AXIOMTEK

IPC962-511-FL series
IPC962-512-FL series
IPC964-512-FL Series

Industrial and Fanless Computers

User's Manual

RoHS

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Safety Precautions

Before getting started, please read the following important safety precautions.

1. The IPC962-511-FL/IPC962-512-FL/IPC964-512-FL Series does not come equipped with an operating system. An operating system must be loaded first before installing any software into the computer.

2. Be sure to ground yourself to prevent static charge when installing the internal components. Use a grounding wrist strap and place all electronic components in any static-shielded devices. Most electronic components are sensitive to static electrical charge.

3. Disconnect the power cord from the IPC962-511-FL/IPC962-512-FL/IPC964-512-FL Series before making any installation. Be sure both the system and the external devices are turned OFF. Sudden surge of power could ruin sensitive components. Make sure the IPC962-511-FL/IPC962-512-FL/IPC964-512-FL Series is properly grounded.

4. Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.

5. Turn OFF the system power before cleaning. Clean the system using a cloth only. Do not spray any liquid cleaner directly onto the screen.

6. Do not leave this equipment in an uncontrolled environment where the storage temperature is below -20℃ or above 80℃. It may damage the equipment.

7. Do not open the system's back cover. If opening the cover for maintenance is a must, only a trained technician is allowed to do so. Integrated circuits on computer boards are sensitive to static electricity. To avoid damaging chips from electrostatic discharge, observe the following precautions:

   ■ Before handling a board or integrated circuit, touch an unpainted portion of the system unit chassis for a few seconds. This will help to discharge any static electricity on your body.

   ■ When handling boards and components, wear a wrist-grounding strap, available from most electronic component stores.

Classification

1. Degree of production against electric shock: not classified

2. Degree of protection against the ingress of water: IPX40

3. Equipment not suitable for use in the presence of a flammable anesthetic mixture with air or with oxygen or nitrous oxide.

4. Mode of operation: Continuous

5. Type of protection against electric shock: Class I equipment

General Cleaning Tips

You may need the following precautions before you begin to clean the computer. When you clean any single part or component for the computer, please read and understand the details below fully.

When you need to clean the device, please rub it with a piece of dry cloth.

1. Be cautious of the tiny removable components when you use a vacuum cleaner to absorb the dirt on the floor.

2. Turn the system off before you start to clean up the component or computer.

3. Never drop the components inside the computer or get circuit board damp or wet.

4. Be cautious of all kinds of cleaning solvents or chemicals when you use it for the sake of cleaning. Some individuals may be allergic to the ingredients.

5. Try not to put any food, drink or cigarette around the computer.

Cleaning Tools:

Although many companies have created products to help improve the process of cleaning your computer and peripherals users can also use household items to clean their computers and peripherals. Below is a listing of items you may need or want to use while cleaning your computer or computer peripherals.

Keep in mind that some components in your computer may only be able to be cleaned using a product designed for cleaning that component, if this is the case it will be mentioned in the cleaning.

- Cloth: A piece of cloth is the best tool to use when rubbing up a component. Although paper towels or tissues can be used on most hardware as well, we still recommend you to rub it with a piece of cloth.

- Water or rubbing alcohol: You may moisten a piece of cloth a bit with some water or rubbing alcohol and rub it on the computer. Unknown solvents may be harmful to the plastics parts.

- Vacuum cleaner: Absorb the dust, dirt, hair, cigarette particles, and other particles out of a computer can be one of the best methods of cleaning a computer. Over time these items can restrict the airflow in a computer and cause circuitry to corrode.

- Cotton swabs: Cotton swaps moistened with rubbing alcohol or water are excellent tools for wiping hard to reach areas in your keyboard, mouse, and other locations.

- Foam swabs: Whenever possible it is better to use lint free swabs such as foam swabs.

Note: It is strongly recommended that you should shut down the system before you start to clean any single components.

Please follow the steps below:

1. Close all application programs
2. Close operating software
3. Turn off power switch
4. Remove all device
5. Pull out power cable

Scrap Computer Recycling

If the computer equipments need the maintenance or are beyond repair, we strongly recommended that you should inform your Axiomtek distributor as soon as possible for the suitable solution. For the computers that are no longer useful or no longer working well, please contact your Axiomtek distributor for recycling and we will make the proper arrangement.

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CHAPTER 1
INTRODUCTION

This chapter contains general information and a detailed specification of the IPC962-511-FL/IPC962-512-FL/IPC964-512-FL Series. Chapter 1 includes the following sections:

- General Description
- System Specifications
- Dimensions
- I/O Outlets
- Jumper Settings
- Connectors
- Package List

1.1   General Description

The IPC962-511-FL/IPC962-512-FL/IPC964-512-FL Series is a fanless system that can support LGA1151 socket for Intel® 6th/7th generation Core™ i7/i5/i3 processors. The IPC962-511-FL/IPC962-512-FL/IPC964-512-FL Series supports Windows® 7, Windows® 10 which are suitable for the most endurable operation.

> The IPC962-511-FL/IPC962-512-FL/IPC964-512-FL Series support two hard-drive bays, which makes it easy to install for customer maintain the system.

> Embedded O.S. Supported

> The IPC962-511-FL/IPC962-512-FL/IPC964-512-FL Series not only supports Windows® 7 and Windows® 10, but also supports embedded OS, such as Windows® 7 embedded. For storage device, the IPC962-511-FL/IPC962-512-FL/IPC964-512-FL Series supports two 2.5" HDD driver bay.

1.2 System Specifications

1.2.1 Main CPU Board

- **CPU**
  - Socket LGA1151 for 6th /7th Generation Intel® Core™ i7/i5/i3 processors, up to 35W
- **System Chipset**
  - Intel® H110 chipset (IPC962-511)
  - Intel® Q170 chipset (IPC962-512/IPC964-512)
- **BIOS**
  - AMI BIOS, with Smart View and Customer CMOS Backup.
- **System Memory**
  - Two DDR4-2133 un-buffered SO-DIMM max. up to 32GB
- **Features**
  - Fanless Operation
  - Compact & Front IO design
  - Supports two expansion slots(IPC962-511/IPC962-512) or four expansion slots(IPC964-512)
  - DC to DC power supply support 24VDC (uMin=19V/uMax=30V)
  - Supports two 2.5" HDD (IPC962-512/IPC964-512 support RAID 0,1)
  - TPM2.0
  - Supports optional WLAN module & antenna

1.2.2 I/O System

- **Standard I/O Interface -- Font**
  - One ATX power on/off switch
  - One ATX/AT Mode switch
  - One Reset switch
  - One 2-pin connector output for remote power on/off switch
  - DC to DC power supply, supports 24VDC (uMin=19V/uMax=30V) with phoenix power plug
  - Four USB 3.0 ports
  - HDD access/Power LEDs
  - Two G.E. LAN ports (i211AT)
  - Flexible IO
    - ➢ AX93511 4 x RS-232/422/485 module (default RS-232) or
    - ➢ AX93512 2 x RS-232/422/485 w/ isolated 1.5KVDC protection and 8-in/8-out isolated 1.5KVDC DIO or
    - ➢ AX93516 4 x RS232/422/485 w/isolated 2KVDC module

- One VGA supports resolution up to 1920 x 1200 @60Hz

- One HDMI.4b supports resolution up to 4096 x 2304 @60MHz

- 1 x Audio (MIC-in/Line-out)

● **Expansion Slot**

IPC962-511 / IPC962-512

- 1 x on board full-size PCI Express Mini Card slot with USB interface(IPC962-511)

- 1 x on board full-size PCI Express Mini Card slot with USB/PCIe interface(IPC962-512)

- AX96205: 1 PCIe x16 + 1 PCIe x4

- AX96206: 1 PCIe x16 + 1 PCI or

- AX96207: 2 PCI or

IPC964-512

- 1 x on board full-size PCI Express Mini Card slot with USB/PCIe interface

- AX96410: 1 PCIex16 + 3 PCIex4   or

- AX96411: 1 PCIex16 + 1 PCIex4 + 2PCI

Note: **The maximum power rating for expansion slots at 60℃ can not be exceeded the following value.**

The maximum loading of +3.3V+5V+12V<150W

Note: **12V maximum loading 10A(120W), the remaining 30W is shared by 3.3V & 5V.**

1.2.3 System Specification

● **Drive Capacity**

- Supports two 2.5" HDD driver bay (SSD/HDD thickness<=15mm)

*Note: **Due to Gen. 2 SSD with JMicron controller has compatibility issue with Intel H110 PCH, we strongly recommend to use Gen. 3 SSD on IPC962 Series.***

● **Power Input**

- 24VDC (uMin=19V/uMax=30V) with phoenix power plug

● **Operation Temperature**

- Ambient with air flow: -10℃ ~ +60℃ with 6th gen CPU and W.T. HDD or W.T. SSD

- Ambient with air flow: -10℃ ~ +50℃ with 7th gen CPU and W.T. HDD or W.T. SSD

● **Storage Temperature**

- -20℃ ~ 80℃

● **Humidity**

- 10% ~ 90% (Non-condensing)

● **Dimensions**

IPC962-511 / IPC962-512

■ 147.5 mm (5.81") (W) x 192 mm (7.56") (H) x 230 mm (9.06") (D)

IPC964-512

■ 188.1 mm (7.39") (W) x 192 mm (7.54") (H) x 230 mm (9.04") (D) (IPC964-512)

Note: *All specifications and images are subject to change without notice.*

The performance of the system might be adversely affected at an operatingtemperature above 60°C.

Note: *If the operating temperature is above 35 °C, it is recommended to use a wide temperature SSD on the device.*

1.3　Dimensions

The following diagrams show you dimensions and outlines of the IPC962-511-FL/IPC962-512-FL/IPC964-512-FL Series.

IPC962-511 / IPC962-512
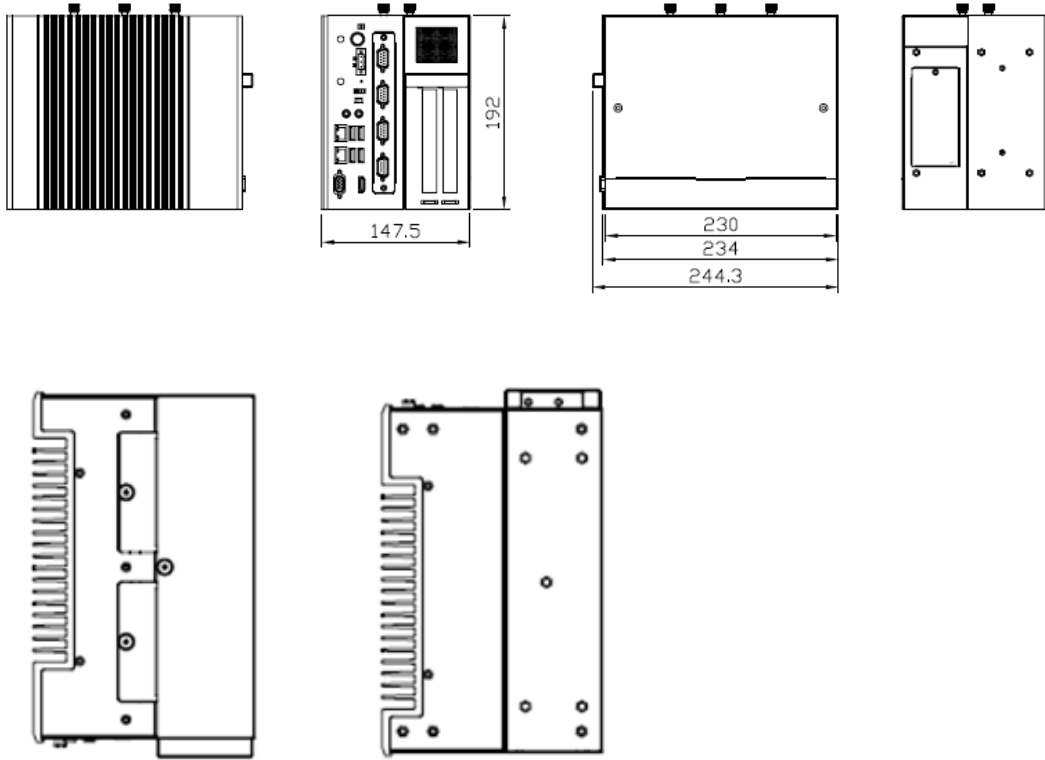
IPC964-512
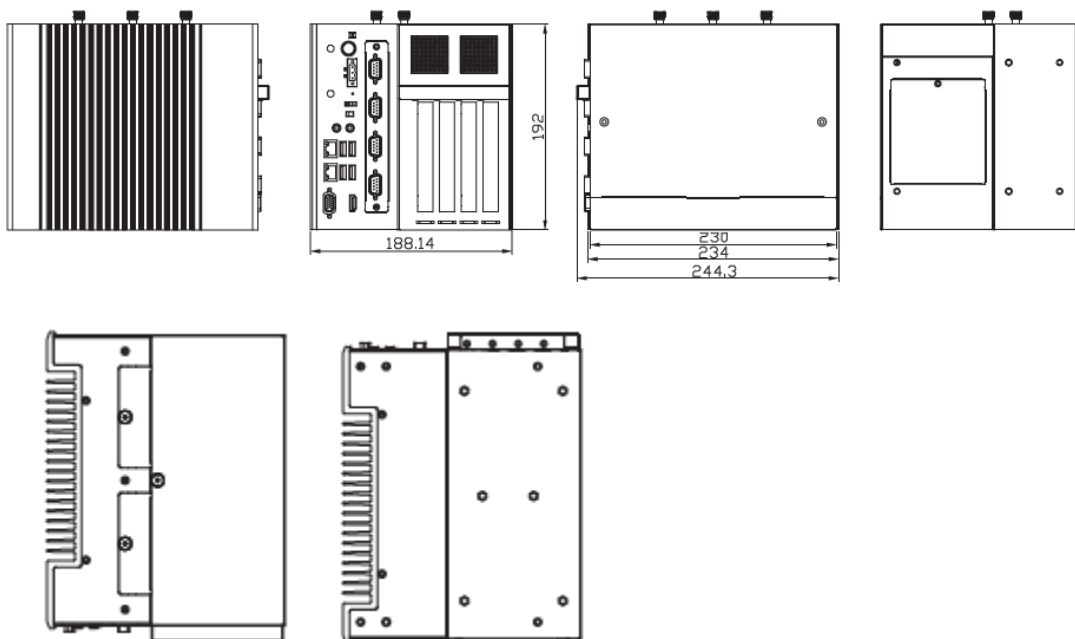
1.4   I/O Outlets

The following figures show you I/O outlets on front and rear panels of the IPC962-511-FL/IPC962-512-FL/IPC964-512-FL Series.

IPC962-511 / IPC962-512

Front Panel

1. 2 x Antenna opening
2. Remote switch
3. Mic-in & Line-out
4. 2 x LAN
5. VGA

6. Reset switch
7. Power switch
8. Terminal block
9. HDD & Power LEDs
10. 4 x USB 3.0
11. HDMI

12. (1) AX93511: 4 x RS-232/422/485 (default RS-232)
    (2) AX93512: 2 x RS-232/422/485 with isolated
         1.5KVDC & 8-in/8-out DIO with
         isolated 1.5KVDC
    (3) AX93516: 4 x RS-232/422/485 with isolated
         2KVDC module
13. (1) AX96205: 1 PCIe x16 + 1 PCIe x4
    (2) AX96206: 1 PCIe x16 + 1 PCI
    (3) AX96207: 2 PCI

IPC964-512

Front Panel

1. 2 x Antenna opening
2. Remote switch
3. Mic-in & Line-out
4. 2 x LAN
5. VGA

6. Reset switch
7. Power switch
8. Terminal block
9. HDD & Power LED
10. 4 x USB 3.0
11. HDMI

12. (1) AX93511: 4 x RS-232/422/485 module
     (default RS-232)
  (2) AX93512: 2 x RS-232/422/485 with isolated
     1.5KVDC & 8-in/8-out with isolated
     1.5KVDC DIO module
  (3) AX93516: 4 x RS-232/422/485 with isolated
     2KVDC module
  (4) AX93519: 1 x 10/100/1000 Mbps Ethernet
     2 x RS-232/422/485
     2 x USB 3.0 module
13. (1) AX96410: 1 PCIe x16 + 3 PCIe x4
  (2) AX96411: 1 PCIe x16 + 1 PCIe x4 + 2 PCI

1.5 Packing List

The package bundled with your IPC962-511-FL/IPC962-512-FL/IPC964-512-FL Series should contain the following items:

- **IPC962-511-FL/IPC962-512-FL/IPC964-512-FL-DC Series Unit x 1**

- **Driver CD**

- **Screw pack x 1**

- **Foot pad x 4**

- **CPU grease x 1**

- **Terminal block x 1**

- **Remote switch cable x 1**

- **Holder bracket x1**

If you can not find this package or any items are missing, please contact Axiomtek distributors immediately.

1.6   Jumper Settings

Properly configure jumper settings on the SBC87511/SBC87512 to meet your application purpose. Below you can find a summary table of all jumpers and onboard default settings.

Note: **How to setup Jumpers**

That a cap on a jumper is to "close" the jumper, whereas that offs a jumper is to "open" the jumper.

[Open]   [Closed]   [Pin1-2 Closed]
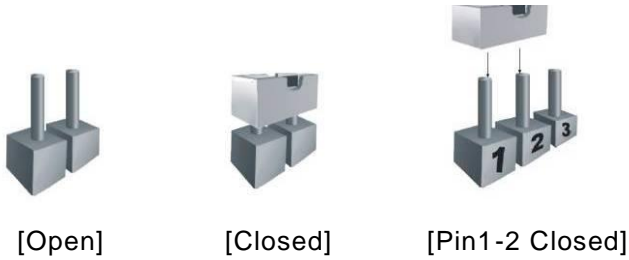
Jumper	Descriptions	Setting
JP1	Clear RTC : Normal	Short 1-2

1.6.1   Restore BIOS Optimal Defaults (JP1)

Put jumper clip to pin 2-3 for a few seconds then move it back to pin 1-2. Doing this procedure can restore BIOS optimal defaults.

Function	Setting
Normal operation (Default)	1-2 close
Restore BIOS optimal defaults	2-3 close

3 2 1

1.7   Connectors

Connectors connect this board with other parts of the system. Loose or improper connection might cause problems. Make sure all connectors are properly and firmly connected.

Here is a summary table shows you all connectors on the board.

Connector	Label
MINI CARD SLOT	CN3
LAN1+USB3.0	CN4
LAN2+USB3.0	CN5
VGA Connector	CN6
Audio Connector	CN7
DC-in Phoenix Power Connector	CN8
HDMI Connector	CN9
SATA Power connector	SCN1、SCN2
SATA III connector	SATA1~2
DDR4 SO-DIMM(260 Pin)	SDIMM1、SDIMM2
Power botton	SW1
AT/ATX Power Selet	SW2
Reset botton	SW3
Remote SW	PWRBT1
Flexible IO- COM x4(RS232/422/485)	AX93511
Flexible IO – Isolated COM x4(RS232/422/485)	AX93516
Flexible IO – Isolated COM x2(RS232/422/485) & 8in/8out DIO	AX93512
Riser Card Power output	ATX1,ATX2

1.7.1 MINI CARD SLOT (CN3)

There is a PCI-Express Mini Card connector on the top side applying USB 2.0. It supports an USB mini card.

Pins	Signals	Pins	Signals
1	WAKE#	2	+3.3VSB
3	No use	4	GND
5	No use	6	+1.5V
7	CLKREQ#	8	No use
9	GND	10	No use
11	REFCLK-	12	No use
13	REFCLK+	14	No use
15	GND	16	No use
17	No use	18	GND
19	No use	20	W_DISABLE#
21	GND	22	PERST#
23	PE_RXN3/	24	+3.3VSB
25	PE_RXP3/	26	GND
27	GND	28	+1.5V
29	GND	30	SMB_CLK
31	PE_TXN3/	32	SMB_DATA
33	PE_TXP3/	34	GND
35	GND	36	USB_D8-
37	GND	38	USB_D8+
39	+3.3VSB	40	GND
41	+3.3VSB	42	No use
43	GND	44	No use
45	No use	46	No use
47	No use	48	+1.5V
49	No use	50	GND
51	No use	52	+3.3VSB
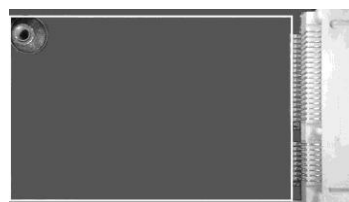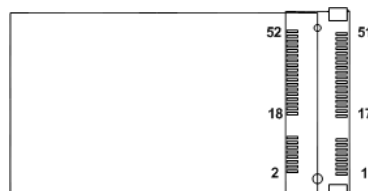
1.7.2   LAN+USB3.0 (CN4、CN5)

The system has two RJ-45 connectors: LAN1 and LAN2. Ethernet connection can be established by plugging one end of the Ethernet cable into this RJ-45 connector and the other end (phone jack) to a 1000/100/10-Base-T hub.

Pins	1000 Base-T	100/10 Base-T	Descriptions
L1	BI_DA+	TX+	Bidirectional or Transmit Data+
L2	BI_DA-	TX-	Bidirectional or Transmit Data-
L3	BI_DB+	RX+	Bidirectional or Receive Data+
L4	BI_DC+	N.C.	Bidirectional or Not Connected
L5	BI_DC-	N.C.	Bidirectional or Not Connected
L6	BI_DB-	RX-	Bidirectional or Receive Data-
L7	BI_DD+	N.C.	Bidirectional or Not Connected
L8	BI_DD-	N.C.	Bidirectional or Not Connected
A	Active Link LED (Yellow) Off: No link Blinking: Data activity detected		
B	Speed LED 1000: Orange 100: Green 10: OFF		
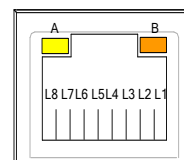
The Universal Serial Bus connectors are compliant with USB 3.0 (5Gb/s), and ideally for installing USB peripherals such as scanner, camera and USB devices, etc.

Pins	Signal USB Port 0	Pins	Signal USB Port 1
1	USB_VCC (+5V level standby power)	10	USB_VCC (+5V level standby power)
2	USB_Data2-	11	USB_Data3-
3	USB_Data2+	12	USB_Data3+
4	GND	13	GND
5	SSRX2-	14	SSRX3-
6	SSRX2+	15	SSRX3+
7	GND	16	GND
8	SSTX2-	17	SSTX3-
9	SSTX2+	18	SSTX3+

1.7.3   VGA Connector (CN6)

The CN9 is a 15-pin D-Sub connector which is commonly used for CRT monitor.
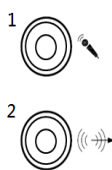
Pins	Signals	Pins	Signals
1	Red	2	Green
3	Blue	4	N.C.
5	GND	6	DETECT
7	GND	8	GND
9	+5V	10	GND
11	N.C.	12	DDC DATA
13	Horizontal Sync	14	Vertical Sync
15	DDC CLK		
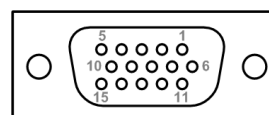
1.7.4   Audio Connector (CN7)

These two audio jacks ideal are for Audio Mic-In and Audio Line-out.
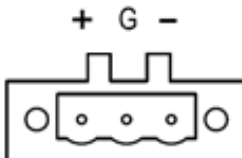
Pins	Signals
1	Line Out
2	Microphone In

1.7.5   DC-in Phoenix Power Connector (CN8)

The system supports 24VDC (uMin=19V/uMax=30V) Phoenix DC-in connector for system power input.

Pins	Signals
1	DC+
2	GND
3	DC-

1.7.6   HDMI Connector (CN9)

The HDMI (High-Definition Multimedia Interface) is a compact digital interface which is capable of transmitting high-definition video and high-resolution audio over a single cable.

Pins	Signals	Pins	Signals
1	HDMI OUT_DATA2+	11	GND
2	GND	12	HDMI OUT Clock-
3	HDMI OUT_DATA2-	13	N.C.
4	HDMI OUT_DATA1+	14	N.C.
5	GND	15	HDMI OUT_SCL
6	HDMI OUT_DATA1-	16	HDMI OUT_SDA
7	HDMI OUT_DATA0+	17	GND
8	GND	18	+5V
9	HDMI OUT_DATA0-	19	HDMI_HTPLG
10	HDMI OUT Clock+		
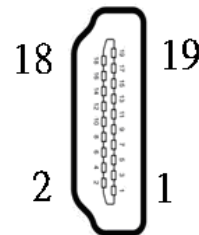
1.7.7   SATA Power connector (SCN1、SCN2)

Use SCN1、SCN2 for interfacing to SATA 2.5" HDD power supply.

Pins	Signals
1	+12V level
2	GND
3	GND
4	+5V level
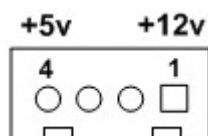
1.7.8   SATA Connector (SATA1、SATA2)

These Serial Advanced Technology Attachment (Serial ATA or SATA) connectors are for high-speed SATA interfaces. They are computer bus interfaces for connecting to devices such as hard disk drives. This board has two SATA 3.0 ports with 6Gb/s performance.

Pins	Signals
1	GND
2	SATA_TX+
3	SATA_TX-
4	GND
5	SATA_RX-
6	SATA_RX+
7	GND
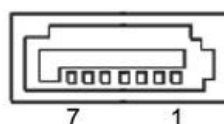
1.7.9   ATX Power On/OFF Button(SW1)

The ATX power button is on the I/O side. It can allow users to control SBC87853 power on/off.

Function	Description
On	Turn on/off system
Off	Keep system status

1.7.10 AT/ATX Switch (SW2)

If you set AT/ATX switch to AT mode, the system will be automatically power on without pressing soft power button during power input; we can use this switch to achieve auto power on demand.
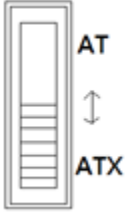
1.7.11 Reset Button(SW3)

The Reset button can allow users to reset SBC87853.

Function	Description
On	Reset system
Off	Keep system status

1.7.12 Remote Power Switch Connector (PWRBT1)

One 2-pin connector output for remote power on/off switch.

Function	Description
Short(1-2)	Turn on/off system
Open	Keep system status
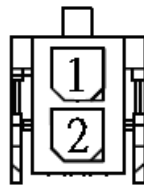
1.7.13 Flexible IO - COM I/O Card Connector (AX93511)

The system has four serial ports. COM1~COM4 are RS-232/422/485 ports. Please refer to Chapter 4 for the detail of BIOS setting.

※**COM1,COM2,COM3,COM4**

Pins	RS-232	RS-422	RS-485
1	DCD, Data Carrier Detect	TX-	Data-
2	RXD, Receive Data	TX+	Data+
3	TXD, Transmit Data	RX+	No use
4	DTR, Data Terminal Ready	RX-	No use
5	GND, Ground	No use	No use
6	DSR, Data Set Ready	No use	No use
7	RTS, Request To Send	No use	No use
8	CTS, Clear To Send	No use	No use
9	RI, Ring Indicator	No use	No use
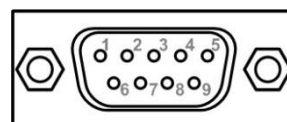
1.7.14 Flexible IO – Isolated COM x4 I/O Card (AX93516)

The system has four serial ports. COM1~COM4 are RS-232/422/485 w/isolated 2KV ports. Please refer to Chapter 4 for the detail of BIOS setting.

※**COM1,COM2,COM3,COM4**

Pins	RS-232	RS-422	RS-485
1	DCD, Data Carrier Detect	TX-	Data-
2	RXD, Receive Data	TX+	Data+
3	TXD, Transmit Data	RX+	No use
4	DTR, Data Terminal Ready	RX-	No use
5	GND, Ground	No use	No use
6	DSR, Data Set Ready	No use	No use
7	RTS, Request To Send	No use	No use
8	CTS, Clear To Send	No use	No use
9	RI, Ring Indicator	No use	No use
10	GND_EARTH	No use	No use

1.7.15 Flexible IO – Isolated COM & DIO I/O Card (AX93512)

 The system has four serial ports.COM1~COM2 are RS-232/422/485 w/ isolated 1.5KVDC protection and DIO1~DIO2 8-in/8-out isolated 1.5KVDC DIO ports. Please refer to Chapter 4 for the detail of BIOS setting.

※**COM1,COM2,DIO1,DIO2**

CN1 (COM1)& CN2(COM2)			
Pins	**RS-232**	**RS-422**	**RS-485**
1	DCD, Data Carrier Detect	TX-	Data-
2	RXD, Receive Data	TX+	Data+
3	TXD, Transmit Data	RX+	No use
4	DTR, Data Terminal Ready	RX-	No use
5	GND, Ground	No use	No use
6	DSR, Data Set Ready	No use	No use
7	RTS, Request To Send	No use	No use
8	CTS, Clear To Send	No use	No use
9	RI, Ring Indicator	No use	No use
10	GND_EARTH	No use	No use

CN3(DIO1)		CN4(DIO2)	
Pin	**Function**	**Pin**	**Function**
1	Common1 PWR+	1	Common2 PWR+
2	DO10	2	DO20
3	DO11	3	DO21
4	DO12	4	DO22
5	DO13	5	DO23
6	Common1 PWR-	6	Common2 PWR-
7	External1 Power	7	External2 Power
8	DI10	8	DI20
9	DI11	9	DI21
10	DI12	10	DI22
11	DI13	11	DI23
12	Isolation1 GND	12	Isolation2 GND
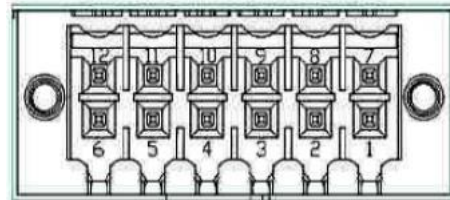
1.7.16 Riser Card Power output (ATX1-Black,ATX2-White)

Pins	Signals
1	GND
2	GND
3	+12V
4	+12V

ATX2

Pins	Signals
1	GND
2	GND
3	+24V
4	+24V

ATX1

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CHAPTER 2
HARDWARE INSTALLATION

The IPC962-511-FL/IPC962-512-FL/IPC964-512-FL Series are convenient for your various hardware configurations, such as CPU (Central Processing Unit), Memory Module, HDD (Hard Disk Drive) and PCIe/PCI card. The chapter 2 will show you how to install the hardware. It includes:

2.1   Installing the Processor

The Intel® Core™ i7/i5/i3 processors are available as a boxed processor for IPC962-511-FL/IPC962-512-FL/IPC964-512-FL system. Intel recommends the processors should be installed by a computer professional since this electronic device may cause serious damage to the installer, system and processor if installed improperly.

Important Notes *Before attempting to install a new processor, carefully review the documentation that came with your system and make sure that you will not be voiding your warranty by opening the computer or replacing your processor.*

Instructions:

1.   Make sure that your system can accommodate the Intel® Core™ i7/i5/i3/Celeron® Processors that you want to install. Check for CPU Card, BIOS, and thermal compatibility by using the manufacturer's documentation for the system, or by contacting the vendor if necessary. This processor should only be installed in systems supporting the Intel® Core™ i7/i5/i3/Celeron® Processors.

2.   Obtain access to your processor socket as described in the documentation for your system.

3.   If the cooling solution prevents you from accessing the processor socket, you may need to remove it. Instructions on how to remove your cooling solution should be provided in the documentation that came with the system.

Procedure of Installation:

Step 1   Turn off the system.

Step 2   Disconnect the power connector.

Step 3   Loosen screws to remove the Heatsink cover from the chassis.

Step 4   After opening the HS cover, you can locate the CPU socket as marked. Align pins of the CPU with pin holes of the socket. Be careful of the CPU's orientation that you need to align the arrow mark on the CPU with the arrow key on the socket. Please remove the Mylar before you install the CPU into the socket.
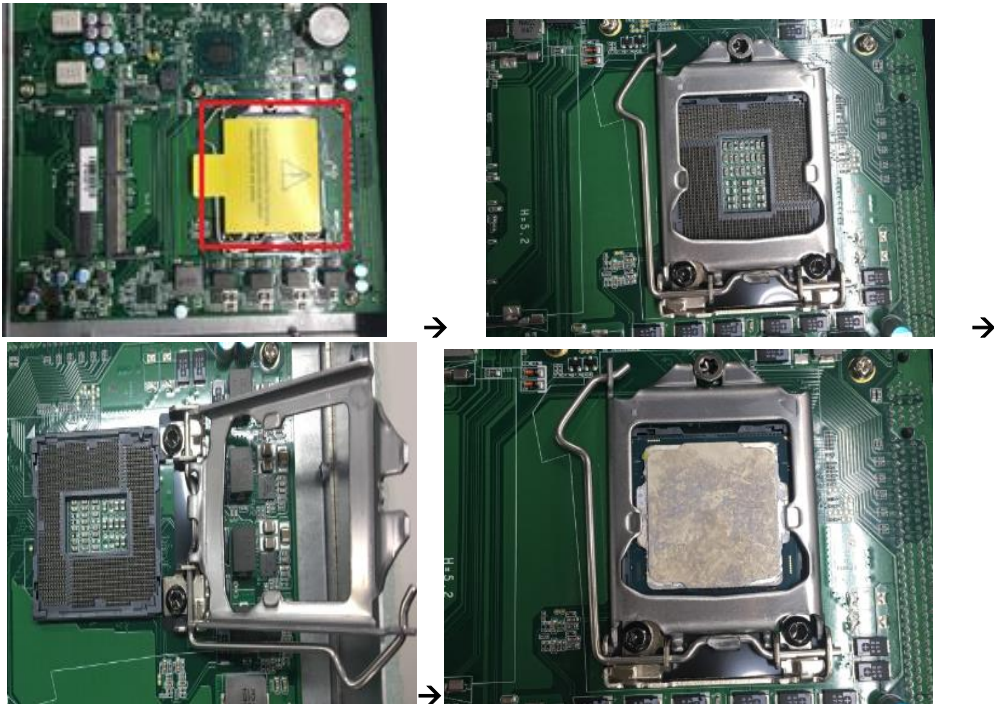
Step 5   Then, applying thermal grease on top of the CPU

Step 6   After install all components, please close the HS cover back to the chassis and fasten all screws.

2.2   Installing the Memory Module

Step 1   Turn off the system.

Step 2   Disconnect the power connector.

Step 3   Loosen screws to remove the Heatsink cover from the chassis.

Step 4   Install the memory module into the socket and push it firmly down until it is fully seated. The socket latches are clipped on to the edges of the SO-DIMM.
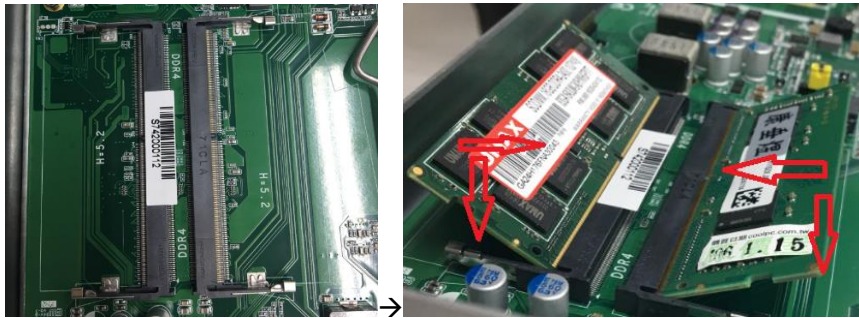
Step 5   After install the ram modules, please close the Heatsink cover back to the chassis and fasten all screws.

2.3   Installing the Hard Disk Drive

The IPC962-511-FL/IPC962-512-FL/IPC964-512-FL Series offers a convenient drive bay module for users to install HDD. The system offers users two 2.5" Hard Disk Drive for installation. Please follow the steps:

Step 1   Turn off the system.

Step 2   Disconnect the power connector.

Step 3   Unscrew the thumbscrew and separating the bracket from the HDD tray.

Step 4   Fix the bracket onto the HDD bracket with four screws.
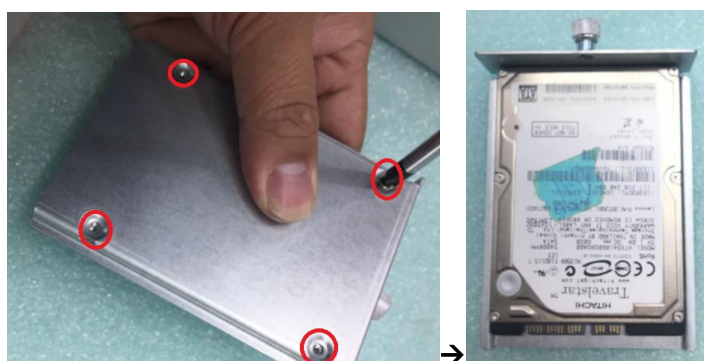
Step 5   Insert the HDD module into the HDD tray and screw it.
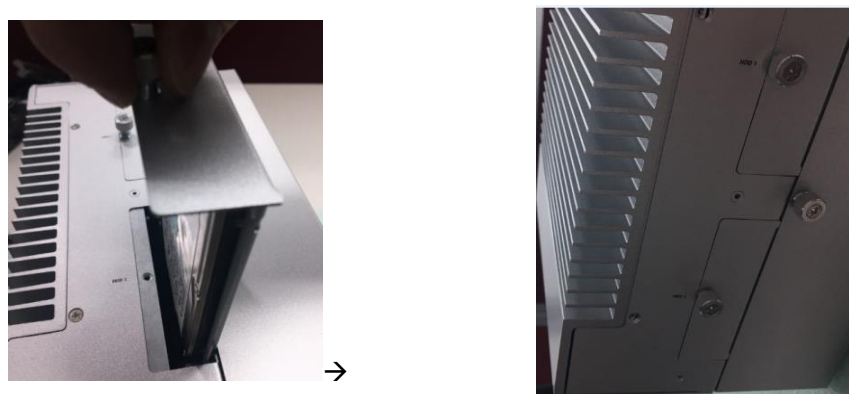
2.4 Installing the Fan Module and PCI or PCIe Card

IPC962-511-FL/IPC962-512-FL/IPC964-512-FL provides two/four PCI or PCIe slots for expansion. The procedure of installing the Fand module and PCI / PCIe expansion card into system is instructed below.

Step 1   Turn off the system.

Step 2   Disconnect the power connector.

Step 3   Unscrew the thumbscrew and separating the cover from the expansion box.
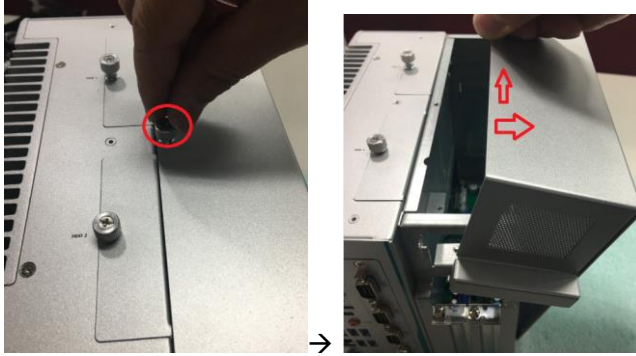
Step 4   Unscrew the fan bracket, fasten the fan module into expansion box and plug two cables to two connectors.
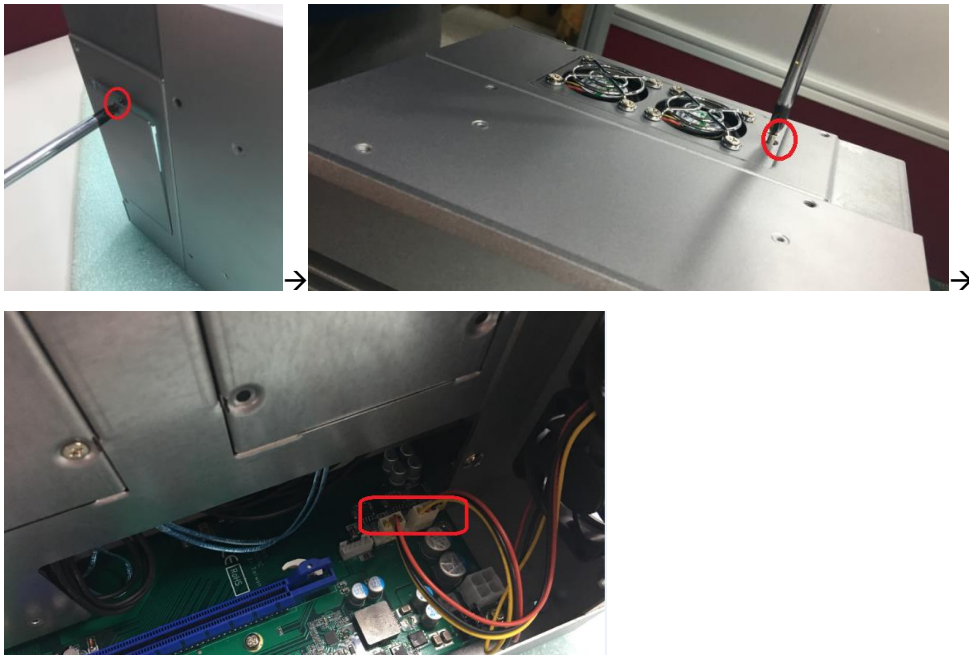
Step 5   Locate the PCI or PCIe slots and remove the slot bracket which you want to add the card in.

Step 6   Align the PCI or PCIe card with the slot, press the card into the slot until it is firmly seated and screw it.
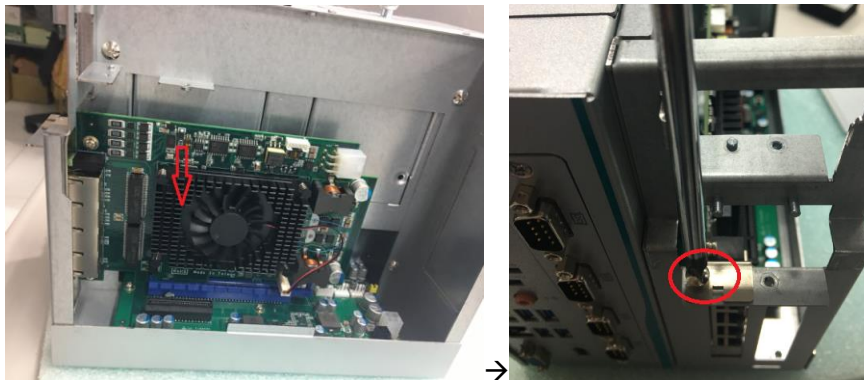
Step 7   Fasten 3 screws to fix the holder bracket.
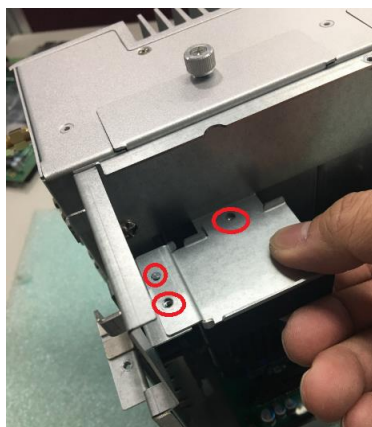
Internal chassis space for add-in cards.

IPC962-511/IPC962-512 w/o fan
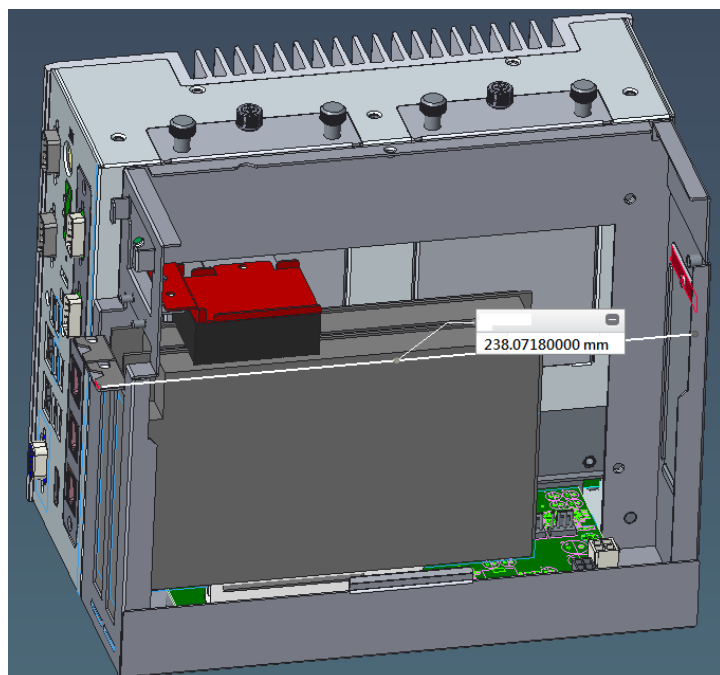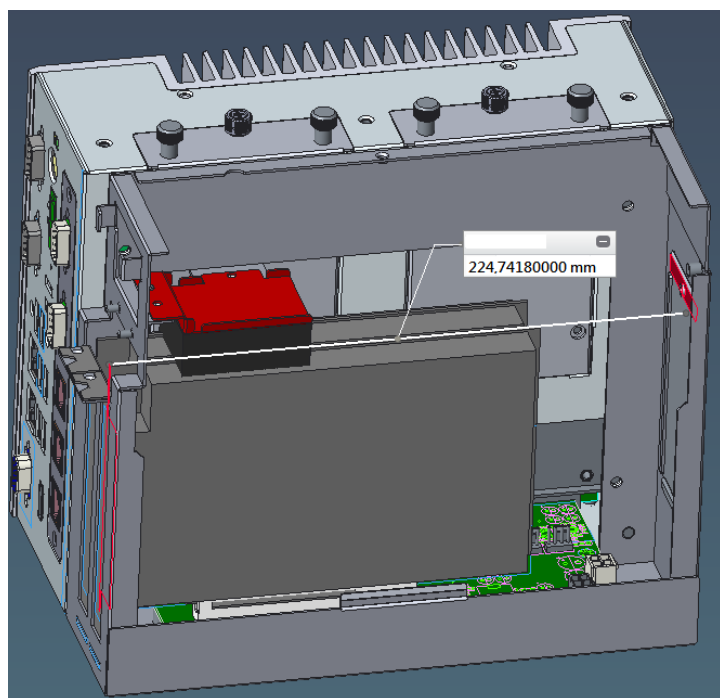
Note: **Please be noted that 238mm is the maximum internal length for add-in card with I/O bracket, in order to avoid heat dissipation potential, it have to leave 30mm between add-on card and system.**

Note: **When using the connector on riser card, it is strongly recommended that add-in cards be used with 167.65mm maximum length.**

IPC962-511/IPC962-512 w/fan

215.94180000 mm

229.27180000 mm
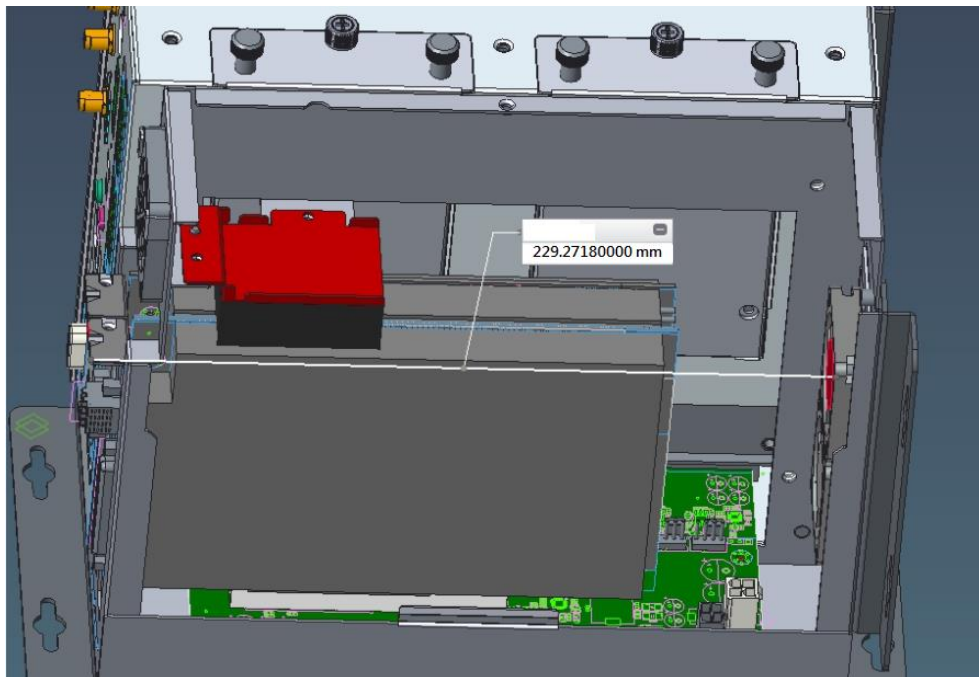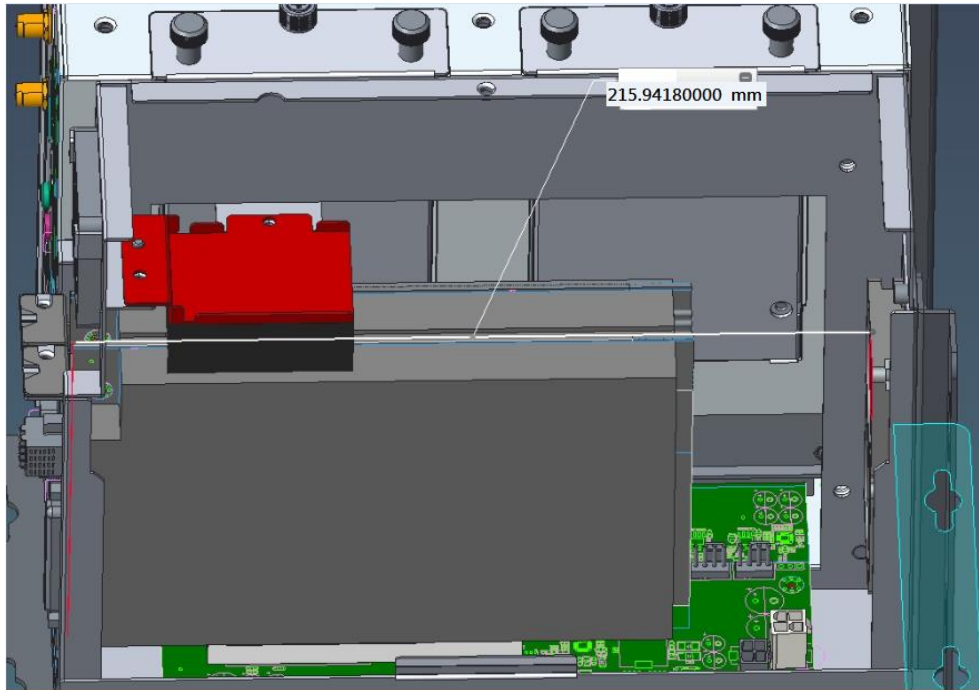
Note: **Please be noted that 229mm is the maximum internal length for add-in card with I/O bracket, in order to avoid heat dissipation potential, it have to leave 50mm between add-on card and option fan.**

Note: **When using the connector on riser card, it is strongly recommended that add-in cards be used with 167.65mm maximum length.**

IPC964-512 w/o fan
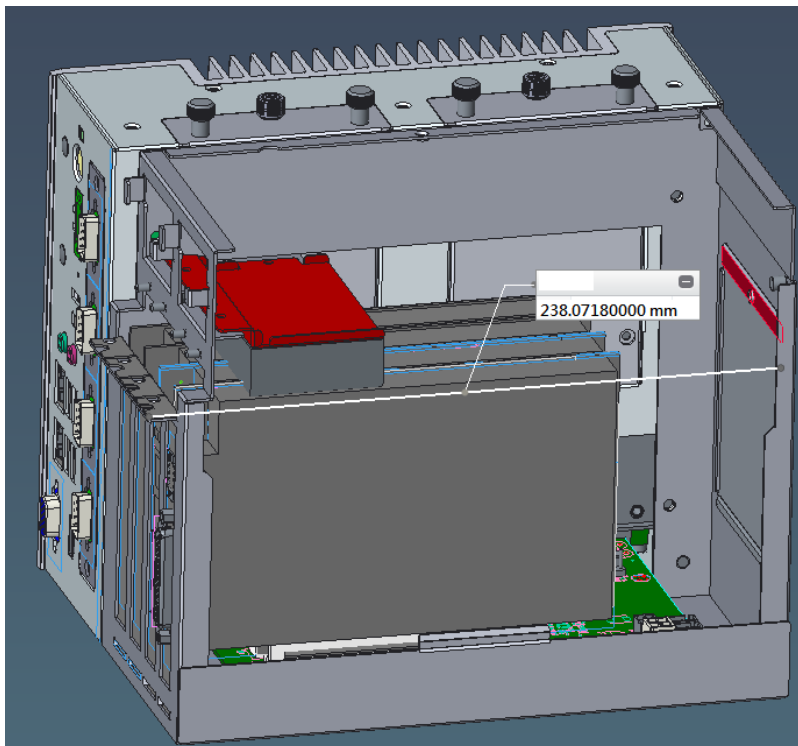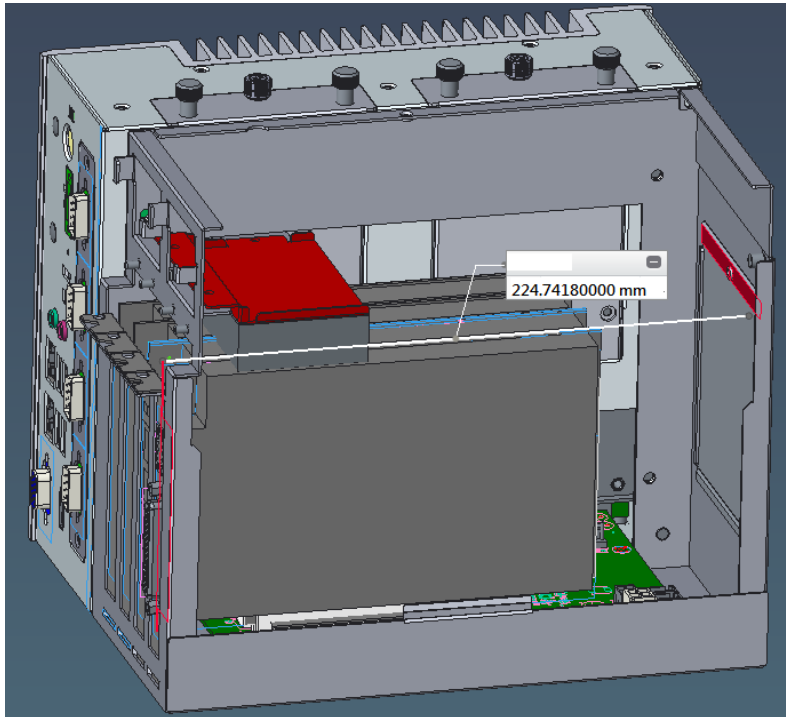
Note: **Please be noted that 238mm is the maximum internal length for add-in card with I/O bracket, in order to avoid heat dissipation potential, it have to leave 30mm between add-on card and system.**

Note: **When using the connector on riser card, it is strongly recommended that add-in cards be used with 167.65mm maximum length.**

IPC964-512 w/fan
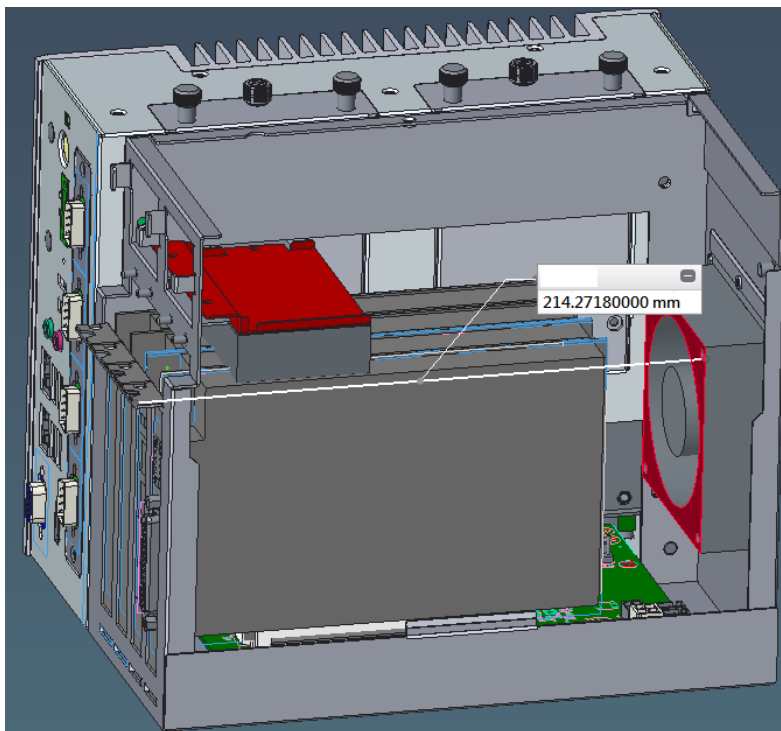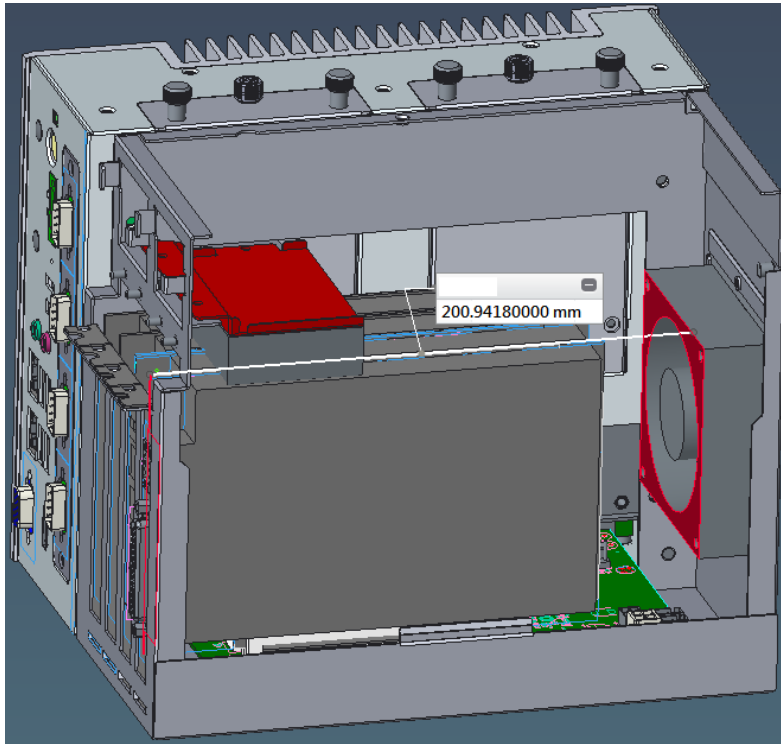
Note: **Please be noted that 214mm is the maximum internal length for add-in card with I/O bracket, in order to avoid heat dissipation potential, it have to leave 40mm between add-on card and option fan.**

Note: **When using the connector on riser card, it is strongly recommended that add-in cards be used with 167.65mm maximum length.**

I
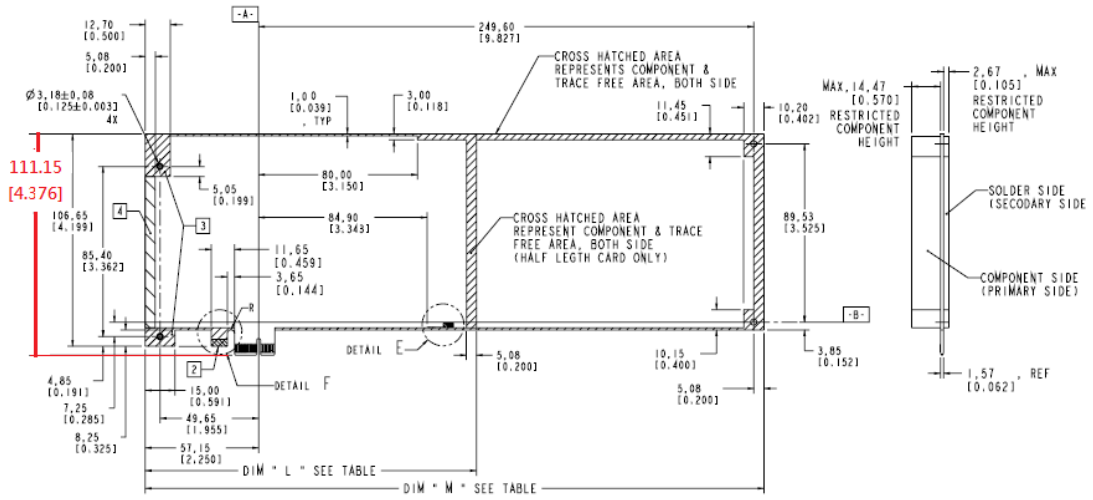
Note: **Please be noted that holder bracket is using for add-in card which is 111mm height..**

Step 8   Close the cover back to the chassis and fasten all screws.
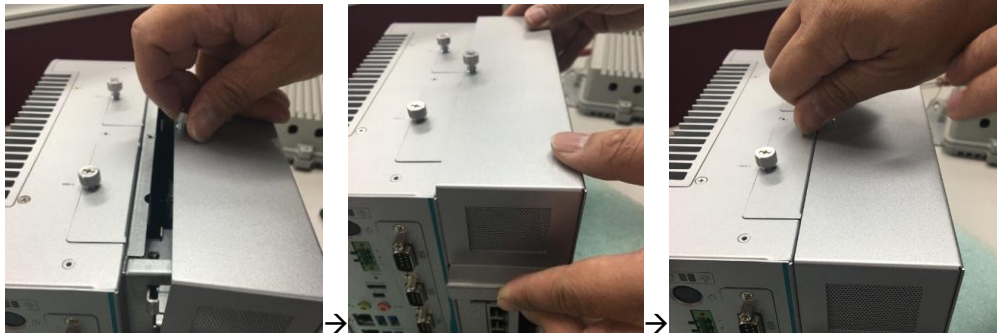
2.5   Installing the WIFI Module

The IPC962-511, IPC962-512 and IPC964-512 come with a Mini card slot and an USB connector for users to install a wireless LAN card. Please refer to the following instructions and illustrationfor the installation of the wireless LAN.

Installing the WIFI Module via Mini card

Step 1   Turn off the system.

Step 2   Disconnect the power connector.

Step 3   Loosen screws to remove the Heatsink cover from the chassis.

Step 4   Insert the wireless LAN card to slot. Push it down firmly.   Then screw tightly the card to the mainboard
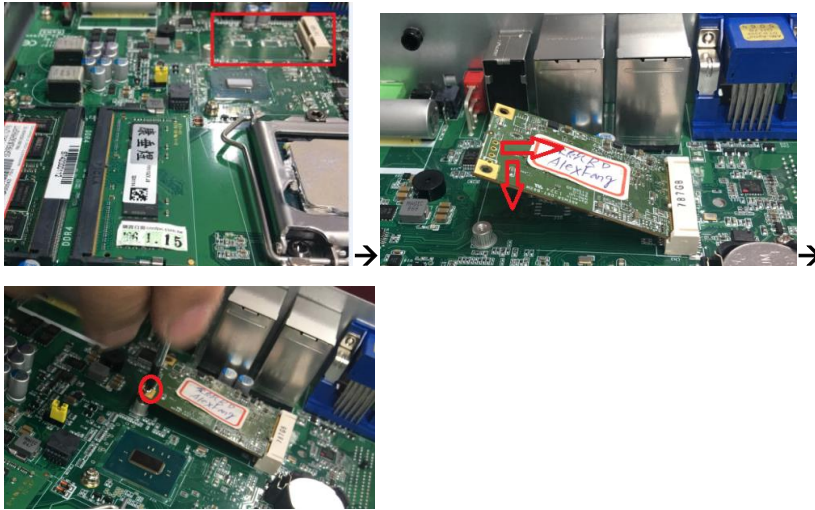
Step 5   Remove the antenna plug from the top of back cover, and then install the antenna on the antenna connector.

Note:Please use an extended bracket when using a half-size Mini card

- 1 x on board full-size PCI Express Mini Card slot with USB interface(IPC962-511)

- 1 x on board full-size PCI Express Mini Card slot with USB/PCIe interface(IPC962-512/IPC964-512))

Installing the WIFI Module via USB

Step 1   Turn off the system.

Step 2   Disconnect the power connector.

Step 3   Loosen screws to remove the Heatsink cover from the chassis.

Step 4   Remove the antenna plug from the top of back cover, and then install the antenna on the antenna connector
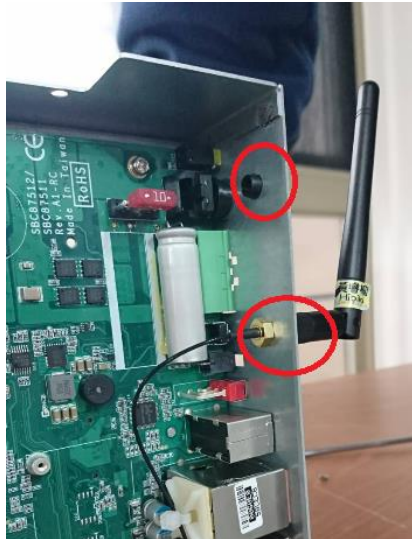
Step 5   Unscrew the thumbscrew and separating the cover from the expansion box
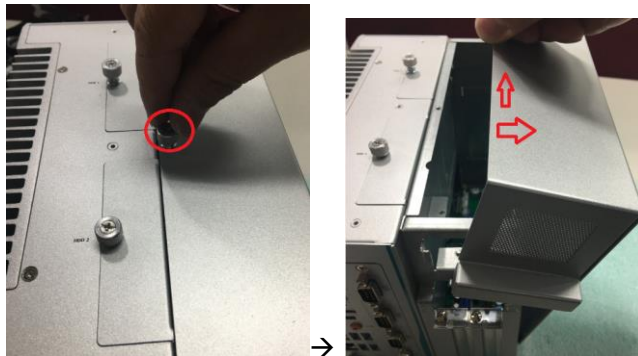
Step 6   Connect the antenna to wifi module via the bottom of main board.

→
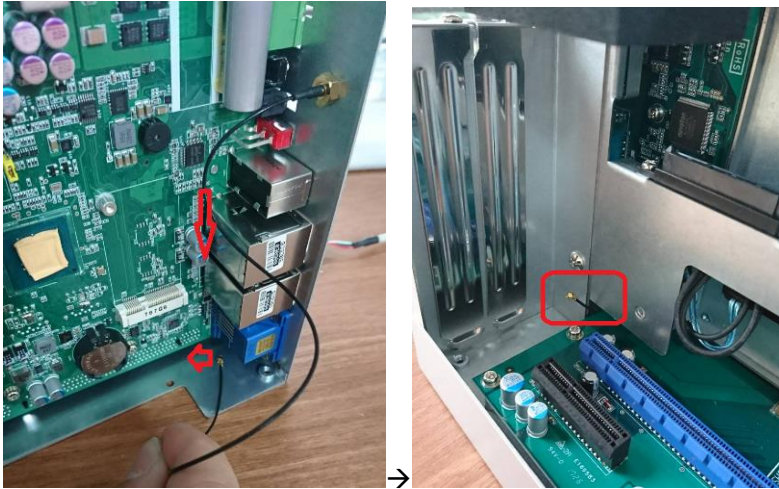
Step 7   Connect USB cable to wifi module.

Step 8   Stick wifi module on chassis. Locate the antenna cable and connect it to the wireless LAN card, then connect the USB cable to USB connector.
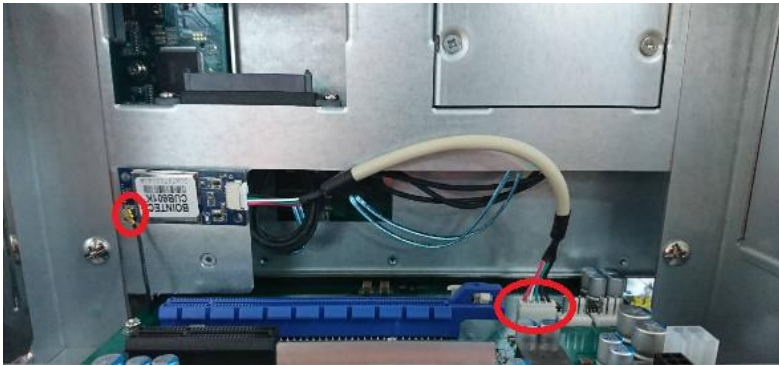
Step 9 Close the cover back to the chassis and fasten all screws. The installation completed.

2.6   Wall mounting

IPC962-511-FL/IPC962-512-FL/IPC964-512-FL provides versatile wall mount kits for optional.
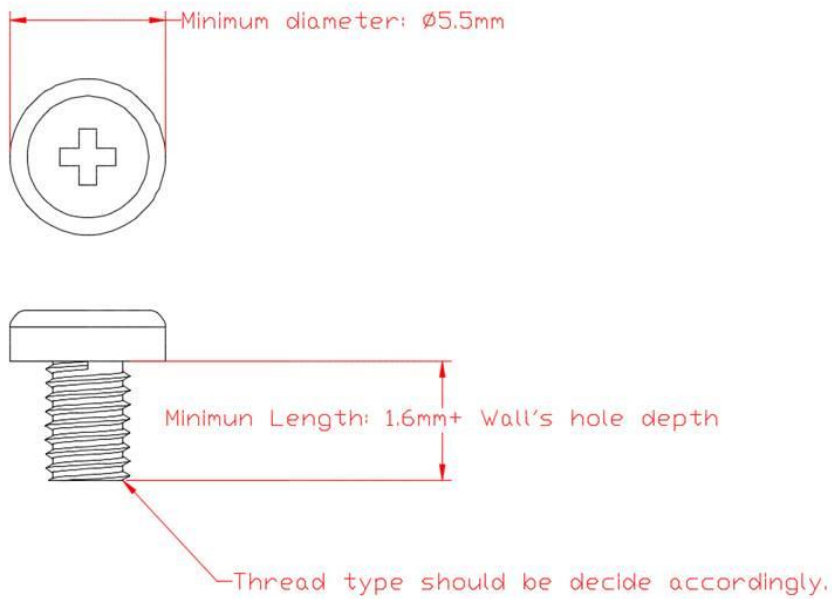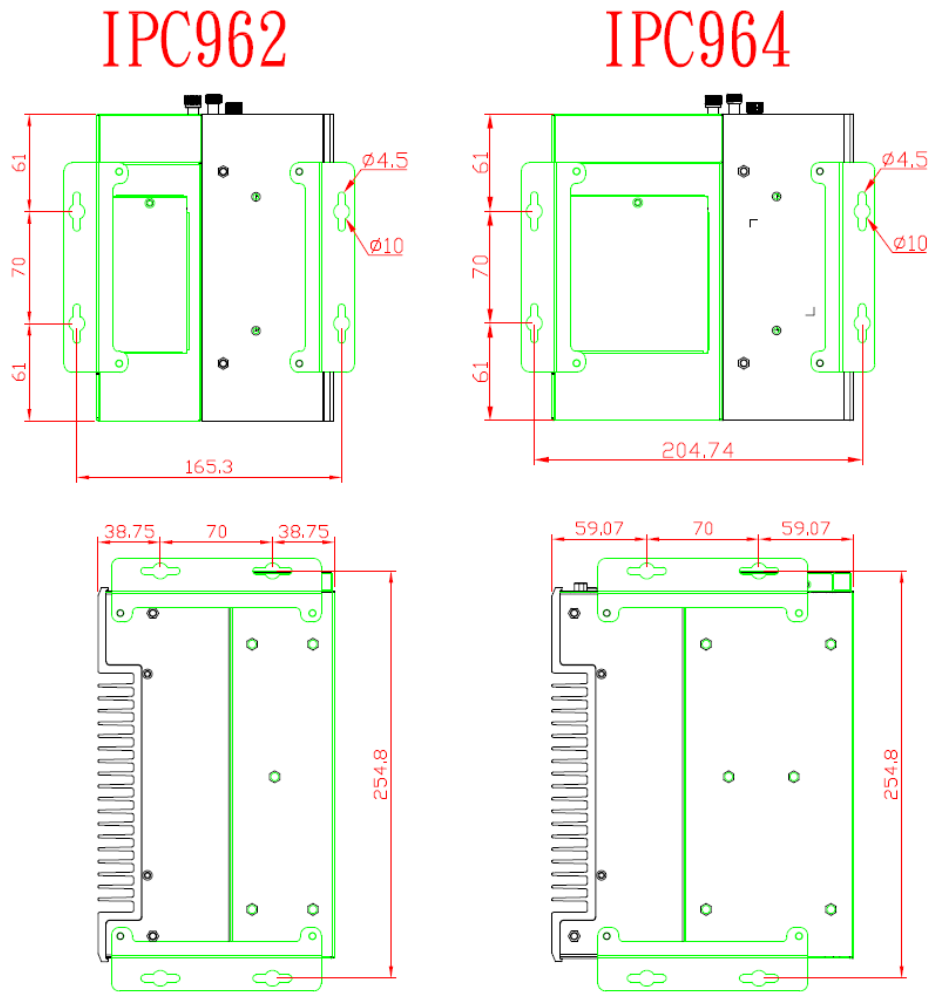
Step1 Find out the screws as below marked on chassis.

Step2 Assemble the wall mount bracket to the chassis, and fix the screws.

Step3 Wall mounting installation completed.
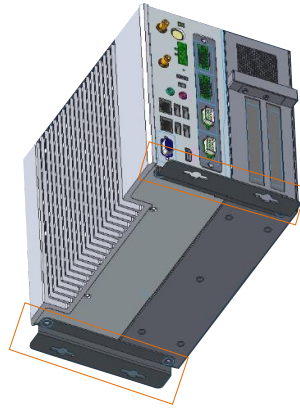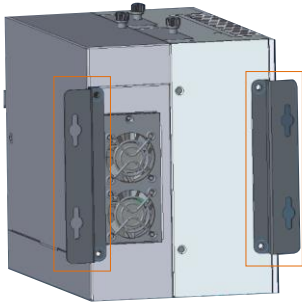
CHAPTER 3
AMI BIOS UTILITY

The AMI UEFI BIOS provides users with a built-in setup program to modify basic system configuration. All configured parameters are stored in a 16MB flash chip to save the setup information whenever the power is turned off. This chapter provides users with detailed description about how to set up basic system configuration through the AMI BIOS setup utility.

3.1   Starting

To enter the setup screens, follow the steps below:

1.   Turn on the computer and press the <Del> key immediately.

2.   After you press the <Del> key, the main BIOS setup menu displays. You can access the other setup screens from the main BIOS setup menu, such as the Advanced and Chipset menus.

Note: ***If your computer cannot boot after making and saving system changes with Setup, you can restore BIOS optimal defaults by setting JP1 (see section 1.6.2).***

It is strongly recommended that you should avoid changing the chipset's defaults. Both AMI and your system manufacturer have carefully set up these defaults that provide the best performance and reliability.

3.2   Navigation Keys

The BIOS setup/utility uses a key-based navigation system called hot keys. Most of the BIOS setup utility hot keys can be used at any time during the setup navigation process. These keys include <F1>, <F2>, <Enter>, <ESC>, <Arrow> keys, and so on.

Note: ***Some of the navigation keys differ from one screen to another.***

Hot Keys	Description
→← Left/Right	The Left and Right <Arrow> keys allow you to select a setup screen.
↑↓ Up/Down	The Up and Down <Arrow> keys allow you to select a setup screen or sub-screen.
+− Plus/Minus	The Plus and Minus <Arrow> keys allow you to change the field value of a particular setup item.
Tab	The <Tab> key allows you to select setup fields.
F1	The <F1> key allows you to display the General Help screen.
F2	The <F2> key allows you to Load Previous Values.
F3	The <F3> key allows you to Load Optimized Defaults.
F4	The <F4> key allows you to save any changes you have made and exit Setup. Press the <F4> key to save your changes.
Esc	The <Esc> key allows you to discard any changes you have made and exit the Setup. Press the <Esc> key to exit the setup without saving your changes.
Enter	The <Enter> key allows you to display or change the setup option listed for a particular setup item. The <Enter> key can also allow you to display the setup sub- screens.

3.3   Main Menu

The first time you enter the setup utility, you will be in the Main setup screen. You can always return to the Main setup screen by selecting the Main tab. System Time/Date can be set up as described below. The Main BIOS setup screen is shown below.
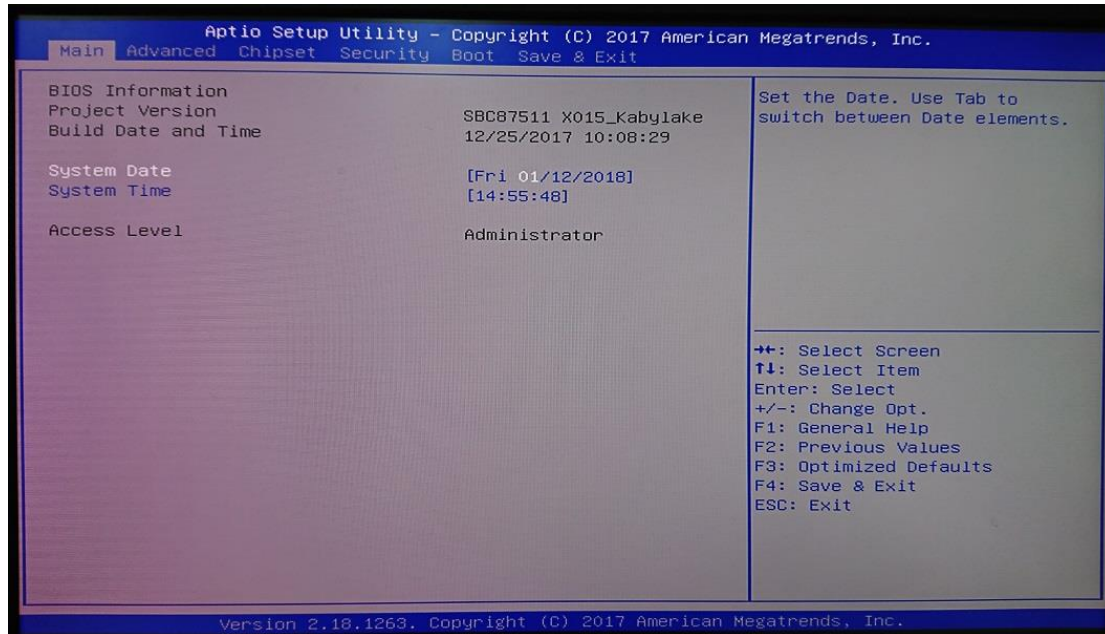
> ➢   System Date/TimeUse this option to change the system time and date. Highlight System Time or System Date using the <Arrow> keys. Enter new values through the keyboard. Press the <Tab> key or the <Arrow> keys to move between fields. The date must be entered in MM/DD/YY format. The time is entered in HH:MM:SS format.

.

3.4   Advanced Menu

● **Launch PXE OpROM**

Use this item to enable or disable the boot ROM function of the onboard LAN chip when the system boots up.

The Advanced menu also allows users to set configuration of the CPU and other system devices. You can select any of the items in the left frame of the screen to go to the sub menus:
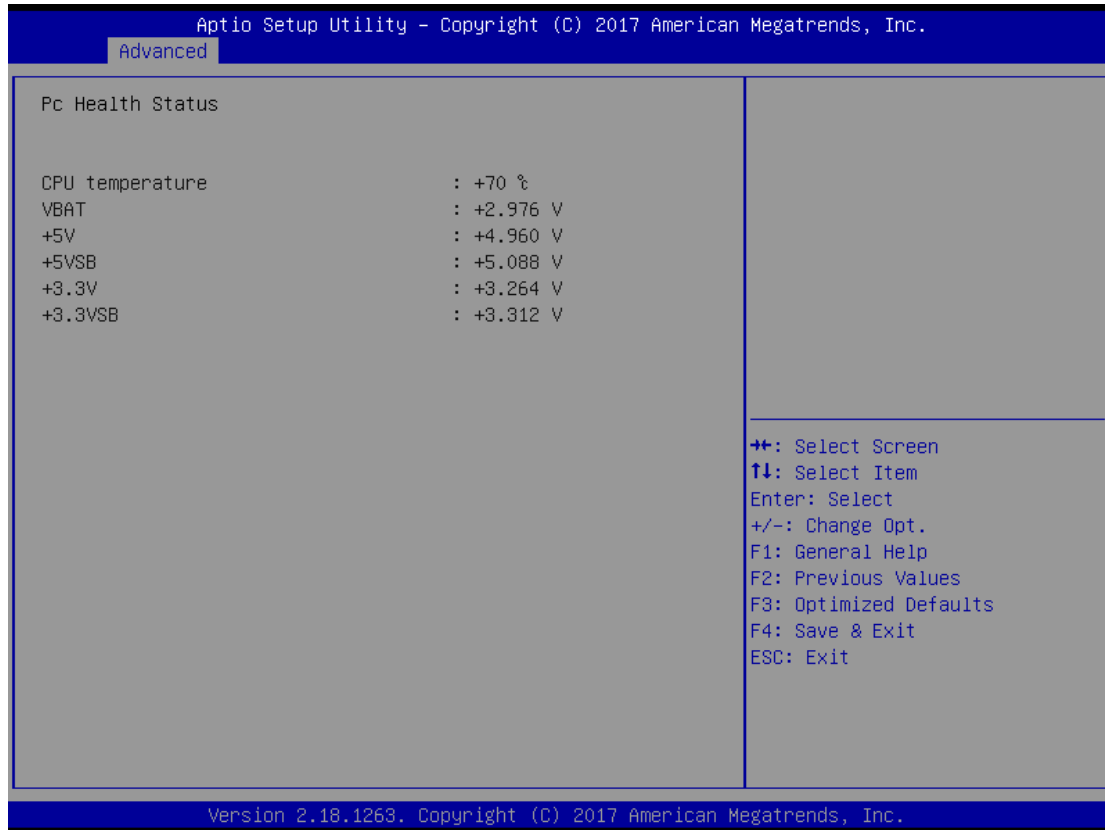
► Hardware Monitor

► ACPI Settings

► Trusted Computing

► CPU Configuration

► SATA Configuration

► PCH-FW Configuration

► USB Configuration

► Utility Configuration

► Device Configuration

For items marked with "►", please press <Enter> for more options.

```
           Aptio Setup Utility - Copyright (C) 2018 American Megatrends, Inc.
      Main  Advanced  Chipset  Security  Boot  Save & Exit

  ▶ Hardware Monitor                               Trusted Computing Settings
  ▶ ACPI Settings
  ▶ Trusted Computing
  ▶ Platform Misc Configuration
  ▶ CPU Configuration
  ▶ SATA Configuration
  ▶ PCH-FW Configuration
  ▶ USB Configuration
  ▶ CSM Configuration
  ▶ Utility Configuration


                                                   →←: Select Screen
                                                   ↑↓: Select Item
                                                   Enter: Select
                                                   +/-: Change Opt.
                                                   F1: General Help
                                                   F2: Previous Values
                                                   F3: Optimized Defaults
                                                   F4: Save & Exit
                                                   ESC: Exit




            Version 2.18.1263. Copyright (C) 2018 American Megatrends, Inc.
```

● **HW Monitor**

This screen monitors hardware health.

```
              Aptio Setup Utility - Copyright (C) 2017 American Megatrends, Inc.
        Advanced

      Pc Health Status


      CPU temperature                   : +70 %
      VBAT                              : +2.976 V
      +5V                               : +4.960 V
      +5VSB                             : +5.088 V
      +3.3V                             : +3.264 V
      +3.3VSB                           : +3.312 V


                                                            →←: Select Screen
                                                            ↑↓: Select Item
                                                            Enter: Select
                                                            +/-: Change Opt.
                                                            F1: General Help
                                                            F2: Previous Values
                                                            F3: Optimized Defaults
                                                            F4: Save & Exit
                                                            ESC: Exit




              Version 2.18.1263. Copyright (C) 2017 American Megatrends, Inc.
```

● **ACPI Settings**

ACPI configuration can be configured in ACPI Settings. A description of the selected item appears on the right side of the screen.

```
           Aptio Setup Utility - Copyright (C) 2017 American Megatrends, Inc.
     Advanced

 ACPI Settings                                              Select the highest ACPI sleep
                                                            state the system will enter
 ACPI Sleep State                [S3 (Suspend to RAM)]      when the SUSPEND button is
                                                            pressed.



                                                            ──────────────────────────────
                                                            →←: Select Screen
                                                            ↑↓: Select Item
                                                            Enter: Select
                                                            +/-: Change Opt.
                                                            F1: General Help
                                                            F2: Previous Values
                                                            F3: Optimized Defaults
                                                            F4: Save & Exit
                                                            ESC: Exit



           Version 2.18.1263. Copyright (C) 2017 American Megatrends, Inc.
```

➢ **ACPI Sleep State**

Select the highest ACPI sleep state the system will enter when the suspend button is pressed. Configuration options are Suspend S3 only (Suspend to RAM).

● **Tursted Computing**

Select the Security Device Support to enable or disable the TPM function.

```
          Aptio Setup Utility - Copyright (C) 2018 American Megatrends, Inc.
     Advanced

                                                        Enables or Disables BIOS
     TPM20 Device Found                                 support for security device.
     Vendor: STM                                        O.S. will not show Security
     Firmware Version: 71.4                             Device. TCG EFI protocol and
                                                        INT1A interface will not be
     Security Device Support          [Enable]          available.
     Active PCR banks                 SHA-1,SHA256
     Available PCR banks              SHA-1,SHA256

     SHA-1 PCR Bank                   [Enabled]
     SHA256 PCR Bank                  [Enabled]

     Pending operation                [None]             ────────────────────────
     Platform Hierarchy               [Enabled]          ++: Select Screen
     Storage Hierarchy                [Enabled]          ↑↓: Select Item
     Endorsement Hierarchy            [Enabled]          Enter: Select
     TPM2.0 UEFI Spec Version         [TCG_2]            +/-: Change Opt.
     Physical Presence Spec Version   [1.3]             F1: General Help
     TPM 20 InterfaceType             [TIS]              F2: Previous Values
     Device Select                    [TPM 2.0]          F3: Optimized Defaults
                                                         F4: Save & Exit
                                                         ESC: Exit




          Version 2.18.1263. Copyright (C) 2018 American Megatrends, Inc.
```

● **CPU Configuration**

This screen shows the CPU Configuration, and you can change the value of the selected option.

```
          Aptio Setup Utility - Copyright (C) 2017 American Megatrends, Inc.
    Advanced

   CPU Configuration                                        When enabled, a VMM can
                                                            utilize the additional
   Type                         Intel(R) Core(TM)           hardware capabilities provided
                                i5-7500T CPU @ 2.70GHz      by Vanderpool Technology.
   ID                           0x906E9
   Speed                        2700 MHz
   L1 Data Cache                32 KB x 4
   L1 Instruction Cache         32 KB x 4
   L2 Cache                     256 KB x 4
   L3 Cache                     6 MB
   L4 Cache                     N/A
   VMX                          Supported
   SMX/TXT                      Supported
                                                            ─────────────────────────
   Intel (VMX) Virtualization   [Enabled]                   →←: Select Screen
   Technology                                               ↑↓: Select Item
                                                            Enter: Select
                                                            +/-: Change Opt.
                                                            F1: General Help
                                                            F2: Previous Values
                                                            F3: Optimized Defaults
                                                            F4: Save & Exit
                                                            ESC: Exit




          Version 2.18.1263. Copyright (C) 2017 American Megatrends, Inc.
```

➢ **Intel Virtualization Technology**

This item allows a hardware platform to run multiple operating systems separately and simultaneously, enabling one system to virtually function as several systems.

● **SATA Configuration**

You can read the current installed hardware configurations from those SATA ports in the SATA Configuration menu. During system boot up, BIOS will detect the present SATA devices automatically.

```
            Aptio Setup Utility - Copyright (C) 2017 American Megatrends, Inc.
      Advanced

  SATA Controller(s)                    [Enabled]              Enable/Disable SATA Device.
  SATA Mode Selection                   [AHCI]

  Serial ATA Port 0                     WDC WD10JUCT-6
                                        (1000.2GB)
    Hot Plug                            [Disabled]
  Serial ATA Port 1                     Empty
    Hot Plug                            [Disabled]



                                                              →←: Select Screen
                                                              ↑↓: Select Item
                                                              Enter: Select
                                                              +/-: Change Opt.
                                                              F1: General Help
                                                              F2: Previous Values
                                                              F3: Optimized Defaults
                                                              F4: Save & Exit
                                                              ESC: Exit



            Version 2.18.1263. Copyright (C) 2017 American Megatrends, Inc.
```

● **FCH-FW Configuation**

Display ME firmware information

```
              Aptio Setup Utility – Copyright (C) 2017 American Megatrends, Inc.
      Advanced

   ME Firmware Version          11.8.50.3425
   ME Firmware Mode             Normal Mode
   ME Firmware SKU              Consumer SKU




                                                        ➤←: Select Screen
                                                        ↑↓: Select Item
                                                        Enter: Select
                                                        +/-: Change Opt.
                                                        F1: General Help
                                                        F2: Previous Values
                                                        F3: Optimized Defaults
                                                        F4: Save & Exit
                                                        ESC: Exit




              Version 2.18.1263. Copyright (C) 2017 American Megatrends, Inc.
```
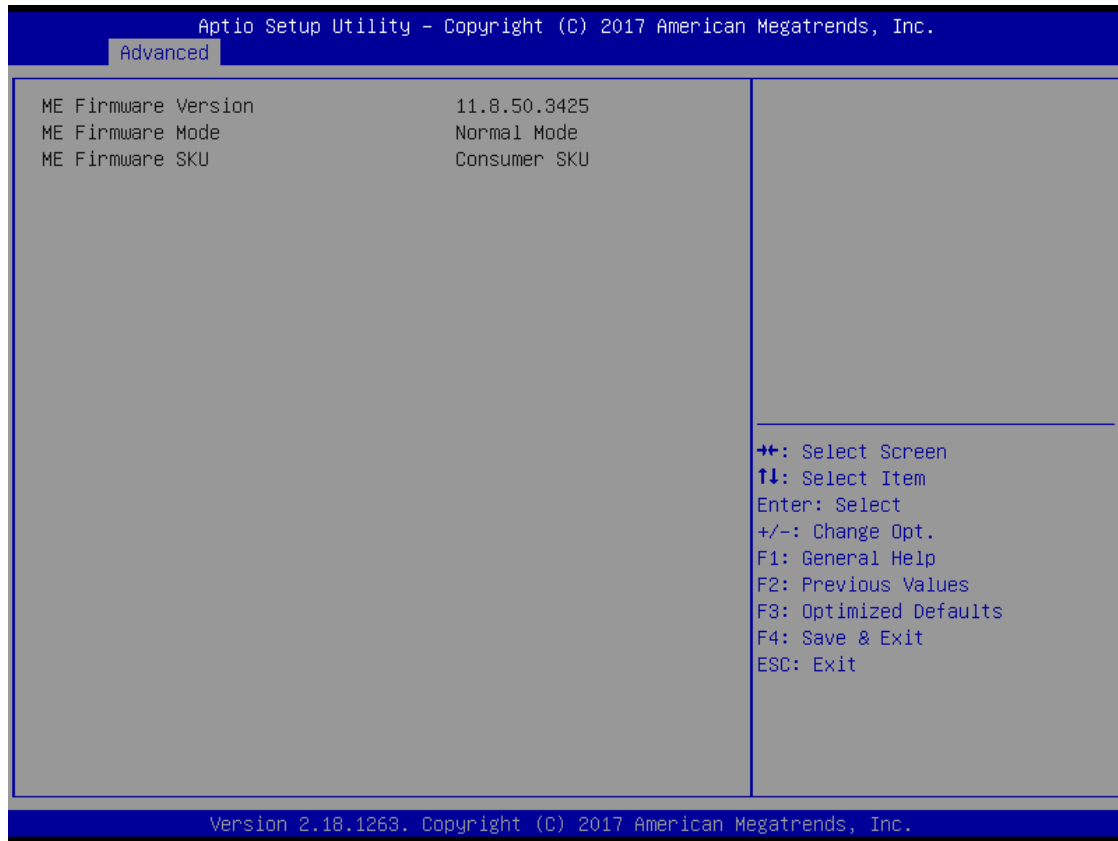
● **USB Configuration**

USB configuration can be configured here by selecting and changing each item. A description of the selected item appears on the right side of the screen.

```
                Aptio Setup Utility - Copyright (C) 2017 American Megatrends, Inc.
          Advanced

    USB Configuration                                        Mass storage device emulation
                                                             type. 'AUTO' enumerates
    USB Module Version                   19                  devices according to their
                                                             media format. Optical drives
    USB Controllers:                                         are emulated as 'CDROM',
         1 XHCI                                              drives with no media will be
    USB Devices:                                             emulated according to a drive
         1 Drive, 1 Keyboard                                 type.

    Mass Storage Devices:
    Generic Flash Disk 8.07             [Auto]

                                                             ➔←: Select Screen
                                                             ↑↓: Select Item
                                                             Enter: Select
                                                             +/-: Change Opt.
                                                             F1: General Help
                                                             F2: Previous Values
                                                             F3: Optimized Defaults
                                                             F4: Save & Exit
                                                             ESC: Exit

                Version 2.18.1263. Copyright (C) 2017 American Megatrends, Inc.
```

➢ **USB Devices**

Display all detected USB devices.

● **Module Configuration**

```
          Aptio Setup Utility - Copyright (C) 2017 American Megatrends, Inc.
    Advanced

  Module Configuration                               Set Parameters of Serial Port
                                                     1 (COMA)
    IO Chip                        AxiomType7
  ▶ Serial Port 1 Configuration
  ▶ Serial Port 2 Configuration
  ▶ Serial Port 3 Configuration
  ▶ Serial Port 4 Configuration


                                                     →←: Select Screen
                                                     ↑↓: Select Item
                                                     Enter: Select
                                                     +/-: Change Opt.
                                                     F1: General Help
                                                     F2: Previous Values
                                                     F3: Optimized Defaults
                                                     F4: Save & Exit
                                                     ESC: Exit



          Version 2.18.1263. Copyright (C) 2017 American Megatrends, Inc.
```

➢ **Serial Port 1~4 Configuration**

Use this item to set parameters of serial port 1 to 4.

● **Serial Port (1~4) Configuration**
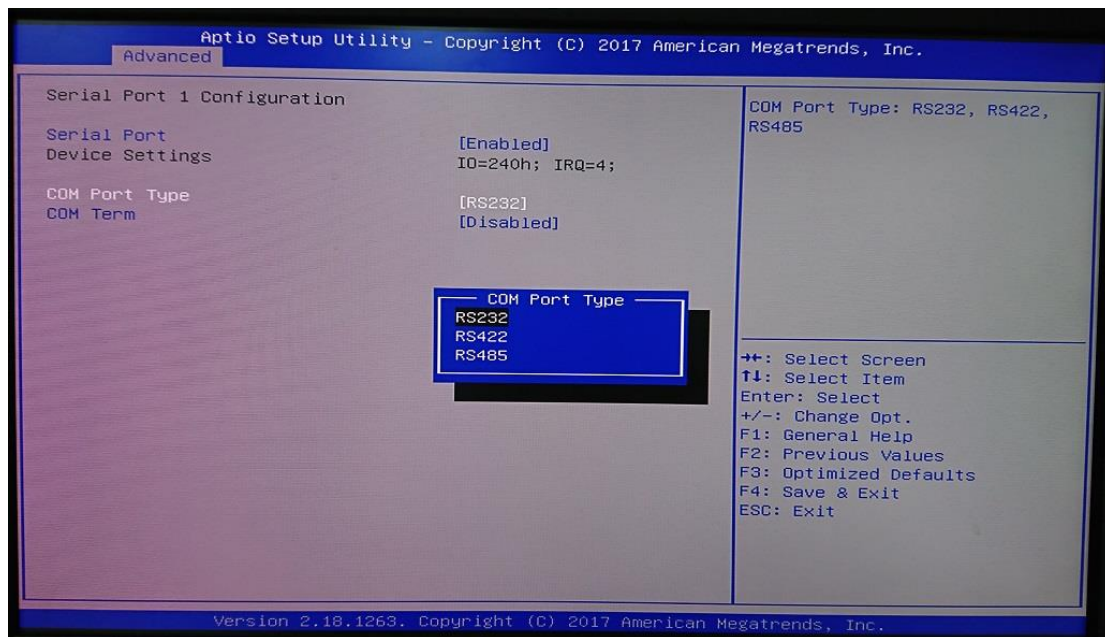
➢ **COM Port Type**

Use this item to set parameters of RS232/422/485.

3.5   Chipset Menu

The Chipset menu allows users to change the advanced chipset settings. You can select any of the items in the left frame of the screen to go to the sub menus:

► **System Agent (SA) Configuration**

For items marked with "►", please press <Enter> for more options.

```
          Aptio Setup Utility – Copyright (C) 2017 American Megatrends, Inc.
    Main   Advanced   Chipset   Security   Boot   Save & Exit

▶ System Agent (SA) Configuration                          System Agent (SA) Parameters








                                                           ──────────────────────────
                                                           ➤←: Select Screen
                                                           ↑↓: Select Item
                                                           Enter: Select
                                                           +/-: Change Opt.
                                                           F1: General Help
                                                           F2: Previous Values
                                                           F3: Optimized Defaults
                                                           F4: Save & Exit
                                                           ESC: Exit




          Version 2.18.1263. Copyright (C) 2017 American Megatrends, Inc.
```
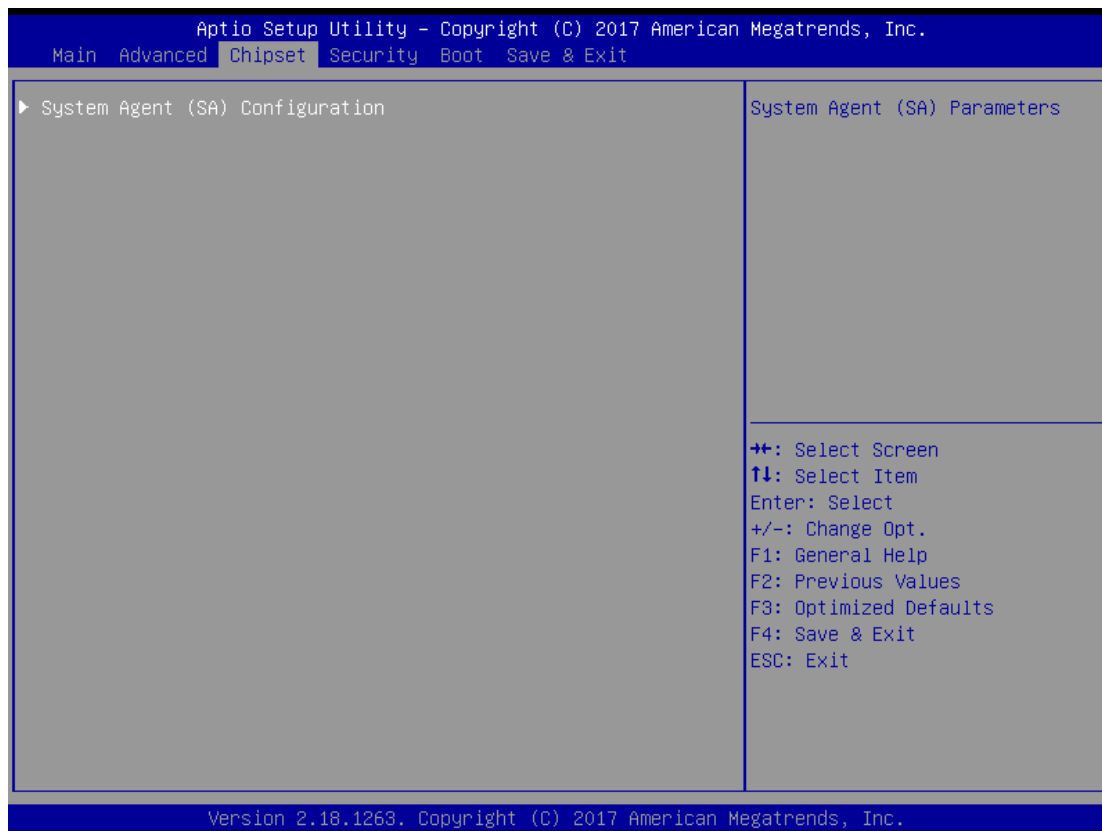
● **System Agent (SA) Configuration**

This screen shows System Agent information and provides function for specifying related parameters. For items marked with "▶", please press <Enter> for more options.

```
             Aptio Setup Utility - Copyright (C) 2017 American Megatrends, Inc.
              Chipset

    SA PCIe Code Version              2.4.0.0              Graphics Configuration
    VT-d                              Supported

  ▶ Graphics Configuration
  ▶ Memory Configuration




                                                           →←: Select Screen
                                                           ↑↓: Select Item
                                                           Enter: Select
                                                           +/-: Change Opt.
                                                           F1: General Help
                                                           F2: Previous Values
                                                           F3: Optimized Defaults
                                                           F4: Save & Exit
                                                           ESC: Exit




             Version 2.18.1263. Copyright (C) 2017 American Megatrends, Inc.
```
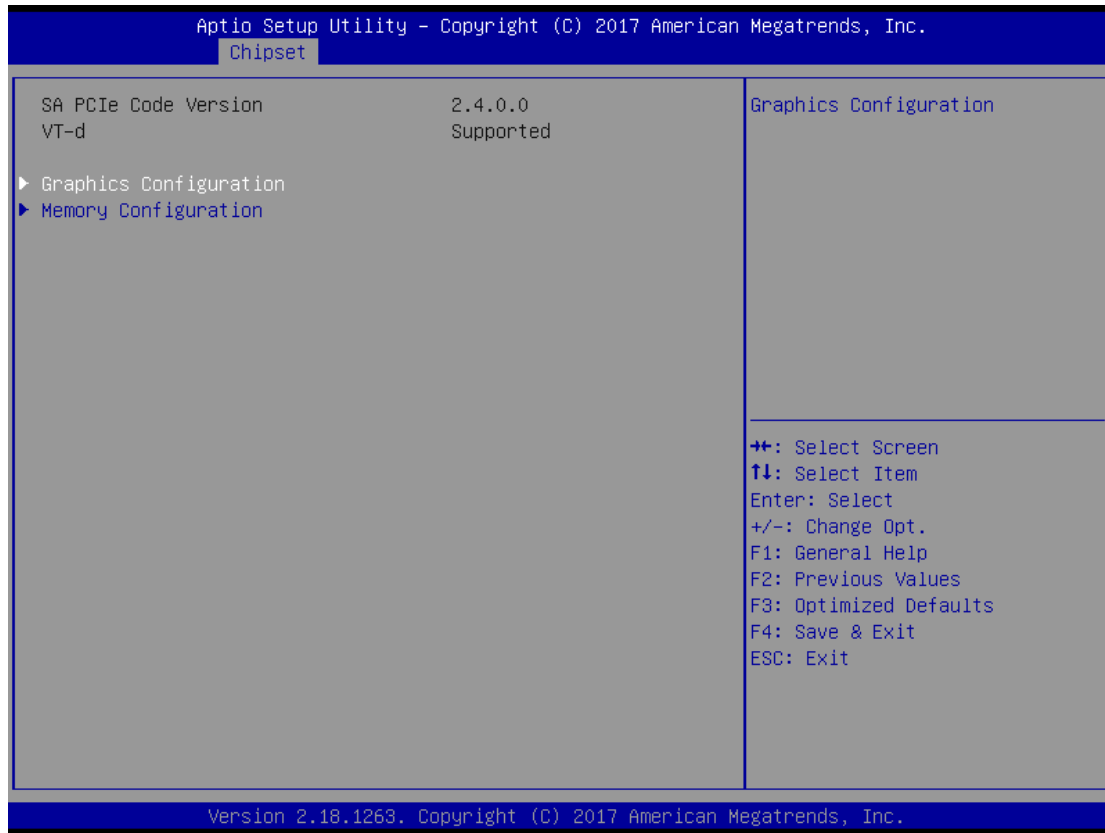
➢ **Graphics Configuration**

Use this item for graphics configuration settings.

➢ **Memory Configuration**

Use this item for memory configuration settings.

● **Graphic Configuration**

```
          Aptio Setup Utility – Copyright (C) 2017 American Megatrends, Inc.
            Chipset

  IGFX VBIOS Version              1043                Select the DDI2(Port-C) signal
                                                      output to DisplayPort or
  Display Select                  [VGA]               HDMI/VGA.




                                                      →←: Select Screen
                                                      ↑↓: Select Item
                                                      Enter: Select
                                                      +/-: Change Opt.
                                                      F1: General Help
                                                      F2: Previous Values
                                                      F3: Optimized Defaults
                                                      F4: Save & Exit
                                                      ESC: Exit




          Version 2.18.1263. Copyright (C) 2017 American Megatrends, Inc.
```

➢ **Displat Select**

Allow you to select which graphics controller to use as the primary boot device.

● **Memory Configuration**

```
          Aptio Setup Utility - Copyright (C) 2017 American Megatrends, Inc.
            Chipset

  Memory RC Version             2.4.0.0
  Total Memory                   8192 MB
     Size                       8192 MB (DDR4)


                                                    →←: Select Screen
                                                    ↑↓: Select Item
                                                    Enter: Select
                                                    +/-: Change Opt.
                                                    F1: General Help
                                                    F2: Previous Values
                                                    F3: Optimized Defaults
                                                    F4: Save & Exit
                                                    ESC: Exit




          Version 2.18.1263. Copyright (C) 2017 American Megatrends, Inc.
```

3.6 Security Menu

The Security menu allows users to change the security settings for the system.

```
              Aptio Setup Utility – Copyright (C) 2017 American Megatrends, Inc.
   Main  Advanced  Chipset  Security  Boot  Save & Exit

 Password Description                                     Set Administrator Password

 If ONLY the Administrator's password is set,
 then this only limits access to Setup and is
 only asked for when entering Setup.
 If ONLY the User's password is set, then this
 is a power on password and must be entered to
 boot or enter Setup. In Setup the User will
 have Administrator rights.
 The password length must be
 in the following range:
 Minimum length                    3
 Maximum length                    20                     ─────────────────────────

                                                          →←: Select Screen
 Administrator Password                                   ↑↓: Select Item
 User Password                                            Enter: Select
                                                          +/-: Change Opt.
                                                          F1: General Help
                                                          F2: Previous Values
                                                          F3: Optimized Defaults
                                                          F4: Save & Exit
                                                          ESC: Exit




              Version 2.18.1263. Copyright (C) 2017 American Megatrends, Inc.
```

➢ **Administrator Password**

This item indicates whether an administrator password has been set (installed or uninstalled).

➢ **User Password**

This item indicates whether an user password has been set (installed or uninstalled).

3.7   Boot Menu

The Boot menu allows users to change boot options of the system.

```
            Aptio Setup Utility - Copyright (C) 2017 American Megatrends, Inc.
    Main  Advanced  Chipset  Security  Boot  Save & Exit

    Boot Configuration                              Number of seconds to wait for
    Setup Prompt Timeout              1             setup activation key.
    Bootup NumLock State              [On]          65535(0xFFFF) means indefinite
                                                    waiting.
    Quiet Boot                        [Disabled]
    Launch PXE OpROM policy           [Disabled]

    Boot Option Priorities
    Boot Option #1                    [Generic Flash Disk
                                      8.07]
    Boot Option #2                    [UEFI: Generic Flash
                                      Disk 8.07, Partition 1]

    USB Device BBS Priorities                       ↔: Select Screen
                                                    ↑↓: Select Item
                                                    Enter: Select
                                                    +/-: Change Opt.
                                                    F1: General Help
                                                    F2: Previous Values
                                                    F3: Optimized Defaults
                                                    F4: Save & Exit
                                                    ESC: Exit



            Version 2.18.1263. Copyright (C) 2017 American Megatrends, Inc.
```
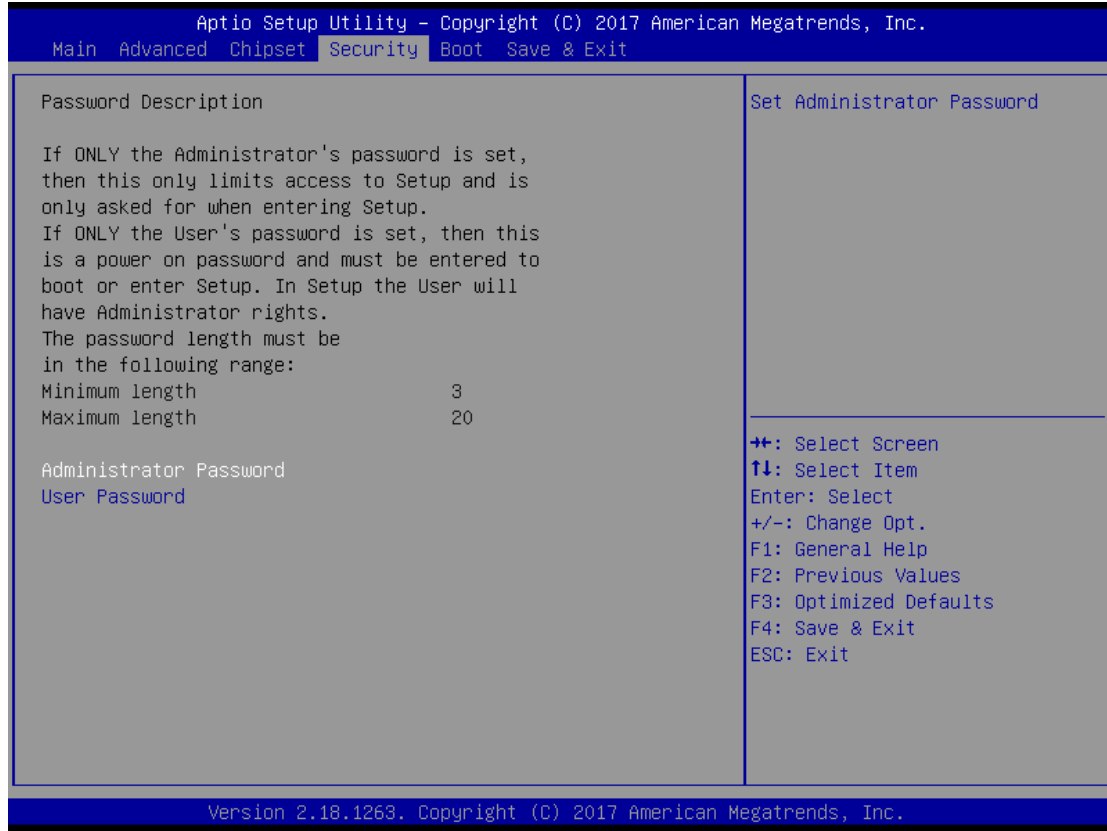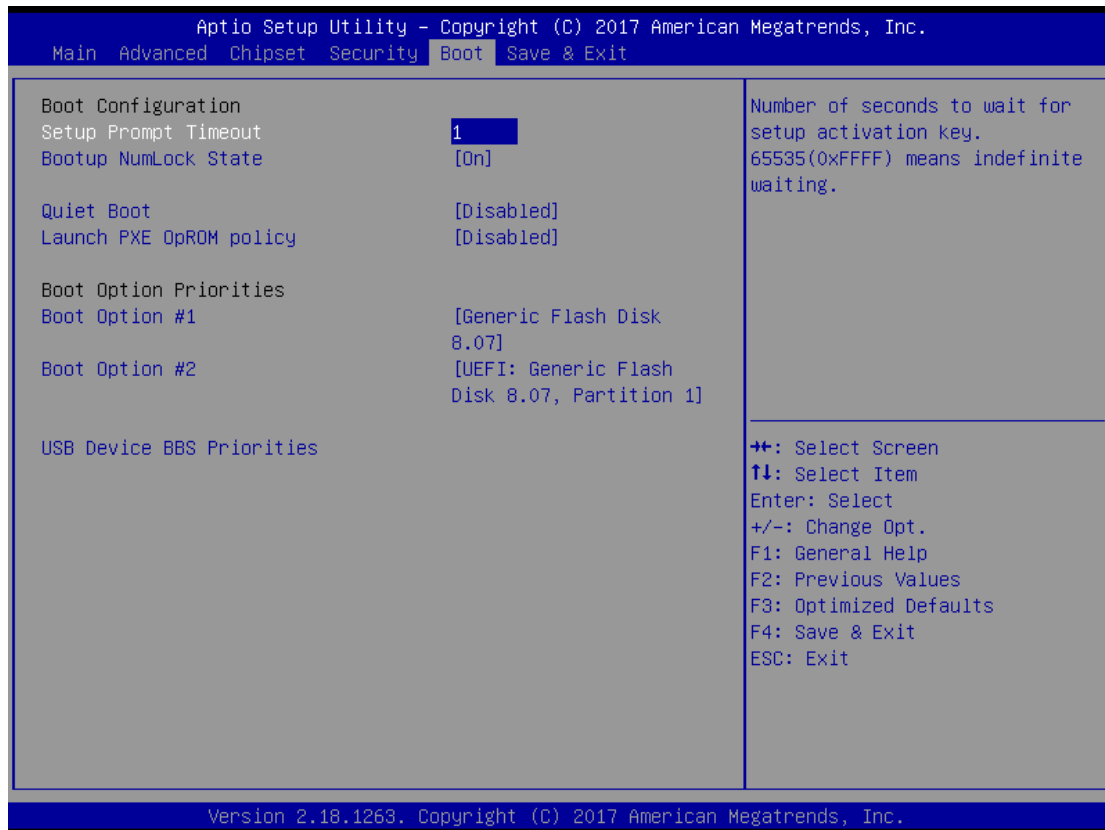
➢ **Setup Prompt Timeout**
Number of seconds to wait for setup activation key. 65535(0xFFFF) means indefinite waiting.

➢ **Bootup NumLock State**
Use this item to select the power-on state for the keyboard NumLock.

➢ **Quiet Boot**
Select to display either POST output messages or a splash screen during boot-up.

➢ **Launch PXE OpROM policy**
Use this item to enable or disable the boot ROM function of the onboard LAN chip when the system boots up.

➢ **Boot Option Priorities**
These are settings for boot priority. Specify the boot device priority sequence from the available devices.

3.8   Save & Exit Menu

The Save & Exit menu allows users to load your system configuration with optimal or fail-safe default values.

```
              Aptio Setup Utility - Copyright (C) 2017 American Megatrends, Inc.
     Main   Advanced   Chipset   Security   Boot   Save & Exit

     Save Options                                         Exit system setup after saving
     Save Changes and Exit                                the changes.
     Discard Changes and Exit

     Save Changes and Reset
     Discard Changes and Reset

     Save Changes
     Discard Changes

     Default Options
     Restore Defaults
     Save as User Defaults
     Restore User Defaults                                ──────────────────────────

     Boot Override                                        →←: Select Screen
     Generic Flash Disk 8.07                              ↑↓: Select Item
     UEFI: Generic Flash Disk 8.07, Partition 1           Enter: Select
                                                          +/-: Change Opt.
                                                          F1: General Help
                                                          F2: Previous Values
                                                          F3: Optimized Defaults
                                                          F4: Save & Exit
                                                          ESC: Exit

              Version 2.18.1263. Copyright (C) 2017 American Megatrends, Inc.
```

➢ **Save Changes and Exit**

When finish the system configuration settings, select this option to leave Setup and return to Main Menu. Select Save Changes and Exit from the Save & Exit menu and press <Enter>. Select Yes to save changes and exit.

➢ **Discard Changes and Exit**

Select this option to quit Setup without making any permanent changes to the system configuration and return to Main Menu. Select Discard Changes and Exit from the Save & Exit menu and press <Enter>. Select Yes to discard changes and exit.

➢ **Save Changes and Reset**

When finish the system configuration settings, select this option to leave Setup and reboot the computer so the new system configuration parameters can take effect. Select Save Changes and Reset from the Save & Exit menu and press <Enter>. Select Yes to save changes and reset.

➢ **Discard Changes and Reset**

Select this option to quit Setup without making any permanent changes to the system configuration and reboot the computer. Select Discard Changes and Reset from the Save & Exit menu and press <Enter>. Select Yes to discard changes and reset.

➢ **Save Changes**

When finish the system configuration settings, select this option to save changes. Select Save Changes from the Save & Exit menu and press <Enter>. Select Yes to save changes.

➢ **Discard Changes**

Select this option to quit Setup without making any permanent changes to the system configuration. Select Discard Changes from the Save & Exit menu and press <Enter>. Select Yes to discard changes.

➢ **Restore Defaults**

When select this option, all the settings will be restored to defaults automatically. Select Restore Defaults from the Save & Exit menu and press <Enter>.

➢ **Save as User Defaults**

Select this option to save your current system configuration settings as User Defaults. Select Save as User Defaults from the Save & Exit menu and press <Enter>.

➢ **Restore User Defaults**

When select this option, all the settings will be restored to user defaults automatically. Select Restore User Defaults from the Save & Exit menu and press <Enter>.

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APPENDIX A
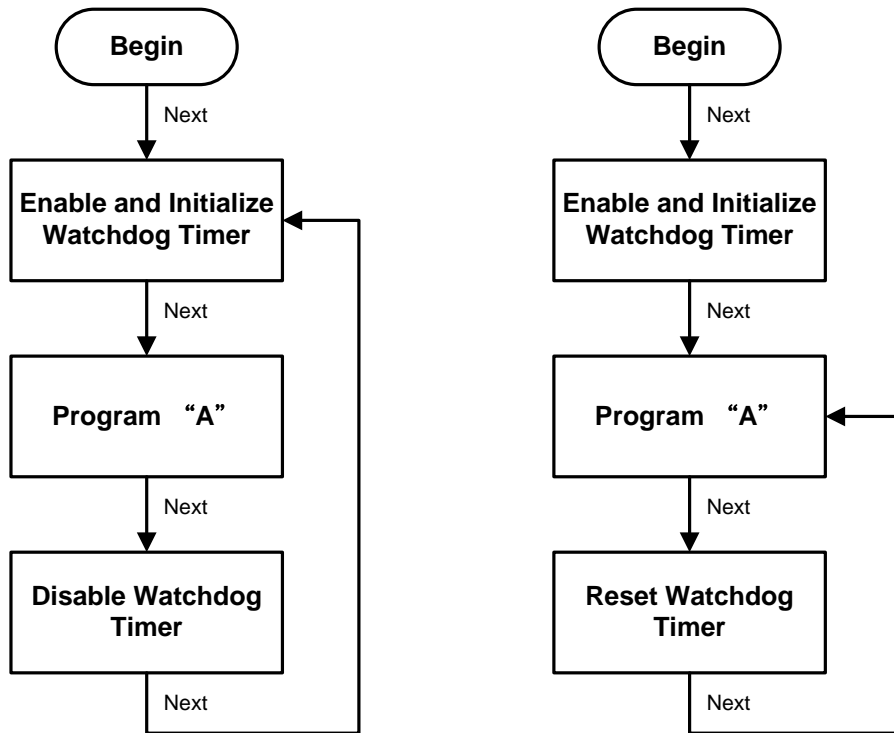# WATCHDOG TIMER

A.1   About Watchdog Timer

Software stability is major issue in most application. Some embedded systems are not watched by operator for 24 hours. It is usually too slow to wait for someone to reboot when computer hangs. The systems need to be able to reset automatically when things go wrong. The watchdog timer gives us solution.

The watchdog timer is a counter that triggers a system reset when it counts down to zero from a preset value. The software starts counter with an initial value and must reset it periodically. If the counter ever reaches zero which means the software has crashed, the system will reboot.

A.2   How to Use Watchdog Timer

The I/O port base addresses of watchdog timer are 2E (hex) and 2F (hex). The 2E (hex) and 2F (hex) are address and data port respectively.

Assume that program A is put in a loop that must execute at least once every 10ms. Initialize watchdog timer with a value bigger than 10ms. If the software has no problems; watchdog timer will never expire because software will always restart the counter before it reaches zero.

```
        ┌─────────┐                        ┌─────────┐
        │  Begin  │                        │  Begin  │
        └────┬────┘                        └────┬────┘
             │ Next                             │ Next
             ▼                                  ▼
   ┌──────────────────┐               ┌──────────────────┐
   │ Enable and       │◄──┐           │ Enable and       │
   │ Initialize       │   │           │ Initialize       │
   │ Watchdog Timer   │   │           │ Watchdog Timer   │
   └────────┬─────────┘   │           └────────┬─────────┘
            │ Next        │                    │ Next
            ▼             │                    ▼
   ┌──────────────────┐   │           ┌──────────────────┐◄──┐
   │  Program  "A"    │   │           │  Program  "A"    │   │
   └────────┬─────────┘   │           └────────┬─────────┘   │
            │ Next        │                    │ Next        │
            ▼             │                    ▼             │
   ┌──────────────────┐   │           ┌──────────────────┐   │
   │ Disable Watchdog │   │           │ Reset Watchdog   │   │
   │ Timer            │   │           │ Timer            │   │
   └──────────────────┘   │           └──────────────────┘   │
              │ Next      │                      │ Next      │
              └───────────┘                      └───────────┘
```

A.3   Sample Program

Assembly sample code :

```
;Enable WDT:
mov    dx,2Eh
mov    al,87          ;Un-lock super I/O
out    dx,al
out    dx,al


;Select Logic device:
mov    dx,2Eh
mov    al,07h
out    dx,al
mov    dx,2Fh
mov    al,07h
out    dx,al


;Enable WDT base address:
mov    dx,2Eh
mov    al,30h
out    dx,al
mov    dx,2Fh
mov    al,01h
out    dx,al


;Activate WDT:
mov    dx,2Eh
mov    al,0F0h
out    dx,al
mov    dx,2Fh
mov    al,80h
out    dx,al


;Set base timer :
mov    dx,2Eh
```

```
mov    al,0F6h
out    dx,al
mov    dx,2Fh
mov    al,Mh          ;M=00h,01h,...FFh (hex),Value=0 to 255
out    dx,al          ;(see 🖺 Note below)


;Set Second or Minute :
mov    dx,2Eh
mov    al,0F5h
out    dx,al
mov    dx,2Fh
mov    al,Nh          ;N=71h or 79h(see 🖺 Note below)
out    dx,al
```

🖺 **Note**:

If **N**=71h, the time base is set to second.

M = time value

    00: Time-out disable

    01: Time-out occurs after 1 second

    02: Time-out occurs after 2 seconds

    03: Time-out occurs after 3 seconds

     .

     .

    FFh: Time-out occurs after 255 seconds

If **N**=79h, the time base is set to minute.

M = time value

    00: Time-out disable

    01: Time-out occurs after 1 minute

    02: Time-out occurs after 2 minutes

    03: Time-out occurs after 3 minutes

     .

     .

    FFh: Time-out occurs after 255 minutes