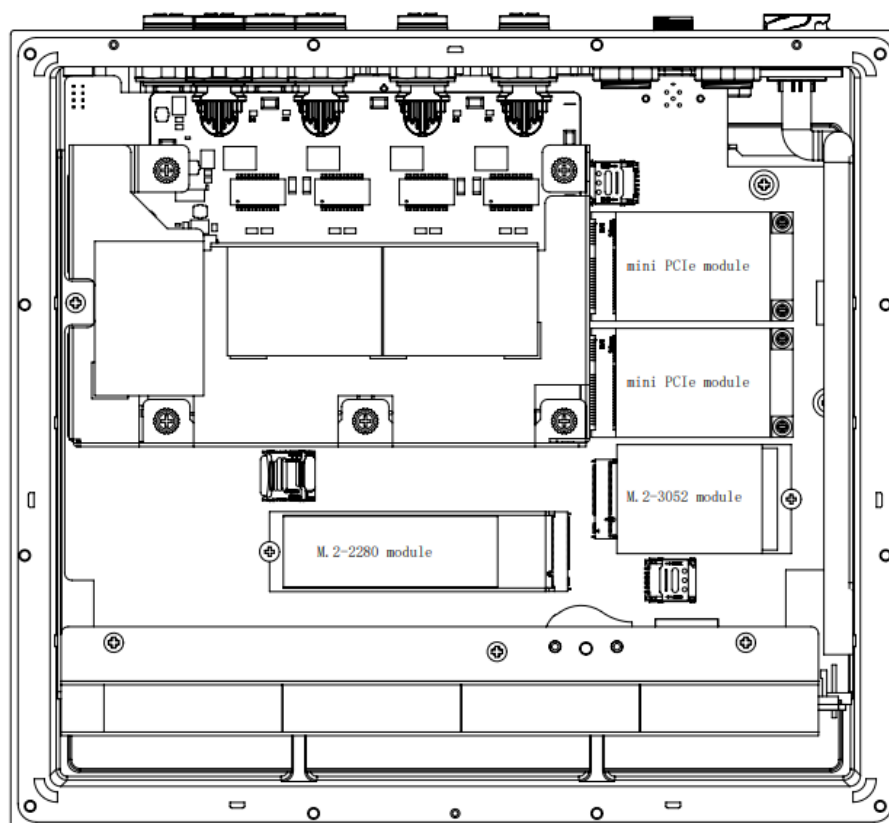
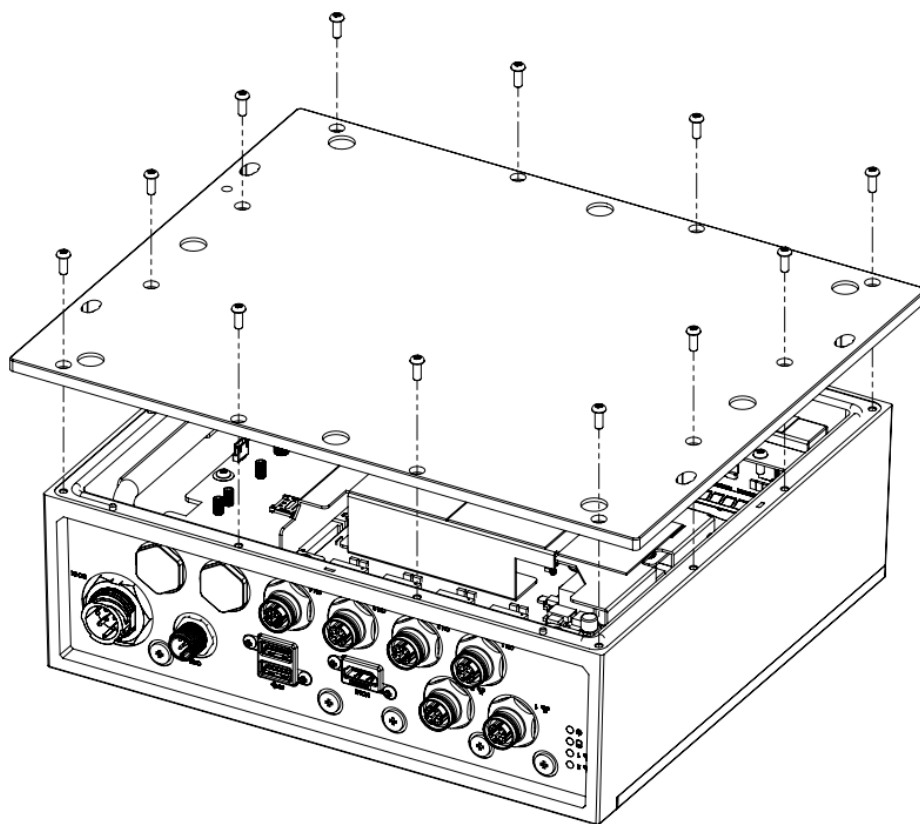
请在HOST PC输入：lsusb

如果能够看到 NVIDIA Corp.，则表示 MIC-715-0X 已经在 recovery mode

\*MIC-715-0X 系统密碼：MIC-715-0X



## 2.4 Internal Module Installation / 内部模块安装 / 内部模组安装



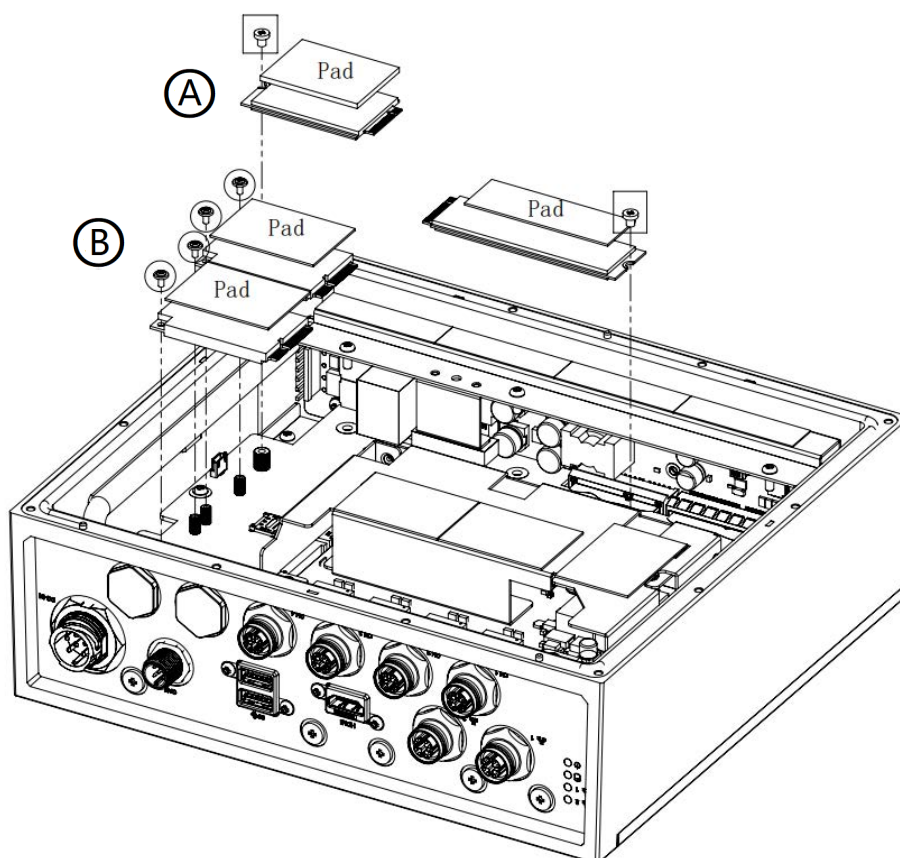
**MIC-715 M2 / Mini PCIe Module Thermal Kit:**

PN: 96627150000

It includes all items bellow.

Part number notice:

1. For M.2 module:  
Screw: 1930005673-11  
Thermal pad: (M.2-3052)1990030086N000 (stick A)
2. For Mini PCIe:  
Screw: 1930008089  
Thermal pad: 1990027303N010 (Stick B)



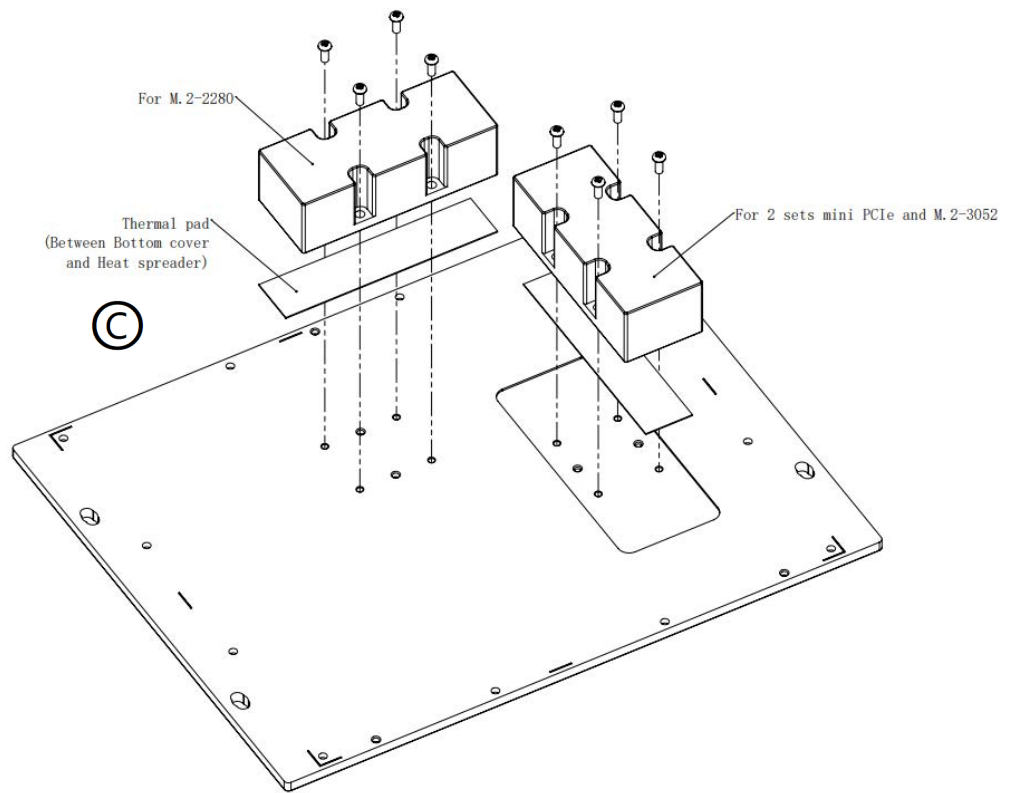


Part number notice:

Screw: 1930008772

Heat spreader: 1970004928T000

Thermal pad: 1990021446N000 (Stick C)





# Chapter 3

MCU

## 3.1 Introduction

This document is intended to introduce the MCU functionalities shown below.

- Vehicle Power Management (VPM) for ignition
- GPIO configuration or pin assignments
- I2C device list

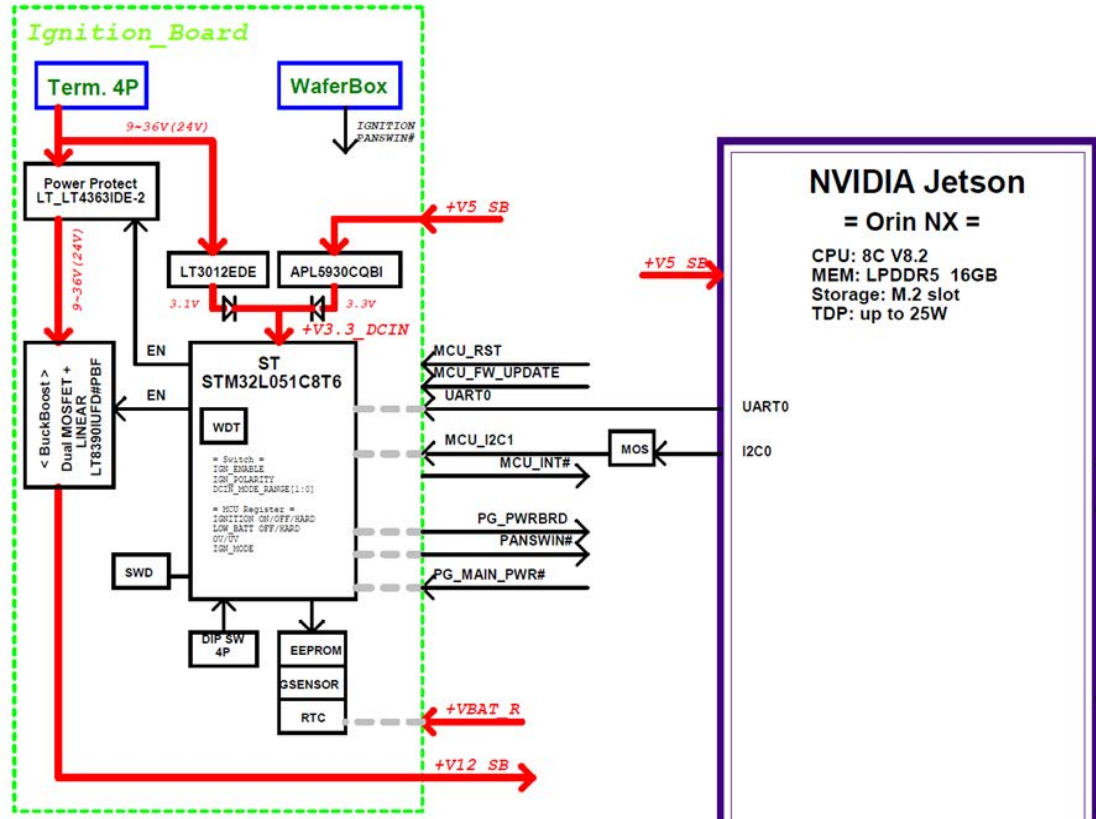
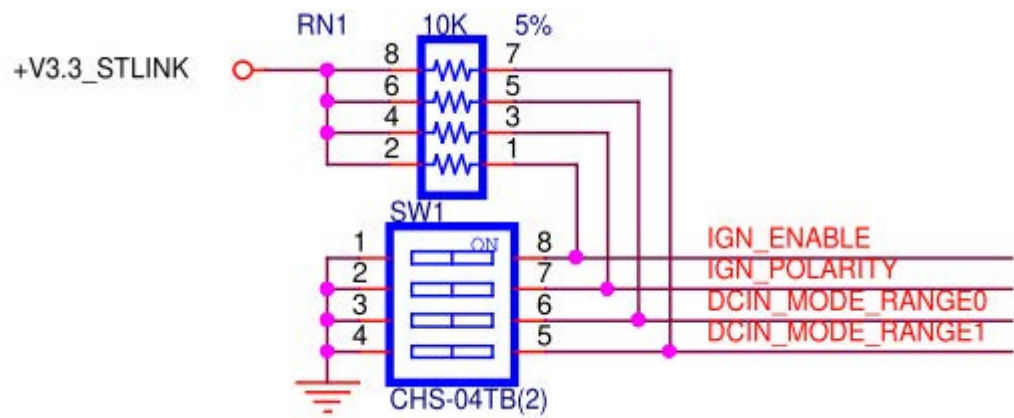


Figure 3.1 STM32L05 MCU Block Diagram

## 3.2 MCU STM32L0 Pin Assignments and Jumper Settings

| Table 3.1: MCU Pin Assignments |           |                      |                                                                                                      |
|--------------------------------|-----------|----------------------|------------------------------------------------------------------------------------------------------|
| Port                           | Port Type | Signal Name          | Notice                                                                                               |
| PA1                            | GPI       | IGN_ENABLE           | Low: ignition disable<br>High: ignition enable                                                       |
| PA2                            | GPI       | IGN_POLARITY         | Low: IGN_SW(PB2)=Low, then Enable System<br>High: IGN_SW(PB2)=High, then Enable System               |
| PA3                            | GPI       | DCIN_MODE_RANGE0     | DCIN_MODE_RANGE[1:0] :<br>00 => 12V, 01 => 24V                                                       |
| PA4                            | GPI       | DCIN_MODE_RANGE1     |                                                                                                      |
| PA6                            | ADC_IN6   | ADC_12V_24V          | ADC                                                                                                  |
| PA7                            | ADC_IN7   | ADC_37V_48V          | ADC                                                                                                  |
| PA9                            | USART1_TX | USART1_TX            | Firmware upgrade                                                                                     |
| PA10                           | USART1_RX | USART1_RX            |                                                                                                      |
| PA12                           | GPO       | MCU_LT4363_SHDN      | Low: Enable DCIN<br>High: Disable DCIN                                                               |
| PB1                            | GPI       | PG_DCIN#             | Low: DCIN Power Good<br>High: DCIN Power not ready                                                   |
| PB2                            | GPI       | IGN_SW               | Low: IGN_POLARITY(PA2)=Low , then Enable System<br>High: IGN_POLARITY(PA2)=High , then Enable System |
| PB3                            | GPO       | EN_B_+V12SB          | Low: Disable +V12SB<br>High: Enable + V12SB                                                          |
| PB4                            | GPI       | +V12_SB_D_PG#        | Low: +V12_SB Power Good<br>High: +V12_SB Power not ready                                             |
| PB5                            | GPO       | PG_PWRBRD            | Low: MIC-715-XPB Power not ready<br>High: MIC-715-XPB Power Good                                     |
| PB6                            | GPI       | DCIN_M_PANSWIN#      | Power BTN# input                                                                                     |
| PB7                            | GPO       | DCIN_MCU_B_PAN-SWIN# | Power BTN# output                                                                                    |
| PB8                            | I2C1_SCL  | MCU_I2C1_R_SCL       | Communication between System and MCU                                                                 |
| PB9                            | I2C1_SDA  | MCU_I2C1_R_SDA       |                                                                                                      |
| PB10                           | I2C2_SCL  | MCU_I2C2_R_SCL       | Read/Write RTC & EEPROM & G-SENSOR                                                                   |
| PB11                           | I2C2_SDA  | MCU_I2C2_R_SDA       |                                                                                                      |
| PB12                           | GPO       | MCU_INT#             | Communication between System and MCU                                                                 |



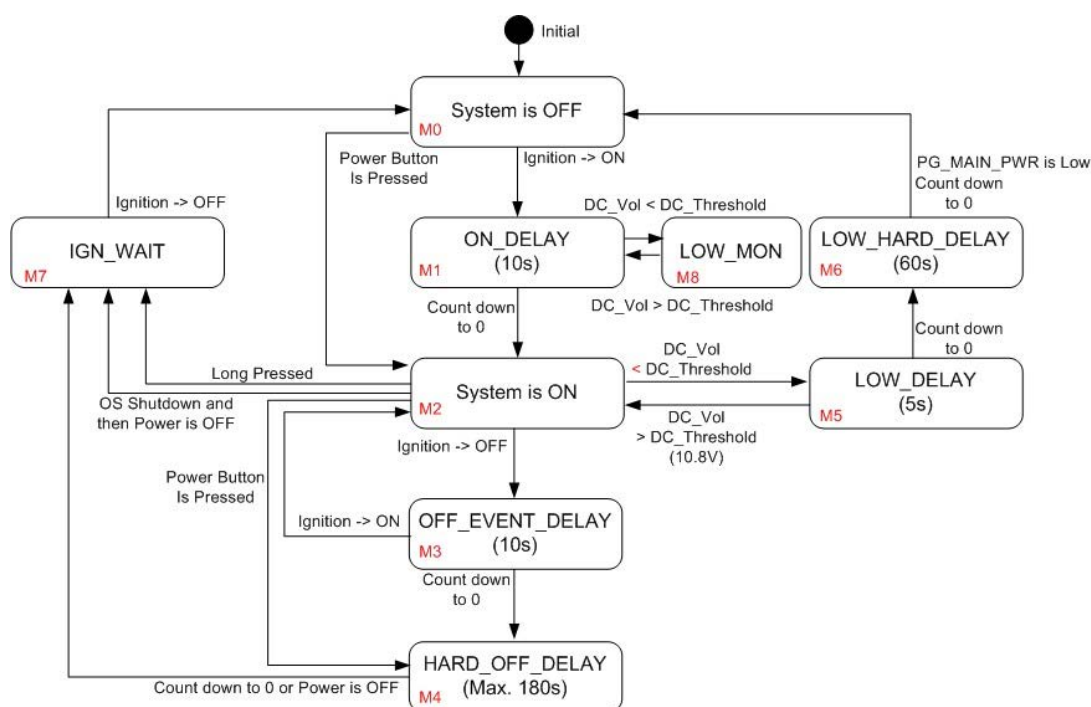
**Figure 3.2 SW1 Jumper**

| Table 3.2: SW1 Jumper Descriptions |                  |                                                          |
|------------------------------------|------------------|----------------------------------------------------------|
| Pin                                | Name             | Description                                              |
| 1                                  | IGN_ENABLE       | ON: ignition disabled<br>OFF: ignition enabled (default) |
| 2                                  | IGN_POLARITY     | ON: active low<br>OFF: active high (default)             |
| 3                                  | DCIN_MODE_RANGE0 | 00: 12 V (default)                                       |
| 4                                  | DCIN_MODE_RANGE1 | 01: 24 V                                                 |

## 3.3 MCU Hardware Management

### 3.3.1 Vehicle Power Management (VPM)

The features of Vehicle Power Management (VPM) is provided for users to fulfill the special requirements on in-vehicle applications. The following chart is the VPM state machine.



**Figure 3.3 VPM State Machine**

The table below lists the user programmable parameters for VPM features:

| Table 3.3: VPM Parameters |               |                      |
|---------------------------|---------------|----------------------|
| Name                      | Default Value | Acceptable Range (*) |
| ON_DELAY                  | 10 seconds    | 0-18000 seconds      |
| OFF_EVENT_DELAY           | 10 seconds    | 0-18000 seconds      |
| HARD_OFF_DELAY            | 180 seconds   | 0-18000 seconds      |
| LOW_THRESHOLD (12 V mode) | 10.8V         | 10.09-12.25 V        |
| LOW_DELAY                 | 5 seconds     | 0-3600 seconds       |
| LOW_HARD_DELAY            | 60 seconds    | 0-3600 seconds       |

### 3.3.1.1 Ignition On/Off

#### 1. Turn on the system by ignition

For in-vehicle applications, an ignition signal is often used to turn on or shut down the system. When the system is in the OFF state and the ignition is turned ON, MCU will count down for ON\_DELAY second(s); once it counts to zero, the system will be turned on immediately.

The MCU boot console is shown as below.

```
000000.001 Board: MIC-715-XPB
000000.004 Version: 211001
000000.007 DCIN_MODE_RANGE0: 1
000000.011 DCIN_MODE_RANGE1: 1
000000.014 IGN_ENABLE: 1
000000.017 IGN_POLARITY: 0
000000.021 I2C dev RTC 0x30 ret = 0 reg[0] = 0x00
000000.026 I2C dev EEPROM 0x57 ret = 0 reg[0] = 0xff
000000.032 main:86 [M0: System is OFF
```

Note: A rework might be needed for the MCU UART console.

Change SW1 pin1 to OFF and SW1 pin2 to OFF respectively; ignition is enabled.

```
000000.036 main:89[M0: System is IGN_SW and IGN_POLARITY HIGH
000000.064 _Batt_Low_power_status:434 12.11v
000010.079 main:112 [M1: ON Delay
000012.428 main:120 [M2: System is on
000013.521 _Batt_Low_power_status:434 12.01v
000014.626 _Batt_Low_power_status:434 12.00v
000015.731 _Batt_Low_power_status:434 12.00v
000016.836 _Batt_Low_power_status:434 12.02v
000017.941 _Batt_Low_power_status:434 12.01v
000019.046 _Batt_Low_power_status:434 12.00v
000020.151 _Batt_Low_power_status:434 12.01v
000021.256 _Batt_Low_power_status:434 12.00v
000022.361 _Batt_Low_power_status:434 11.96v
000023.466 _Batt_Low_power_status:434 11.99v
000024.571 _Batt_Low_power_status:434 11.98v
```

#### 2. Shutdown the system by ignition

When the system is powered on and the ignition is turned off, the OFF\_EVENT\_DELAY will start to count down. During this stage, if the ignition is backed to ON, MCU will stop the countdown and reset the OFF\_EVENT\_DELAY value.

If OFF\_EVENT\_DELAY counts to zero, MCU will send an event (power button press) to the system and start to count down HARD\_OFF\_DELAY.

```
000127.657 main:261 [M3: OFF EVENT DELAY
000137.671 main:275 [M4: HARD OFF DELAY
000169.507 main:87 [M0: System is OFF
```

Note: Nvidia will send a "Power Off" dialog when entering the power off state.

### 3. Accidentally touched shutdown menu

When the user accidentally touches a button or shuts down in a short case, the OS will pop out a window and the system will start counting for 30s to shut down.

At this time, if the window is closed via the mouse, the system will consider the behavior mode of an improper shutdown and start counting down for 180s to shut down.

```
000201.744 AT button: 1
000202.008 AT button: 2
000202.021 main:146 [M2-1: power button short off
000202.026 main:229 [M4: HARD OFF DELAY
000383.011 main:220 [M7: POWER OFF DELAY
```

Note: Nvidia will send a “Power Off” dialog when entering the power off state.

### 4. Power LED OFF behavior

When the user switches to any function, as long as the final path is related to the M7 function, the green Power LED will light off. At this time, the user needs to manually turn the switch back to OFF, and the system will return to the System OFF stage, then proceed to the power-on and power-off options that the user needs.

### 5. Low battery protection

To avoid draining the car battery, low-battery protection is used to ensure the car battery is able to start the vehicle. When the system is ON, MCU will monitor the car battery voltage. If the battery voltage is lower than a programmable threshold (LOW\_THRESHOLD), MCU will go into the LOW\_DELAY stage and start to count down. During the LOW\_DELAY countdown, if battery voltage rises above the LOW\_THRESHOLD, MCU will stop counting down and return to the System ON stage. If LOW\_DELAY counts to zero, MCU will send an event (power button pressed) to notify the system and go into the LOW\_HARD\_DELAY stage and start to count down. Once LOW\_HARD\_DELAY counts to zero, MCU will cut off the system power immediately to avoid draining the car battery.

```
000065.165 main:117 [M2: System is ON
000111.509 main:252 [M5: LOW DELAY
000111.513 _Batt_Low_power_status:438 Batt low 10.8 10.43
000112.521 _Batt_Low_power_status:438 Batt low 10.8 9.90
000113.528 _Batt_Low_power_status:438 Batt low 10.8 9.90
000114.535 _Batt_Low_power_status:438 Batt low 10.8 9.89
000115.542 _Batt_Low_power_status:438 Batt low 10.8 9.90
000116.549 main:266 [M6: LOW HARD DELAY
000148.385 main:86 [M0: System is OFF
000148.389 main:89 [M0: System is IGN_SW and IGN_POLARITY on
000148.416 _Batt_Low_power_status:438 Batt low 10.8 10.10
000148.422 main:243 [M8: check Battery
000148.427 _Batt_Low_power_status:438 Batt low 10.8 10.10
000149.434 _Batt_Low_power_status:438 Batt low 10.8 10.10
000150.441 _Batt_Low_power_status:438 Batt low 10.8 10.10
000151.448 _Batt_Low_power_status:438 Batt low 10.8 10.10
000152.455 _Batt_Low_power_status:438 Batt low 10.8 10.10
000153.462 _Batt_Low_power_status:438 Batt low 10.8 10.10
000154.469 _Batt_Low_power_status:438 Batt low 10.8 10.10
```

Note: Nvidia will send a “Power Off” dialog when entering the power off state.



### 3.3.1.2 Ignition Disabling

The feature of Vehicle Power Management (VPM) is provided for users to fulfill the special requirements on in-vehicle applications. The following chart is the VPM state machine.

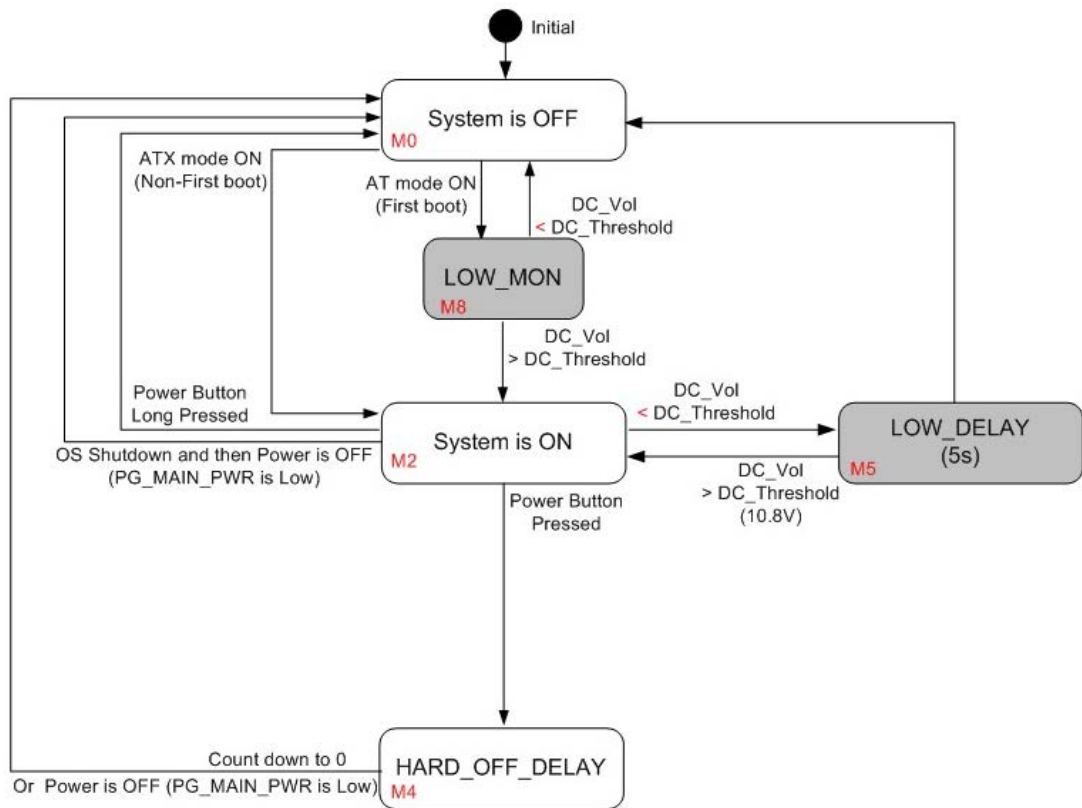


Figure 3.4 Ignition Disable

1. Turn on the system when ignition is disabled.

For cases of in-vehicle applications, an ignition signal is often used to turn on or shut down the system. When the system is in an OFF state and the ignition is disabled, after the AC is ON, the system will be turned on.

The MCU boot console is shown as below.

```
000000.001 Board: MIC-715-OXPB
000000.004 Version: 211001
000000.008 DCIN_MODE_RANGE0: 1
000000.011 DCIN_MODE_RANGE1: 1
000000.015 IGN_ENABLE: 0
000000.018 IGN_POLARITY: 1
000000.021 I2C dev RTC 0x30 ret = 0 reg[0] = 0x00
000000.026 I2C dev EEPROM 0x57 ret = 0 reg[0] = 0xff
000000.032 main:321 [M0-1: AT mode system is on
000000.032 _Batt_Low_power_status:438 12.46v
```

Note: A rework might be needed for the MCU UART console.

Change SW pin1 to ON and SW1 pin remain OFF respectively, Ignition is disabled

```
000004.417 main:323 [M2-1: ATX mode system is on
000234.218 _Batt_Low_power_status:441 12.32v
000234.231 _Batt_Low_power_status:441 12.33v
000234.244 _Batt_Low_power_status:441 12.32v
000234.257 _Batt_Low_power_status:441 12.31v
000234.271 _Batt_Low_power_status:441 12.31v
000234.284 _Batt_Low_power_status:441 12.29v
000234.297 _Batt_Low_power_status:441 12.32
```

## 2. Shut down the system by power button.

When the system is powered on and the power button is long-pressed, the system will be powered off immediately. Afterward, once the power button is pressed again, the system will boot up in ATX mode. When the system is powered on and the power button is short-pressed, the OS will pop out a window and start counting for 30 seconds to shut down. After the system has shut down, once the power button is pressed again, the system will boot up with the ATX mode.

```
000235.374 _Batt_Low_power_status:441 12.30v
000235.600 button: 1
000235.630 button: 2
000235.883 button: 3
000236.136 button: 4
000236.389 button: 5
000236.642 button: 6
000236.644 main:365 [M2-1: power button short off
000236.650 main:411 [M4-1: HARD OFF DELAY
```

Note: Nvidia will send a "Power Off" dialog when entering the power off state.

## 3. Low battery protection.

To avoid draining out the car battery, low-battery protection is involved to ensure the car battery is able to start the vehicle. When the system is ON, MCU will monitor the car battery voltage. If the battery voltage is lower than a programmable threshold (LOW\_THRESHOLD), MCU will go into LOW\_DELAY stage and start to count down. Once LOW\_DELAY counts to zero, MCU will cut off the system power immediately to avoid draining out the car battery. Afterward, once the power button is pressed, MCU will send an event (power button pressed) to notify the system to boot up.

```
000010.453 main:323 [M2-1: AT mode system is on
000099.601 _Batt_Low_power_status:445 Batt low 10.8 10.49
000099.608 main:393 [M5-1: LOW DELAY
000099.612 _Batt_Low_power_status:445 Batt low 10.8 10.48
000100.620 _Batt_Low_power_status:445 Batt low 10.8 8.67
000101.627 _Batt_Low_power_status:445 Batt low 10.8 9.28
000102.634 _Batt_Low_power_status:445 Batt low 10.8 9.65
000103.641 _Batt_Low_power_status:445 Batt low 10.8 9.66
000161.495 main:334 [M0-1: Power Button on
000083.863 _Batt_Low_power_status:412 12.66v
000083.868 main:323 [M2-1: AT mode system is on
```

### 3.3.2 I2C

The I2C device table is shown below.

| Table 3.4: MIC-715-XPB I2C Device List |             |        |                  |
|----------------------------------------|-------------|--------|------------------|
| Bus                                    | I2C Address | Name   | Description      |
| 2                                      | 0x30-0x37   | RTC    | SEIKO_S-35390A   |
| 2                                      | 0x57        | EEPROM | ST_M24512-RMN6TP |

The I2C devices of RTC, G-Sensor and EEPROM are present if ret=0.

```
000000.021 I2C dev RTC 0x30 ret= 0 reg[0] = 0x00
000000.027 I2C dev EEPROM 0x57 ret= 0 reg[0] = 0xff
```

### 3.3.3 Firmware Upgrade

The firmware can be upgraded via ST-LINK or the Linux stm32flash utility on the host.

```
# tar -jxf mic715_mcu_0805.tbz2
# cd mic715_mic
# sudo bash main.sh
```

It's recommended to have a clear power cycle after a firmware upgrade.

```
mic-715@ubuntu:~/mic715_mcu_0805$ sudo bash main.sh
[sudo] password for mic-715:
[INFO] Resetting the MCU into the upgrade mode
[INFO] Find the MCU bin file MIC715PB-0805.bin
[INFO] Set up the serial with flash tool
[INFO] Upgrade the MCU with flash tool
[FAIL] Upgarde the MCU upgarde fail
mic-715@ubuntu:~/mic715_mcu_0805$
```

Figure 3.5 TM32 Flash Update

## 3.4 MIC-715-OX UTILITY – VPM Controller (vpmctrl)

The Vehicle Power Management (VPM) Controller (vpmctrl) is a host utility. It allows the user to interact with MCU. The vpmctrl utility provides the command line interface (CLI) for user operations. User can operate the features below through the vpmctrl utility.

- Vehicle Power Management (VPM)
- Monitor system health (voltages)

**Note!** It is necessary to get the Root or Super User (sudo) permission during using the vpmctrl utility.



### 3.4.1 vpmctrl Functions

Currently, the vpmctrl utility provides the functions as below. This command “vpmctrl help” will show the vpmctrl utility usage.

- Access the MCU information.
- Access DC information. (+12V/+24V)
- Access Ignition information.
- Access AT information
- Access board-id information.
- Access Delay information.
- Access LOW VOL ERROR information.
- Access reset MCU information.
- Access VPM information.

| Table 3.5: vpmctrl functions |                      |                          |
|------------------------------|----------------------|--------------------------|
| Function                     | MCU Command          | Description              |
| Access MCU information       | get-api-version      | Get API Version          |
|                              | get-firmware-version | Get MCU Firmware Version |
| Access DC information        | get-dc-mode          | Get DC Mode              |
|                              | get-dc-voltage       | Get DC Voltage (mV)      |
|                              | get-12v-threshold    | Get 12V Threshold (mV)   |
|                              | set-12v-threshold    | Set 12V Threshold (mV)   |
| Access Ignition information  | get-ignition-status  | Get Ignition Status      |
|                              | get-ignition-setting | Get Ignition Setting     |
| Access AT information        | get-atx-mode         | Get AT/ATX Mode          |
| Access board-id information  | get-board-product-id | Get Board Product ID     |
|                              | get-board-rev-num    | Board Revision Number    |
|                              | get-board-serial-num | Board Serial Number      |
|                              | set-board-serial-num | Board Serial Number      |

**Table 3.5: vpmctrl functions**

|                                  |                         |                             |
|----------------------------------|-------------------------|-----------------------------|
| Access Delay information         | get-low-delay           | LOW_DELAY                   |
|                                  | set-low-delay           | LOW_DELAY                   |
|                                  | get-low-hard-delay      | LOW_HARD_DELAY              |
|                                  | set-low-hard-delay      | LOW_HARD_DELAY              |
|                                  | get-on-delay            | ON_DELAY                    |
|                                  | set-on-delay            | ON_DELAY                    |
|                                  | get-off-event-delay     | OFF_EVENT_DELAY             |
|                                  | set-off-event-delay     | OFF_EVENT_DELAY             |
|                                  | get-hard-off-delay      | HARD_OFF_DELAY              |
|                                  | set-hard-off-delay      | HARD_OFF_DELAY              |
| Access LOW VOL ERROR information | get-low-vol-err-count   | Get Low Voltage Error Count |
|                                  | clear-low-vol-err-count | Clear Voltage Error Count   |
| Access reset MCU information     | reset-mcu               | Reset MCU                   |
| Access VPM information           | get-all-info            | Get All VPM Information     |

*Usage:*

```

./vpmctrl.sh <cmd> [<arg>]
<cmd> : one of VPM commands below.
    get-api-version           : Get API Version.
    get-firmware-version     : Get Firmware Version.
    get-dc-mode              : Get DC Mode.
    get-dc-voltage           : Get DC Voltage (mV).
    get-ignition-status      : Get Ignition Status.
    get-ignition-setting      : Get Ignition Setting.
    get-atx-mode             : Get AT/ATX Mode.
    get-board-product-id     : Get Board Product ID.
    get-board-rev-num        : Get Board Revision Number.
    get-board-serial-num     : Get Board Serial Number.
    set-board-serial-num     : Set Board Serial Number.
    get-low-delay            : Get LOW_DELAY.
    set-low-delay            : Set LOW_DELAY.
    get-low-hard-delay       : Get LOW_HARD_DELAY.
    set-low-hard-delay       : Set LOW_HARD_DELAY.
    get-12v-threshold        : Get 12V Threshold (mV).
    set-12v-threshold        : Set 12V Threshold (mV).
    get-on-delay             : Get ON_DELAY.
    set-on-delay             : Set ON_DELAY.
    get-off-event-delay      : Get OFF_EVENT_DELAY.
    set-off-event-delay      : Set OFF_EVENT_DELAY.
    get-hard-off-delay       : Get HARD_OFF_DELAY.
    set-hard-off-delay       : Set HARD_OFF_DELAY.
    get-low-vol-err-count    : Get Low Voltage Error Count.
    clear-low-vol-err-count  : Clear Voltage Error Count.
    reset-mcu                : Reset MCU.
    get-all-info            : Get All VPM Information.
<arg>                        : VPM command argumant to set,
                              '?' for help.

```

### 3.4.2 Nvidia Commands

The vpmctrl utility provides the Nvidia BSP commands with the syntax and structure below for user interaction. For an explanation of each command, please refer to the sections below for more details.

#### 3.4.2.1 vpmctrl get-api-version

This command will get the API version.

```
Usage:
  ./vpmctrl get-api-version [?]

where
  '?' : for help.

Example:
$ sudo ./vpmctrl get-api-version
API ver: 0
```

#### 3.4.2.2 vpmctrl get-firmware-version

This command will get the MCU firmware version.

```
Usage:
  ./vpmctrl get-firmware-version [?]

where
  '?' : for help.

Example:
$ sudo ./vpmctrl get-firmware-version
FW ver: 211008
```

#### 3.4.2.3 vpmctrl get-dc-mode

This command will get the DC mode.

```
Usage:
  ./vpmctrl get-dc-mode [?]

where
  '?' : for help.

Example:
$ sudo ./vpmctrl get-dc-mode
DC mode: 0 (12V)
```

#### 3.4.2.4 **vpmctrl get-dc-voltage**

This command will get the DC voltage.

```
Usage:
    ./vpmctrl get-dc-voltage [?]  
  
where  
    '?' : for help.  
  
Example:  
$ sudo ./vpmctrl get-dc-voltage  
DC volt: 12094 mV
```

#### 3.4.2.5 **vpmctrl get-ignition-status**

This command will get the ignition status.

```
Usage:
    ./vpmctrl get-ignition-status [?]  
  
where  
    '?' : for help.  
  
Example:  
$ sudo ./vpmctrl get-ignition-status  
IGN status: 0 (off)
```

#### 3.4.2.6 **vpmctrl get-ignition-setting**

This command will get the ignition setting.

```
Usage:
    ./vpmctrl get-ignition-setting [?]  
  
where  
    '?' : for help.  
  
Example:  
$ sudo ./vpmctrl get-ignition-setting  
IGN setting: 1 (enable)
```

#### 3.4.2.7 **vpmctrl get-atx-mode**

This command will get the AT/ATX mode.

```
Usage:
    ./vpmctrl get-atx-mode [?]  
  
where  
    '?' : for help.  
  
Example:  
$ sudo ./vpmctrl get-atx-mode  
AT/ATX mode: 1 (ATX)
```



**3.4.2.8 vpmctrl get-board-product-id**

This command will get the board product ID.

```
Usage:
  ./vpmctrl get-board-product-id [?]

where
  '?' : for help.

Example:
$ sudo ./vpmctrl get-board-product-id
Board product ID: MIC-715-OXPB
```

**3.4.2.9 vpmctrl get-board-rev-num**

This command will get the board revision number.

```
Usage:
  ./vpmctrl get-board-rev-num [?]

where
  '?' : for help.

Example:
$ sudo ./vpmctrl get-board-rev-num
Board revision number: 0 (A101-1)
```

**3.4.2.10 vpmctrl get-board-serial-num**

This command will get the board serial number.

```
Usage:
  ./vpmctrl get-board-serial-num [?]

where
  '?' : for help.

Example:
$ sudo ./vpmctrl get-board-serial-num
Board SN: ESPE012345
```

**3.4.2.11 vpmctrl set-board-serial-num**

This command will set the board serial number.

```
Usage:
  ./vpmctrl set-board-serial-num <sn>
  ./vpmctrl set-board-serial-num [?]

where
  <sn> : board serial number to set.
  '?' : for help.

Example:
$ sudo ./vpmctrl set-board-serial-num ESPE012345
Set board SN: 0 (OK)
```

#### 3.4.2.12 **vpmctrl get-low-delay**

This command will get the LOW\_DELAY (0-3600 sec).

```
Usage:
    ./vpmctrl get-low-delay [?]

where
    '?' : for help.

Example:$ sudo ./vpmctrl get-low-delay
LOW_DELAY: 5 sec
```

#### 3.4.2.13 **vpmctrl set-low-delay**

This command will set the low delay.

```
Usage:
    ./vpmctrl set-low-delay <delay>
    ./vpmctrl set-low-delay [?]

where
    <delay> : LOW_DELAY (0-3600 sec) to set.
    '?' : for help.

Example:
$ sudo ./vpmctrl set-low-delay 5
Set LOW_DELAY: 0 (OK)
```

#### 3.4.2.14 **vpmctrl get-low-hard-delay**

This command will get the LOW\_HARD\_DELAY (0-3600 sec).

```
Usage:
    ./vpmctrl get-low-hard-delay [?]

where
    '?' : for help.

Example:
$ sudo ./vpmctrl get-low-hard-delay
LOW_HARD_DELAY: 60 sec
```

#### 3.4.2.15 **vpmctrl set-low-hard-delay**

This command will set the LOW\_HARD\_DELAY (0-3600 sec).

```
Usage:
    ./vpmctrl set-low-hard-delay <delay>
    ./vpmctrl set-low-hard-delay [?]

where
    <delay> : LOW_HARD_DELAY (0-3600 sec) to set.
    '?' : for help.

Example:
$ sudo ./vpmctrl set-low-hard-delay 60
Set LOW_HARD_DELAY: 0 (OK)
```

#### 3.4.2.16 **vpmctrl get-12v-threshold**

This command will get the 12 V threshold (10090-12250 mV).

```
Usage:
  ./vpmctrl get-12v-threshold [?]
```

where

'?' : for help.

Example:

```
$ sudo ./vpmctrl get-12v-threshold
12V Threshold: 10800 mV
```

#### 3.4.2.17 **vpmctrl set-12v-threshold**

This command will set the 12V threshold (10090-12250 mV).

```
Usage:
  ./vpmctrl set-12v-threshold <thr>
  ./vpmctrl set-12v-threshold [?]
```

where

<thr> : 12V Threshold (10090-12250 mV) to set.

'?' : for help.

Example:

```
$ sudo ./vpmctrl set-12v-threshold 10800
Set 12V Threshold: 0 (OK)
```

#### 3.4.2.18 **vpmctrl get-on-delay**

This command will get the ON\_DELAY (0-18000 sec).

```
Usage:
  ./vpmctrl get-on-delay [?]
```

where

'?' : for help.

Example:

```
$ sudo ./vpmctrl get-on-delay
ON_DELAY: 10 sec
```

### 3.4.2.19 **vpmctrl set-on-delay**

This command will set the ON\_DELAY (0-18000 sec).

```
Usage:
  ./vpmctrl set-on-delay <delay>
  ./vpmctrl set-on-delay [?]

where
  <delay> : ON_DELAY (0-18000 sec) to set.
  '?' : for help.

Example:
$ sudo ./vpmctrl set-on-delay 10
Set ON_DELAY: 0 (OK)
```

### 3.4.2.20 **vpmctrl get-off-event-delay**

This command will get the OFF\_EVENT\_DELAY (0-18000 sec).

```
Usage:
  ./vpmctrl get-off-event-delay [?]

where
  '?' : for help.

Example:
$ sudo ./vpmctrl get-off-event-delay
OFF_EVENT_DELAY: 10 sec
```

### 3.4.2.21 **vpmctrl set-off-event-delay**

This command will set the OFF\_EVENT\_DELAY (0-18000 sec).

```
Usage:
  ./vpmctrl set-off-event-delay <delay>
  ./vpmctrl set-off-event-delay [?]

where
  <delay> : OFF_EVENT_DELAY (0-18000 sec) to set.
  '?' : for help.

Example:
$ sudo ./vpmctrl set-off-event-delay 10
Set OFF_EVENT_DELAY: 0 (OK)
```

**3.4.2.22 vpmctrl get-hard-off-delay**

This command will get the HARD\_OFF\_DELAY (0-18000 sec).

```
Usage:
  ./vpmctrl get-hard-off-delay [?]

where
  '?' : for help.

Example:
$ sudo ./vpmctrl get-hard-off-delay
HARD_OFF_DELAY: 180 sec
```

**3.4.2.23 vpmctrl set-hard-off-delay**

This command will set the HARD\_OFF\_DELAY (0-18000 sec).

```
Usage:
  ./vpmctrl set-hard-off-delay <delay>
  ./vpmctrl set-hard-off-delay [?]

where
  <delay> : HARD_OFF_DELAY (0-18000 sec) to set.
  '?' : for help.

Example:
$ sudo ./vpmctrl set-hard-off-delay 180
Set HARD_OFF_DELAY: 0 (OK)
```

**3.4.2.24 vpmctrl get-low-vol-err-count**

This command will get the low voltage error count.

```
Usage:
  ./vpmctrl get-low-vol-err-count [?]

where
  '?' : for help.

Example:
$ sudo ./vpmctrl get-low-vol-err-count
Low Volt Err Cnt: 0
```

**3.4.2.25 vpmctrl clear-low-vol-err-count**

This command will clear the low voltage error count.

```
Usage:
  ./vpmctrl clear-low-vol-err-count [?]

where
  '?' : for help.

Example:
$ sudo ./vpmctrl clear-low-vol-err-count
Clear Low Volt Err Cnt: 0 (OK)
```

### 3.4.2.26 **vpmctrl reset-mcu**

This command will reset (reboot) MCU.

```
Usage:
    ./vpmctrl reset-mcu [?]

where
    '?' : for help.

Example:
$ sudo ./vpmctrl reset-mcu
Reset MCU: 0 (OK)
```

### 3.4.2.27 **vpmctrl get-all-info**

This command will get all the VPM information.

```
Usage:
    ./vpmctrl get-all-info [?]

where
    '?' : for help.

Example:
$ sudo ./vpmctrl get-all-info
API ver: 0
FW ver: 211008
DC mode: 0 (12V)
DC volt: 12084 mV
IGN status: 0 (off)
IGN setting: 1 (enable)
AT/ATX mode: 1 (ATX)
Board product ID: MIC-715-OXPB
Board revision number: 0 (A101-1)
Board SN: ESPE012345
LOW_DELAY: 5 sec
LOW_HARD_DELAY: 60 sec
12V Threshold: 10800 mV
ON_DELAY: 10 sec
OFF_EVENT_DELAY: 10 sec
HARD_OFF_DELAY: 180 sec
Low Volt Err Cnt: 0
```

### 3.4.3 Write the Delay Value to EEPROM

Please open test\_init\_delay\_time.sh.

```
# cd tool
# sudo chmod +x test_init_delay_time.sh
# sudo vim test_init_delay_time.sh
```

We can adjust this value to meet our boot or shutdown time. For example, change “set-on-delay 10” to “set-on-delay 20”. After the modification, as shown in Figure 6, turn the AC OFF/ON of the machine again.

```
echo; echo "===== [ init delay time ] ====="
echo; ./vpmctrl set-low-delay 5; ./vpmctrl get-low-delay
echo; ./vpmctrl set-low-hard-delay 60; ./vpmctrl get-low-hard-delay
echo; ./vpmctrl set-on-delay 10; ./vpmctrl get-on-delay
echo; ./vpmctrl set-off-event-delay 10; ./vpmctrl get-off-event-delay
echo; ./vpmctrl set-hard-off-delay 180; ./vpmctrl get-hard-off-delay
```

It's recommended to have a clear power cycle after the modification has been written to MCU.

```
mic-715@ubuntu:~/test$ sudo ./test_init_delay_time.sh

===== [ init delay time ] =====

Set LOW_DELAY: 0 (OK)
LOW_DELAY: 10 sec

Set LOW_HARD_DELAY: 0 (OK)
LOW_HARD_DELAY: 60 sec

Set ON_DELAY: 0 (OK)
ON_DELAY: 20 sec

Set OFF_EVENT_DELAY: 0 (OK)
OFF_EVENT_DELAY: 10 sec

Set HARD_OFF_DELAY: 0 (OK)
HARD_OFF_DELAY: 180 sec
mic-715@ubuntu:~/test$
```

Figure 3.6 Delay Time

## 3.5 Terms and Definitions

| Abbreviations | Definitions                    |
|---------------|--------------------------------|
| VPM           | Vehicle Power Management (VPM) |

## 3.6 Reference

| ID | Description                                          |
|----|------------------------------------------------------|
| 1  | TREK-570_User_Manual, v004                           |
| 2  | MIC-715-OXPB Schematics, Terry.Lin                   |
| 3  | MIC-715-OXPB Ignition Specification v1.04, Terry.Lin |



## 限用物質含有情況標示聲明書

### Declaration of the Presence Condition of the Restricted Substances Marking

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                              |                      |                      |                                         |                                           |                                                      |                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|----------------------|----------------------|-----------------------------------------|-------------------------------------------|------------------------------------------------------|---------------------------|
| 設備名稱：電腦<br>Equipment name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 型號（型式）：MIC-715-0X<br>Type designation (Type)                 |                      |                      |                                         |                                           |                                                      |                           |
| 單元<br>Unit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 限用物質及其化學符號<br>Restricted substances and its chemical symbols |                      |                      |                                         |                                           |                                                      |                           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 鉛<br>Lead<br>(Pb)                                            | 汞<br>Mercury<br>(Hg) | 鎘<br>Cadmium<br>(Cd) | 六價鉻<br>Hexavalent<br>chromium<br>(Cr+6) | 多溴聯苯<br>Polybrominated<br>biphenyls (PBB) | 多溴二苯醚<br>Polybrominated<br>diphenyl ethers<br>(PBDE) | 相對應排除<br>專案依據<br>(D1~D37) |
| 電路板                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | -                                                            | ○                    | ○                    | ○                                       | ○                                         | ○                                                    | D13,D14,D16,D17           |
| 內外殼                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | -                                                            | ○                    | ○                    | ○                                       | ○                                         | ○                                                    | D13                       |
| 線材                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | ○                                                            | ○                    | ○                    | ○                                       | ○                                         | ○                                                    |                           |
| 其它固定組件<br>(螺絲, 螺柱)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | -                                                            | ○                    | ○                    | ○                                       | ○                                         | ○                                                    | D13                       |
| 電源供應器                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | -                                                            | ○                    | ○                    | ○                                       | ○                                         | ○                                                    | D14,D16                   |
| 散熱模組                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | -                                                            | ○                    | ○                    | ○                                       | ○                                         | ○                                                    | D14,D16                   |
| 備考 1. “超出 0.1 wt%” 及 “超出 0.01 wt%” 係指限用物質之百分比含量超出百分比含量基準值。<br>Note 1: “Exceeding 0.1 wt %” and “exceeding 0.01 wt %” indicate that the percentage content of the restricted substance exceeds the reference percentage value of presence condition.<br>備考 2. “○” 係指該項限用物質之百分比含量未超出百分比含量基準值。<br>Note 2: “○” indicates that the percentage content of the restricted substance does not exceed the percentage of reference value of presence.<br>備考 3. “-” 係指該項限用物質為排除項目。<br>Note 3: The “-” indicates that the restricted substance corresponds to the exemption. |                                                              |                      |                      |                                         |                                           |                                                      |                           |

## 3.7 MIC-715 Power Supply Installation Guide

### 3.7.1 Power Supply 115 V / 230 V Adjustment

Before use, please check the AC power input is 110 V or 220 V.

1. If the AC power input is 110 V, please check the switch in power supply right side, confirmed it is 115 V. (See Figure 3.7)
2. If the AC power input is 220 V, please check the switch in power supply right side and adjust it to 230 V. (See Figure 3.8)



Figure 3.7



Figure 3.8

### 3.7.2 Power Cord Installation

#### IGN Mode

1. Obtain the power cord from the accessory box. (See Figure 3.9)
2. Follow the below instructions to connect the pins to the power supply.  
Please connect the V+, and the IGN (two) pins to the 2nd V+ screw. In IGN mode, the PSW will be suspended.  
(See Figure 3.10)



Figure 3.9



Figure 3.10

### ATX Mode

1. Connect the PSW wire to one of the button connections,
  2. Connect the other button connection with a wire to V-, as shown in Figure 3.11.
- Note: In ATX mode, IGN is suspended.

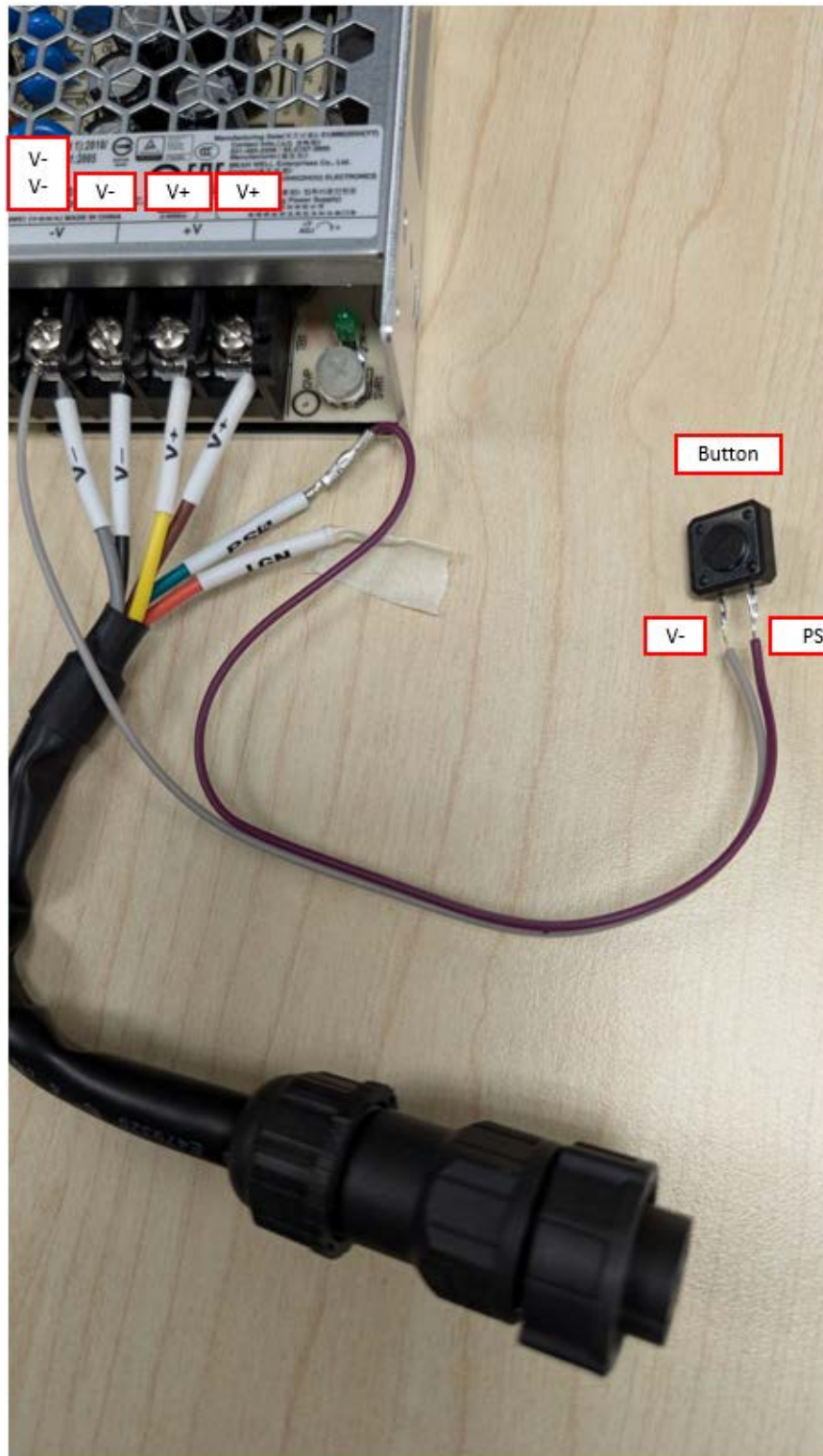


Figure 3.11 ATX Mode Connections

### 3.7.3 12 V / 24 V DC Power Input Adjustment

The MIC-715 default is 12 VDC in. If the needed power input is 24 VDC, please follow the below steps to change to 24 VDC power input.

1. Switch on board default is 00, 12 VDC in. (See Figure 3.11)
2. Change the switch to 01 to 24 VDC in. (See Table 3.6.)

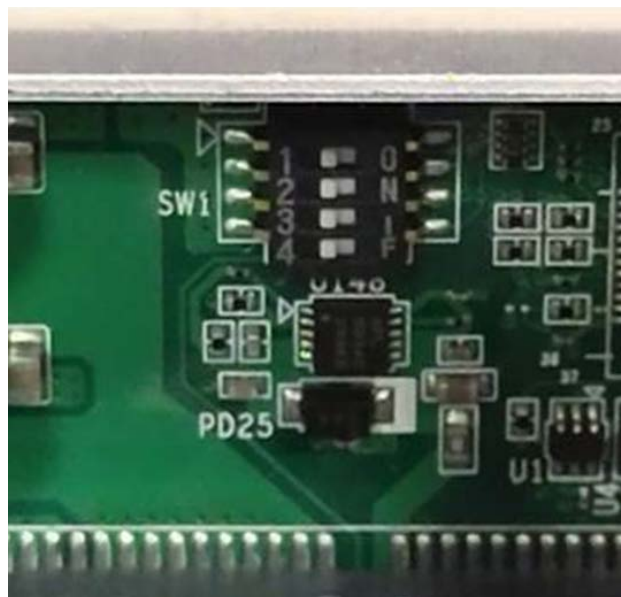


Figure 3.12

| Table 3.6: Power Input Adjustment |                  |                                                          |
|-----------------------------------|------------------|----------------------------------------------------------|
| Pin                               | Name             | Description                                              |
| 1                                 | IGN_ENABLE       | ON: ignition disabled<br>OFF: ignition enabled (default) |
| 2                                 | IGN_POLARITY     | ON: active low<br>OFF: active high (default)             |
| 3                                 | DCIN_MODE_RANGED | 00: 12 V (default)                                       |
| 4                                 | DCIN_MODE_RANGE  | 01: 24 V                                                 |

### 3.7.4 Vehicle Power Management (VPM)

The feature of Vehicle Power Management (VPM) is provided for users to fulfill special requirements on in-vehicle applications. The following chart is the VPM state machine.

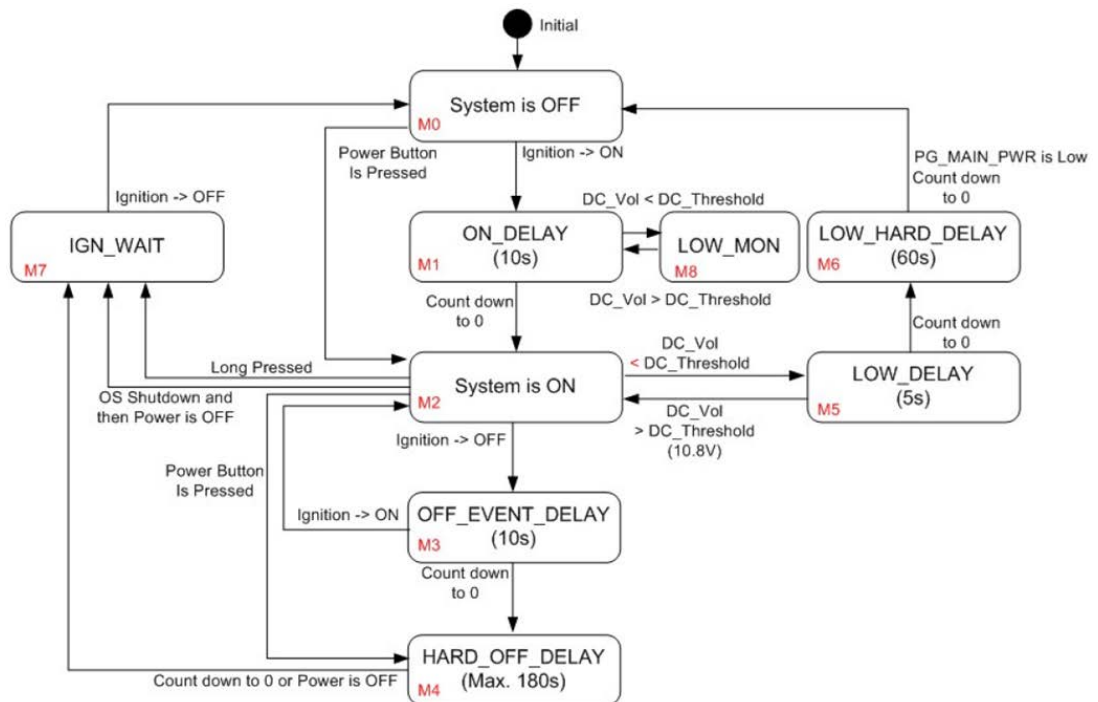


Figure 3.13

The table below lists the user-programmable parameters for VPM features:

| Table 3.7: User-Programmable Parameters for VPM Features |               |                     |
|----------------------------------------------------------|---------------|---------------------|
| Name                                                     | Default Value | Acceptable Range () |
| ON DELAY                                                 | 10 seconds    | 0-18000 seconds     |
| OFF EVENT DELAY                                          | 10 seconds    | 0-18000 seconds     |
| HARD OFF DELAY                                           | 180 seconds   | 0-18000 seconds     |
| LOW THRESHOLD (12 V mode)                                | 10.8 V        | 10.09-12.25 V       |
| LOW DELAY                                                | 5 seconds     | 0-3600 seconds      |
| LOW HARD DELAY                                           | 60 seconds    | 0-3600 seconds      |



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