MAI602 Series

Machine Automation Fanless System

User's Manual

Version 1.0b
(Sep. 2018)

iBASE

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Disclaimer

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Trademarks

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Compliance

CE

This product has passed CE tests for environmental specifications and limits. This product is in accordance with the directives of the Union European (EU). If users modify and/or install other devices in this equipment, the CE conformity declaration may no longer apply.

FC

This product has been tested and found to comply with the limits for a Class B device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with manufacturer's instructions, may cause harmful interference to radio communications.

WEEE

This product must not be disposed of as normal household waste, in accordance with the EU directive of for waste electrical and electronic equipment (WEEE - 2012/19/EU). Instead, it should be disposed of by returning it to a municipal recycling collection point. Check local regulations for disposal of electronic products.

Green IBASE

This product is compliant with the current RoHS restrictions and prohibits use of the following substances in concentrations exceeding 0.1% by weight (1000 ppm) except for cadmium, limited to 0.01% by weight (100 ppm).

- Lead (Pb)
- Mercury (Hg)
- Cadmium (Cd)
- Hexavalent chromium (Cr6+)
- Polybrominated biphenyls (PBB)
- Polybrominated diphenyl ether (PBDE)

Important Safety Information

Carefully read the precautions before using the device.

Environmental conditions:

- Lay the device horizontally on a stable and solid surface in case the device may fall, causing serious damage.
- Make sure you leave plenty of space around the device for ventilation.
- Use this product in environments with ambient temperatures -10˚C ~ 60˚C with airflow.
- DO NOT LEAVE THIS DEVICE IN AN ENVIRONMENT WHERE THE STORAGE TEMPERATURE MAY GO BELOW -20˚C OR ABOVE 80˚C. This could damage the device. The device must be used in a controlled environment.

Care for your IBASE products:

- Before cleaning the device, turn it off and unplug all cables such as power in case a small amount of electrical current may still flow.
- Use neutral cleaning agents or diluted alcohol to clean the device chassis with a cloth. Then wipe the chassis with a dry cloth.
- Vacuum the dust with a computer vacuum cleaner to prevent the air vent or slots from being clogged.

WARNING

Attention during use:

- Do not use this product near water.
- Do not spill water or any other liquids on your device.
- Do not place heavy objects on the top of the device.
- Operate this device from the type of power indicated on the marking label. If you are not sure of the type of power available, consult your distributor or local power company.
- Ensure that you apply correctly the power supply voltage.
- Do not walk on the power cord or allow anything to rest on it.
- If you use an extension cord, make sure that the total ampere rating of the product plugged into the extension cord does not exceed its limits.

Avoid Disassembly

You are not suggested to disassemble, repair or make any modification to the device. Disassembly, modification, or any attempt at repair could generate hazards and cause damage to the device, even bodily injury or property damage, and will void any warranty.

CAUTION

Danger of explosion if internal lithium-ion battery is replaced by an incorrect type. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

Warranty Policy

- **IBASE standard products:**

  24-month (2-year) warranty from the date of shipment. If the date of shipment cannot be ascertained, the product serial numbers can be used to determine the approximate shipping date.

- **3rd-party parts:**

  12-month (1-year) warranty from delivery for the 3rd-party parts that are not manufactured by IBASE, such as CPU, memory, storage device, power adapter, panel and touchscreen.

* PRODUCTS, HOWEVER, THAT FAILS DUE TO MISUSE, ACCIDENT, IMPROPER INSTALLATION OR UNAUTHORIZED REPAIR SHALL BE TREATED AS OUT OF WARRANTY AND CUSTOMERS SHALL BE BILLED FOR REPAIR AND SHIPPING CHARGES.

Technical Support & Services

1. Visit the IBASE website at www.ibase.com.tw to find the latest information about the product.
2. If you need any further assistance from your distributor or sales representative, prepare the following information of your product and elaborate upon the problem.
   - Product model name
   - Product serial number
   - Detailed description of the problem
   - The error messages in text or in screenshots if there is any
   - The arrangement of the peripherals
   - Software in use (such as OS and application software, including the version numbers)
3. If repair service is required, you can download the RMA form at http://www.ibase.com.tw/english/Supports/RMAService/. Fill out the form and contact your distributor or sales representative.

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Table of Contents

Chapter 1
General Information

The information provided in this chapter includes:

- Features
- Packing List
- Optional Accessories
- Specifications
- Overview
- Dimensions

1.1 Introduction

The MAI602 series is applicable to smart industrial automation or controller, such as motion control and digital input and output control. It is a compact and fanless design with an Intel® 7th / 6th Gen. Core™ i7 / i5 / i3 desktop processor. This product series also features iSmart that allows the device capable of auto-scheduling for general applications and gives energy savings on power. It can be operated at the ambient operating temperature ranging from -10 ~ 60 °C with airflow, and even from -20 ~ 80 °C for storage.

1.2 Features

- Compact fanless system with IBASE MB300-TLP customized board
- Onboard Intel® 7th / 6th Gen. Core™ i7 / i5 / i3 processors
- Removable SSD/HDD drive bay with RAID 0/1 supported
- Two independent display outputs
- Optional 2 MB MRAM module
- 4-axis pulse command motion control (for MAI602-M4D80 only)
- 80-channel Isolated Digital I/O (48-channel DI / 32-channel DO, for MAI602-M4D80 only)
- Over / Under / Reverse voltage protection
- Wall mount and DIN rail mount compatibility
- iSmart, iAMT 11.6

1.3 Packing List

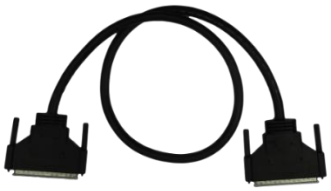
Your product package should include the items listed below. If any of the items below is missing, contact the distributor or the dealer from whom you purchased the product.

- MAI602 x 1
- Terminal Block for DC-In Power Adapter (3 pins) x 1
- Terminal Block for Remote Power Button (2 pins) x 1
- Wall Mount Kit x 1
- Round Head Screw (for Wall Mount Kit) x 6

1.4 Optional Accessories

IBASE provide optional accessories as follows. Please contact us or your dealer if you need any.

- DC-In Power Adapter
- Power Cord
- WiFi Antenna Kit
- 2nd SSD/HDD and SATA Cable
- Side Mount Bracket
- DIN Rail Bracket
- SCSI Cable (2 meter long, 100 pin, for motion card or digital I/O card)



- Terminal Board (for motion card or digital I/O card)

1.5 Specifications

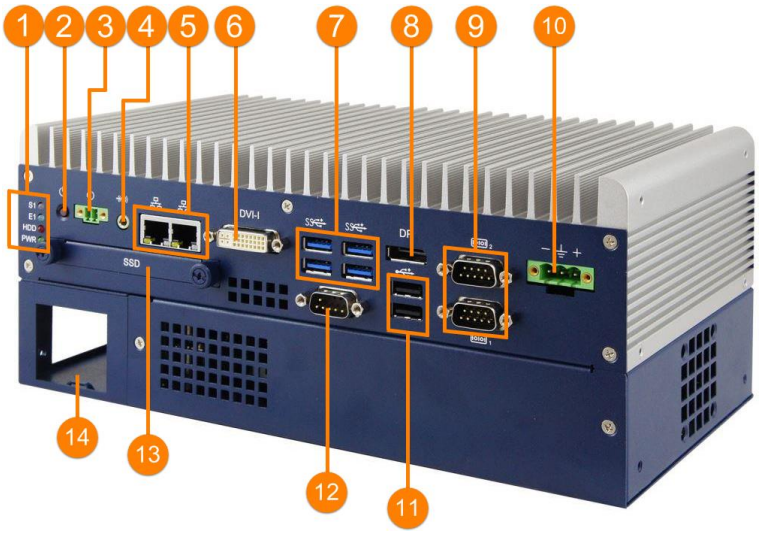
Product Name	MAI602	MAI602-M4D80
System		
Motherboard	MB300-TPL	
CPU	Intel® 7th / 6th Gen. Core™ i7 / i5 / i3 Desktop Processor TDP = 35W	
Operating System	**For Intel® 7th Gen. Core™:** • Windows10 (64-bit) • Windows 7 (32-bit & 64-bit) • Linux Ubuntu **For Intel® 6th Gen. Core™:** • Windows 7 (32-bit & 64-bit) • Linux Ubuntu	**For Intel® 7th Gen. Core™:** • Windows10 (64-bit) • Windows 7 (32-bit & 64-bit) **For Intel® 6th Gen. Core™:** • Windows 7 (32-bit & 64-bit)
CPU Speed	Up to 3.4 GHz	
Chipset	Intel® Q170	
Memory	2 x DDR4-2133 SO-DIMM 4GB, expandable to 32 GB (Non-ECC)	
Storage	• 2.5” SSD/HDD (the first one is external and installed by default, the second one is internal for option.) • mSATA	
Super I/O	Fintek F81846AD-I	
Audio Codec	Realtek ALC662	
Network	• Intel® I219LM GbE PHY • Intel® I211AT GbE	
Power Supply	DC-In 24V (3-pin terminal block)	
BIOS	AMI BIOS	
Watchdog	Watchdog Timer 256 segments, 0, 1, 2…255 sec/min	
iSmart	Yes	
iAMT	11.6	
Chassis	Aluminum & steel, silver	
Mounting	• Desktop mount / Wall mount (wall mount kit included) • DIN rail mount (optional)	
Dimensions (W x H x D)	275 x 113 x 140 mm (10.83” x 4.45” x 5.51”)	
Weight	2.7 kg (5.95 lb)	3.1 kg (6.83 lb)
Certificate	CE / LVD / FCC Class B	

Product Name	MAI602	MAI602-M4D80
I/O Ports		
Remote Power Button	2-pin terminal block for the external / remote power button	
DC Input	24V DC-in through a 3-pin terminal block	
LAN	2 x RJ45 GbE LAN	
USB	• 4 x USB 3.0 • 2 x USB 2.0	
Serial	**2 x COM ports:** • COM1: RS-232/422/485, selectable from BIOS • COM2: RS-232 only	
Digital I/O	4-In & 4-Out (Optional)	
Display	• 1 x DVI-I • 1 x DisplayPort	
Audio Jack	1 x Line-Out	
SATA	2 x SATA III connector	
Expansion	• 1 x Mini-PCIe (full-size) • 1 x PCIe (x8) • 1 x PCIe (x4)	• 1 x Mini-PCIe (full-size) • 4-axis motion control • 80-ch digital I/O (48-In / 32-Out)
Environment		
Temperature	• **Operating:** -10 ~ 60 °C (14 ~ 140 °F) with airflow -10 ~ 50 °C (14 ~ 122 °F) without airflow • **Storage:** -20~ 80 °C (-4 ~ 176 °F)	
Relative Humidity	5 ~ 90% at 45 °C (non-condensing)	
Vibration Protection	Shinewave tests: • **Operating:** 0.25 Grms / 5 ~ 500 Hz • **Non-operating:** 1 Grms / 5 ~ 500Hz	
Shock Protection	• **Operating:** 20 g / 11 ms • **Non-operating:** 40 g / 11 ms	

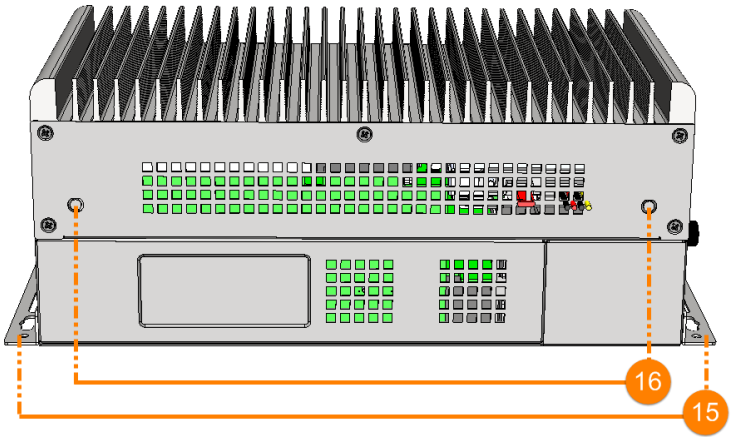
All specifications are subject to change without prior notice.

1.6 Overview

Oblique View



Rear View



No.	Name	No.	Name
1	LED Indicator (from top to bottom: S1*, E1*, SSD/HDD, Power)	9	COM Ports (COM1 RS-232/422/485, COM2 RS-232)
2	Power Button	10	DC-In Power Connector (3 pins)
3	Terminal Block for Remote Power Button (2 pins)	11	USB 2.0 Ports
4	Audio Jack for Line-Out	12	Reserved RS-232 Port
5	GbE LAN Ports	13	1st SSD/HDD Drive Bay
6	DVI-I Port	14	Expansion Card Cable Organizer
7	USB 3.0 Ports	15	Wall Mount Kit
8	DisplayPort	16	Antenna Holes

* The LED indicators S1 (for status) and E1 (for errors) are configurable by users.

⚠ Be cautious of the hot surface when using the device.

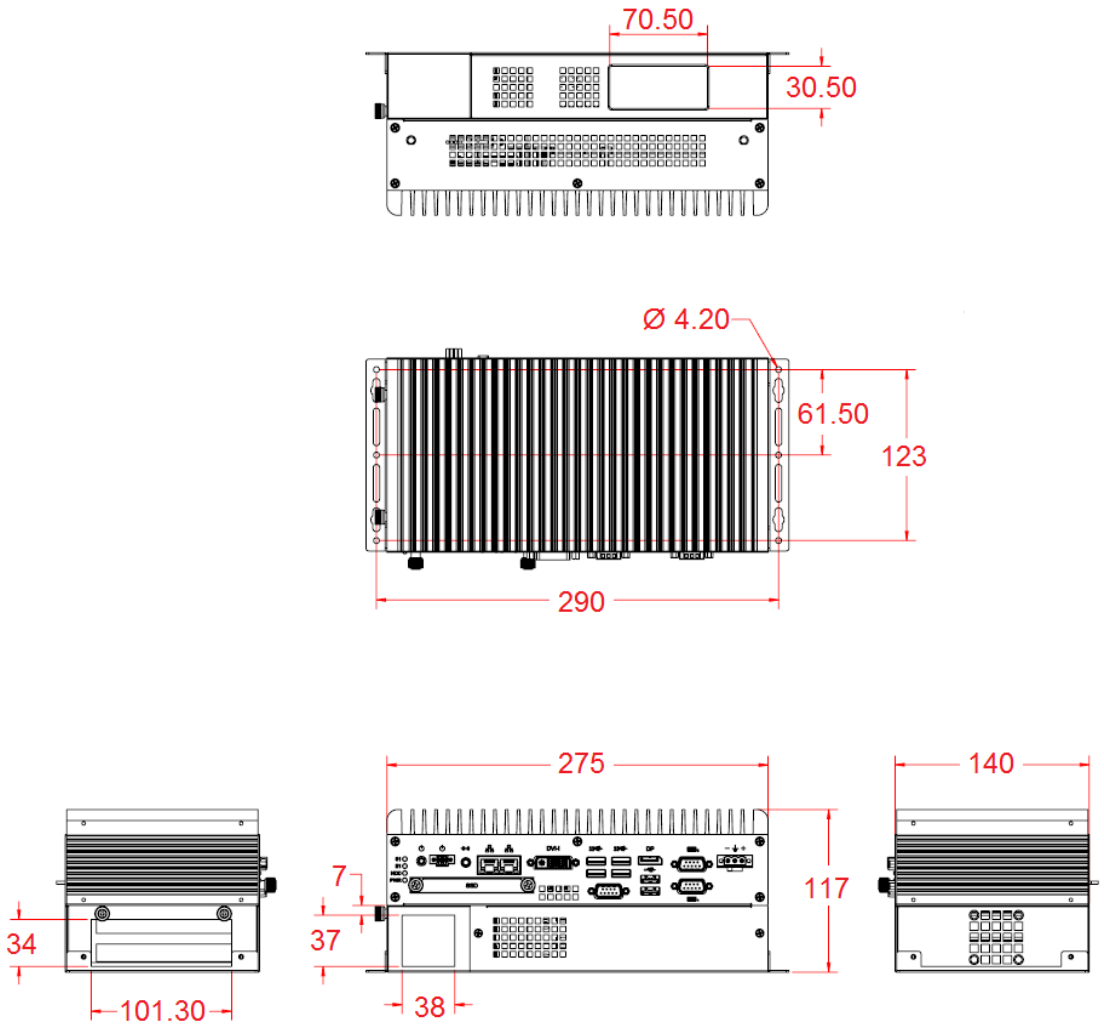
Wall Mount

Side Mount

DIN Rail Mount

1.7 Dimensions

Unit: mm



Chapter 2
Hardware Configuration

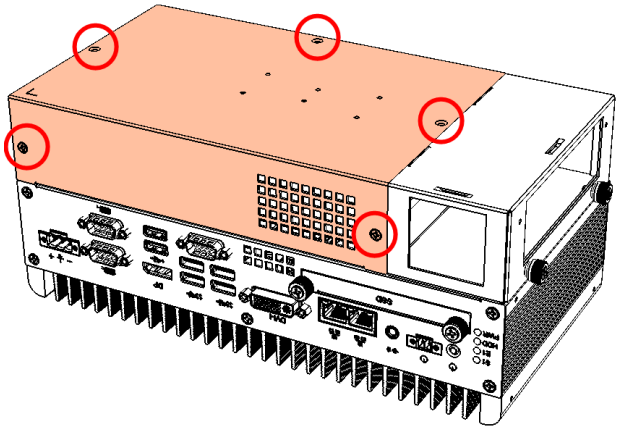
The information provided in this chapter includes:

- Installation / Replacement
- Information and locations of connectors

2.1 Installation / Replacement

You need to take away the device bottom cover for the installation / replacement of memory module cards, CPU, and expansion cards except for the 1st SSD/HDD. After installations, secure the device bottom cover back.

Release 2 screws on the lower front side of the device and another 3 screws on the bottom.

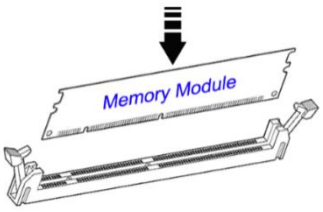


2.1.1 Memory Installation or Replacement

If you need to install or replace a memory module, follow the instructions below for installation after you remove the device cover.

1. Locate the memory slots in your device.
2. Press the ejector tab of the memory slot outwards with your fingertips.

3. Hold the memory module and align the key of the module with that on the memory slot.
4. Gently push the module in an upright position until the ejector tabs of the memory slot close to hold the module in place when the module touches the bottom of the slot.



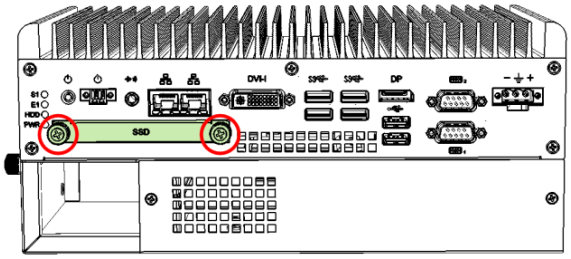
To remove the module, press the ejector tabs outwards with your fingertips to eject the module.

2.1.2 SSD/HDD Installation or Replacement

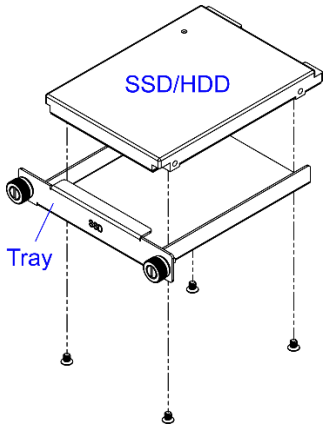
To install or replace the SSD/HDD, follow the instructions below for installation.

1st SSD/HDD:

1. Release 2 screws to pull out the SSD/HDD tray.



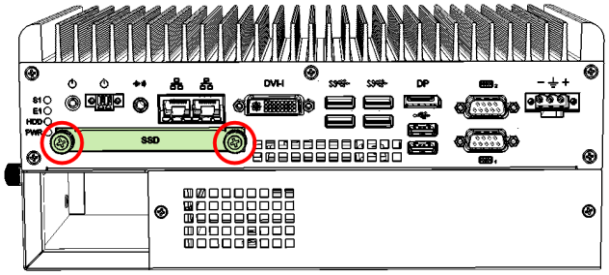
2. Put your 2.5” SSD/HDD into the tray and secure it with the supplied 4 screws



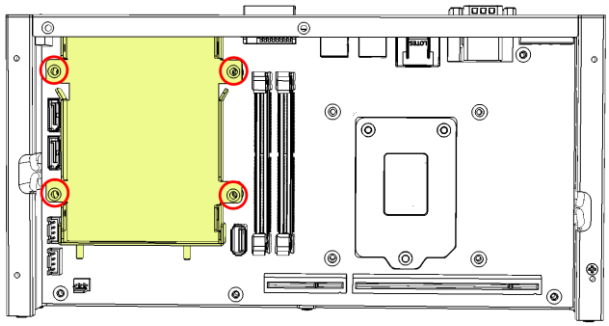
3. Put and secure the tray back to the device.

2nd SSD/HDD (optional):

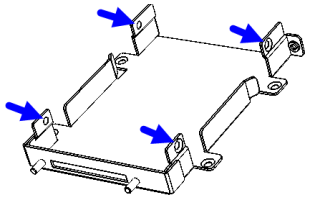
1. Release 2 screws to pull out the SSD/HDD tray.



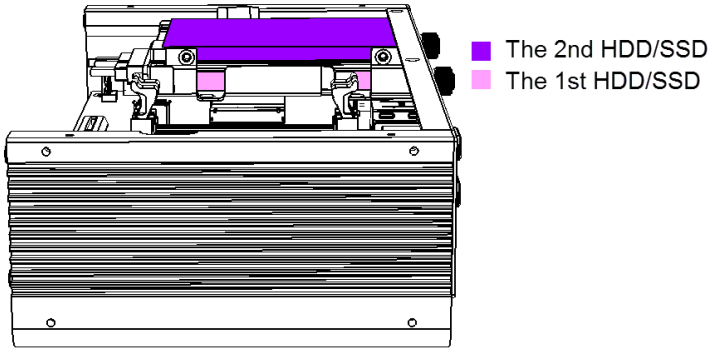
2. Remove the device bottom cover as mentioned in the section 2.1 and release 4 screws below to take out the bracket.



3. Install the 2nd SSD/HDD onto the bracket, secure it with 4 screws as pointed by arrows below.



4. Then secure the bracket and put the tray back to the device.

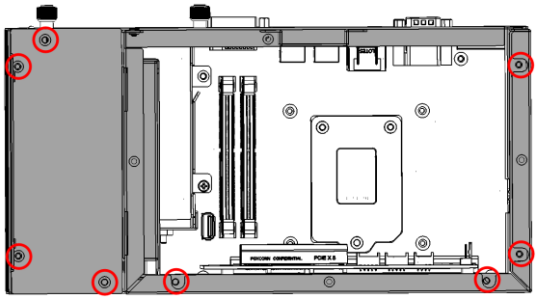


Note: The screws and cables for the 2nd SSD/HDD can be optionally purchased from IBASE.

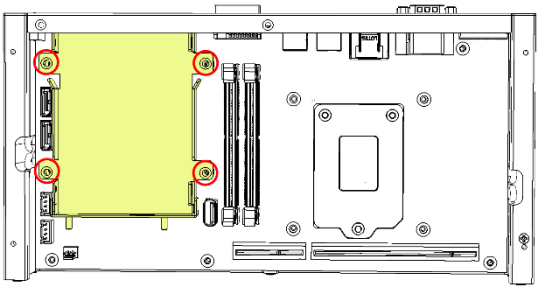
2.1.3 Mini-PCIe Network Cards Installation or Replacement

After removing the bottom cover, follow the instructions

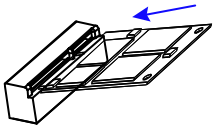
1. Remove the SSD/HDD tray by releasing 2 screws below.
2. Take away the expansion bracket by releasing the 8 screws below.



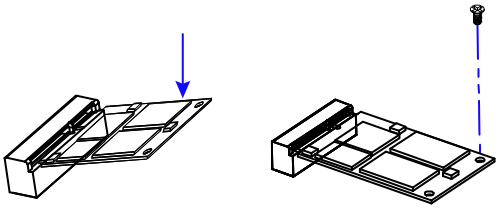
3. Then release the 4 screws below to take out the bracket.



4. Locate the mini-PCIe slot, align the key of the mini-PCIe card to the interface, and insert the card slantwise.

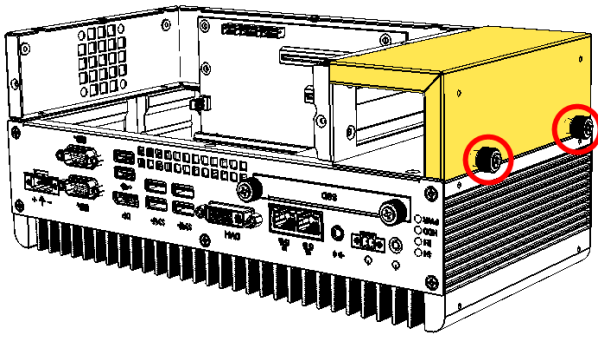


5. Push the mini-PCIe card down, fix it with the supplied 2 flat head screws for full-sized card, and with one screw for half-sized card.

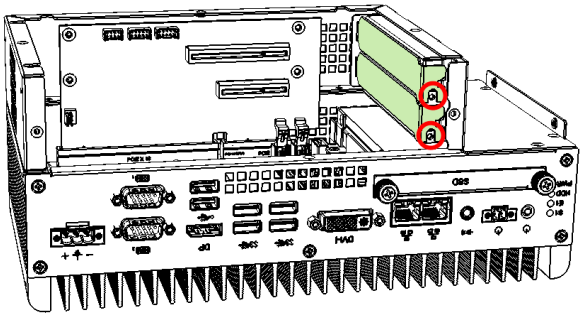


2.1.4 Expansion Card Installation or Replacement

1. After removing the device bottom cover, loosen two screws below to remove the cable organizer.

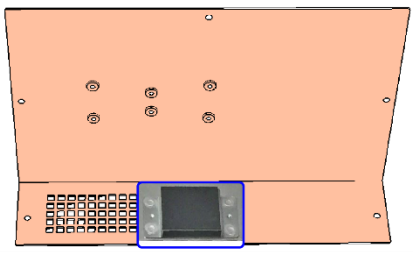


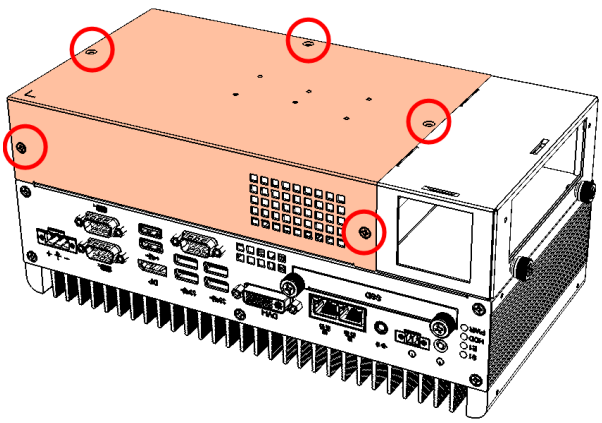
2. Remove the expansion slot fillers by releasing the two screws below.



3. Install the expansion cards and fix with the screws mentioned in step 2. Then secure the cable organizer back.

4. Then secure the device bottom cover back, The rubber inside the bottom cover firmly fixes the expansion cards and prevents the cards from coming off the PCIe slots.





2.1.5 WiFi / 3G / 4G Antenna Installation

Thread the WiFi / 3G / 4G antenna extension cable through an antenna hole of the front I/O cover and fasten the antenna as shown below. Then apply adhesive to the edge of the hex nut behind the front I/O cover to prevent the extension cable from falling if the cable becomes loose.

1. Thread and fasten the hex nut and the washer. Then install the antenna.
2. Apply adhesive around here.

Info: The diameter of the nut is around 6.35 mm (0.25”-36UNC).

2.1.6 Mounting Installation

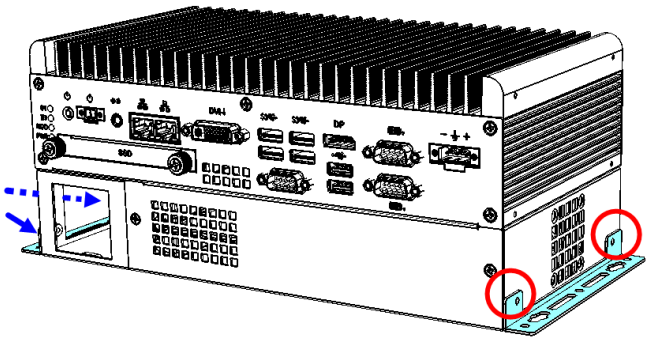
Note: Before mounting the system on wall, ensure that you are following all applicable building and electric codes.

Requirements:

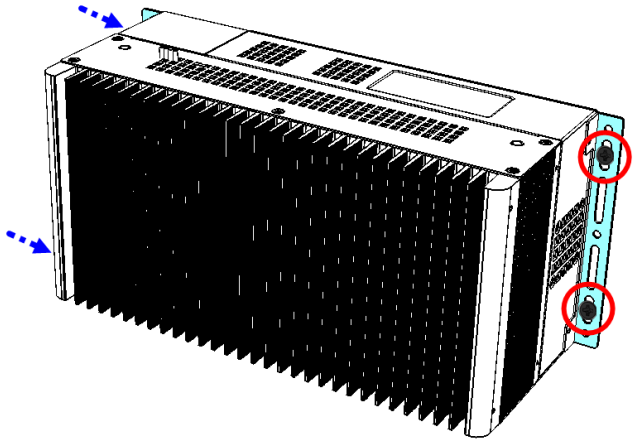
Before mounting the brackets, ensure that you have enough room for power and signal cable routing. The method of mounting must be able to support weight of the system plus the suspend weight of all the cables to be attached to the system.

Wall mounting instructions:

1. Attach the mounting brackets to your product, and secure with the supplied 4 screws.

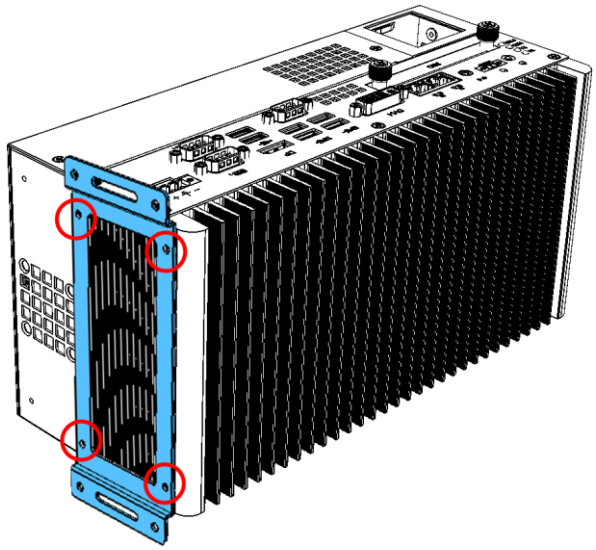


2. Prepare at least 4 screws (M3) to install the device on wall .

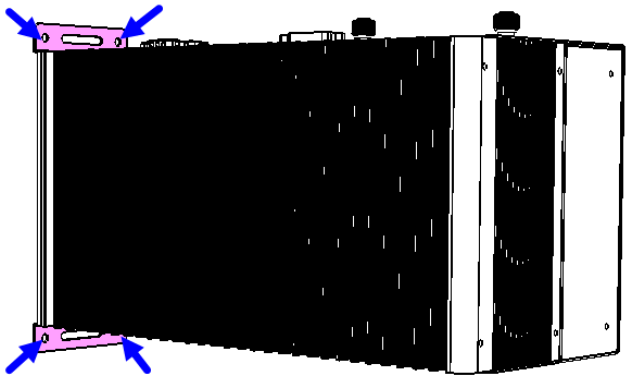


2.1.6.1. Side-Mounting Installation (Optional)

1. Attach the mounting bracket to your product, and secure with the supplied 4 screws.



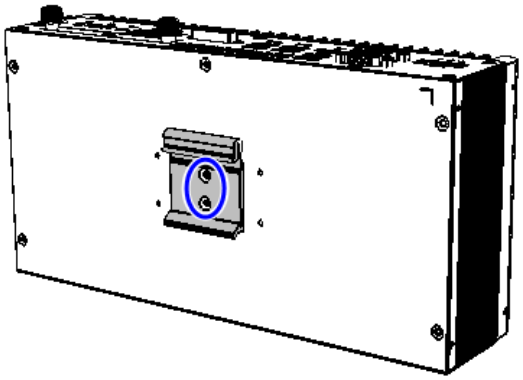
2. Prepare at least 4 screws (M3) to install the device on wall .



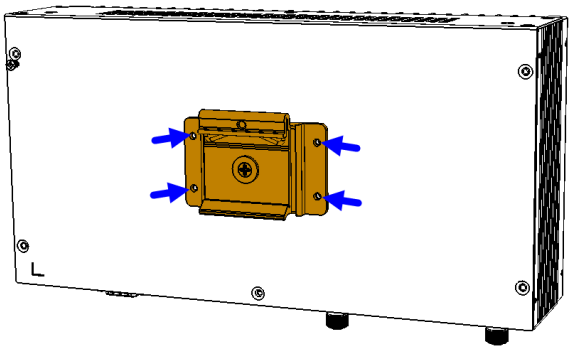
2.1.6.2. DIN Rail Mounting Installation (Optional)

1. Attach the DIN rail mounting bracket to your product, and secure with the supplied screws.

   a.) Secure with 2 screws for a general bracket.



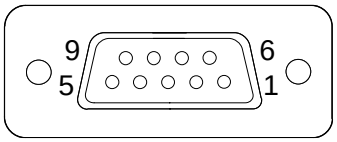
   b.) Secure with 4 screws for a rotatable bracket.



2. Hook the DIN rail mounting bracket over the top of the DIN rail, and then press the lower section of the bracket towards the DIN rail to clip the bracket onto it.

2.1.7 Pinout for COM Ports, DC-In & Power Button Connectors

- **COM1 RS232/422/485 Port**

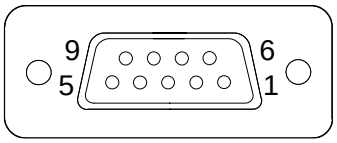


COM1 port is jumperless and configurable in BIOS.

Pin	Assigment	Pin	Assigment
1	DCD, Data carrier detect	6	DSR, Data set ready
2	RXD, Receive data	7	RTS, Request to send
3	TXD, Transmit data	8	CTS, Clear to send
4	DTR, Data terminal ready	9	RI, Ring indicator
5	Ground		

Pin	Assignment		
	RS-232	RS-422	RS-485
1	DCD	TX-	DATA-
2	RX	TX+	DATA+
3	TX	RX+	NC
4	DTR	RX-	NC
5	Ground	Ground	Ground
6	DSR	NC	NC
7	RTS	NC	NC
8	CTS	NC	NC
9	RI	NC	NC

- **COM2 RS-232 Port**

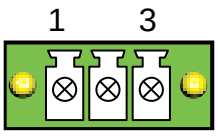


Pin	Assigment	Pin	Assigment
1	DCD, Data carrier detect	6	DSR, Data set ready
2	RXD, Receive data	7	RTS, Request to send
3	TXD, Transmit data	8	CTS, Clear to send
4	DTR, Data terminal ready	9	RI, Ring indicator
5	Ground		

Note:

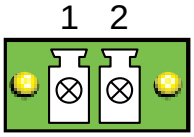
1. You can externally use COM3 & COM4 for MAI602 by connecting them from the motherboard.
2. COM5 and COM6 are both available for MAI602-M4D80 only (from the riser card IP302).

- **DC-In Power Connector (3-pin terminal block)**



Pin	Assigment	Pin	Assigment
1	24V	3	Power Ground
2	Case Ground		

- **Remote Control Connector (2-pin terminal block)**



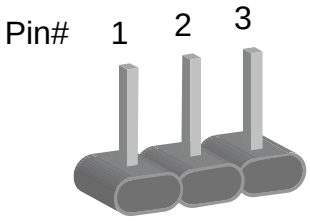
Pin	Assigment	Pin	Assigment
1	Power BTN	2	Ground

2.2 Setting the Jumpers

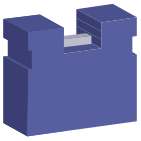
Set up and configure your device by using jumpers for various settings and features according to your needs and applications. Contact your supplier if you have doubts about the best configuration for your use.

2.2.1 How to Set Jumpers

Jumpers are short-length conductors consisting of several metal pins with a non-conductive base mounted on the circuit board. Jumper caps are used to have the functions and features enabled or disabled. If a jumper has 3 pins, you can connect either PIN1 to PIN2 or PIN2 to PIN3 by shorting.

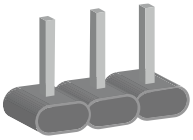
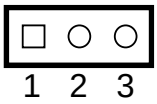
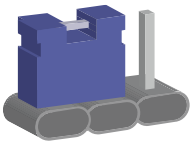
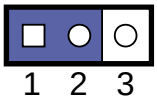
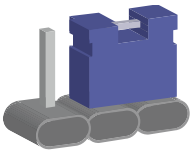
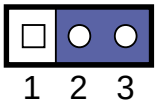


A 3-pin jumper



A jumper cap

Refer to the illustration below to set jumpers.

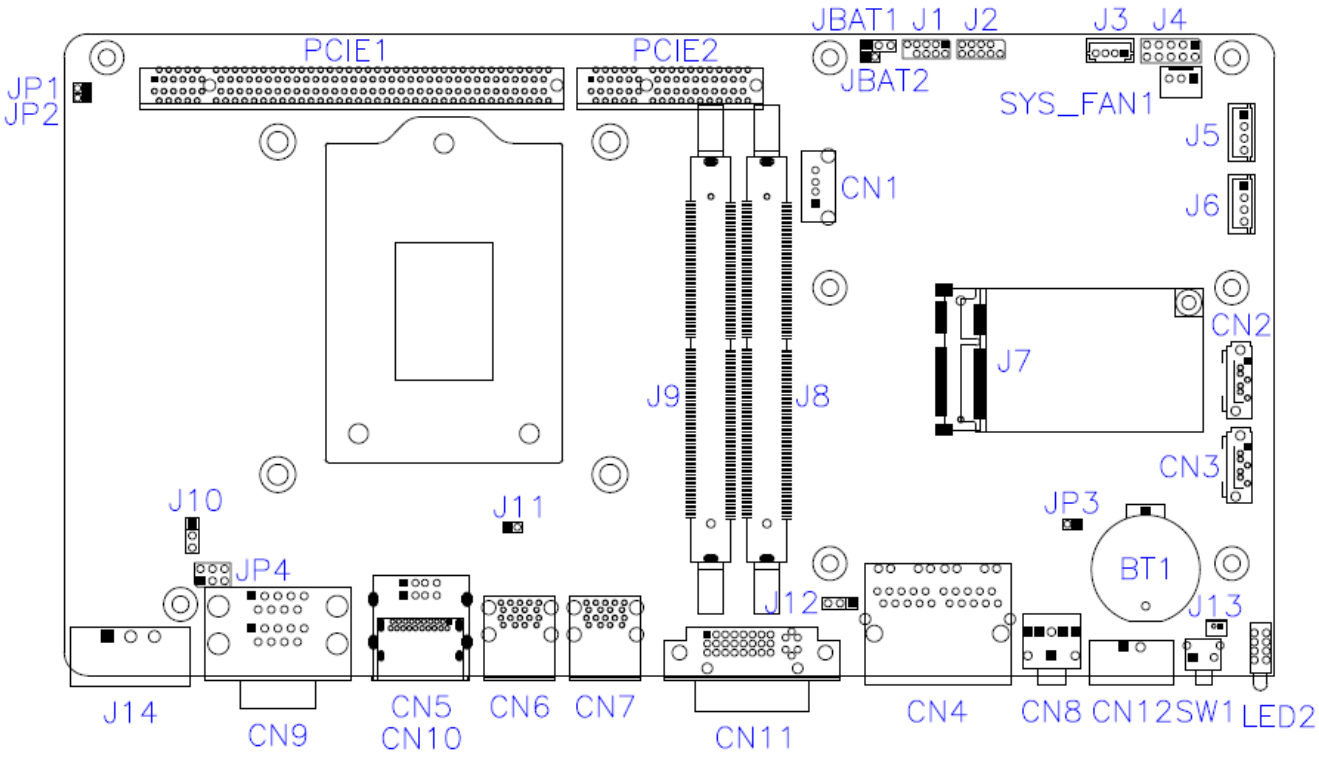
Pin closed	Oblique view	Schematic illustration in the manual
Open		
1-2		
2-3		

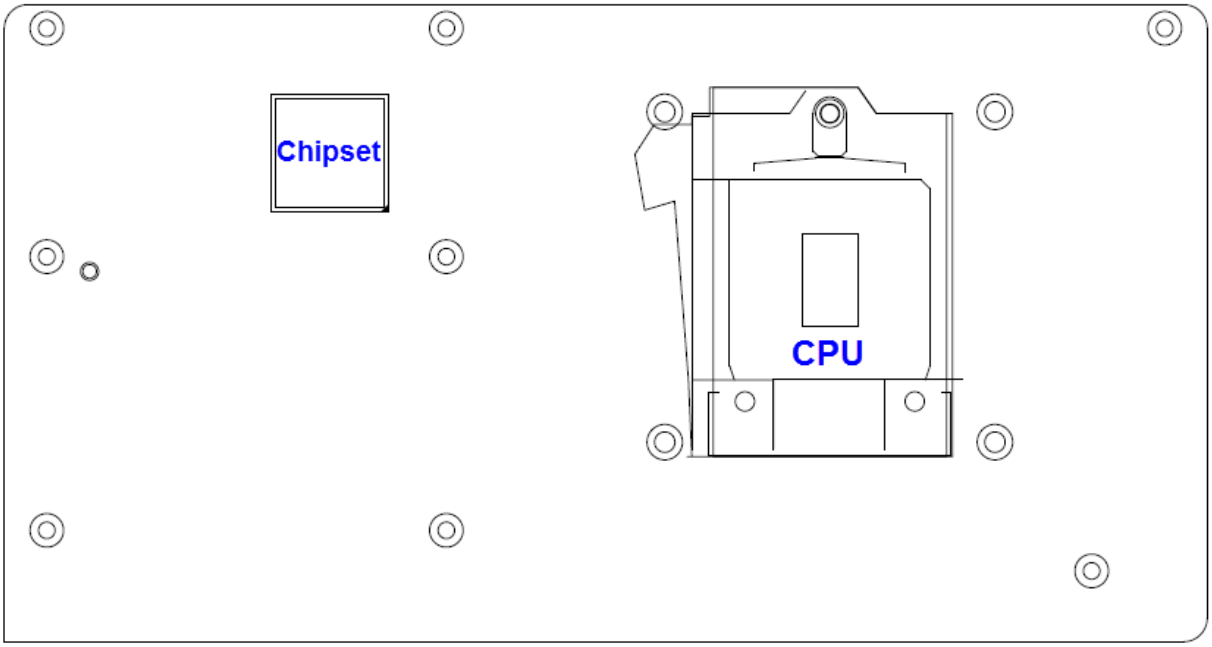
When two pins of a jumper are encased in a jumper cap, this jumper is **closed**, i.e. turned **On**.

When a jumper cap is removed from two jumper pins, this jumper is **open**, i.e. turned **Off**.

2.3 Jumper & Connector Locations on Motherboard

Motherboard: MB300

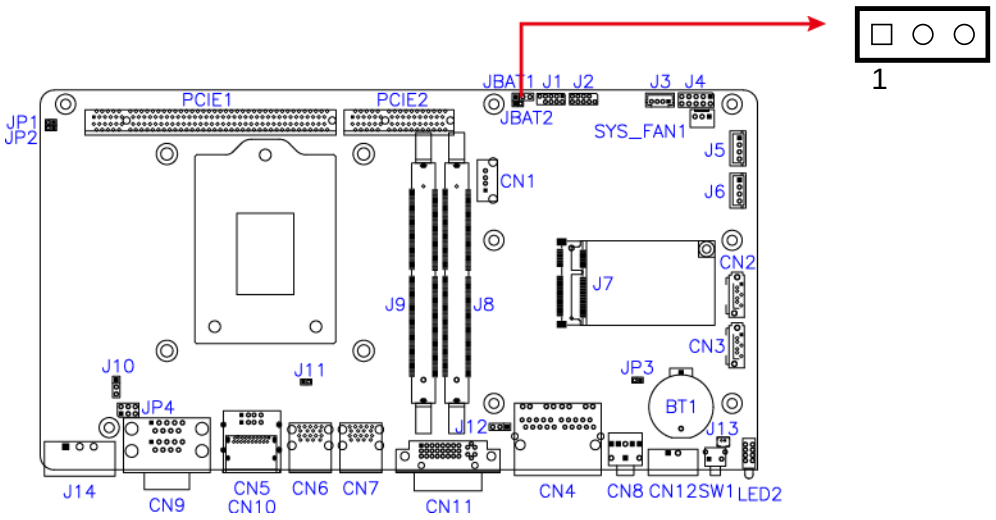


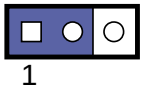
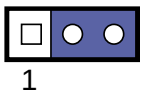


2.4 Jumpers Quick Reference

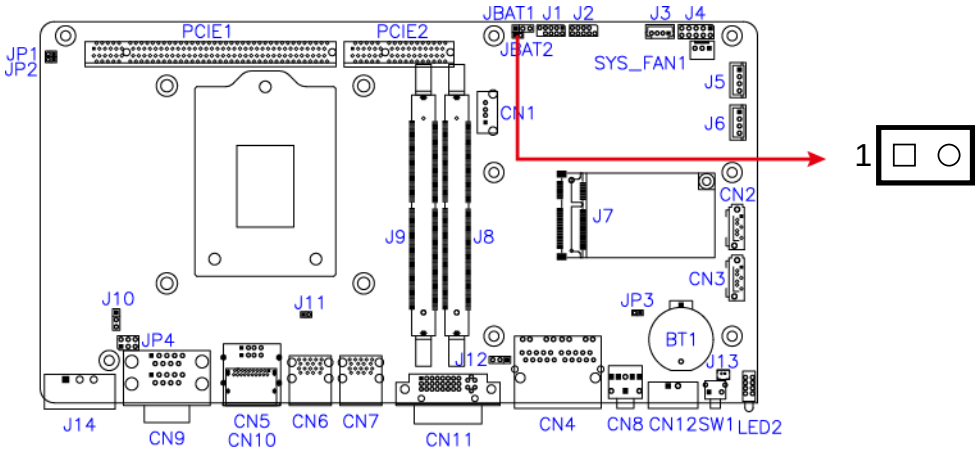
Function	Connector Name	Page
CMOS Data Clearance	JBAT1	23
RTC Content Clearance	JBAT2	24
CPU dGfx Bifurcation Selection	JP1, JP2	25
COM2 RS-232 Power Selection	JP4	26
Factory Use Only	JP3	--

2.4.1 CMOS Data Clearance (JBAT1)



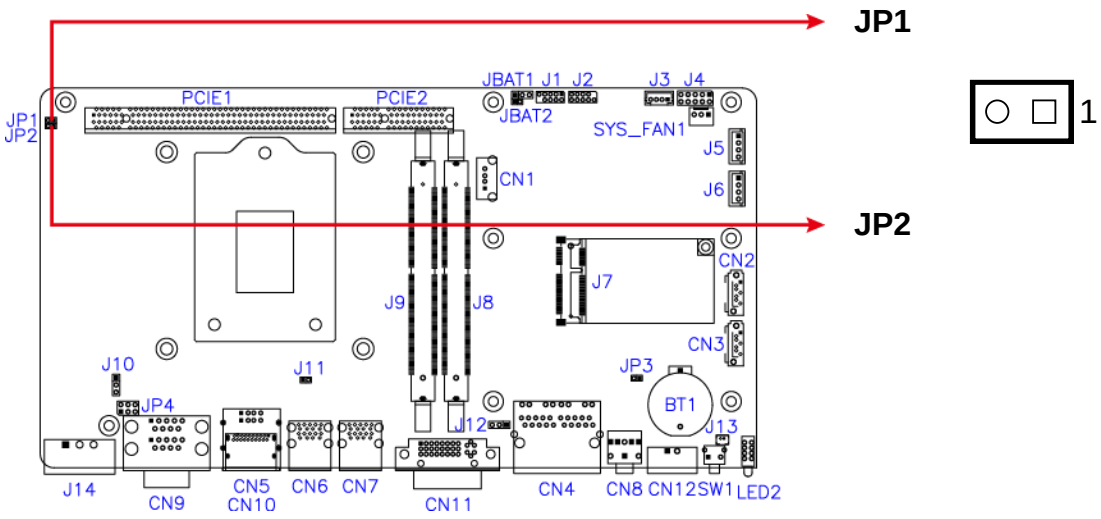
Function	Pin closed	Illustration
Normal (default)	1-2	
Clear CMOS	2-3	

2.4.2 RTC Content Clearance (JBAT2)



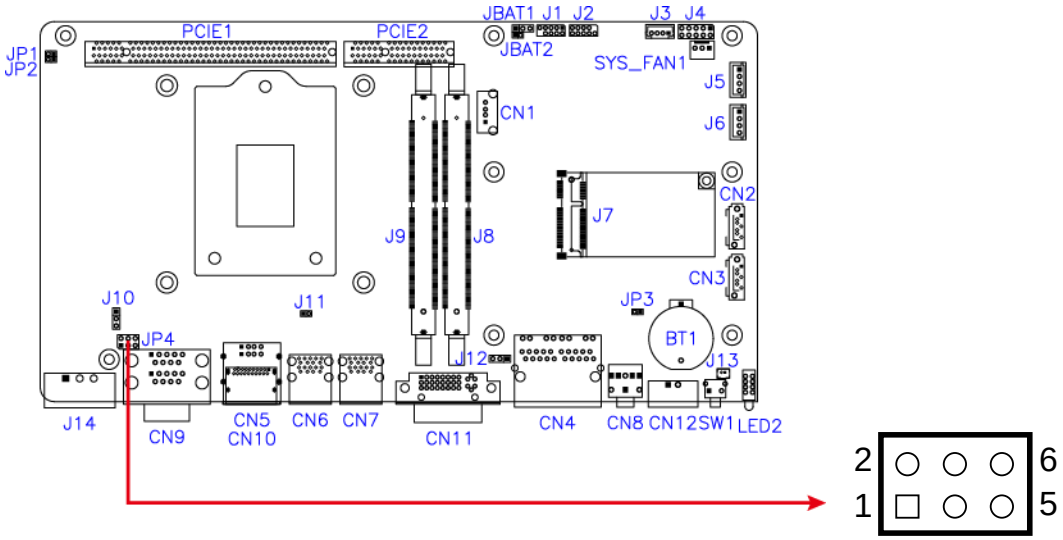
Function	Pin closed	Illustration
Normal (default)	Open	1 □ ○
Clear RTC	Close	1 ■ ○

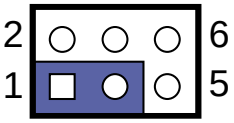
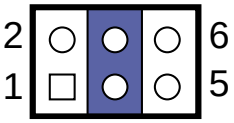
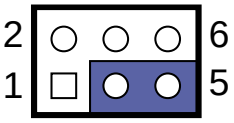
2.4.3 CPU dGfx Bifurcation Selection (JP1, JP2)



Function	Pin closed	Illustration
1 x PCIe (x16) (default)	**JP1:** Open	1
	JP2: Open	1
2 x PCIe (x8)	**JP1:** Close	1
	JP2: Open	1
RSVD	**JP1:** Open	1
	JP2: Close	1
1 x PCIe (x8), 1 x PCIe (x4), 1 x PCIe (x4)	**JP1:** Close	1
	JP2: Close	1

2.4.4 COM2 RS-232 Power Selection (JP4)



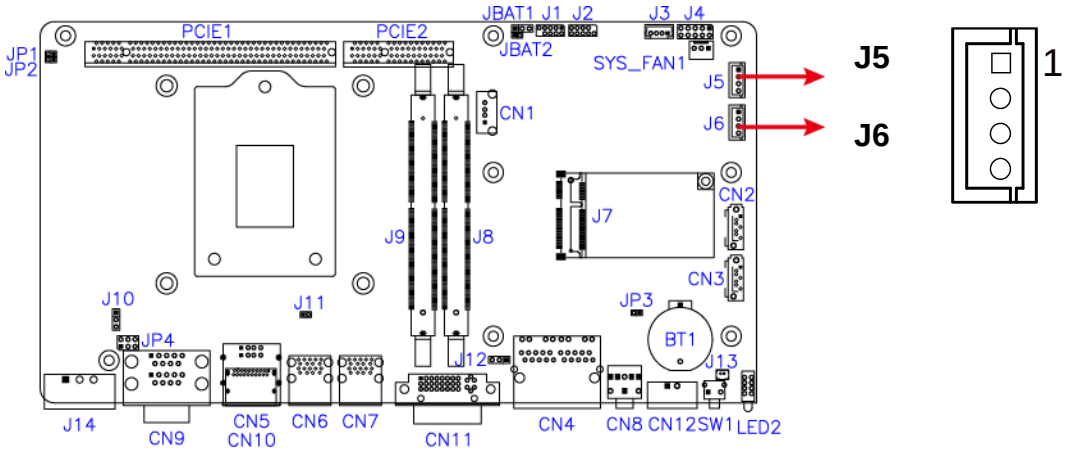
Function	Pin closed	Illustration
12V	1-3	
RI (default)	3-4	
5V	3-5	

2.5 Connectors Quick Reference

Function	Connector Name	Page
SATA SDD Power Connector	J5, J6	28
Digital I/O Connector	J4	28
System Fan Power Connector	SYS_FAN1	29
COM1 & COM2 Serial Ports [1]	CN9	--
Power Remote Control Connector [2]	CN12	--
DC-In Power Connector [3]	J14	--
DVI-I Port	CN11	--
USB 2.0 Port	CN1, CN5	--
USB 3.0 Port	CN6, CN7	--
DisplayPort	CN10	--
GbE LAN Ports	CN4	--
HD Audio Line-Out	CN8	--
SATA Connector	CN2, CN3	--
Power Button	SW1	--
Mini-PCIe (x1) Slot	J7	--
LED Indicators	LED2	--
PCIe (x16) Slot	PCIE1	--
PCIe (x4) Slot	PCIE2	--
Factory Use Only	J1, J2,	--

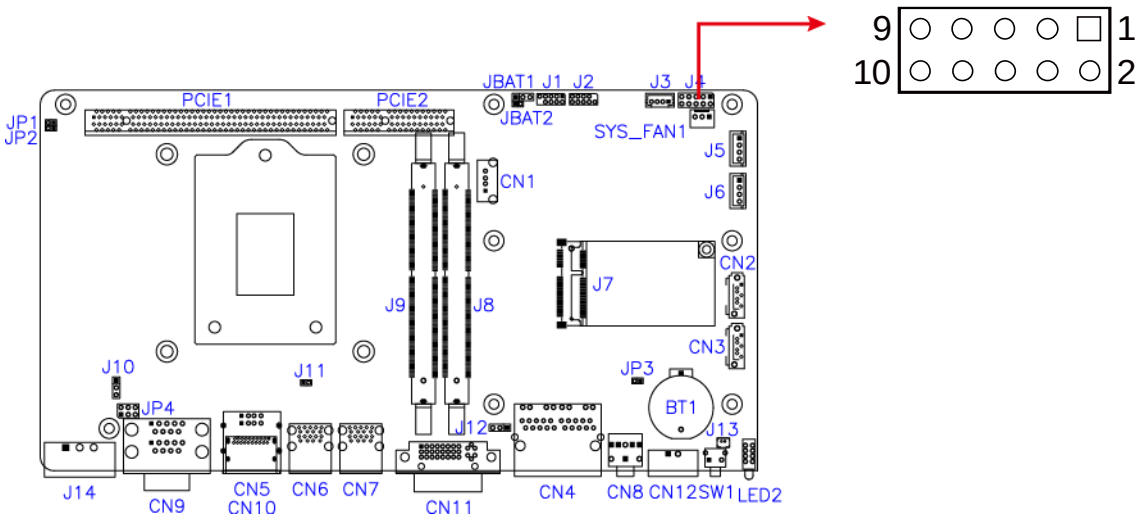
[1], [2], [3] : Refer to *2.1.7 Pinout for COM Ports, DC-In & Power Button Connectors*.

2.5.1 SATA Power Connector (J5, J6)



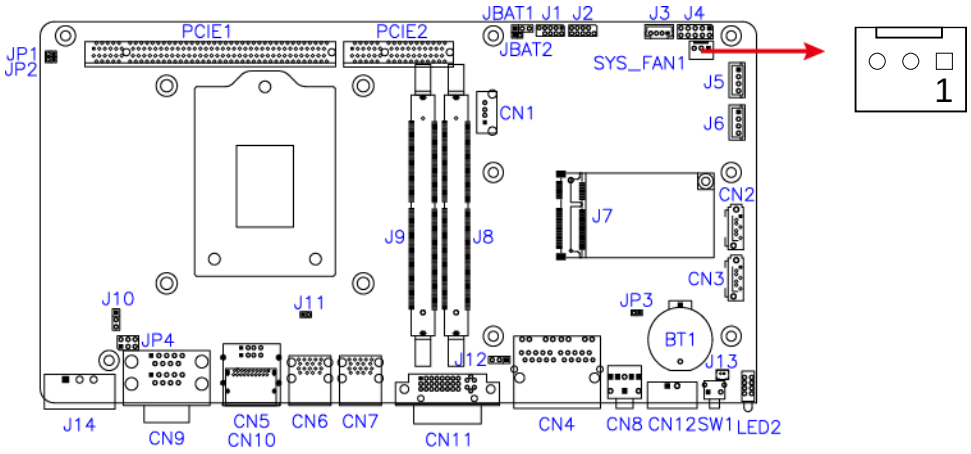
Pin	Assignment	Pin	Assignment
1	5V	3	Ground
2	Ground	4	12V

2.5.2 Digital I/O Connector (J4)



Pin	Assignment	Pin	Assignment
1	Ground	2	VCC5
3	OUT3	4	OUT1
5	OUT2	6	OUT0
7	IN3	8	IN1
9	IN2	10	IN0

2.5.3 System Fan Power Connector (SYS_FAN1)



Pin	Assignment	Pin	Assignment
1	Ground	3	Rotation detection
2	12V		

Chapter 3
Driver Installation

The information provided in this chapter includes:

- Intel® Chipset Software Installation Utility
- HD Audio Driver Installation
- LAN Driver Installation
- Intel® Management Engine Driver Installation
- USB 3.1 Driver Installation

3.1 Introduction

This section describes the installation procedures for software drivers.

Note: After installing your Windows operating system, you must install the Intel® Chipset Software Installation Utility first before proceeding with the drivers installation.

3.2 Intel® Chipset Software Installation Utility

The Intel® Chipset drivers should be installed first before the software drivers to install INF files for Plug & Play function for the chipset components. Follow the instructions below to complete the installation.

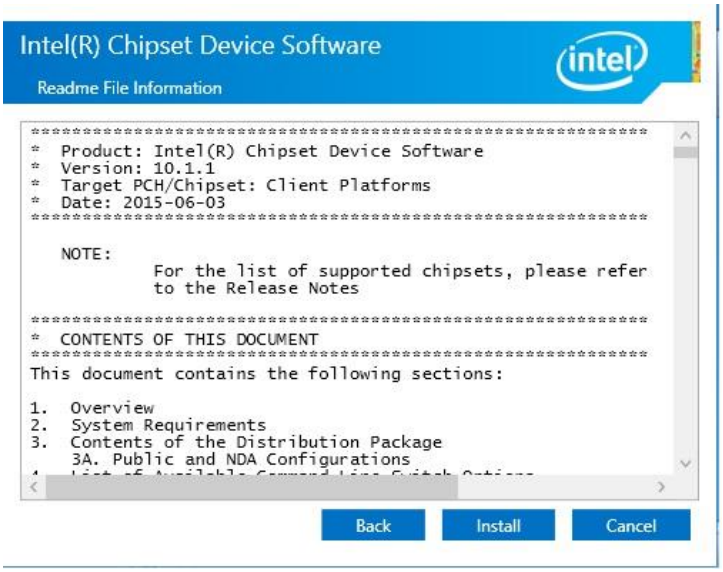
1. Go to the download page of the product. Copy the compressed drivers file to your computer. Double click the file to decompress it. Run “CDGuide” to go to the main drivers page as shown. Click **Intel** and then **Intel(R) Skylake-U/Kabylake-U Chipset Drivers**.

2. Click **Intel(R) Chipset Software Installation Utility**.

3. When the *Welcome* screen to the Intel® Chipset Device Software appears, click **Next** to continue.

4. Accept the software license agreement and proceed with the installation process.

5. On the *Readme File Information* screen, click **Install** and then **Next** for installation.



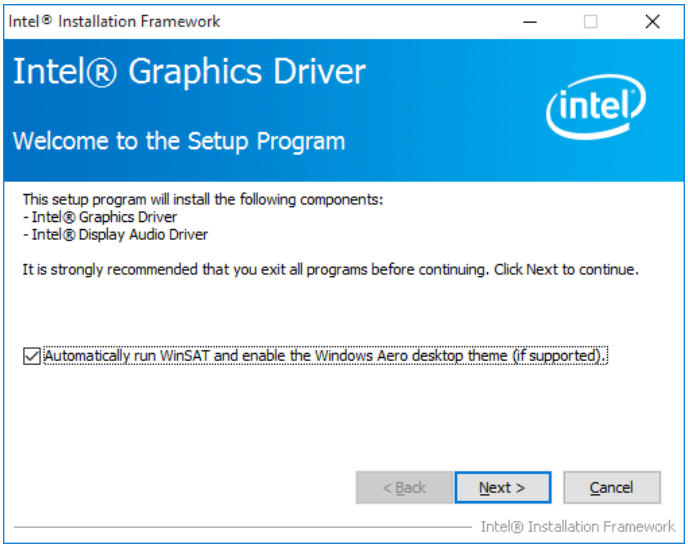
6. Installation is now complete. Restart the system for changes to take effect.

3.3 Graphics Driver Installation

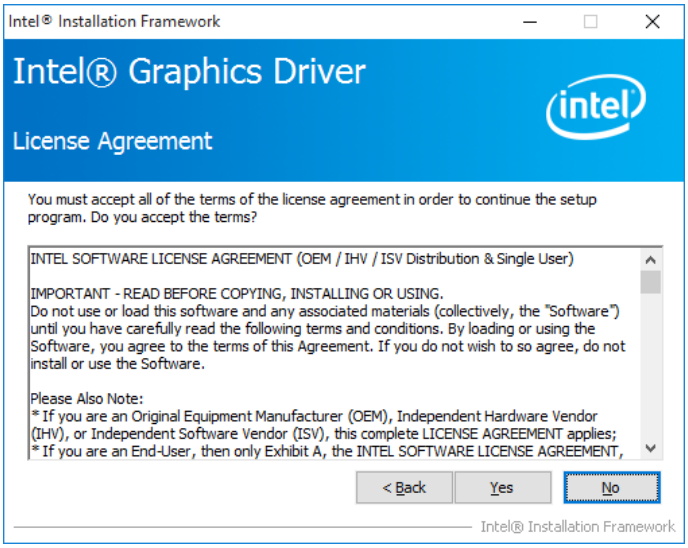
1. Click **Intel** and then **Intel(R) Skylake-U/Kabylake-U Chipset Drivers**.

2. Click **Intel(R) HD Graphics Driver**.

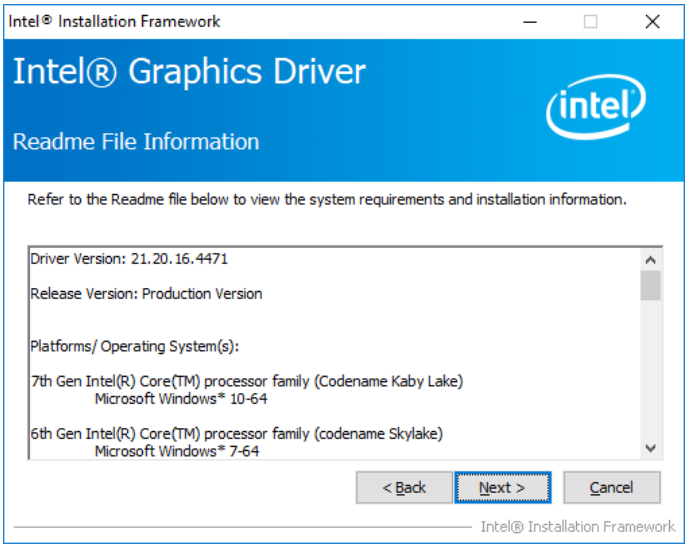
3. When the *Welcome* screen appears, click **Next** to continue.



4. Click **Yes** to agree with the license agreement and continue the installation.



5. Read the *Readme File Information* and then click **Next**.



6. Choose a destination folder for installation.

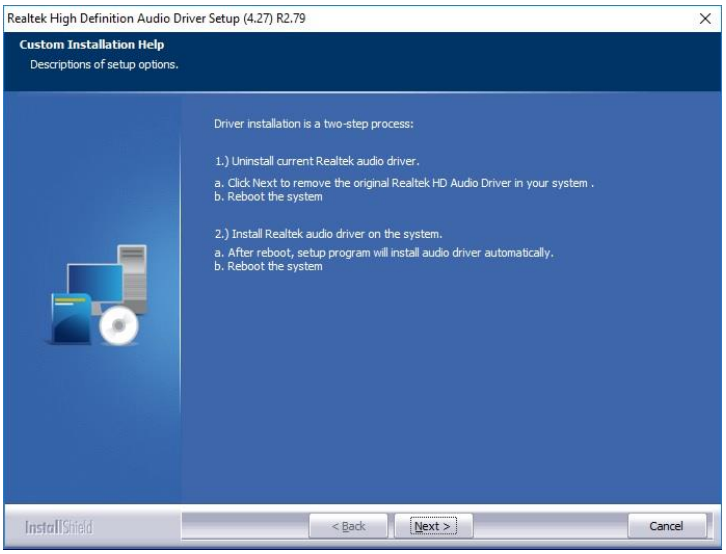
7. Installation is now complete. Restart the system for changes to take effect.

3.4 HD Audio Driver Installation

1. Click **Intel** and then **Intel(R) Skylake-U/Kabylake-U Chipset Drivers**.

2. Click **Realtek High Definition Audio Driver**.

3. On the *Welcome* screen of the InstallShield Wizard, click **Next** for installation.



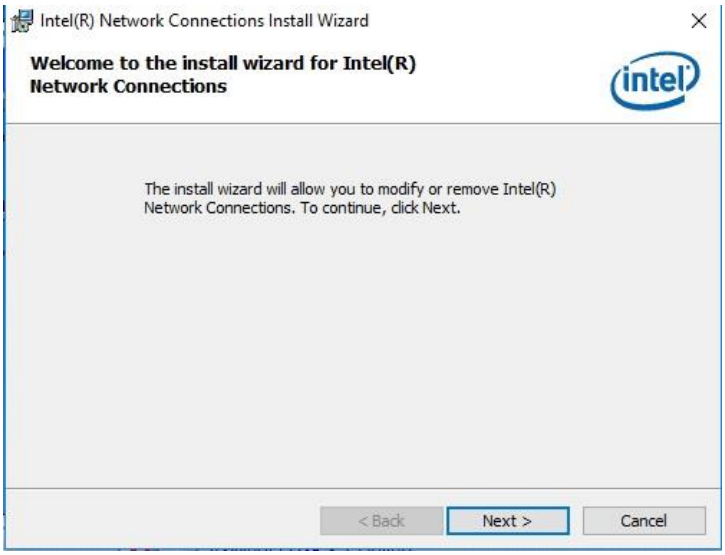
4. Installation is now complete. Restart the system for changes to take effect..

3.5 LAN Driver Installation

1. Click **LAN Card** and then **Intel(R) Skylake-U/Kabylake-U Chipset Drivers**

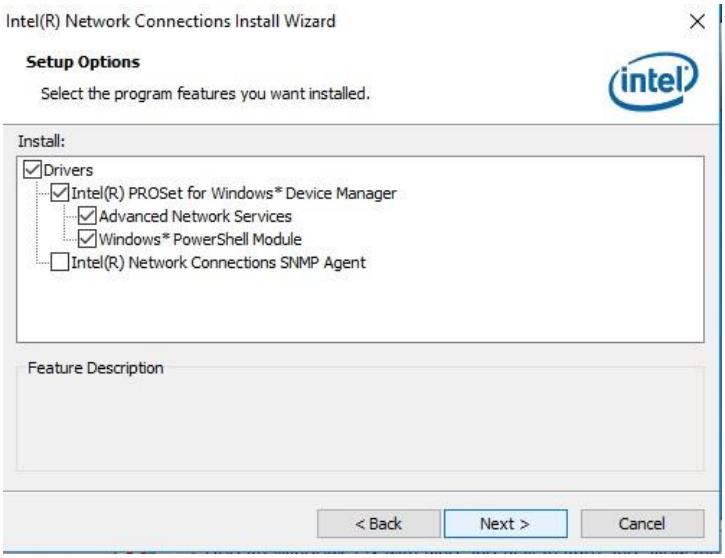
2. Click **Intel(R) PRO LAN Network Drivers.**.

3. When the *Welcome* screen appears, click **Next** to continue.



4. Accept the license agreement and click **Next** to continue.

5. Tick the checkbox for **Drivers** to select the related drivers and click **Next**.



6. When the wizard is ready for installation, click **Install**.

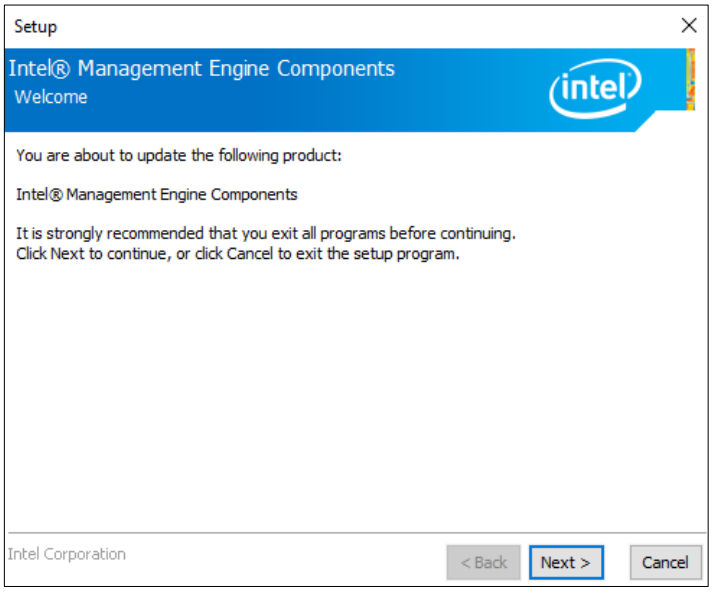
7. Installation is now complete. Restart the system for changes to take effect.

3.6 Intel® Management Engine Components Driver Installation

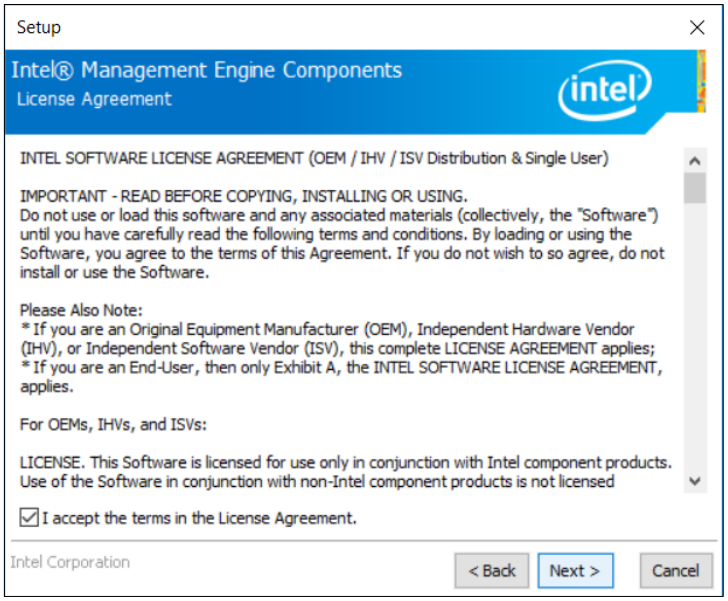
1. Click **Intel** and then **Intel(R) Skylake-U/Kabylake-U Chipset Drivers**.

2. Click **Intel(R) ME 11.x Drivers**.

3. When the *Welcome* screen appears, click **Next** to continue.



4. Accept the licence agreement and click **Next** to continue.

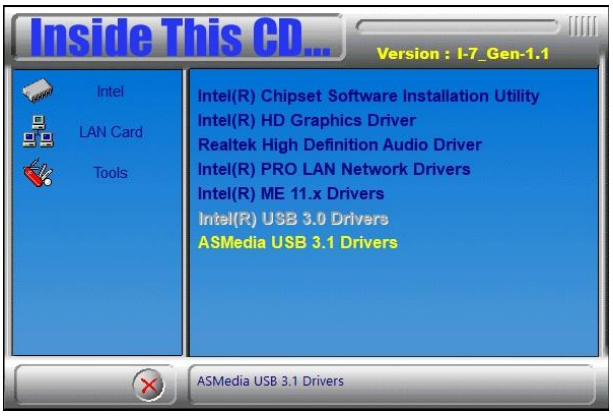


5. Installation is now complete. Restart the system for changes to take effect.

3.7 USB 3.1 Driver Installation

1. Click **Intel** and then **Intel(R) Skylake-U/Kabylake-U Chipset Drivers**.

2. Click **ASMedia USB 3.1 Drivers**.



3. When the *Welcome* screen appears, click **Next** to continue.

4. Accept the licence agreement and click **Next** to continue.

5. Installation is now complete. Restart the system for changes to take effect.

Chapter 4
BIOS Setup

This chapter describes the different settings available in the AMI BIOS that comes with the board. The topics covered in this chapter are as follows:

- Main Settings
- Advanced Settings
- Chipset Settings
- Security Settings
- Boot Settings
- Save & Exit

4.1 Introduction

The BIOS (Basic Input/Output System) installed in the ROM of your computer system supports Intel® processors. The BIOS provides critical low-level support for standard devices such as disk drives, serial ports and parallel ports. It also provides password protection as well as special support for detailed fine-tuning of the chipset controlling the entire system.

4.2 BIOS Setup

The BIOS provides a Setup utility program for specifying the system configurations and settings. The BIOS ROM of the system stores the Setup utility. When you turn on the computer, the BIOS is immediately activated. Press the <Del> key immediately allows you to enter the Setup utility. If you are a little bit late pressing the <Del> key, POST (Power On Self Test) will continue with its test routines, thus preventing you from invoking the Setup.

If you still need to enter Setup, restart the system by pressing the ”Reset” button or simultaneously pressing the <Ctrl>, <Alt> and <Delete> keys. You can also restart by turning the system Off and back On again.

The following message will appear on the screen:

```
Press <DEL> to Enter Setup
```

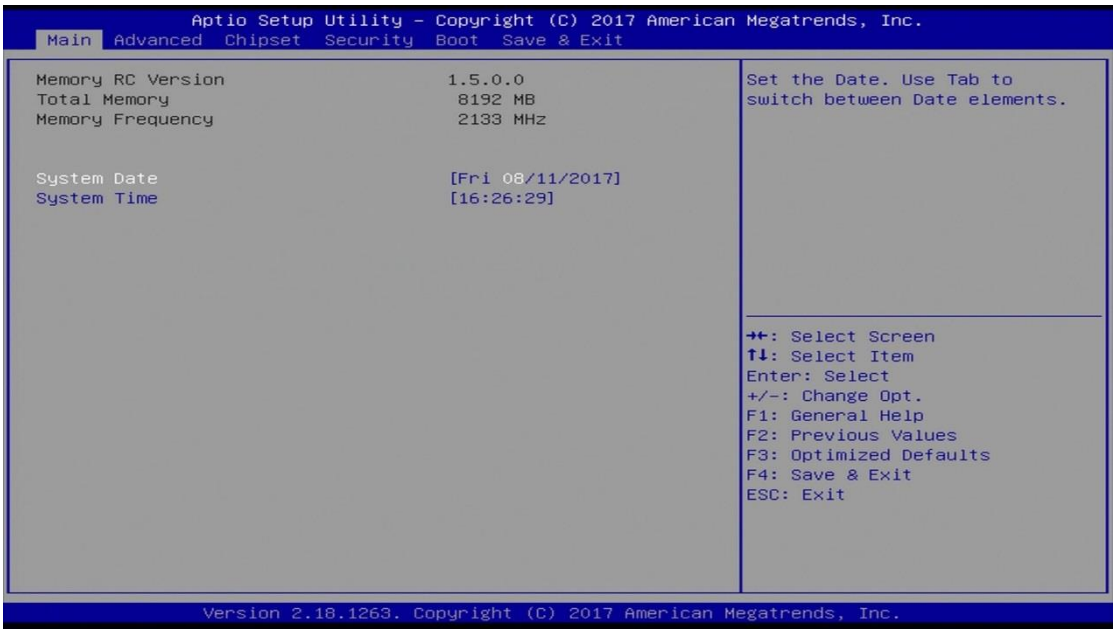
In general, press the arrow keys to highlight items, <Enter> to select, the <PgUp> and <PgDn> keys to change entries, <F1> for help, and <Esc> to quit.

When you enter the BIOS Setup utility, the *Main Menu* screen will appear on the screen. The Main Menu allows you to select from various setup functions and exit choices.

Warning: It is strongly recommended that you avoid making any changes to the chipset defaults.

These defaults have been carefully chosen by both AMI and your system manufacturer to provide the absolute maximum performance and reliability. Changing the defaults could make the system unstable and crash in some cases.

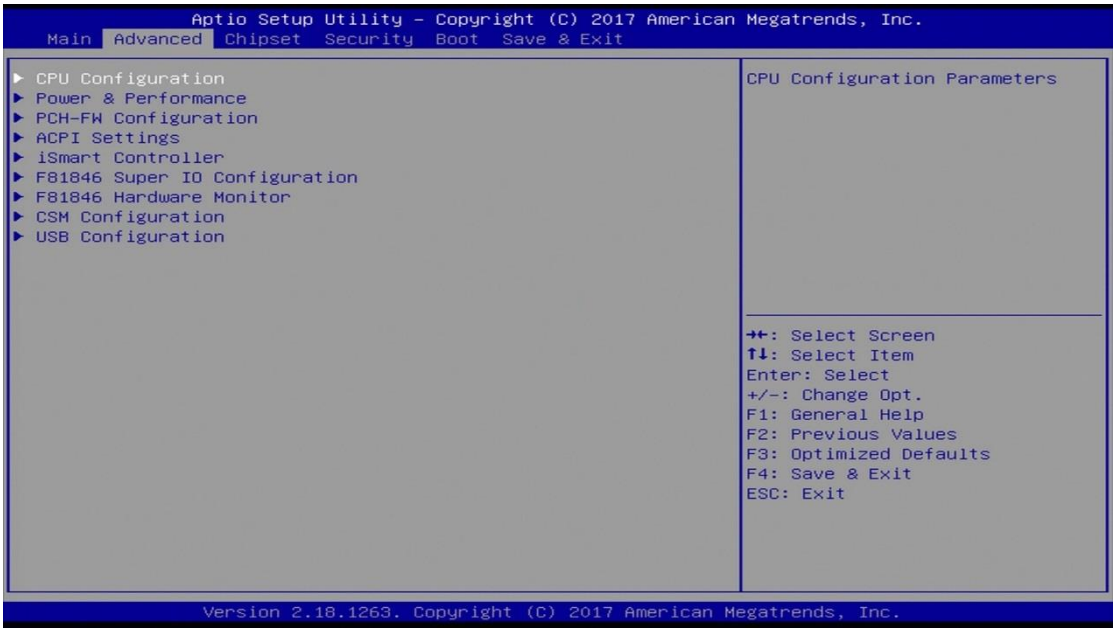
4.3 Main Settings



BIOS Setting	Description
System Date	Sets the date. Use the <Tab> key to switch between the date elements.
System Time	Set the time. Use the <Tab> key to switch between the time elements.

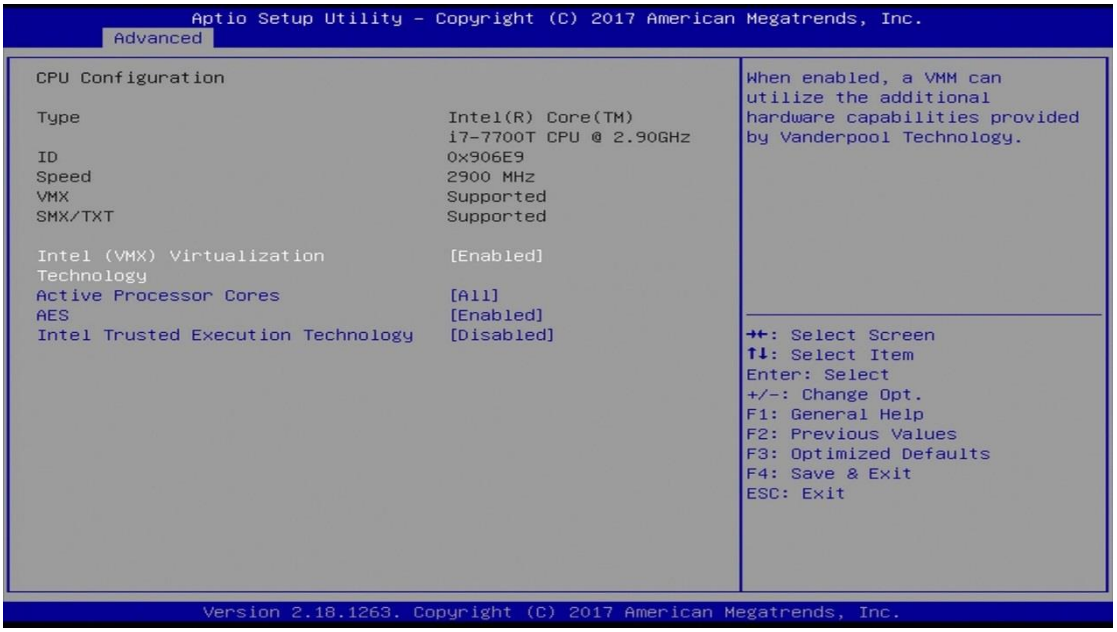
4.4 Advanced Settings

This section allows you to configure, improve your system and allows you to set up some system features according to your preference.



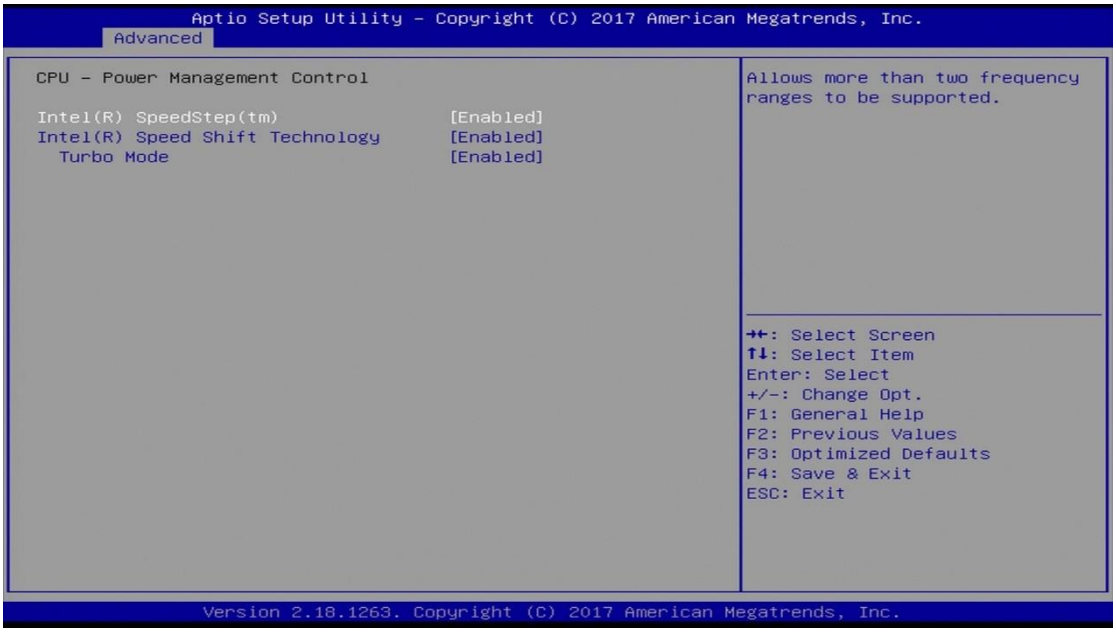
BIOS Setting	Description
CPU Configuration	Displays CPU configuration parameters.
Power & Performance	Shows power and performance options.
PCH-FW Configuration	Configures management engine technology parameters.
ACPI Settings	Displays system ACPI parameters.
iSmart Controller	Sets up schedules for power management.
F81846 Super IO Configuration	Displays super IO chip parameters.
F81846 Hardware Monitor	Shows super IO monitor hardware status.
CSM Configuration	Enables / Disables option ROM execution settings, etc.
USB Configuration	Displays USB configuration parameters.

4.4.1 CPU Configuration



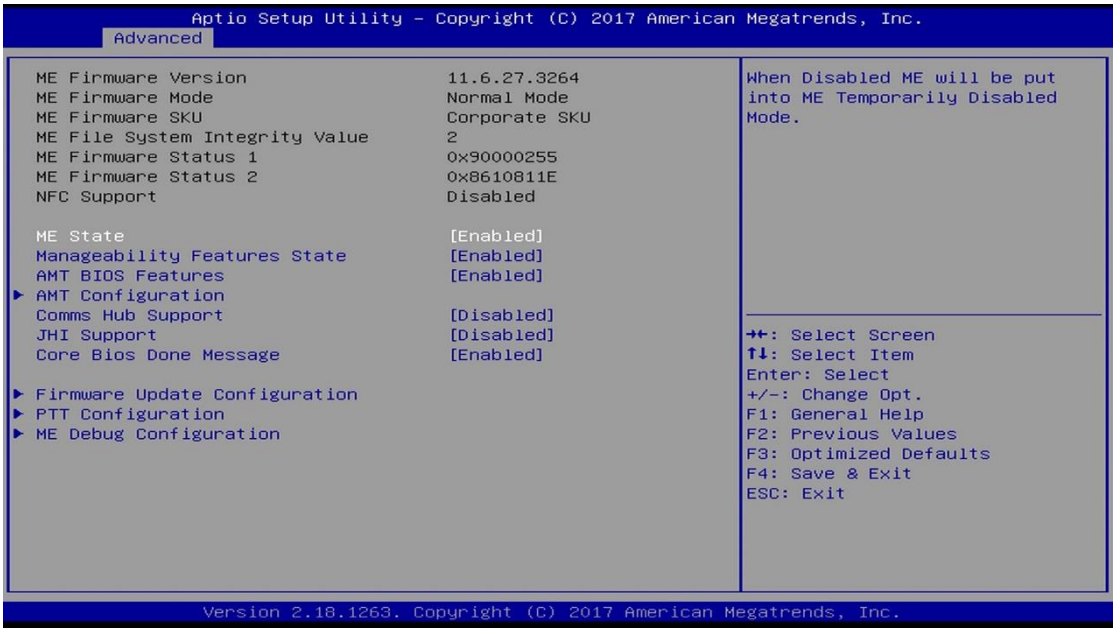
BIOS Setting	Description
Intel (VMX) Virtualization Technology	Enables / Disables a VMM can utilize the additional hardware capabilities provided by Vanderpool Technology.
Active Processor Cores	Number of cores to enable in each processor package. Options: All, 1, 2, 3
AES	Enables / Disables AES (Advanced Encryption Standard).
Intel Trusted Execution Technology	Enables / Disables unilization of additional hardware capabilities provided by Intel(R) Trusted Execution Technology. Changes require a full power cycle to take effect.

4.4.2 Power & Performance



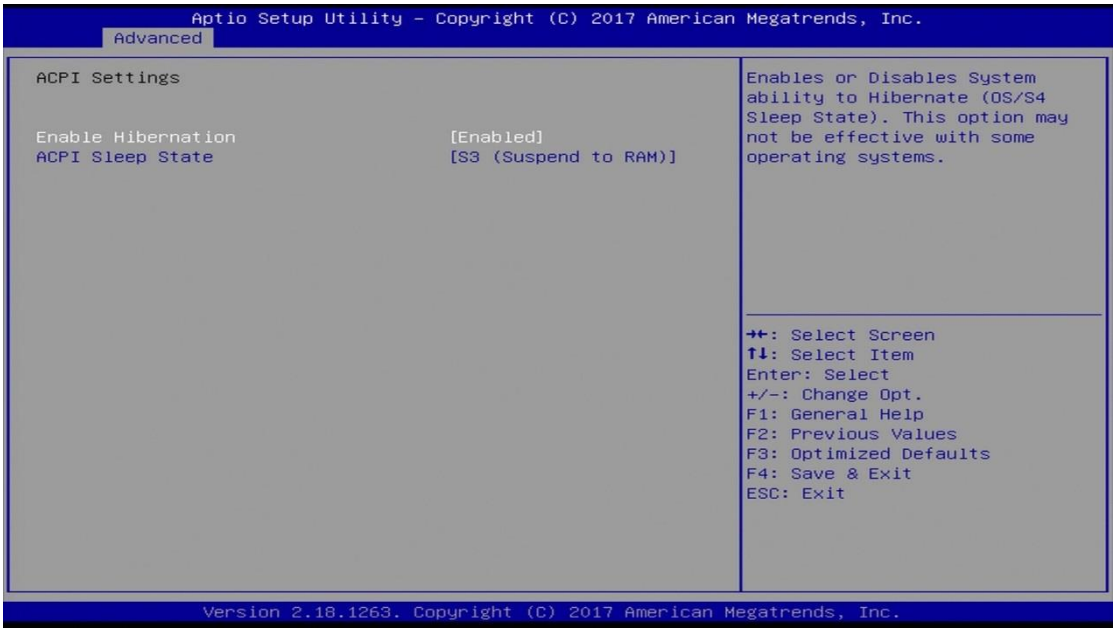
BIOS Setting	Description
Intel(R) SpeedStep(tm)	Allows more than two frequency ranges to be supported.
Intel(R) Speed Shift Technology	Enables / Disables the support of Intel(R) Speed Shift Technology. Enabling the function will expose the CPPC v2 interface to allow for hardware controlled P-states.
Turbo Mode	Enables / Disables processor Turbo Mode (requires EMTTM enabled too). “Auto” means enabled unless max turbo ratio is bigger than 16-SKL A0 W/A.

4.4.3 PCH-FW Configuration



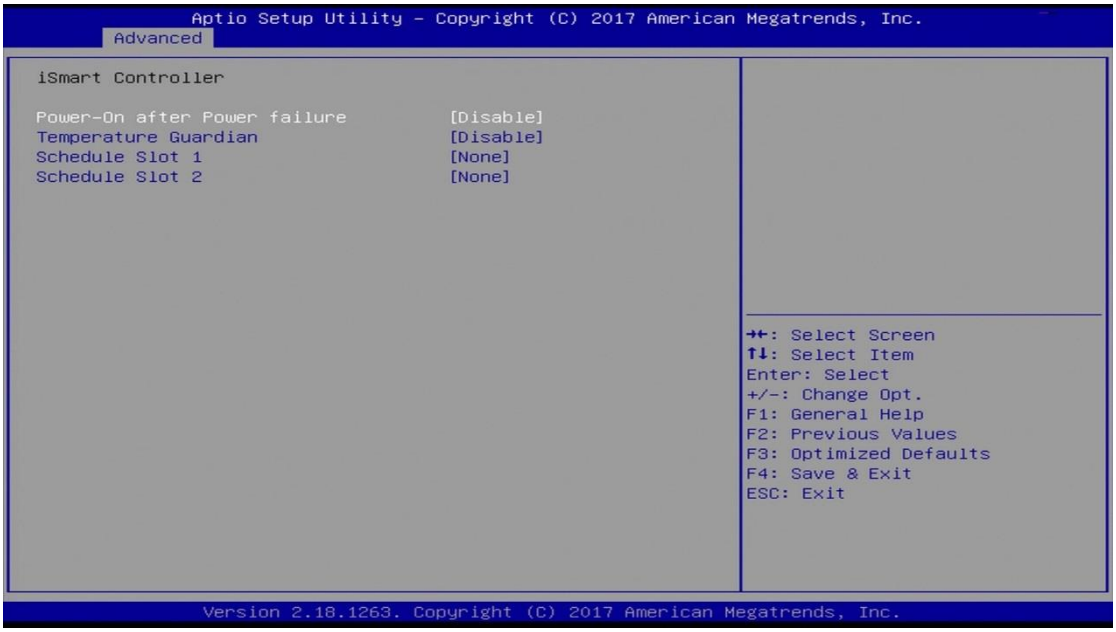
BIOS Setting	Description
AMT BIOS Features	When disabled AMT BIOS features are no longer supported and user is no longer able to access MEBx Setup. Note: This option does not disable manageability features in FW.

4.4.4 ACPI Settings



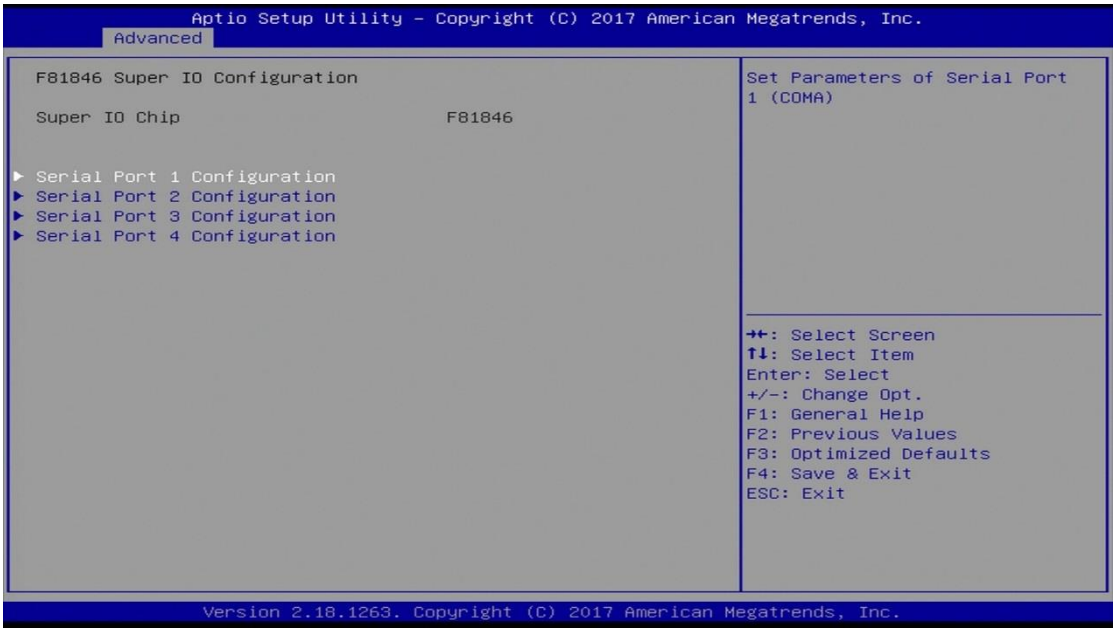
BIOS Setting	Description
Enable Hibernation	Enables / Disables the system ability to hibernate (OS/S4 Sleep State). This option may not be effective with some OS.
ACPI Sleep State	Selects a ACPI sleep state for the system to enter. Options: Suspend Disabled, S3 (Suspend to RAM)

4.4.5 iSmart Controller



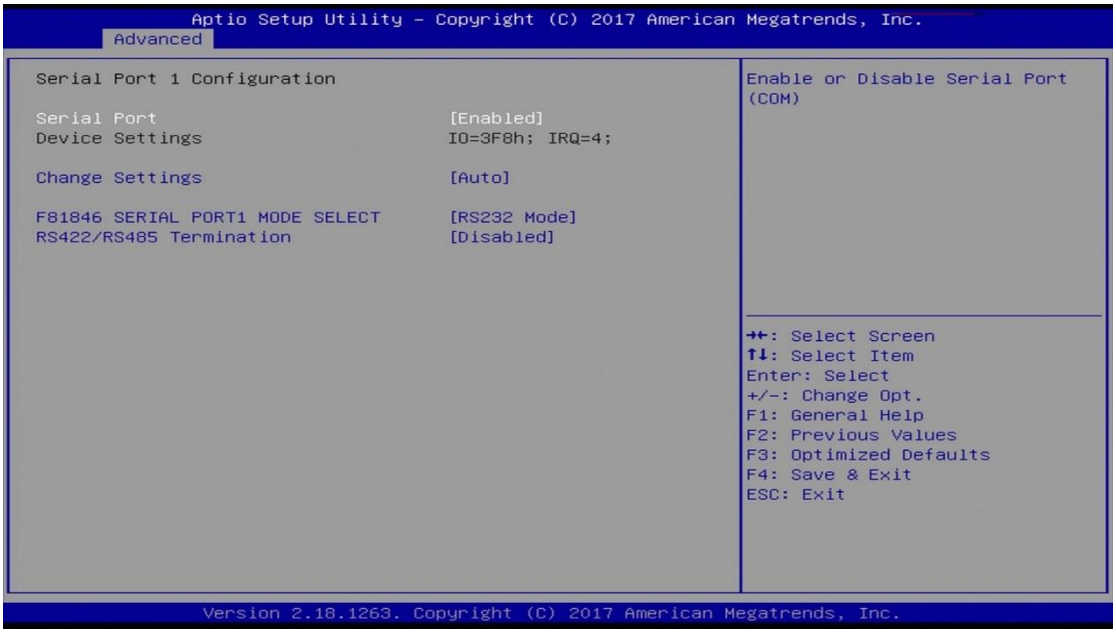
BIOS Setting	Description
Power-On after Power failure	Enables / Disables the system to be turned on automatically after a power failure.
Temperature Guardian	Generate the reset signal when system hands up on POST.
Schedule Slot 1 / 2	Sets up the hour / minute / day for the power-on schedule for the system. Options: • None • Power On • Power On / Off **Important:** If you would like to set up a schedule between adjacent days, configure two schedule slots. For example, if setting up a schedule from Wednesday 5 p.m. to Thursday 2 a.m., configure two schedule slots. But if setting up a schedule from 3 p.m to 5 p.m. on Wednesday, configure only a schedule slot.

4.4.6 F81846 Super IO Configuration



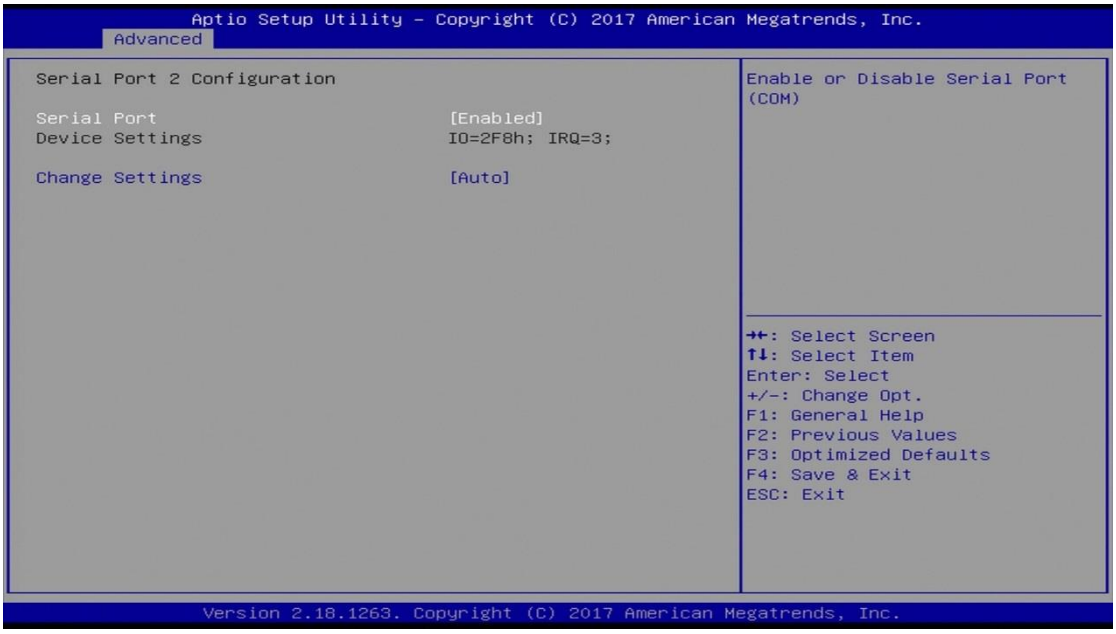
BIOS Setting	Description
Serial Port Configuration	Sets Parameters of Serial Ports. You can enable / disable the serial port and select an optimal settings for the Super IO device.

4.4.6.1. Serial Port 1 Configuration



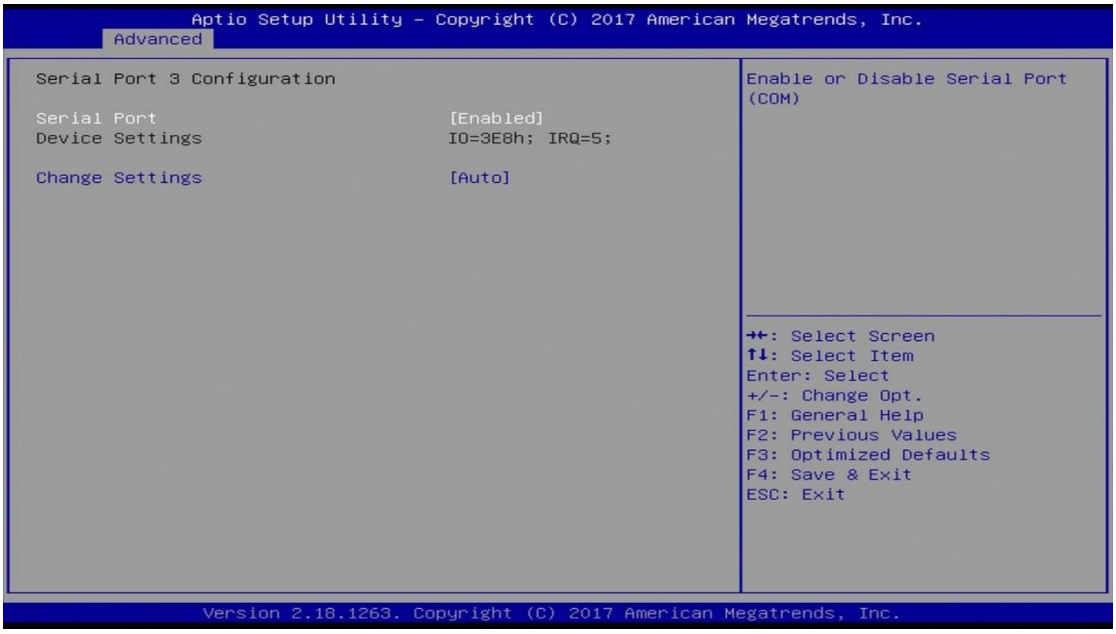
BIOS Setting	Description
Serial Port	Enables / Disables serial port (COM).
Change Settings	Selects an optimal settings for Super I/O device. Options: • Auto • IO = 3F8h; IRQ = 4 • IO = 3F8h; IRQ = 3, 4, 5, 6, 7, 9, 10, 11, 12 • IO = 2F8h; IRQ = 3, 4, 5, 6, 7, 9, 10, 11, 12 • IO = 3E8h; IRQ = 3, 4, 5, 6, 7, 9, 10, 11, 12 • IO = 2E8h; IRQ = 3, 4, 5, 6, 7, 9, 10, 11, 12
F81846 Serial Port1 Mode Select	F81846 serial port 1 loop back / RS232 / RS422 / RS485 model select.
RS422/RS485 Termination	Enables / Disables RS422/RS485 termination.

4.4.6.2. Serial Port 2 Configuration



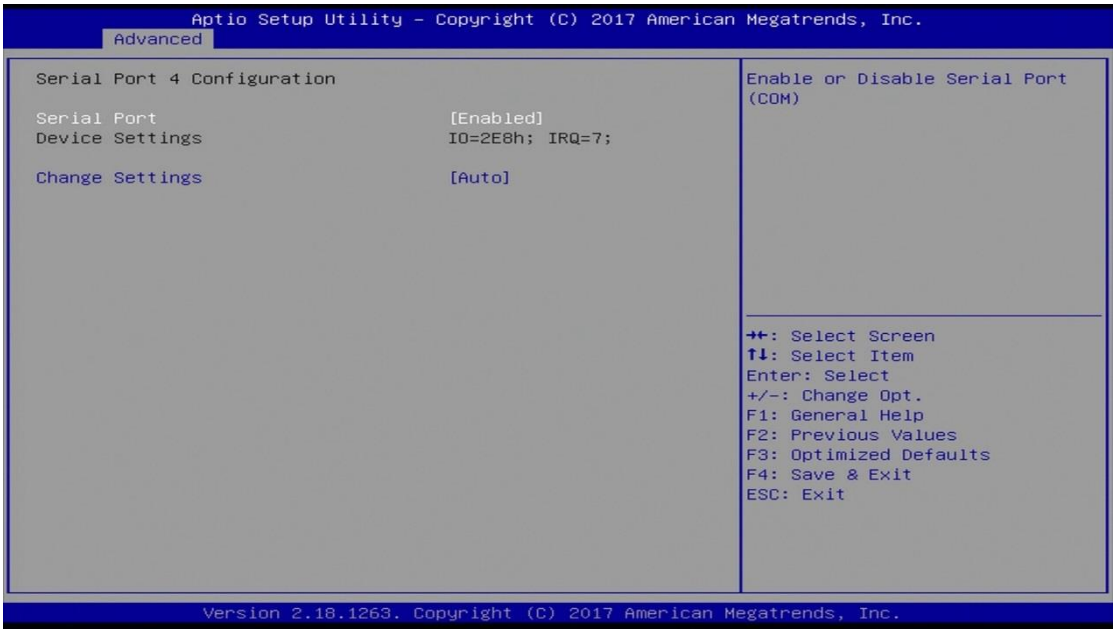
BIOS Setting	Description
Serial Port	Enables / Disables serial port (COM).
Change Settings	Selects an optimal settings for Super I/O device. Options: • Auto • IO = 2F8h; IRQ = 4 • IO = 3F8h; IRQ = 3, 4, 5, 6, 7, 9, 10, 11, 12 • IO = 2F8h; IRQ = 3, 4, 5, 6, 7, 9, 10, 11, 12 • IO = 3E8h; IRQ = 3, 4, 5, 6, 7, 9, 10, 11, 12 • IO = 2E8h; IRQ = 3, 4, 5, 6, 7, 9, 10, 11, 12

4.4.6.3. Serial Port 3 Configuration



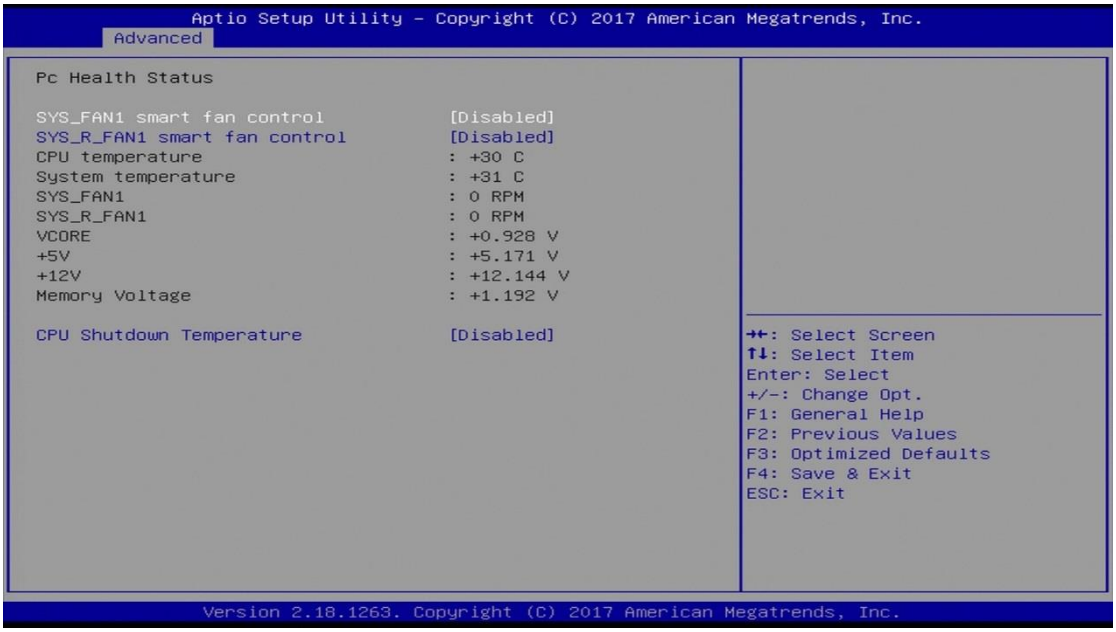
BIOS Setting	Description
Serial Port	Enables / Disables serial port (COM).
Change Settings	Selects an optimal settings for Super I/O device. Options: • Auto • IO = 3E8h; IRQ = 7 • IO = 3E8h; IRQ = 3, 4, 5, 6, 7, 9, 10, 11, 12 • IO = 2E8h; IRQ = 3, 4, 5, 6, 7, 9, 10, 11, 12 • IO = 2F0h; IRQ = 3, 4, 5, 6, 7, 9, 10, 11, 12 • IO = 2E0h; IRQ = 3, 4, 5, 6, 7, 9, 10, 11, 12

4.4.6.4. Serial Port 4 Configuration



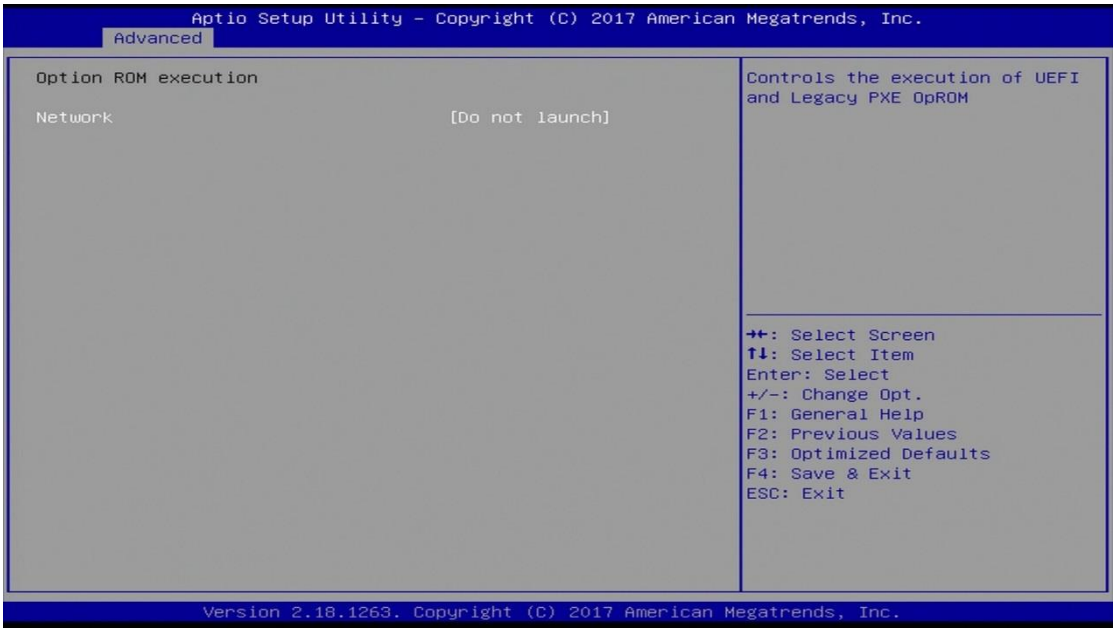
BIOS Setting	Description
Serial Port	Enables / Disables serial port (COM).
Change Settings	Selects an optimal settings for Super I/O device. Options: • Auto • IO = 2E8h; IRQ = 7 • IO = 3E8h; IRQ = 3, 4, 5, 6, 7, 9, 10, 11, 12 • IO = 2E8h; IRQ = 3, 4, 5, 6, 7, 9, 10, 11, 12 • IO = 2F0h; IRQ = 3, 4, 5, 6, 7, 9, 10, 11, 12 • IO = 2E0h; IRQ = 3, 4, 5, 6, 7, 9, 10, 11, 12

4.4.7 F81846 Hardware Monitor



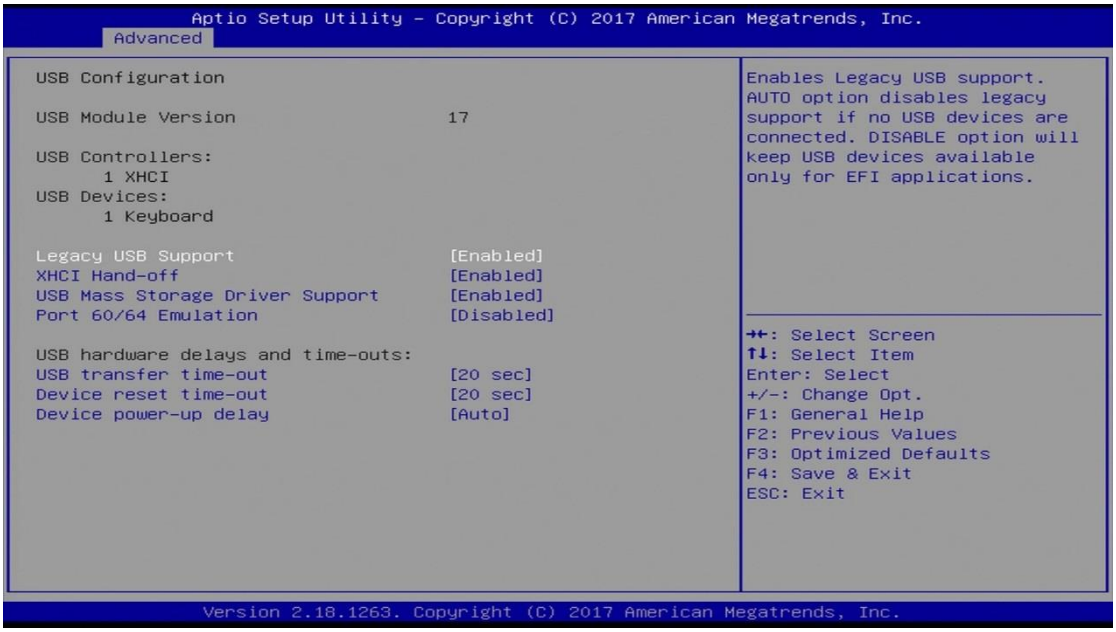
BIOS Setting	Description
SYS_FAN1 Smart Fan Control	Controls the system fan temperature by setting up a threashold temperature. Options: Disabled (default),. 50°C, 60°C, 70°C, 80°C
SYS_R_FAN1 Smart Fan Control	Controls the system fan temperature by setting up a threashold temperature. Options: Disabled (default),. 50°C, 60°C, 70°C, 80°C
Temperatures / Voltages	These fields are the parameters of the hardware monitoring function feature of the motherboard. The values are read-only as monitored by the system and showing the PC health status
CPU Shutdown Temperature	This field enables or disables the Shutdown Temperature Options: Disabled (default),. 70°C, 75°C, 80°C, 85°C, 90°C, 95°C

4.4.8 CSM Configuration



BIOS Setting	Description
Network	Controls the execution of UEFI and Legacy PXE OpROM.

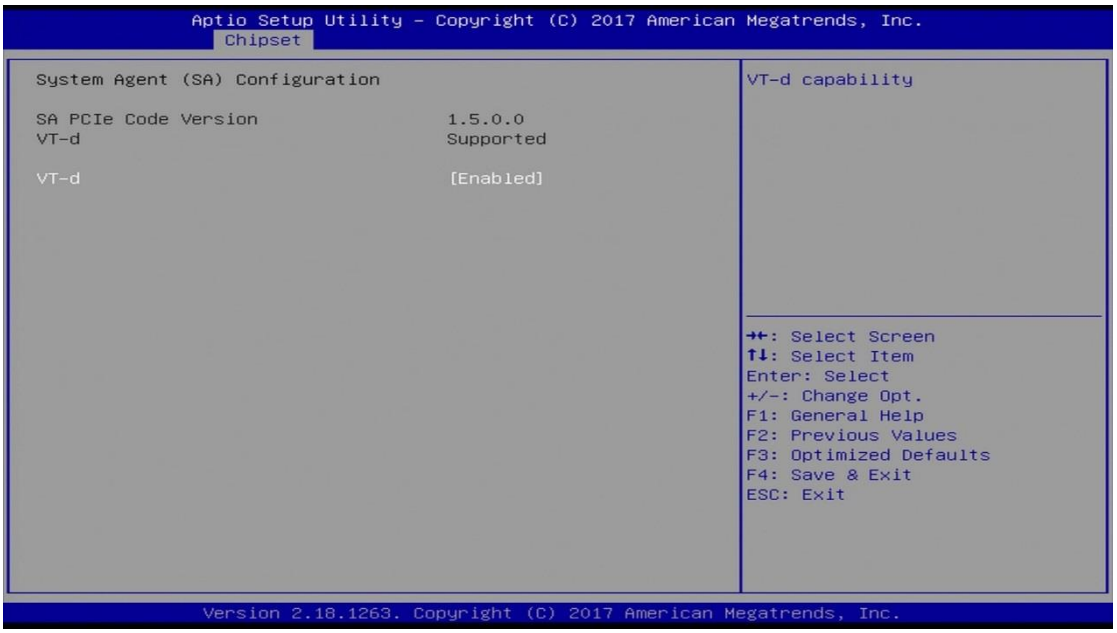
4.4.9 USB Configuration



BIOS Setting	Description
Legacy USB Support	Enables / Disables Legacy USB support. • **Auto** disables legacy support if there is no USB device connected. • **Disable** keeps USB devices available only for EFI applications.
XHCI Hand-pff	This is a workaround for OSes without XHCI hand-off support. The XHCI ownership change should be claimed by XHCI driver.
USB Mass Storage Driver Support	Enables / Disables USB mass storage driver support.
Port 60/64 Emulation	Enables / Disables I/O port 60h/64h emulation support. This should be enabled for the complete USB keyboard legacy support for non-USB aware OSes.
USB Transfer time-out	Sets the time-out value 1, 5, 10 or 20 sec(s) for Control, Bulk, and Interrupt transfers.
Device reset time-out	Sets the seconds (10, 20, 30, 40 secs) of delaying execution of start unit command to USB mass storage device.

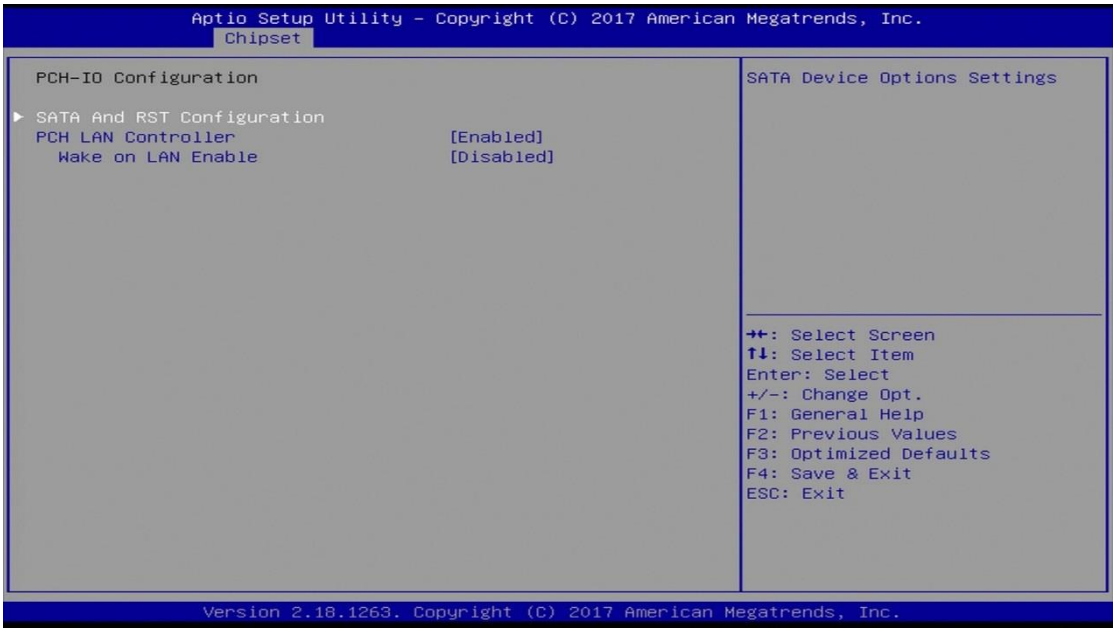
BIOS Setting	Description
Device power-up delay	The maximum time the device will take before it properly reports itself to the Host Controller. **Auto** uses default value. For a Root port, it is 100 ms. For a Hub port, the delay is taken from Hub descriptor.

4.5 Chipset Settings



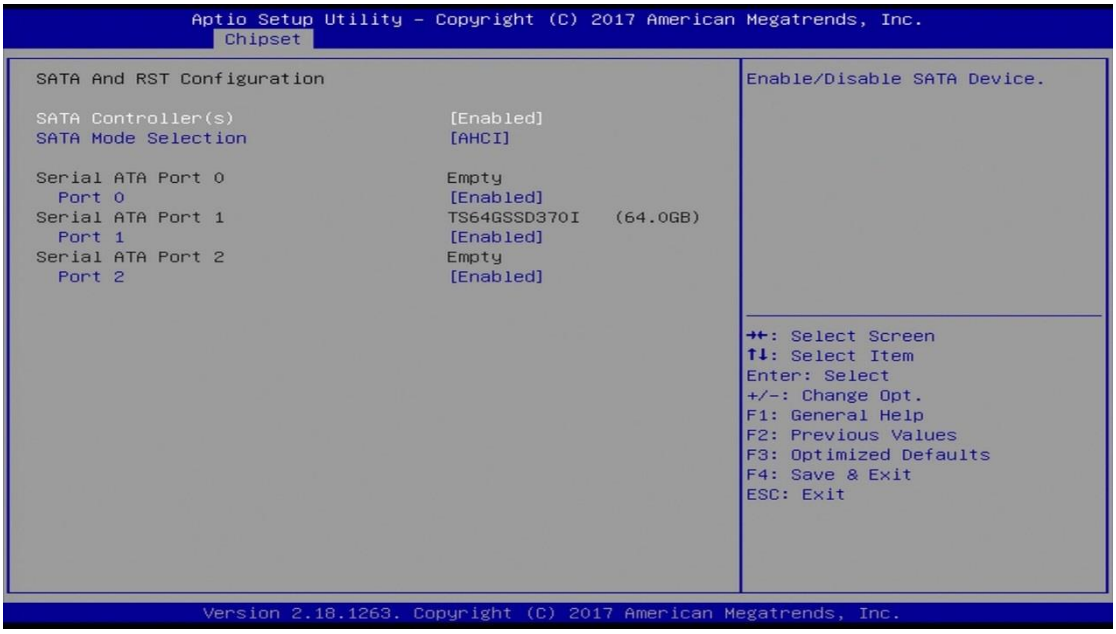
BIOS Setting	Description
System Agent (SA) Configuration	System Agent (SA) parameters
VT-d	Enables / Disables VT-d capability.

4.5.1 PCH-IO Configuration



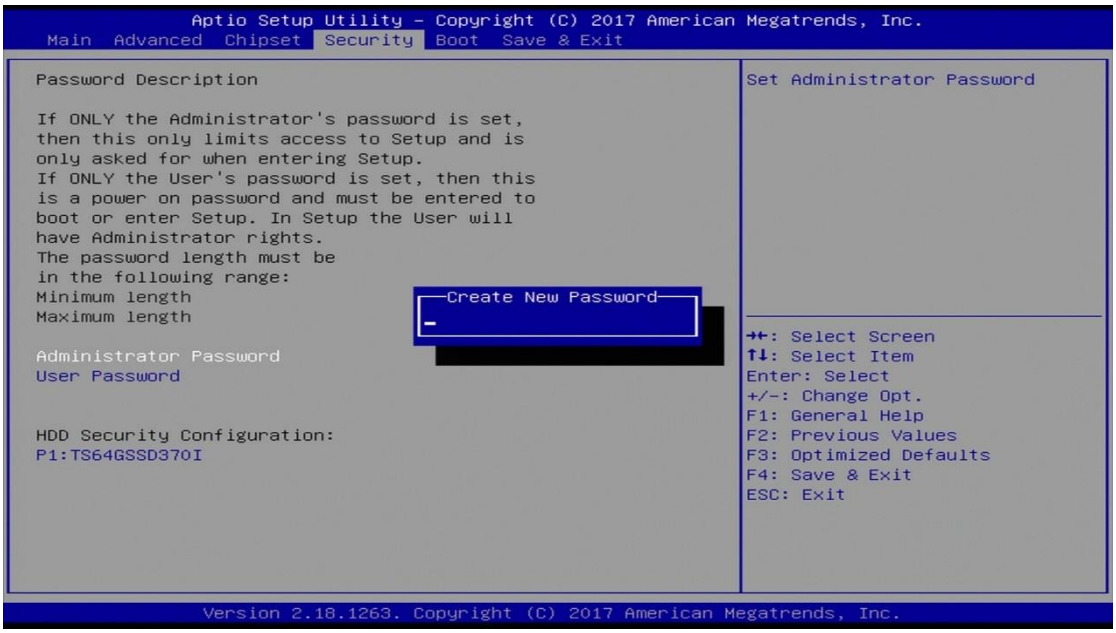
BIOS Setting	Description
SATA and RST Configuration	SATA device options and settings
PCH LAN Controller	Enables / Disables onboard NIC.
Wake on LAN Enable	Enables / Disables integrated LAN to wake the system.

4.5.1.1. SATA and RST Configuration



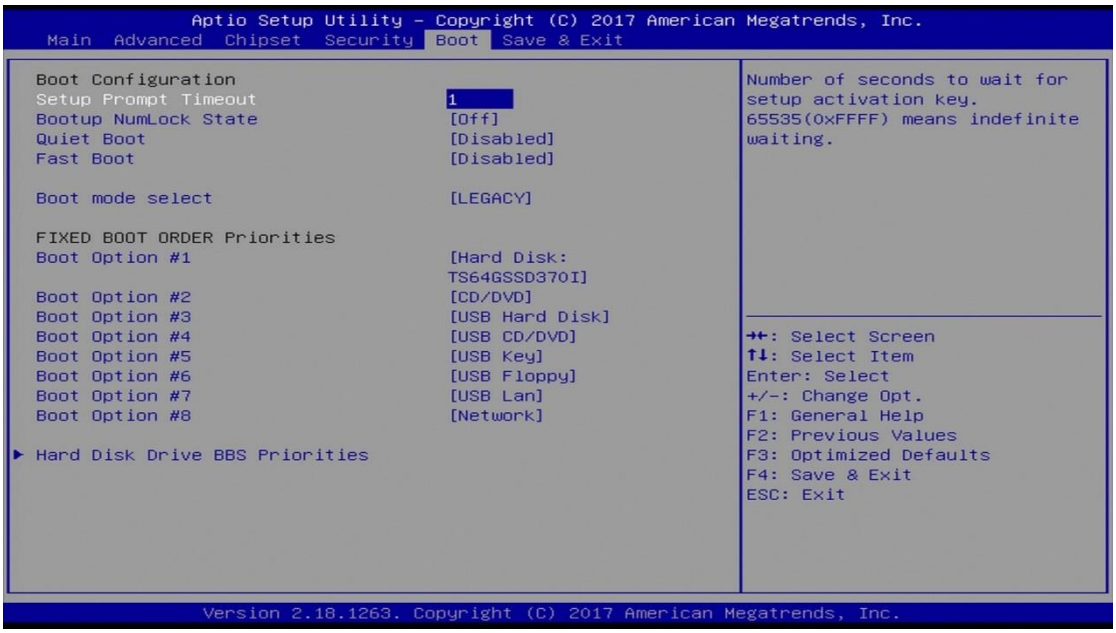
BIOS Setting	Description
SATA Controller(s)	Enables / Disables the Serial ATA.
SATA Mode Selection	Determines how SATA controller(s) works. AHCI Mode or Intel RST Premium.
Serial ATA Port 0~2	Enables / Disables Serial Port 0 ~ 2.

4.6 Security Settings



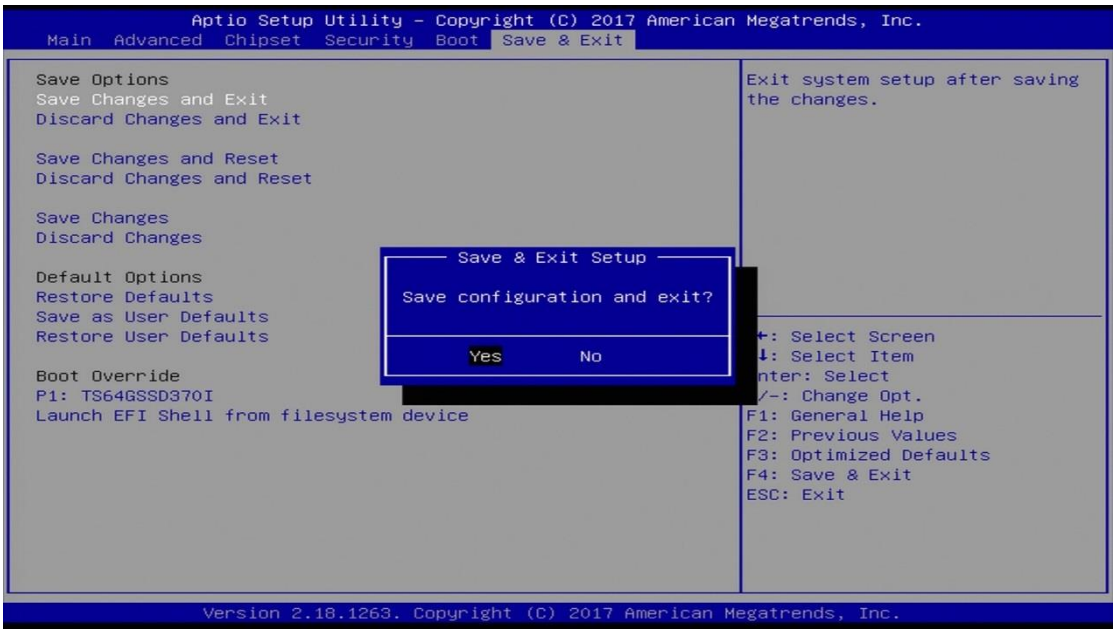
BIOS Setting	Description
Administrator Password	Sets an administrator password for the setup utility.
User Password	Sets a user password.

4.7 Boot Settings



BIOS Setting	Description
Setup Prompt Timeout	Number of seconds to wait for setup activation key. 65535 (0xFFFF) means indefinite waiting.
Bootup NumLock State	Selects the keyboard NumLock state.
Quiet Boot	Enables / Disables Quiet Boot option.
Fast Boot	Enables / Disables boot with initialization of a minimal set of devices required to launch the active boot option. Has no effect for BBS boot options.
Boot mode select	Selects a Boot mode, Legacy / UEFI.
Boot Option Priorities	Sets the system boot order priorities for hard disk, CD/DVD, USB, Network.

4.8 Save & Exit Settings



BIOS Setting	Description
Save Changes and Exit	Exits system setup after saving the changes.
Discard Changes and Exit	Exits system setup without saving any changes.
Save Changes and Reset	Resets the system after saving the changes.
Discard Changes and Reset	Resets system setup without saving any changes.
Save Changes	Saves changes done so far to any of the setup options.
Discard Changes	Discards changes done so far to any of the setup options.
Restore Defaults	Restores / Loads defaults values for all the setup options.
Save as User Defaults	Saves the changes done so far as user defaults.
Restore User Defaults	Restores the user defaults to all the setup options.

Appendix A
System Additional Information

This section provides the mapping addresses of peripheral devices and the sample code of watchdog timer configuration.

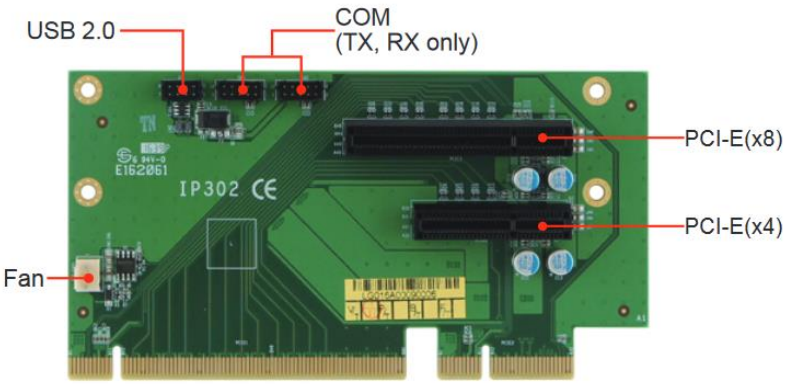
- Compatible Expansion Card for MAI602
- I/O Port Address Map
- Interrupt Request Lines (IRQ)
- Watchdog Timer Configuration

A.1 Compatible Expansion Card for MAI602

Currently the IBASE expansion card compatible with MAI602 is IP302.

Expansion Card Overview

IP302



A.2 I/O Port Address Map

Each peripheral device in the system is assigned a set of I/O port addresses which also becomes the identity of the device. The following table lists the I/O port addresses used.

Address	Device Description
0x00000A00-0x00000A0F	Motherboard resources
0x00000A10-0x00000A1F	Motherboard resources
0x00000A10-0x00000A1F	Motherboard resources
0x0000002E-0x0000002F	Motherboard resources
0x0000004E-0x0000004F	Motherboard resources
0x00000061-0x00000061	Motherboard resources
0x00000063-0x00000063	Motherboard resources
0x00000065-0x00000065	Motherboard resources
0x00000067-0x00000067	Motherboard resources
0x00000070-0x00000070	Motherboard resources
0x00000070-0x00000070	System CMOS/real time clock
0x00000080-0x00000080	Motherboard resources
0x00000092-0x00000092	Motherboard resources
0x000000B2-0x000000B3	Motherboard resources

Address	Device Description
0x00000680-0x0000069F	Motherboard resources
0x0000FFFF-0x0000FFFF	Motherboard resources
0x0000FFFF-0x0000FFFF	Motherboard resources
0x0000FFFF-0x0000FFFF	Motherboard resources
0x00001800-0x000018FE	Motherboard resources
0x0000164E-0x0000164F	Motherboard resources
0x00000020-0x00000021	Programmable interrupt controller
0x00000024-0x00000025	Programmable interrupt controller
0x00000028-0x00000029	Programmable interrupt controller
0x0000002C-0x0000002D	Programmable interrupt controller
0x00000030-0x00000031	Programmable interrupt controller
0x00000034-0x00000035	Programmable interrupt controller
0x00000038-0x00000039	Programmable interrupt controller
0x0000003C-0x0000003D	Programmable interrupt controller
0x000000A0-0x000000A1	Programmable interrupt controller
0x000000A4-0x000000A5	Programmable interrupt controller
0x000000A8-0x000000A9	Programmable interrupt controller
0x000000AC-0x000000AD	Programmable interrupt controller
0x000000B0-0x000000B1	Programmable interrupt controller
0x000000B4-0x000000B5	Programmable interrupt controller
0x000000B8-0x000000B9	Programmable interrupt controller
0x000000BC-0x000000BD	Programmable interrupt controller
0x000004D0-0x000004D1	Programmable interrupt controller
0x00000800-0x0000087F	Motherboard resources
0x0000E000-0x0000EFFF	Intel(R) 100 Series/C230 Series Chipset Family PCI Express Root Port #6 - A115
0x000000F0-0x000000F0	Numeric data processor
0x0000F090-0x0000F097	Standard SATA AHCI Controller
0x0000F080-0x0000F083	Standard SATA AHCI Controller
0x0000F060-0x0000F07F	Standard SATA AHCI Controller
0x000003F8-0x000003FF	Communications Port (COM1)
0x000002F8-0x000002FF	Communications Port (COM2)
0x000003E8-0x000003EF	Communications Port (COM3)
0x000002E8-0x000002EF	Communications Port (COM4)

Address	Device Description
0x00000040-0x00000043	System timer
0x00000050-0x00000053	System timer
0x00001854-0x00001857	Motherboard resources
0x00000000-0x00000CF7	PCI Express Root Complex
0x00000D00-0x0000FFFF	PCI Express Root Complex
0x0000F0A0-0x0000F0A7	Intel(R) Active Management Technology - SOL (COM5)
0x0000F000-0x0000F03F	Intel(R) HD Graphics 630
0x000003B0-0x000003BB	Intel(R) HD Graphics 630
0x000003C0-0x000003DF	Intel(R) HD Graphics 630
0x0000FF00-0x0000FFFE	Motherboard resources
0x0000F040-0x0000F05F	Intel(R) 100 Series/C230 Series Chipset Family SMBus - A123
0x00000060-0x00000060	Standard PS/2 Keyboard
0x00000064-0x00000064	Standard PS/2 Keyboard

A.3 Interrupt Request Lines (IRQ)

Peripheral devices use interrupt request lines to notify CPU for the service required. The following table shows the IRQ used by the devices on board.

Level	Function
IRQ 0	System timer
IRQ 1	Standard PS/2 Keyboard
IRQ 3	Communications Port (COM2)
IRQ 4	Communications Port (COM1)
IRQ 5	Communications Port (COM3)
IRQ 7	Communications Port (COM4)
IRQ 8	System CMOS/real time clock
IRQ 11	Intel(R) 100 Series/C230 Series Chipset Family SMBus - A123
IRQ 11	Intel(R) 100 Series/C230 Series Chipset Family Thermal subsystem - A131
IRQ 12	Microsoft PS/2 Mouse
IRQ 13	Numeric data processor
IRQ 14	Motherboard resources
IRQ 16	High Definition Audio Controller
IRQ 19	Intel(R) Active Management Technology - SOL (COM5)
IRQ 54 ~ IRQ 204	Microsoft ACPI-Compliant System
IRQ 256 ~ IRQ 511	Microsoft ACPI-Compliant System
IRQ 4294967283	Intel(R) Management Engine Interface
IRQ 4294967284	Intel(R) I211 Gigabit Network Connection
IRQ 4294967285	Intel(R) I211 Gigabit Network Connection
IRQ 4294967286	Intel(R) I211 Gigabit Network Connection
IRQ 4294967287	Intel(R) I211 Gigabit Network Connection
IRQ 4294967288	Intel(R) I211 Gigabit Network Connection
IRQ 4294967289	Intel(R) I211 Gigabit Network Connection
IRQ 4294967290	Intel(R) USB 3.0 eXtensible Host Controller - 1.0 (Microsoft)
IRQ 4294967291	Intel(R) HD Graphics 630
IRQ 4294967292	Intel(R) Ethernet Connection (2) I219-LM
IRQ 4294967293	Standard SATA AHCI Controller
IRQ 4294967294	Intel(R) 100 Series/C230 Series Chipset Family PCI Express Root Port #6 - A115

A.4 Watchdog Timer Configuration

The Watchdog Timer (WDT) is used to generate a variety of output signals after a user programmable count. The WDT is suitable for the use in the prevention of system lock-up, such as when software becomes trapped in a deadlock. Under these sorts of circumstances, the timer will count to zero and the selected outputs will be driven.

Under normal circumstance, you will need to restart the WDT at regular intervals before the timer counts to zero.

Sample Code

```
//---------------------------------------------------------------------------
//
// THIS CODE AND INFORMATION IS PROVIDED "AS IS" WITHOUT WARRANTY OF ANY
// KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE
// IMPLIED WARRANTIES OF MERCHANTABILITY AND/OR FITNESS FOR A
PARTICULAR
// PURPOSE.
//
//---------------------------------------------------------------------------
#include <dos.h>
#include <conio.h>
#include <stdio.h>
#include <stdlib.h>
#include "F81846.H"
//---------------------------------------------------------------------------
int main (int argc, char *argv[]); void EnableWDT(int);
void DisableWDT(void);
//---------------------------------------------------------------------------
int main (int argc, char *argv[])
{
	unsigned char bBuf;
	unsigned char bTime;
	char **endptr;

	char SIO;
	printf("Fintek 81846 watch dog program\n");
	SIO = Init_F81846();
	if (SIO == 0)
	{
		printf("Can not detect Fintek 81846, program abort.\n");
		return(1);
	}//if (SIO == 0)

	if (argc != 2)
	{
		printf(" Parameter incorrect!!\n");
		return (1);
	}
```

```
        bTime = strtol (argv[1], endptr, 10);
        printf("System will reset after %d seconds\n", bTime);

        if (bTime)
        {       EnableWDT(bTime); }
        else
        {       DisableWDT();  }
        return 0;
}
//---------------------------------------------------------------------------
void EnableWDT(int interval)
{
        unsigned char bBuf;

        bBuf = Get_F81846_Reg(0x2B);
        bBuf &= (~0x20);
        Set_F81846_Reg(0x2B, bBuf);             //Enable WDTO

        Set_F81846_LD(0x07);                    //switch to logic device 7
        Set_F81846_Reg(0x30, 0x01);             //enable timer

        bBuf = Get_F81846_Reg(0xF5);
        bBuf &= (~0x0F);
        bBuf |= 0x52;
        Set_F81846_Reg(0xF5, bBuf);             //count mode is second
        Set_F81846_Reg(0xF6, interval);         //set timer
        bBuf = Get_F81846_Reg(0xFA);
        bBuf |= 0x01;
        Set_F81846_Reg(0xFA, bBuf);             //enable WDTO output

        bBuf = Get_F81846_Reg(0xF5);
        bBuf |= 0x20;
        Set_F81846_Reg(0xF5, bBuf);             //start counting
}
//---------------------------------------------------------------------------
void DisableWDT(void)
{
        unsigned char bBuf;
        Set_F81846_LD(0x07);                    //switch to logic device 7
        bBuf = Get_F81846_Reg(0xFA);
        bBuf &= ~0x01;
        Set_F81846_Reg(0xFA, bBuf);             //disable WDTO output

        bBuf = Get_F81846_Reg(0xF5);
        bBuf &= ~0x20;
        bBuf |= 0x40;
        Set_F81846_Reg(0xF5, bBuf);             //disable WDT
}
//---------------------------------------------------------------------------
```

```
//---------------------------------------------------------------------------
//
// THIS CODE AND INFORMATION IS PROVIDED "AS IS" WITHOUT WARRANTY OF ANY
// KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE
// IMPLIED WARRANTIES OF MERCHANTABILITY AND/OR FITNESS FOR A
PARTICULAR
// PURPOSE.
//
//---------------------------------------------------------------------------
#include "F81846.H"
#include <dos.h>
//---------------------------------------------------------------------------
unsigned int F81846_BASE; void Unlock_F81846 (void); void Lock_F81846 (void);
//---------------------------------------------------------------------------
unsigned int Init_F81846(void)
{
	unsigned int result;
	unsigned char ucDid;

	F81846_BASE = 0x4E;
	result = F81846_BASE;

	ucDid = Get_F81846_Reg(0x20);
	if (ucDid == 0x07)			//Fintek 81846
	{	goto Init_Finish;}

	F81846_BASE = 0x2E;
	result = F81846_BASE;

	ucDid = Get_F81846_Reg(0x20);
	if (ucDid == 0x07)			//Fintek 81846
	{	goto Init_Finish;}

	F81846_BASE = 0x00;
	result = F81846_BASE;

Init_Finish:
	return (result);
}
//---------------------------------------------------------------------------
void Unlock_F81846 (void)
{
	outportb(F81846_INDEX_PORT, F81846_UNLOCK);
	outportb(F81846_INDEX_PORT, F81846_UNLOCK);
}
//---------------------------------------------------------------------------
void Lock_F81846 (void)
{
	outportb(F81846_INDEX_PORT, F81846_LOCK);
}
//---------------------------------------------------------------------------
void Set_F81846_LD( unsigned char LD)
{
	Unlock_F81846();
```

```
        outportb(F81846_INDEX_PORT, F81846_REG_LD);
        outportb(F81846_DATA_PORT, LD); Lock_F81846();
}
//-----------------------------------------------------------------------
void Set_F81846_Reg( unsigned char REG, unsigned char DATA)
{
        Unlock_F81846();
        outportb(F81846_INDEX_PORT, REG);
        outportb(F81846_DATA_PORT, DATA);
        Lock_F81846();
}
//-----------------------------------------------------------------------
unsigned char Get_F81846_Reg(unsigned char REG)
{
        unsigned char Result;
        Unlock_F81846();
        outportb(F81846_INDEX_PORT, REG);
        Result = inportb(F81846_DATA_PORT);
        Lock_F81846();
        return Result;
}
//-----------------------------------------------------------------------
```

```
//-----------------------------------------------------------------------
//
// THIS CODE AND INFORMATION IS PROVIDED "AS IS" WITHOUT WARRANTY OF ANY
// KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE
// IMPLIED WARRANTIES OF MERCHANTABILITY AND/OR FITNESS FOR A
PARTICULAR
// PURPOSE.
//
//-----------------------------------------------------------------------
#ifndef        F81846_H
#define        F81846_H     1
//-----------------------------------------------------------------------
#define     F81846_INDEX_PORT      (F81846_BASE)
#define     F81846_DATA_PORT       (F81846_BASE+1)
//-----------------------------------------------------------------------
#define     F81846_REG_LD      0x07
//-----------------------------------------------------------------------
#define F81846_UNLOCK 0x87
#define     F81846_LOCK  0xAA
//-----------------------------------------------------------------------
unsigned int Init_F81846(void);
void Set_F81846_LD( unsigned char);
void Set_F81846_Reg( unsigned char, unsigned char); unsigned char
Get_F81846_Reg( unsigned char);
//-----------------------------------------------------------------------
#endif //     F81846_H
```

Appendix B
Brief Guide to the Digital I/O Card

This section is a brief guide to the digital I/O card used in MAI602 series and provides the information of the I/O interface, isolated digital signals connection and the terminal board for this card.

- Introduction
- Features
- Specifications
- Hardware Layout
- I/O Interface Description
- Terminal Board for the DIO Card
- Signal Connection

B.1 Digital I/O Card Introduction

The digital card for MAI602 series is PCE-D132-SN. It is a 48/32-channel high-density isolated digital input/output card and an advanced-performance data acquisition card based on PCI Express bus architecture. It is suitable for most industrial applications such as in test equipment, instrumentation, industrial automation, lab automation, and process control. The card features a PCI Express x1 lane which can be used in any available x1, x4, x8, or x16 PCI Express expansion slot.

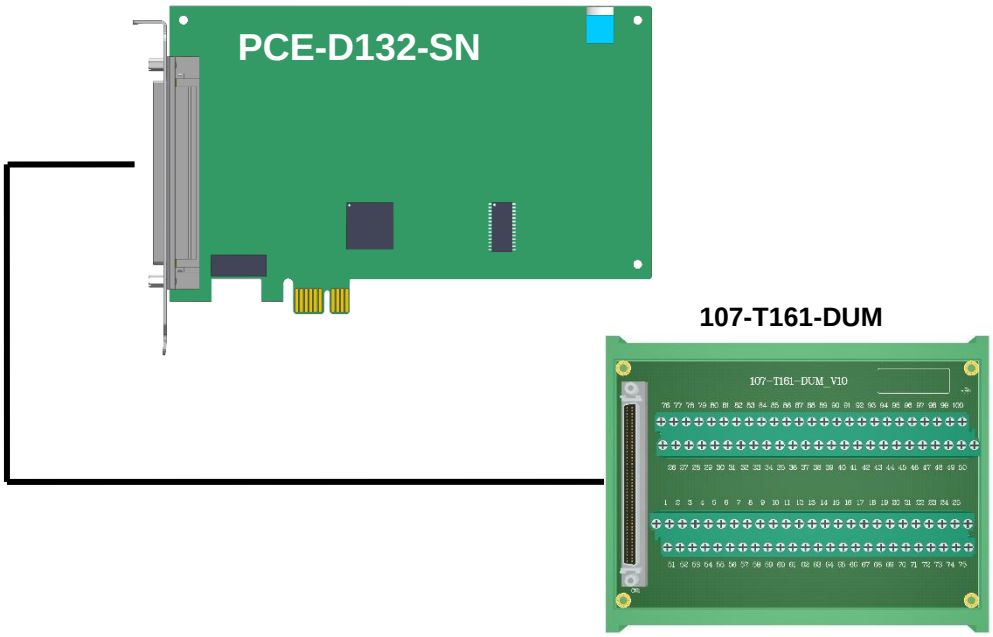


Figure of PCE-D132-SN and the terminal board

B.2 Features

- Board ID
- Keep digital outputs status after warm reboot
- Readable digital output signals
- 2 external interrupt inputs

B.3 Specifications

- Size: (L176 x W98 mm)
- 48/32-ch high-density isolated digital input/output
- Surge Protection: 10KV
- I/O Isolation Voltage: 2.5KVrms
- Output Types: NPN open collector with Darlington transistors
- High sink current on isolated output channels (350mA max./ch)
- Response Time: On to Off about 50μs, Off to On about 8μs
- Input Current: ±10mA (Max)
- Either NPN or PNP input for DI by group
- Input Voltage: +18V DC ~ +30V DC

General:

- 1-lane 2.5 GB/s PCI Express
- Power consumption: +3.3 V DC at 430 mA, +12V DC at 55 mA typical
- Working temperature: 0 ~ 60°C

B.4 Hardware Layout

The digital I/O card PCe-D132-SN PCB layout and I/O interface are introduced as follows.

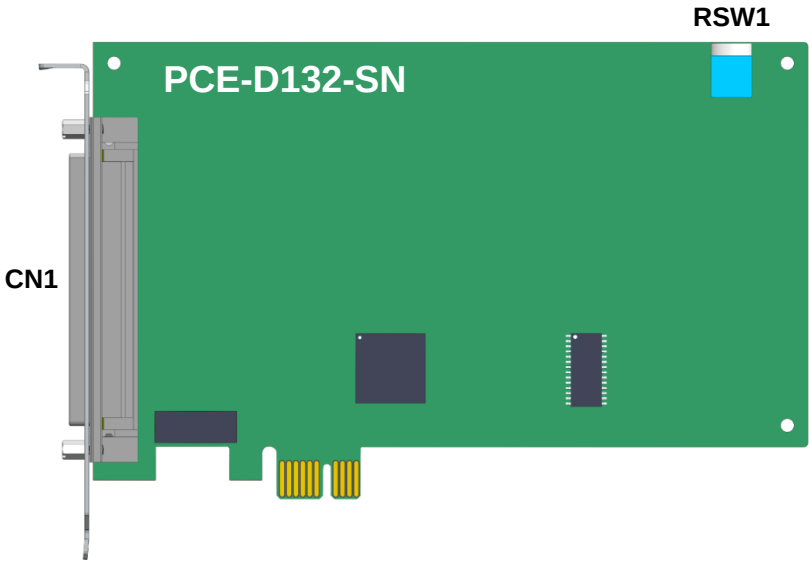
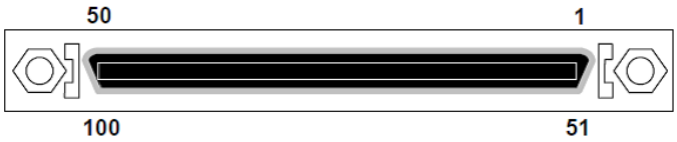


Figure of PCE-D132-SN PCB Layout

Connector descriptions:

- **CN1:** I/O interface and SCSI 100 pins connector



Pin	Label	Port	Pin	Label	Port
1	COM1	0	51	COM6	5
2	IN 0	0	52	IN 40	5
3	IN 1	0	53	IN 41	5
4	IN 2	0	54	IN 42	5
5	IN 3	0	55	IN 43	5
6	IN 4	0	56	IN 44	5
7	IN 5	0	57	IN 45	5
8	IN 6	0	58	IN 46	5
9	IN 7	0	59	IN 47	5
10	COM1	0	60	COM6	5
11	COM2	1	61	+COM7	6
12	IN 8	1	62	OUT 0	6
13	IN 9	1	63	OUT 1	6
14	IN 10	1	64	OUT 2	6
15	IN 11	1	65	OUT 3	6
16	IN 12	1	66	OUT 4	6
17	IN 13	1	67	OUT 5	6
18	IN 14	1	68	OUT 6	6
19	IN 15	1	69	OUT 7	6
20	COM2	1	70	-COM7	6
21	COM3	2	71	+COM8	7
22	IN 16	2	72	OUT 8	7
23	IN 17	2	73	OUT 9	7
24	IN 18	2	74	OUT 10	7
25	IN 19	2	75	OUT 11	7
26	IN 20	2	76	OUT 12	7
27	IN 21	2	77	OUT 13	7
28	IN 22	2	78	OUT 14	7
29	IN 23	2	79	OUT 15	7
30	COM3	2	80	-COM8	7
31	COM4	3	81	+COM9	8
32	IN 24	3	82	OUT 16	8
33	IN 25	3	83	OUT 17	8

Pin	Label	Port	Pin	Label	Port
34	IN 26	3	84	OUT 18	8
35	IN 27	3	85	OUT 19	8
36	IN 28	3	86	OUT 20	8
37	IN 29	3	87	OUT 21	8
38	IN 30	3	88	OUT 22	8
39	IN 31	3	89	OUT 23	8
40	COM4	3	90	-COM9	8
41	COM5	4	91	+COM10	9
42	IN 32	4	92	OUT 24	9
43	IN 33	4	93	OUT 25	9
44	IN 34	4	94	OUT 26	9
45	IN 35	4	95	OUT 27	9
46	IN 36	4	96	OUT 28	9
47	IN 37	4	97	OUT 29	9
48	IN 38	4	98	OUT 30	9
49	IN 39	4	99	OUT 31	9
50	COM5	4	100	-COM10	9

- **RSW1:** Rotary switch for card number setting

B.5 Terminal Board for the Digital I/O Card

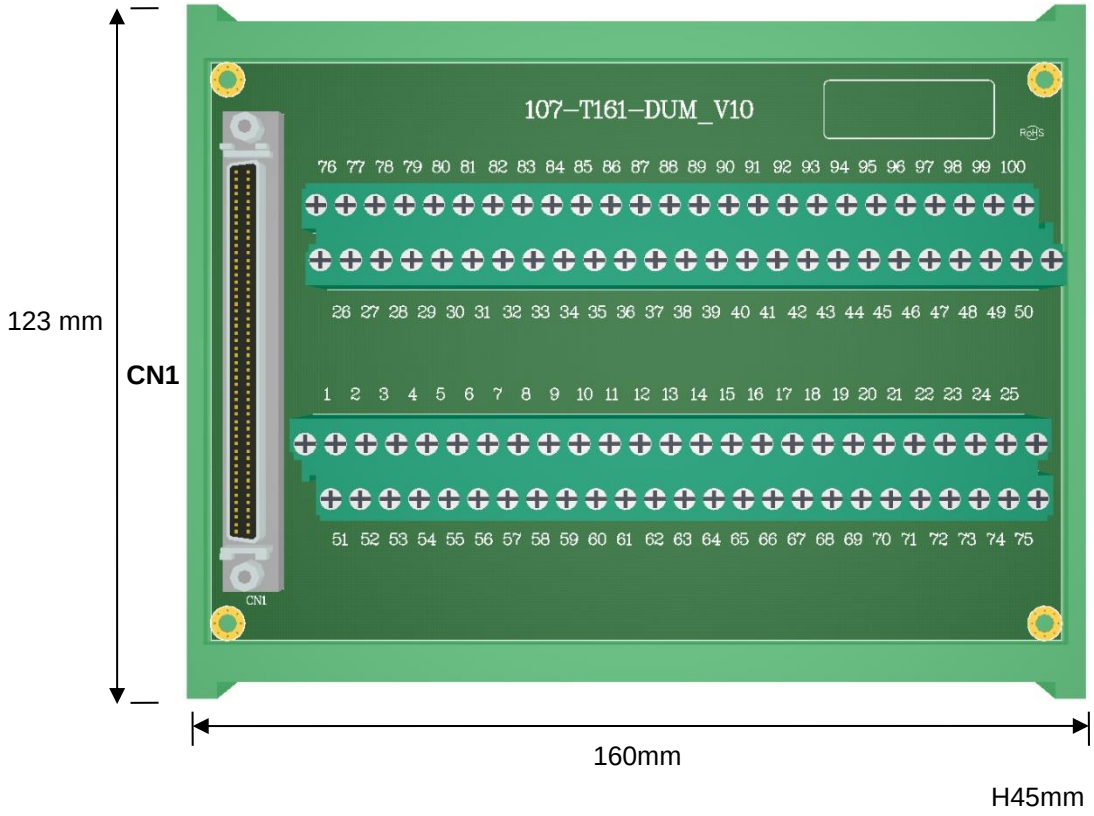


Figure of Terminal Board 107-T161-DUM

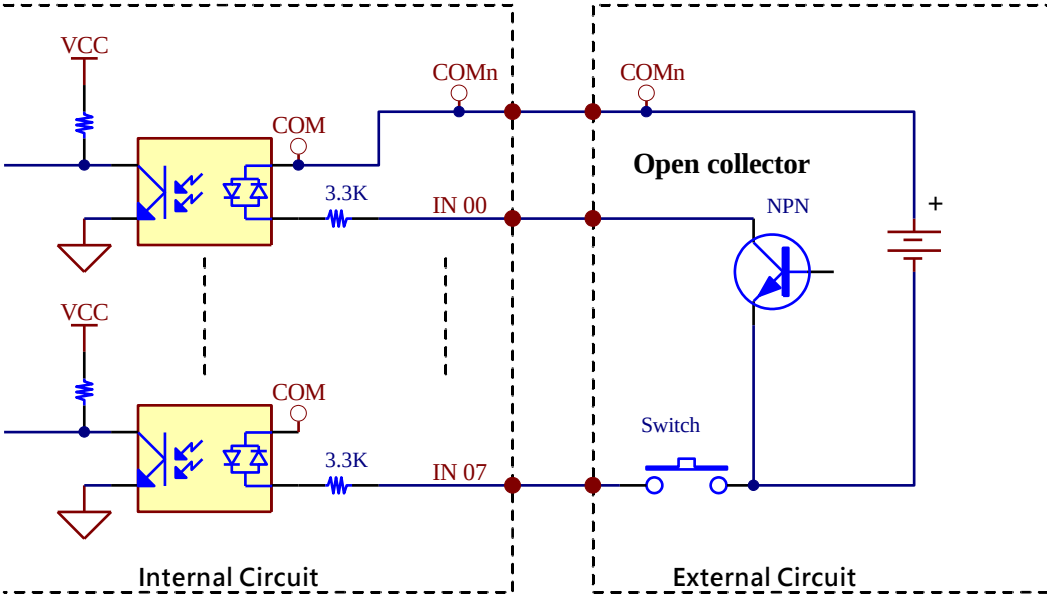
Connector description:

CN1: I/O interface and SCSI 100 pins connector

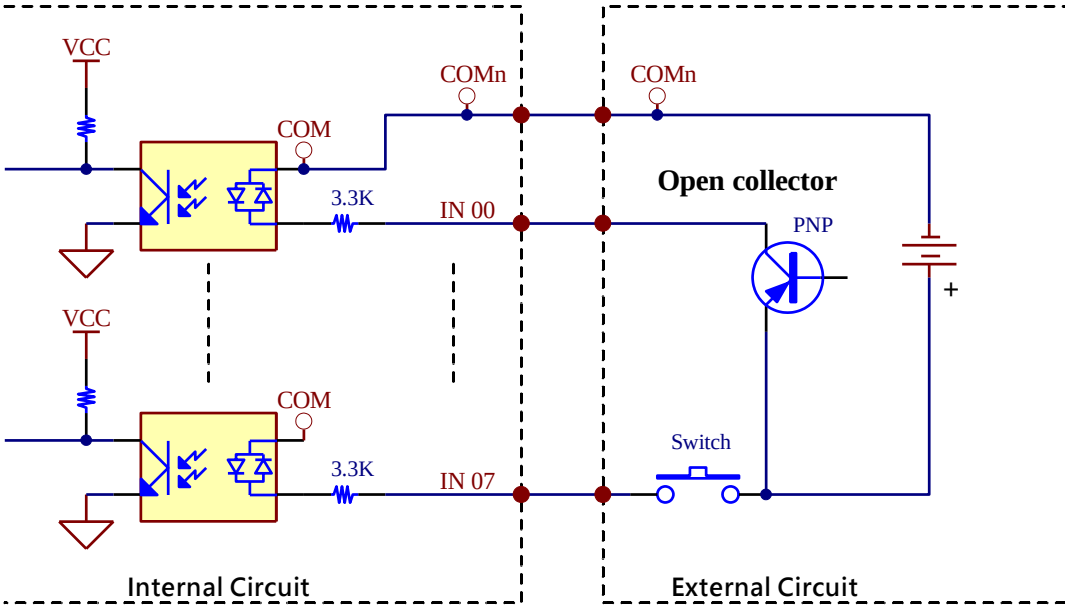
B.6 Signal Connection

B.6.1. Isolated Digital Input Channels Interface

1. The input signal circuit in SINK mode (NPN) is illustrated as follows.

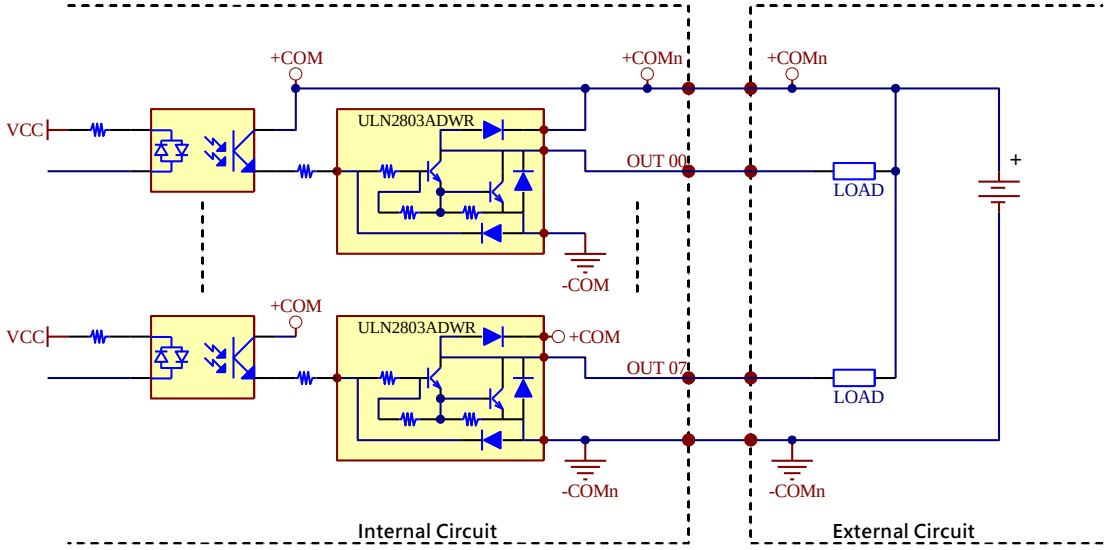


2. The input signal circuit in SOURCE mode (PNP) is illustrated as follows.



B.6.2. Isolated Digital Output Channels Interface

The output signal circuit in SINK mode (NPN) is illustrated as follows.



Appendix C
Brief Guide to the Motion Card

This section is a brief guide to the motion card used in MAI602 series and provides the information of the I/O interface, machine I/O interface signals connection and the terminal board for this card.

- Introduction
- Features
- Specifications
- Hardware Layout
- I/O Interface Description
- Terminal Board for this Motion Card
- Signal Connection

C.1 Motion Card Introduction

The motion card for MAI602 series is PCE-M134. It is a motion controller consisting of 4-axis motion controller. It provides position compare and trigger output functions to interface with other applications, like on-the-fly image acquisition. The position latch and interrupt functions let you interface with other applications like machine tool length measurement. The PCE-M134 provides servo driver/motor dedicated digital I/O interfaces, for example, ALM, INP, and ERC and also machine dedicated digital I/O interfaces, for example, ORG, PEL, and EMG. These dedicated I/O signals guarantee the functionality via hardware and therefore reduces the loading of software.

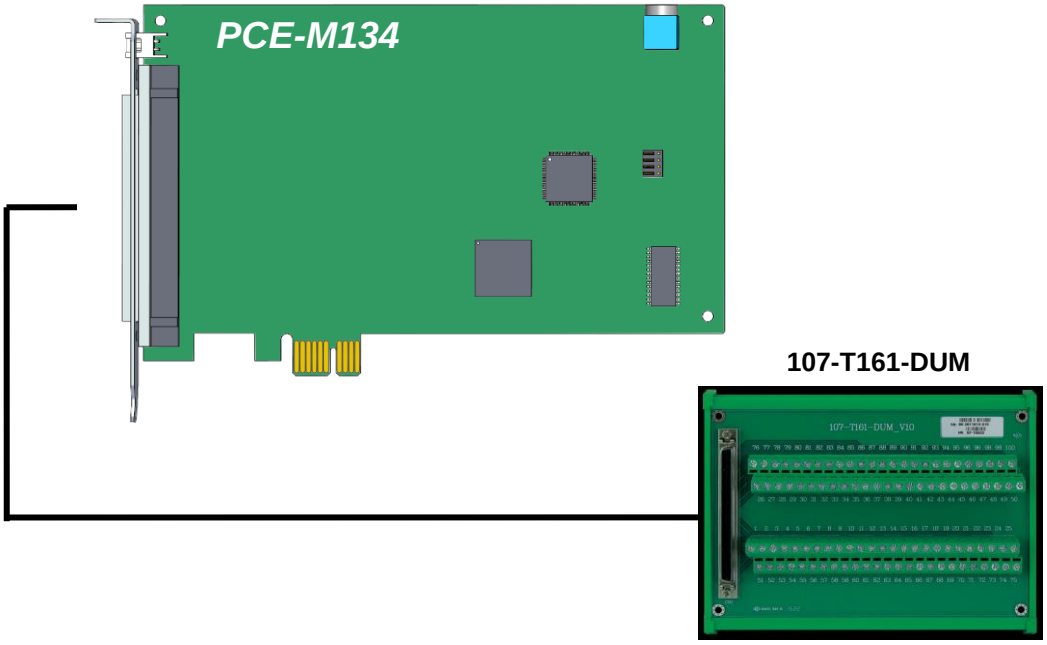


Figure of PCE-M134 and supported control devices

C.2 Features

- PCI Express (x1) compliant
- Max. 2.4 MHz, 4-Axis pulse output
- Linear interpolation
- Programmable acceleration and deceleration time
- Position compare and trigger output

C.3 Specifications

- 4-Axis motion control
- Pulse output mode: ±OUT/DIR, ±CW/CCW
- Pulse output rate: max. 2.4Mpps / Min. 1pps
- Position range: 24 bits
- Home return function
- Velocity profiles: T-curve, S-curve
- Interpolation mode: linear
- Position compare output: CMP x 4, with programmable pulse width
- Compare trigger output rate: Max. 100KHz
- FIFO buffer for compare trigger positions: 4 axes 1000 points for each axis, optional.
- Incremental encoder input: 32bits ±EA x 4, ±EB x 4
- Machine interface: PEL x 4, MEL x 4, ORG x 4, SLD x 4
- Servo driver interface: ALM x 4, RDY x 4, SVON x 4, INP x 4, ERC x 4
- I/O pin type: optically isolated with 2.5KVrms on all SCSI 100 pins

General:

- PCIe Spec.: 1-lane 2.5 Gb/s PCI Express
- Power consumption: 3.3V at 430mA, 12V at 55 mA typical
- Working temperature: 0 ~ 60℃

C.4 Hardware Layout

The PCE-M134 PCB layout and onboard I/O interfaces are introduced as follows.

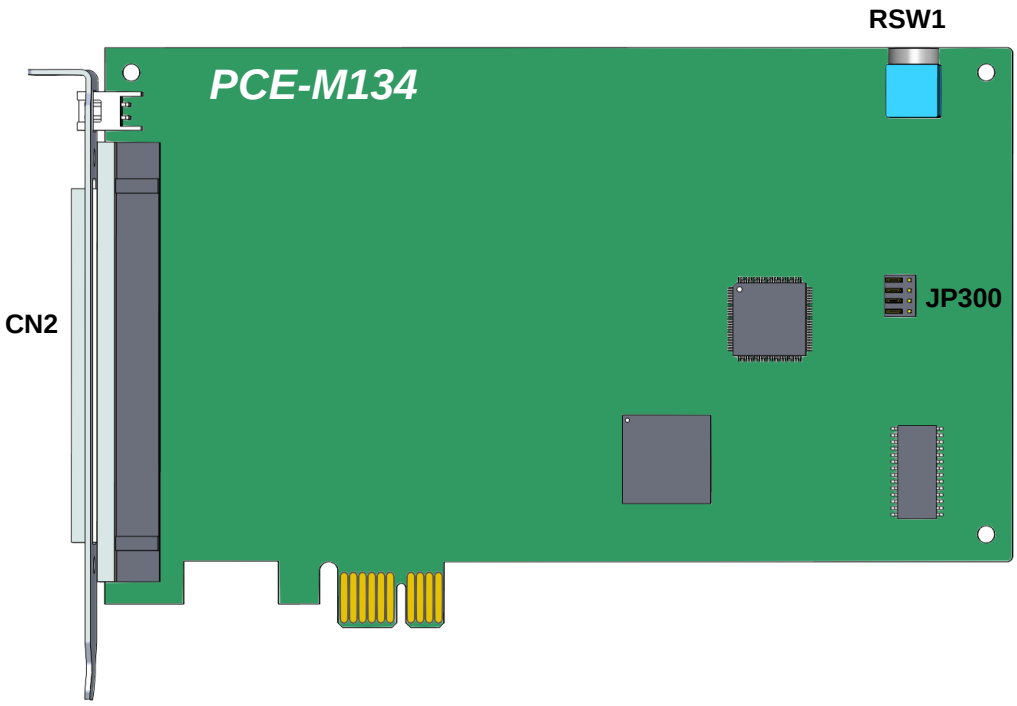
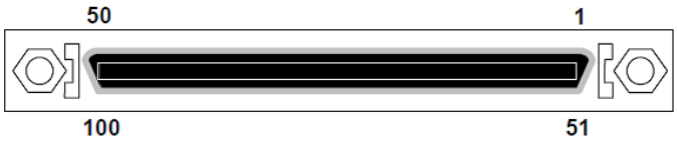


Figure of PCE-M134 PCB layout

Connector descriptions:

- **CN2:** 4 Axis motion SCSI 100-pin connector



Pin	Label	I/O	1st / 2nd / 3rd / 4th Description	Pin	Label	I/O	1st / 2nd / 3rd / 4th Description
1	24V		+24V / 200mA power input	51	24V		+24V / 200mA power input
2	EGND		External ground	52	EGND		External ground
3	EMG	I	Emergency signal	53	EMG	I	Emergency signal
4	MEL_1	I	1st end limit (-)	54	MEL_3	I	3rd end limit (-)

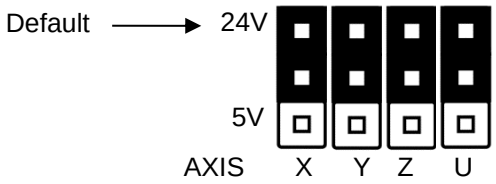
Pin	Label	I/O	1st / 2nd / 3rd / 4th Description	Pin	Label	I/O	1st / 2nd / 3rd / 4th Description
5	PEL_1	I	1st end limit (+)	55	PEL_3	I	3rd end limit (+)
6	ORG_1	I	1st home signal	56	ORG_3	I	3rd home signal
7	SLD_1	I	1st ramp-down signal	57	SLD_3	I	3rd ramp-down signal
8	MEL_2	I	2nd end limit (-)	58	MEL_4	I	4th end limit (-)
9	PEL_2	I	2nd end limit (+)	59	PEL_4	I	4th end limit (+)
10	ORG_2	I	2nd home signal	60	ORG_4	I	4th home signal
11	SLD_2	I	2nd ramp-down signal	61	SLD_4	I	4th ramp-down signal
12	RDY_1	I	1st servo ready	62	RDY_3	I	3rd servo ready
13	INP_1	I	1st servo in-position signal	63	INP_3	I	3rd servo in-position signal
14	ALM_1	I	1st servo alarm	64	ALM_3	I	3rd servo alarm
15			N.C.	65			N.C.
16	RDY_2	I	2nd servo ready	66	RDY_4	I	4th servo ready
17	INP_2	I	2nd servo in-position signal	67	INP_4	I	4th servo in-position signal
18	ALM_2	I	2nd servo alarm	68	ALM_4	I	4th servo alarm
19			N.C.	69			N.C.
20	EGND		External ground	70	EGND		External ground
21	SVON_1	O	1st servo on	71	SVON_3	O	3rd servo on
22	ERC_1	O	1st clear servo error counter	72	ERC_3	O	3rd clear servo error counter
23	ALMC_1	O	1st reset servo alarm	73	ALMC_3	O	3rd reset servo alarm
24	CMP_1	O	1st compare output	74	CMP_3	O	3rd compare output
25	SVON_2	O	2nd servo on	75	SVON_4	O	4th servo on
26	ERC_2	O	2nd clear servo error counter	76	ERC_4	O	4th clear servo error counter
27	ALMC_2	O	2nd reset servo alarm	77	ALMC_4	O	4th reset servo alarm
28	CMP_2	O	2nd compare output	78	CMP_4	O	4th compare output
29	EA+_1	I	1st encoder A phase (+)	79	EA+_3	I	3rd encoder A phase (+)
30	EA-_1	I	1st encoder A phase (-)	80	EA-_3	I	3rd encoder A phase (-)
31	EB+_1	I	1st encoder B phase (+)	81	EB+_3	I	3rd encoder B phase (+)

Pin	Label	I/O	1st / 2nd / 3rd / 4th Description	Pin	Label	I/O	1st / 2nd / 3rd / 4th Description
32	EB-_1	I	1st encoder B phase (-)	82	EB-_3	I	3rd encoder B phase (-)
33			N.C.	83			N.C.
34			N.C.	84			N.C.
35	EA+_2	I	2nd encoder A phase (+)	85	EA+_4	I	4th encoder A phase (+)
36	EA-_2	I	2nd encoder A phase (-)	86	EA-_4	I	4th encoder A phase (-)
37	EB+_2	I	2nd encoder B phase (+)	87	EB+_4	I	4th encoder B phase (+)
38	EB-_2	I	2nd encoder B phase (-)	88	EB-_4	I	4th encoder B phase (-)
39			N.C.	89			N.C.
40			N.C.	90			N.C.
41	DDA 5V		DDA 5V power output. I<100mA	91	DDA 5V		DDA 5V power output. I<100mA
42	DDA GND		Internal 5V ground	92	DDA GND		Internal 5V ground
43	DIR+_1	O	1st direction signal (+)	93	DIR+_3	O	3rd direction signal (+)
44	DIR-_1	O	1st direction signal (-)	94	DIR-_3	O	3rd direction signal (-)
45	OUT+_1	O	1st pulse signal (+)	95	OUT+_3	O	3rd pulse signal (+)
46	OUT-_1	O	1st pulse signal (-)	96	OUT-_3	O	3rd pulse signal (-)
47	DIR+_2	O	2nd direction signal (+)	97	DIR+_4	O	4th direction signal (+)
48	DIR-_2	O	2nd direction signal (-)	98	DIR-_4	O	4th direction signal (-)
49	OUT+_2	O	2nd pulse signal (+)	99	OUT+_4	O	4th pulse signal (+)
50	OUT-_2	O	2nd pulse signal (-)	100	OUT-_4	O	4th pulse signal (-)

- **RSW1:** Rotary switch for card number setting

- **JP300:** Jumper setting for compare trigger

  JP300 sets the voltage and maximum frequency of trigger output signal. The output signal voltage may either be 24V or 5V. The default setting is 24V output.



C.5 Terminal Board for the Motion Card

Below are wiring examples for Panasonic Minas A series drivers.

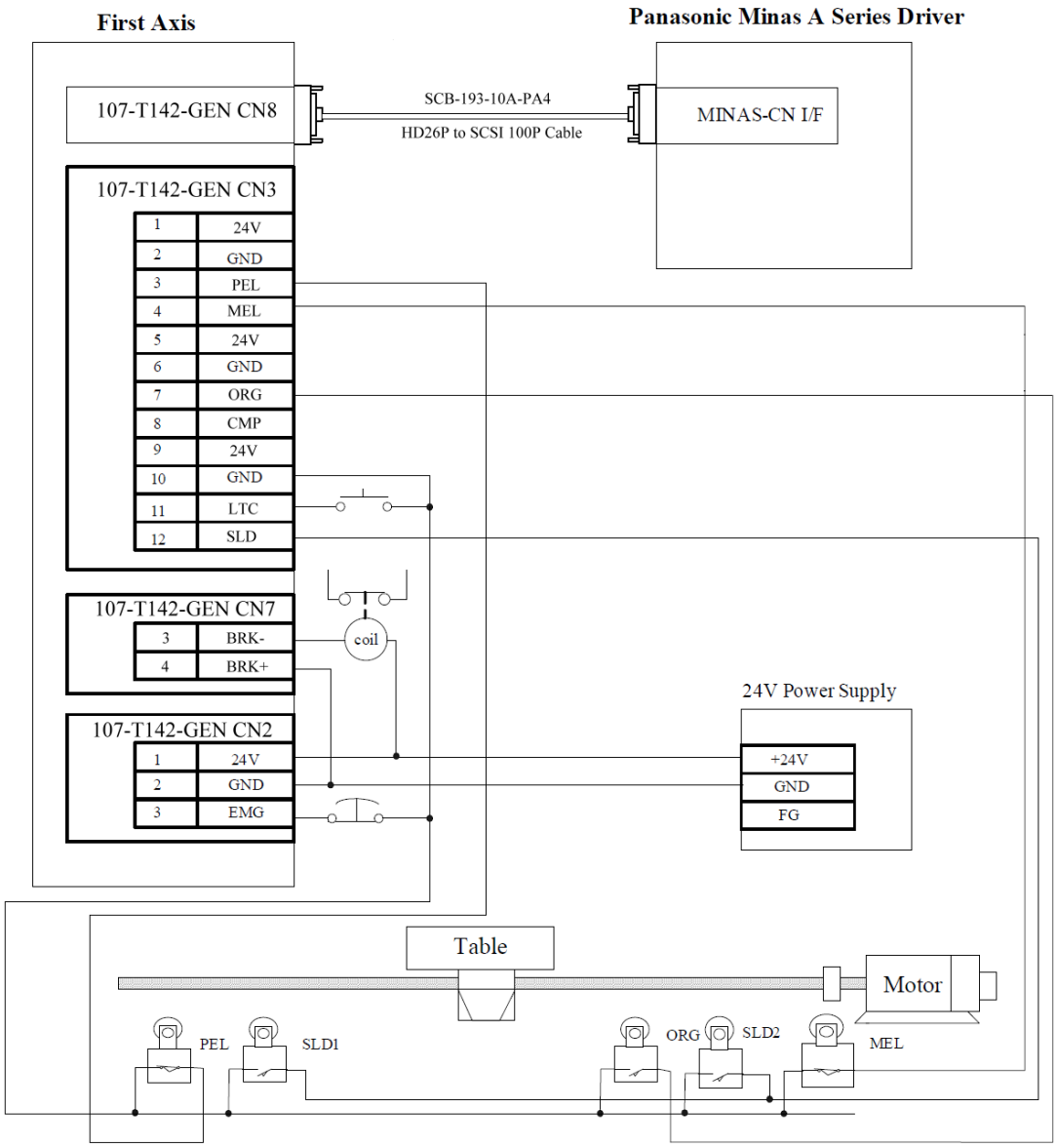


Figure of wiring example for Panasonic A series

C.6 Signal Connection

There are 3 groups of signal connection of PCE-M134 -- Machine I/O, Pulse I/O and Servo Driver I/O interface. They are described in the following sections.

C.6.1. Machine I/O Interface Signals

1. PEL, MEL, EMG (End Limit / Digital Input Signal)

   There are two end-limit signals called PEL and MEL, and one emergency stop signal called EMG for each axis. Usually they are Normal-Close type signals from external sensors. PEL indicates the limit of motion in the plus direction and MEL indicates the limit of motion in the minus direction.

   The signals connections are shown in the following figures.

   Note that the command pulse will be stopped when PEL/MEL is active.

2. ORG (Origin / Digital Input Signal)

   The origin signals (ORG1~ORG4) are necessary when the position feedback is incremental type or without any feedback encoders. They are used to indicate the origin of the system.

   The signals connections are shown in the following figures.

3. SLD (Slow Down / Input Signal)

   The SLD signals are used to help the axis decelerate to stop by hardware. The signals connections are shown in the following figures.

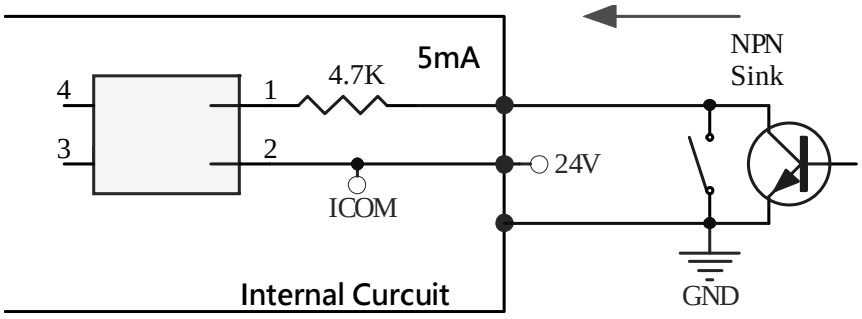


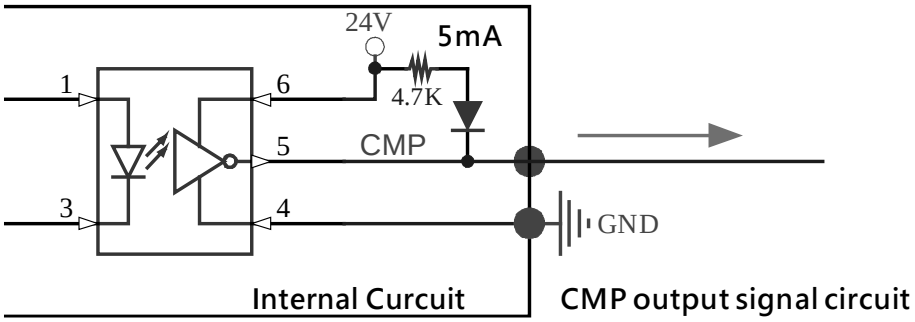
Figure of EL, ORG and SLD wiring for NPN sink mode

4. CMP (Position Compare / Output Signal)

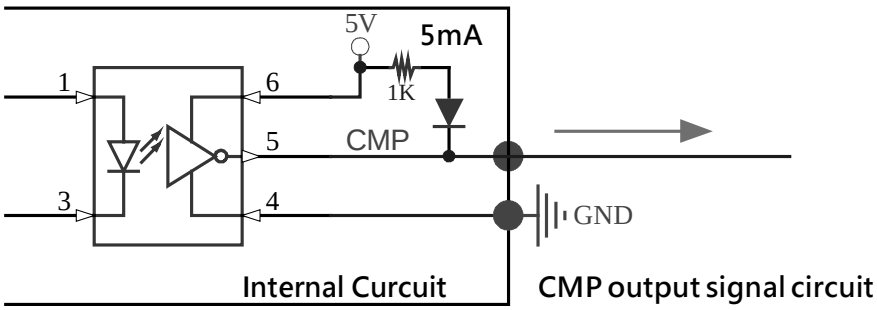
CMP signals are used to make a comparison between target value and actual value and generate a trigger signal output.

The signals connections are shown in the following figures.

Compare Trigger jumper is set as 24V by default.



Compare Trigger jumper is set as 5V.



C.6.2. Driver I/O Interface Signals

1. ALM (Servo Alarm / Digital Input Signal)

ALM- input signal from ALM signal at servo driver. Servo driver will issue ALM output when it is under abnormal operation or over-loading.

The signals connections are shown in the following figures.

2. RDY (Driver Ready Signal / Digital Input Signal)

RDY is an input signal and is used to read the RDY signal at servo driver.

The signals connections are shown in the following figures.

3. INP (Axis In Position Signal / Digital Input Signal)

   INP is an input signal and is used to read the INP status inside servo driver. The signals connections are shown in the following figures.

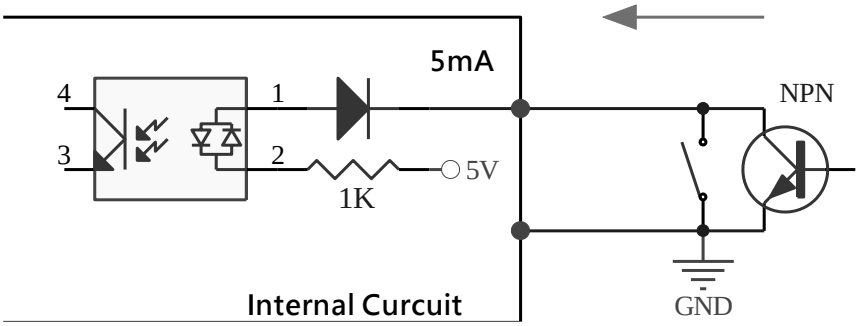


Figure of ALM wiring for NPN sink mode

Note that when ALM is active and enabled, PCE-M134 will stop pulse output.

4. RALM (Servo Alarm Reset / Digital Output Signal)

   This RALM signal is designed to reset ALM status inside servo driver if the alarm status is able to be reset.
   The signals connections are shown in the following figures.

5. SVON (Servo On / Digital Output Signal)

   SVON is an output signal from PCE-M134 and is used to make driver servo-on to hold the motor.
   The signals connections are shown in the following figures.

6. ERC (Deviation Counter Clear / Digital Output Signal)

   This ERC signal is designed to clear deviation counter inside servo driver.
   The signals connections are shown in the following figures.

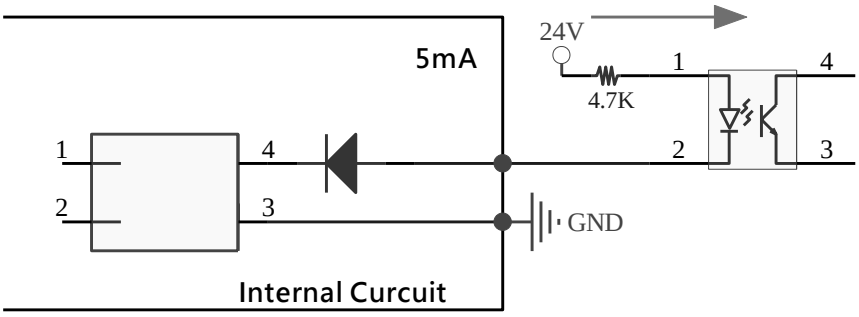


Figure of ERC output wiring diagram

C.6.3. Driver Pulse I/O Interface Signals

1. OUT and DIR (Pulse Output Control / Digital Output Signal)

   There are 8 types of pulse output of PCE-M134. You have to specify the electrical spec. as differential or open the collector first. Then select DIR/OUT or CW/CCW. The signals connections are shown in the following figures.

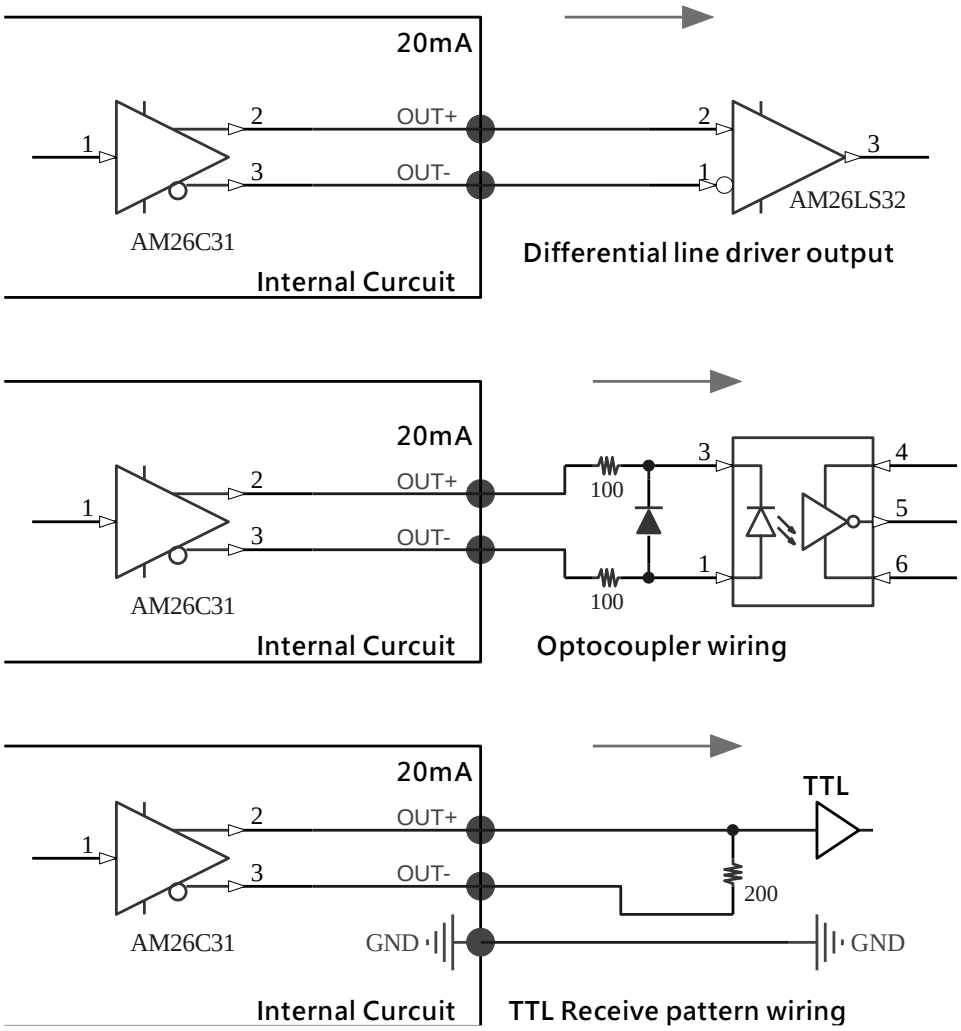


Figure of pulse output wiring diagram

2. EA and EB (Encoder A, B)

The signals connections are shown in the following figures.

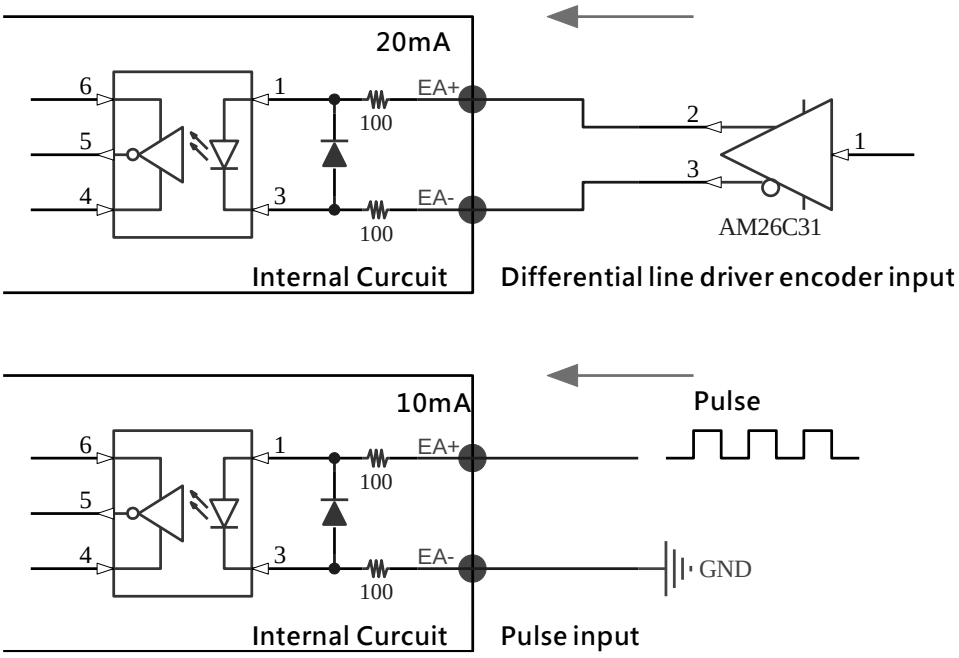


Figure of differential line driver encoder input