PE2000U Series

Embedded Computer

User Manual

HIGH-DEFINITION MULTIMEDIA INTERFACE

E20620
First Edition
January 2023

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About this manual

This manual provides information about the hardware and software features of your Embedded Computer, organized through the following chapters:

Chapter 1: Getting to know your Embedded Computer

This chapter details the hardware components of your Embedded Computer.

Chapter 2: Using your Embedded Computer

This chapter provides you with information on using your Embedded Computer.

Chapter 3: Upgrading your Embedded Computer

This chapter provides you with information on how to upgrade the memory modules, wireless modules, and hard disk drive / solid state drive of your Embedded Computer.

Chapter 4: Using the software

This chapter provides you with information on how to install the ASUS IEC Vision software and also provides a brief summary of the software layout.

Appendix

This section includes notices and safety statements your Embedded Computer.

Conventions used in this manual

To highlight key information in this manual, some text are presented as follows:

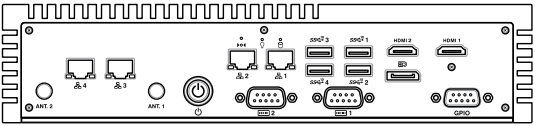
IMPORTANT! This message contains vital information that must be followed to complete a task.

NOTE: This message contains additional information and tips that can help complete tasks.

WARNING! This message contains important information that must be followed to keep you safe while performing certain tasks and prevent damage to your Embedded Computer's data and components.

Package contents

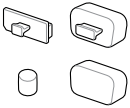
Your Embedded Computer package contains the following items:



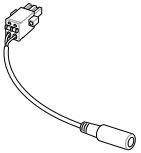
PE2000U Series

AC power adapter*

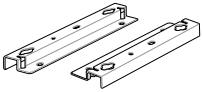
Power cord*



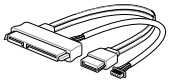
I/O port dust covers



Terminal block power adapter

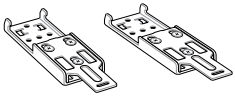


Wall mount kit



SATA and power cable

Optional item(s)



DIN rail clips

NOTE:

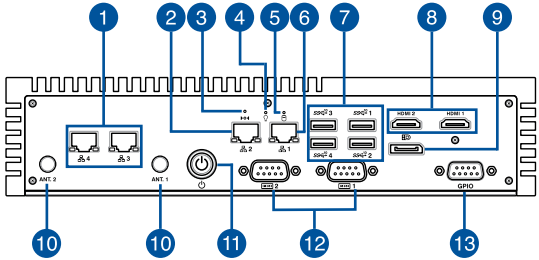
- *The bundled power adapter may vary depending on model and territories.
- Some bundled accessories may vary depending on model. For details on these accessories, refer to their respective user manuals.
- The device illustration is for reference only. Actual product specifications may vary with models.
- If the device or its components fail or malfunction during normal and proper use within the warranty period, bring the warranty card to the ASUS Service Center for replacement of the defective components.

1

Getting to know your Embedded Computer

1.1 Features

1.1.1 Front view



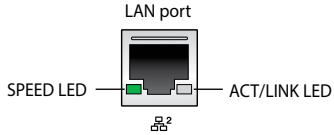
1 **LAN port with PoE (on selected models)**

The 8-pin RJ-45 LAN port supports a standard Ethernet cable for connection to a local network, and supports Power over Ethernet (PoE).

2 **LAN port**

The 8-pin RJ-45 LAN port supports a standard Ethernet cable for for 10/100/1000 Mbps connection to a local network.

LAN port 2 LED indications



Activity Link LED	
Status	**Description**
Off	No link
Yellow	Linked
Yellow (blinking)	Data activity
Yellow (blinking then steady)	Ready to wake up from suspend mode

Speed LED	
Status	**Description**
Off	10 Mbps connection
Orange	100 Mbps connection
Green	1 Gbps connection

3 **System reset pinhole**

The hard reset pinhole allows you to reboot your Embedded Computer.

4 **Power indicator**

The power indicator lights up when your Embedded Computer is turned on and blinks slowly when in sleep mode.

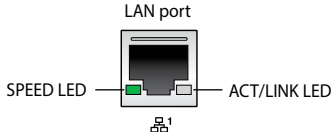
5 **Drive activity indicator**

This indicator lights up when your Embedded Computer is accessing the internal storage drive.

6 **LAN port**

The 8-pin RJ-45 LAN port supports a standard Ethernet cable for 10/100/1000/2500 Mbps connection to a local network.

LAN port 1 LED indications



Activity Link LED	
Status	**Description**
Off	No link
Green	Linked
Green (blinking)	Data activity
Green (blinking then steady)	Ready to wake up from suspend mode

Speed LED	
Status	**Description**
Off	10/100 Mbps connection
Orange	1 Gbps connection
Green	2.5 Gbps connection

7 **USB 3.2 Gen 2 port**

The USB 3.2 Gen 2 (Universal Serial Bus) port provides a transfer rate up to 10 Gbit/s.

8 **HDMI™ port**

The HDMI (High Definition Multimedia Interface) port supports a Full-HD device, such as an LCD TV or monitor, to allow viewing on a larger external display.

9 **Dual-mode DisplayPort**

This port allows you to connect your Embedded Computer to an external display and supports DVI or HDMI™ adapters.

10 ANT. 1 ANT. 2

Antenna hole

The antenna hole allows you to connect a wireless antenna to enhance wireless signal reception.

11

Power button

The power button allows you to turn the Embedded Computer on or off. You can use the power button to put your Embedded Computer to sleep mode or press it for four (4) seconds to force shutdown your Embedded Computer.

12

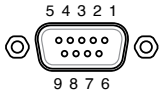
Serial (COM) connector

The 9-pin RS232/422/485 serial (COM) connector allows you to connect devices that have serial ports, such as bar code scanner, modem, or printers.

12 GPIO

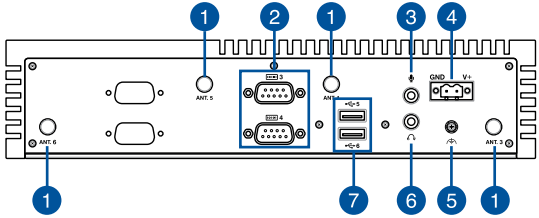
GPIO connector

The 9-pin GPIO (General-purpose Input/Output) connector allows you to program it for input or output use, such as lighting control, door control or alarm control.



Pin	GPIO
1	DIO_0
2	DIO_4
3	DIO_1
4	DIO_5
5	DIO_2
6	DIO_6
7	DIO_3
8	DIO_7
9	GND

1.1.2 Rear view



1 **ANT. 3**
ANT. 4
ANT. 5
ANT. 6

Antenna hole

The antenna hole allows you to connect a wireless antenna to enhance wireless signal reception.

2

Serial (COM) connector (on selected models)

The 9-pin RS-232/DB9 serial (COM) connector allows you to connect devices that have serial ports such as bar code scanner, modem, or printers.

3

Microphone

The built-in microphone can be used for video conferencing, voice narrations, or simple audio recording.

4 V– V+

Power input

The supplied terminal block power adapter converts AC power to DC power for use with this jack. Power supplied through this jack supplies power to the Embedded Computer.

WARNING! The power adapter may become warm to hot when in use. Do not cover the adapter and keep it away from your body.

5

Functional Earth Ground (on selected models)

The Functional Earth Ground provides you with a grounding point.

6

Headphone jack

This port allows you to connect amplified speakers or headphones.

7

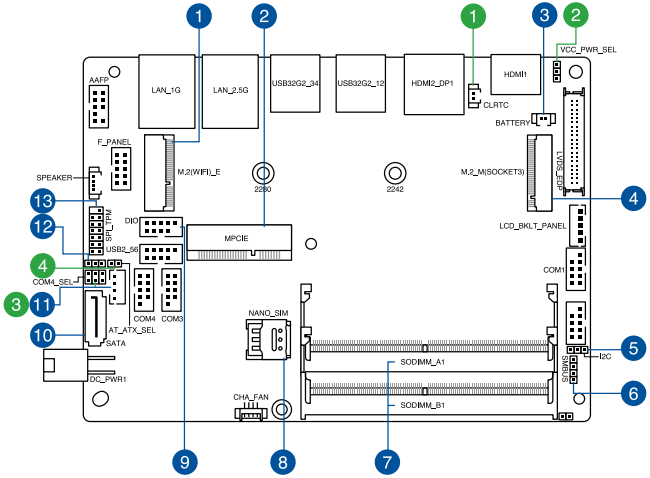
USB 2.0 port (on selected models)

The USB (Universal Serial Bus) port is compatible with USB 2.0 or USB 1.1 devices, such as keyboards, pointing devices, flash disk drives, external HDDs, speakers, cameras, and printers.

1.2 Motherboard Overview

1.2.1 Motherboard layout

The PE2000U Series features a motherboard with a 3.5″ dimension (146mm x 105mm).



Jumpers		Page
1.	Clear RTC RAM jumper	21
2.	Display Panel VCC Power Selection jumper	22
3.	COM4 Ring/+5V/+12V Selection jumper	22
4.	AT/ATX Mode Configuration jumper	23

Connectors/slots		Page
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4.	M.2 (M-key) slot	26
5.	I2C connector	30
6.	SMBus connector	29
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9.	GPIO connector	29
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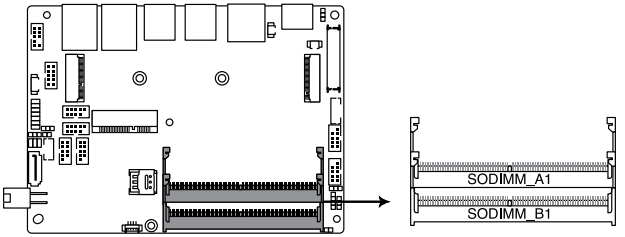
12.	Power Button connector	28
13.	SPI TPM connector	31

1.2.2 System memory

The motherboard comes with two Small Outline Dual Inline Memory Module (SODIMM) slots designed for DDR5 (Double Data Rate 5) memory modules.

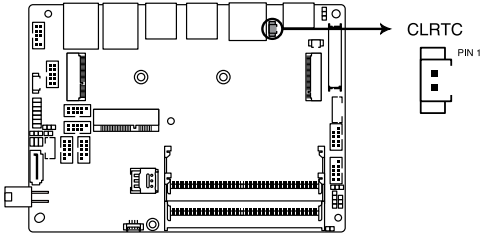


SODIMM slot

1.2.3 Onboard jumpers

1. Clear RTC RAM jumper

The Clear RTC RAM jumper allows you to clear the Real Time Clock (RTC) RAM in the CMOS, which contains the date, time, system passwords, and system setup parameters.



Clear CMOS

To erase the RTC RAM:

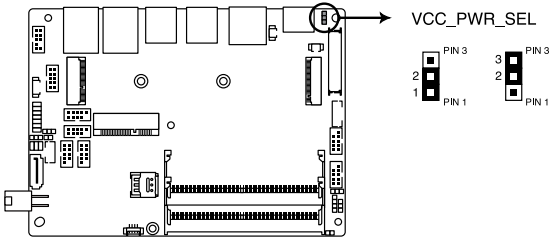
1. Turn OFF the computer and unplug the power cord.
2. Short-circuit pin 1-2 with a metal object or jumper cap for about 5-10 seconds.
3. Plug the power cord and turn ON the computer.
4. Hold down the <Del> key during the boot process and enter BIOS setup to re-enter data.

WARNING! DO NOT remove the jumper cap from its default position except when clearing the RTC RAM. Removing the jumper cap will cause system boot failure!

NOTE: If the steps above do not help, remove the onboard button cell battery and move the jumper again to clear the CMOS RTC RAM data. After clearing the CMOS, reinstall the button cell battery.

2. Display Panel VCC Power Selection jumper (on selected models)

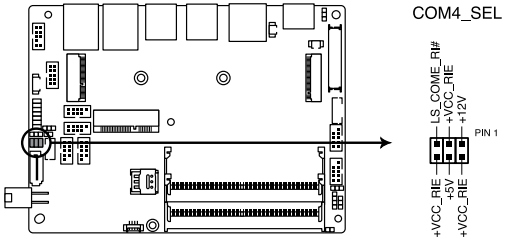
The Display Panel VCC Power jumper allows you to select the voltage for the LVDS panel.



VCC_PWR_SEL Setting

3. COM4 Ring/+5V/+12V Selection jumper

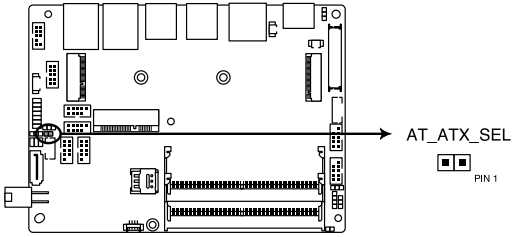
The COM4 Ring/+5V/+12V Selection jumper allows you to select the voltage for the COM4 port.



COM4_SEL Selection jumper

4. AT/ATX Mode Configuration jumper

The AT/ATX Mode Configuration jumper allows you to switch between AT or ATX modes. The default setting for this jumper is set to ATX mode with a jumper cap attached, to switch to AT mode, remove the jumper cap.

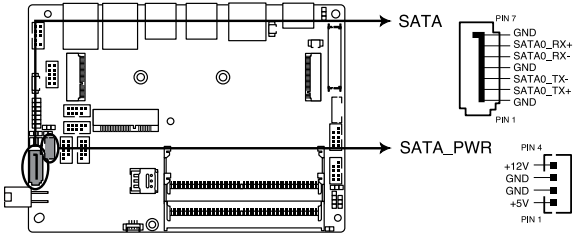


AT/ATX Mode Selection jumper

1.2.4 Internal connectors

1. SATA 6Gb/s & SATA Power connector

The SATA 6Gb/s and SATA Power connectors allow you to connect SATA devices such as optical disc drives and hard disk drives via a SATA cable and power cable.



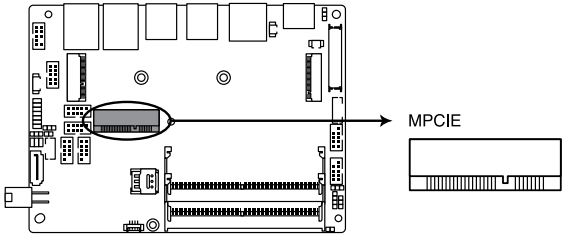
SATA_PWR & SATA connector

Connector type	Wafer HD 4P, 2.0mm pitch & Wafer HD 7p, 1.27mm pitch

NOTE: Ensure to use the bundled cable when connecting a storage device to this connector.

2. Mini PCIe slot

The Mini PCIe slot allows you to install a Mini PCIe peripheral device.



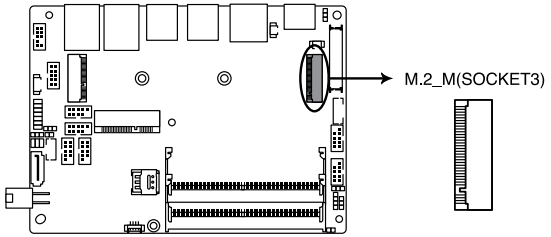
MPCIE slot

NOTE:

- The Mini PCIe peripheral device is purchased separately.
- The mSATA shares the same slot with a full-length Mini PCIe.

3. M.2 (M-key) slot

The M.2 slot allows you to install 2242/2280 M.2 devices, such as 2242/2280 M.2 SSD modules.



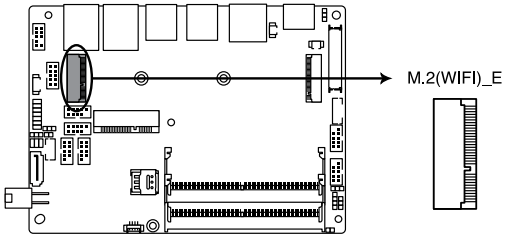
M.2_M(SOCKET3) slot

NOTE:

- The M.2 SSD module is purchased separately.
- This motherboard supports 2242/2280 PCIE SSD devices only.

4. M.2 (E-key) Wi-Fi slot

The M.2 Wi-Fi slot allows you to install an M.2 Wi-Fi module (E-key, type 2230).

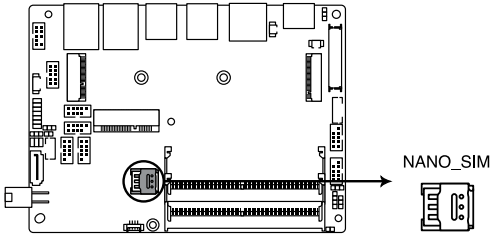


M.2(WIFI)_E slot

NOTE: The M.2 Wi-Fi module is purchased separately.

5. Nano SIM Card slot

The Nano SIM Card slot allows you to install a Nano SIM card.

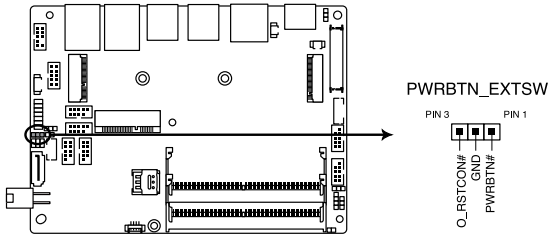


NANO SIM slot

NOTE: The Nano SIM card is purchased separately.

6. Power Button connector

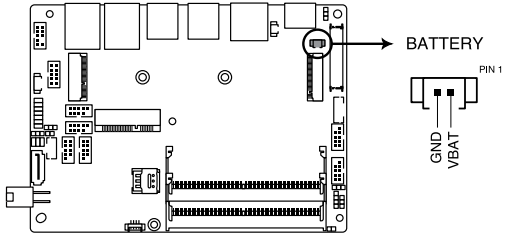
The Power Button connector allows you to connect an external power button.



Power button connector

7. Battery connector

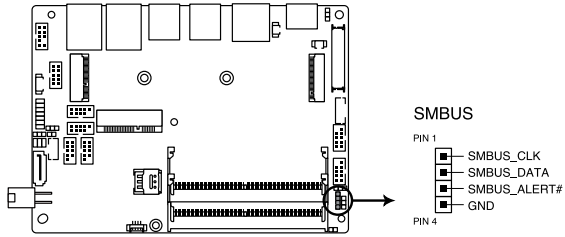
The Battery connector allows you to connect a lithium CMOS battery.



Battery connector

8. SMBus connector

The System Management Bus (SMBus) connector allows you to connect SMBus devices. This connector is generally used for communication with system and power management-related tasks.

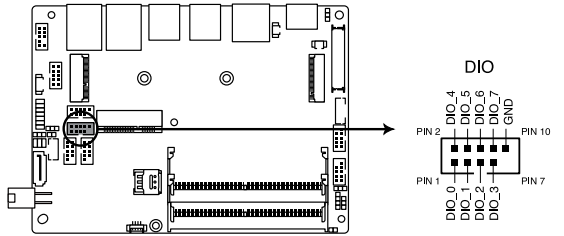


SMBUS connector

Connector type	Header 1x4p, 2.0mm pitch

9. GPIO connector

The GPIO connector allows you to connect a general purpose input/output module to customize digital signal input/output.

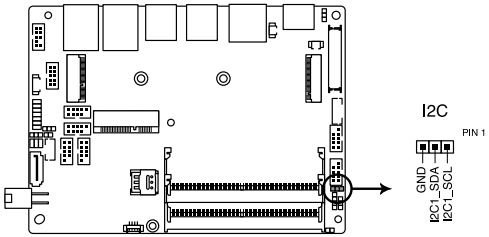


GPIO connector

Connector type	BOX header 2x5p, K9, 2.0mm pitch

10. I2C connector

The I2C (Inter-Integrated Circuit) connector allows you to connect an I2C-compatible IoT security module.

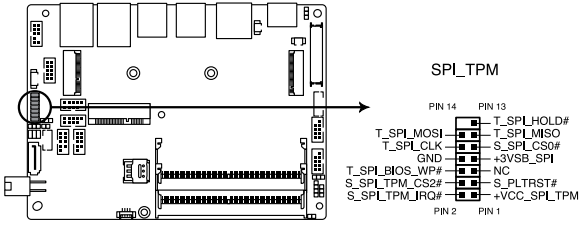


Inter-Integrated Circuit connector

Connector type	Header 2x3p, K6, 2.0mm pitch

11. SPI TPM connector

The SPI TPM connector supports a Trusted Platform Module (TPM) system, which can securely store keys, digital certificates, passwords, and data. A TPM system also helps enhance network security, protects digital identities, and ensures platform integrity.



SPI TPM connector

Connector type	Header 2x7p,K14, 2.0mm pitch

2

Using your Embedded Computer

2.1 Getting started

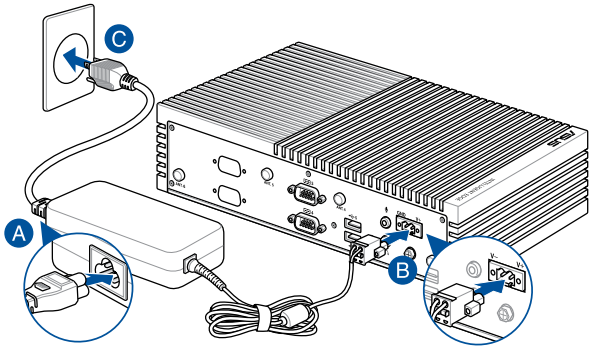
2.1.1 Connect the AC power adapter to your Embedded Computer

To connect the AC power adapter to your Embedded Computer:

A. Connect the power cord to the AC power adapter.

B. Connect the DC power connector into your Embedded Computer's power (DC) input.

C. Plug the AC power adapter into a 100 V~240 V power source.



NOTE:

The power adapter may vary in appearance, depending on the model and your region. Refer to the following for more information on the different power adapters, as well as the system:

90W Power adapter

- Input voltage: 100-240 Vac
- Input frequency: 50-60 Hz
- Rated output current: 7.5 A max (90.0 W)
- Rated output voltage: 12.0 Vdc

120W Power adapter

- Input voltage: 100-240 Vac
- Input frequency: 50-60 Hz
- Rated output current: 6.0 A max (120.0 W)
- Rated output voltage: 20.0 Vdc

System

- Input voltage: 100-240 Vac
- Input frequency: 50-60 Hz
- Rated output current: 10 A - 2.5 A (90.0 W)
  13.33 A - 3.33 A (120.0 W)
- Rated output voltage: 9 - 36 Vdc

IMPORTANT!

- We strongly recommend that you use only the AC power adapter and cable that came with your Embedded Computer.
- We strongly recommend that you use a grounded wall socket while using your Embedded Computer.
- The socket outlet must be easily accessible and near your Embedded Computer.
- To disconnect your Embedded Computer from its main power supply, unplug your Embedded Computer from the power socket.

WARNING!

- Do not use power adapters or batteries from other devices to reduce the risk of injury to persons due to fire or explosion. Use only UL certified power adapters or batteries supplied by the manufacturer or authorized retailers.
- Do not disable or remove the power cord grounding plug, the grounding is an important safety feature.
- Ensure to plug the power cord into a grounded (earthed) electrical outlet that is easily accessible at all times.

2.1.2 Connect a display panel to your Embedded Computer

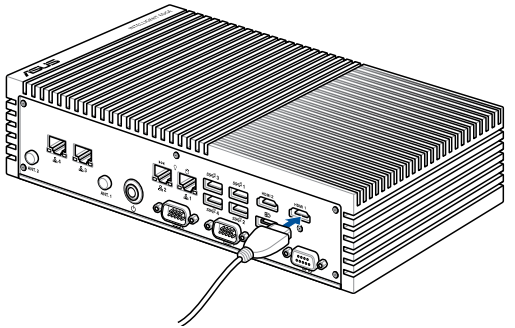
You can connect a display panel or projector to your Embedded Computer that has the following connectors:

- HDMI™ connector
- DisplayPort

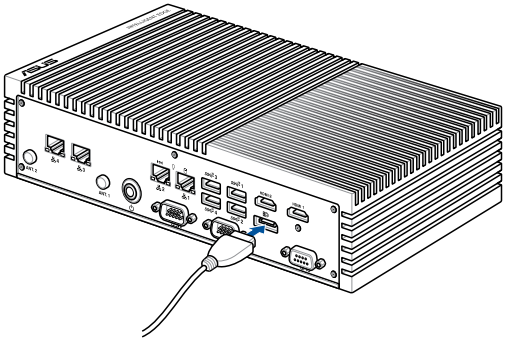
To connect a display panel to your Embedded Computer:

Connect one end of an HDMI™, or a DisplayPort cable to an external display, and the other end of the cable to your Embedded Computer's HDMI™ port, or DisplayPort.

Connect display via HDMI™ port



Connect display via DisplayPort



2.1.3 Connect the USB cable from keyboard or mouse

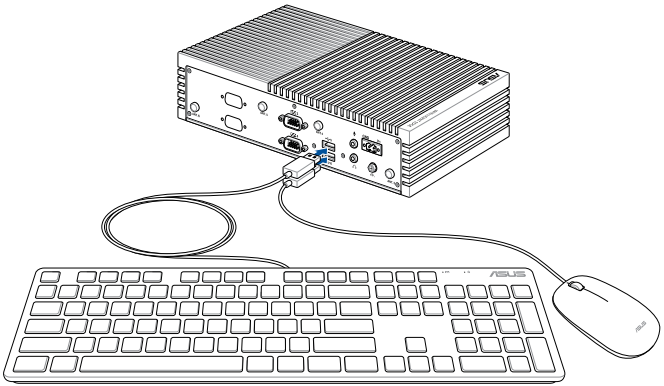
You can connect generally any USB keyboard and mouse to your Embedded Computer. You can also connect a USB dongle for a wireless keyboard and mouse set.

To connect a keyboard and mouse to your Embedded Computer:

Connect the USB cable from your keyboard and mouse to any of the USB ports of your Embedded Computer.

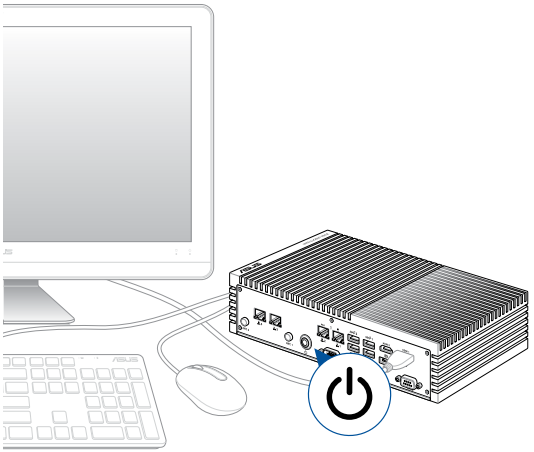
NOTE:

- The keyboard varies with country or region.
- The keyboard and mouse are purchased separately.



2.1.4 Turn on your Embedded Computer

Press the power button to turn on your Embedded Computer.



2.2 Turning off your Embedded Computer

If your Embedded Computer is unresponsive, press and hold the power button for at least four (4) seconds until your Embedded Computer turns off.

2.3 Putting your Embedded Computer to sleep

To put your Embedded Computer on Sleep mode, press the Power button once.

2.4 Entering the BIOS Setup

BIOS (Basic Input and Output System) stores system hardware settings that are needed for system startup in the Embedded Computer.

In normal circumstances, the default BIOS settings apply to most conditions to ensure optimal performance. Do not change the default BIOS settings except in the following circumstances:

- An error message appears on the screen during the system bootup and requests you to run the BIOS Setup.
- You have installed a new system component that requires further BIOS settings or update.

WARNING! Inappropriate BIOS settings may result to instability or boot failure. We strongly recommend that you change the BIOS settings only with the help of a trained service personnel.

2.4.1 Load default BIOS settings

To load the default values for each of the parameters in your BIOS:

1. Enter the BIOS by pressing <F2> or <DEL> on the POST screen.

   NOTE: POST (Power-On Self Test) is a series of software controlled diagnostic tests that run when you turn on your Embedded Computer.

2. Navigate to the **Exit** menu.
3. Select the **Load Optimized Defaults** option, or you may press <F5>.
4. Select **OK** to load the default BIOS values.

3

Upgrading your Embedded Computer

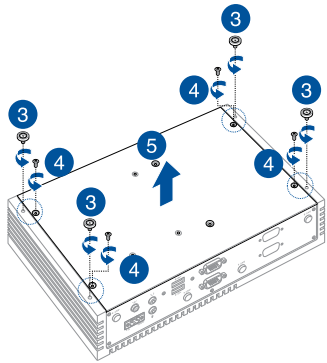
IMPORTANT!

- Ensure that your hands are dry before proceeding with the rest of the installation process. Before installing any of the features in this guide, use a grounded wrist strap or touch a safely grounded object or metal object to avoid damaging them due to static electricity.
- Turn off the power of your Embedded Computer, and allow it to cool for at least 10 minutes before performing any installation/ uninstallation process.

NOTE: The illustrations in this section are for reference only. The slots may vary depending on model.

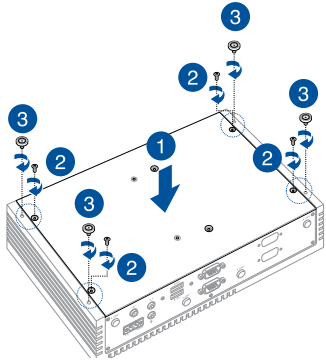
3.1 Removing the bottom cover

1. Turn off your Embedded Computer then disconnect all cables and peripherals.
2. Place the Embedded Computer on a flat stable surface, with its top side facing down.
3. Remove the four (4) rubber feet screws from the bottom cover.
4. Remove the four (4) screws securing the bottom cover.
5. After removing the screws, remove the bottom cover and place it aside.



3.2 Replacing the bottom cover

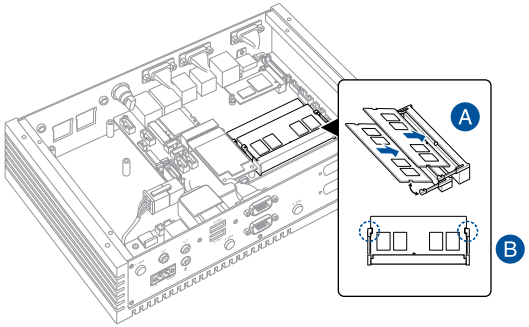
1. Align the bottom cover with the screw holes, then replace the bottom cover onto the Embedded Computer.
2. Secure the bottom cover using the four (4) screws removed previously.
3. Replace the four (4) rubber feet screws removed previously.



3.3 Installing memory modules

Your Embedded Computer comes with two (2) SO-DIMM slots that allow you to install DDR5 SO-DIMMs.

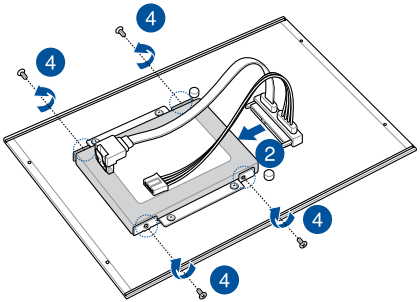
Align and insert the memory module into the slot (A) and press it down (B) until it is securely seated in place.



3.4 Installing 2.5” storage device

1. Prepare your 2.5” storage device, then align it with the storage bay on the bottom cover of your Embedded Computer.
2. Connect the storage device cable to the storage device.
3. Insert your storage device into the storage bay.
4. Secure the storage device to the storage bay using four (4) screws.

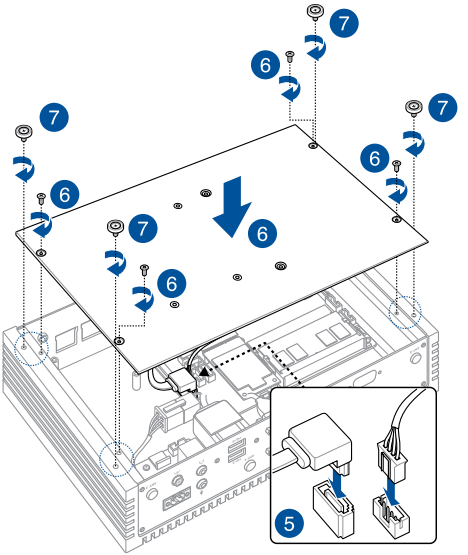
IMPORTANT! This device only supports 7mm 2.5” HDD or SSD.



5. Connect the storage device cable to the **SATA6G** and **SATA_PWR** connectors on the motherboard.

6. Replace the bottom cover, then secure the bottom cover using the four (4) screws removed previously.

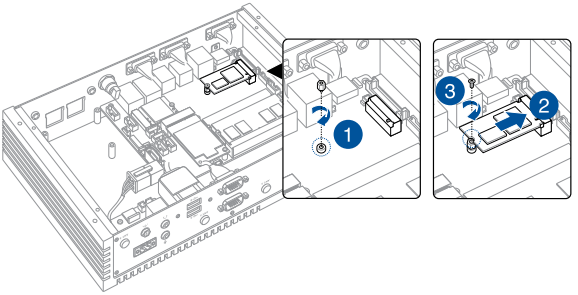
7. Replace the four (4) rubber feet screws removed previously.



3.5 Installing an M.2 SSD

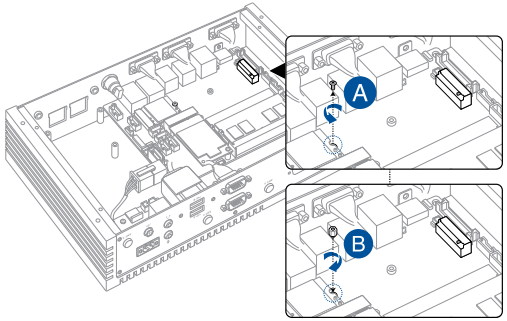
To install a M.2 2242 SSD:

1. (optional) Replace the stand screw if it has been removed.
2. Align and insert the M.2 SSD into its slot inside the Embedded Computer.
3. Gently push down the M.2 SSD on top of the standoff and fasten it using a screw.

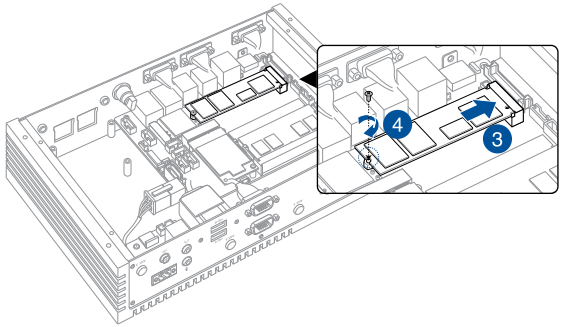


To install an M.2 2280 SSD:

1. (optional) If a wireless card is installed, remove the screw holding it in place (A), replace it with a standoff (B), and skip to step 3.

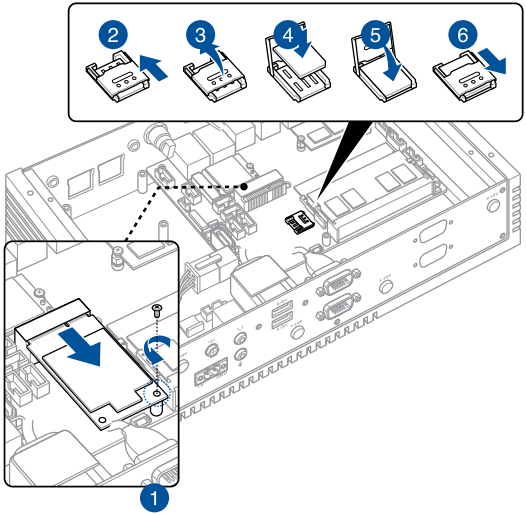


2. (optional) Replace the standoff if it was removed.
3. Align and insert the M.2 SSD into its slot inside the Embedded Computer.
4. Gently push down the M.2 SSD on top of the standoff and fasten it using a screw.



3.6 Installing a nano SIM card

1. (optional) Remove the mPCIe or mSATA card if there is a mPCIe or mSATA card installed by removing the the screw securing the mPCIe or mSATA card first, then removing the mPCIe or mSATA card.
2. Push the nano SIM cover in the direction away from the SO-DIMM slots.
3. Lift the nano SIM cover.
4. Place the nano SIM into the nano SIM slot.
5. Replace the nano SIM cover.
6. Push the nano SIM cover towards the SO-DIMM slots to secure the nano SIM card.

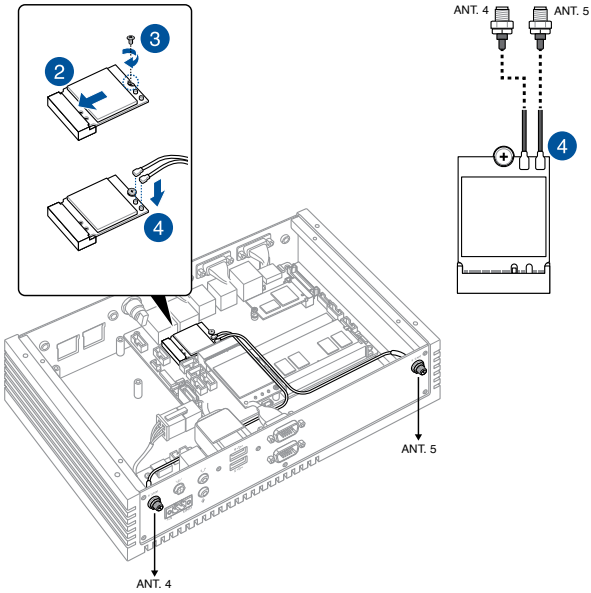

2
3
4
5
6
1

3.7 Installing a wireless card to the M.2 (E-key) slot

1. Remove the M.2 screw.
2. Align and insert the wireless card into the M.2 slot inside the Embedded Computer.
3. Gently push down the wireless card on top of the standoff, and then fasten it using the previously removed screw.
4. (optional) Connect the RF cables from the antennas to your wireless card. Make sure that the correct cable is attached to each of the connectors by referring to the illustration on the next page.

NOTE:

- Please refer to the **Installing antennas** section for more information on installing the antennas.
- Connecting antennas to your wireless card may strengthen the wireless signal.
- A soft clicking sound indicates that the antenna has been securely attached on the wireless card.


ANT. 4
ANT. 5
2
3
4
4
ANT. 5
ANT. 4

3.8 Installing an mPCIe / mSATA module

Your Embedded Computer comes with an mPCIe / mSATA slot that allows you to install an LTE mPCIe module, mPCIe Coral TPU module, or mSATA storage module.

To install a 4G LTE mPCIe module:

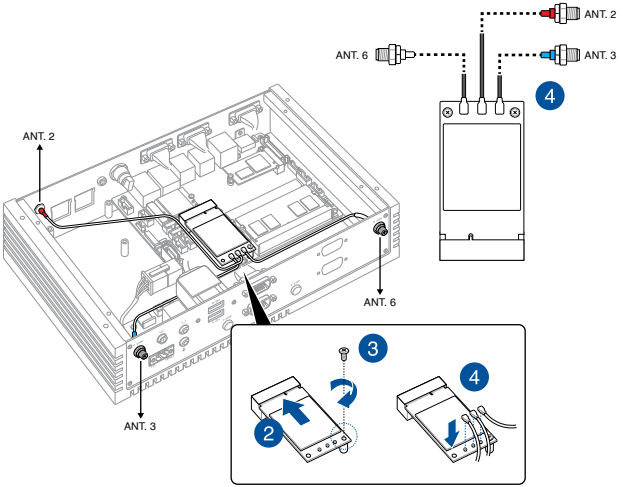
1. Remove the screw from the M.2 standoff.
2. Align and insert the LTE module into the slot.
3. Press down, and then secure it in place using the screw previously removed.
4. (optional) Connect the RF cables from the antennas to your LTE module. Make that the correct cable is attached to each of the connectors by following chart on the next page.

NOTE:

- To enable the hot-plug function of your LTE module, click the **weston-terminal** icon in the upper left corner of your screen, and type the first command below when prompted:

`mm_cli sim-detect 1`	(enable hot-plug function)
`mm_cli sim-detect 0`	(disable hot-plug function)
`mm_cli sim-detect`	(display current setting)

- Refer to **Installing antennas** for more information on installing the antennas.
- Connecting antennas to your LTE module may strengthen the signal.
- A soft clicking sound indicates that the antenna has been securely attached on the LTE module.


ANT. 2
ANT. 6
ANT. 3
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ANT. 2
ANT. 6
ANT. 3
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2
4

To install a 5G LTE mPCIe module:

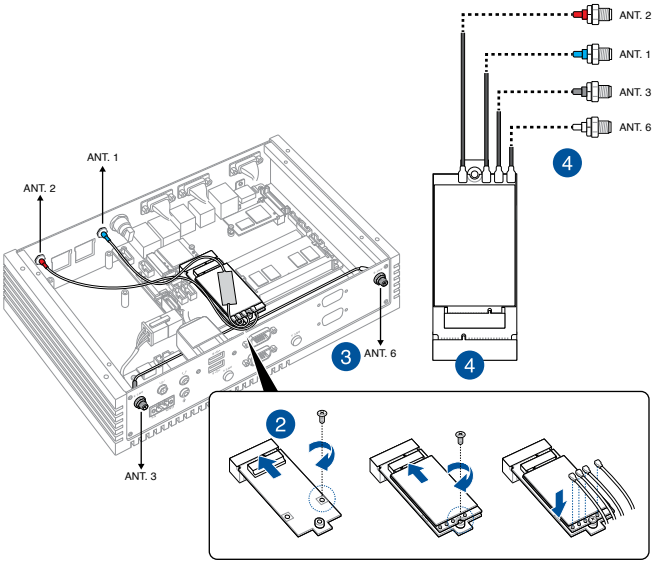
1. Remove the screw from the M.2 standoff.
2. Align and insert the LTE module into the slot.
3. Press down, and then secure it in place using the screw previously removed.
4. (optional) Connect the RF cables from the antennas to your LTE module. Make that the correct cable is attached to each of the connectors by following chart on the next page.
5. (optional) Use the cable clip to organize the cables.

NOTE:

- To enable the hot-plug function of your LTE module, click the **weston-terminal** icon in the upper left corner of your screen, and type the first command below when prompted:

`mm_cli sim-detect 1`	(enable hot-plug function)
`mm_cli sim-detect 0`	(disable hot-plug function)
`mm_cli sim-detect`	(display current setting)

- Refer to **Installing antennas** for more information on installing the antennas.
- Connecting antennas to your LTE module may strengthen the signal.
- A soft clicking sound indicates that the antenna has been securely attached on the LTE module.


ANT. 2
ANT. 1
ANT. 3
ANT. 6
4
ANT. 1
ANT. 2
3
ANT. 6
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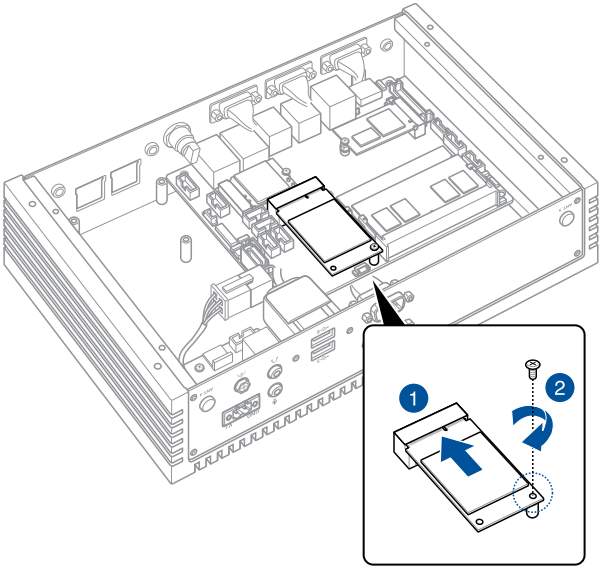
ANT. 3
2

To install an mSATA storage module:

1. Align and insert the mSATA storage module into the slot.
2. Press down, and then secure it in place using one (1) of the bundled screws.



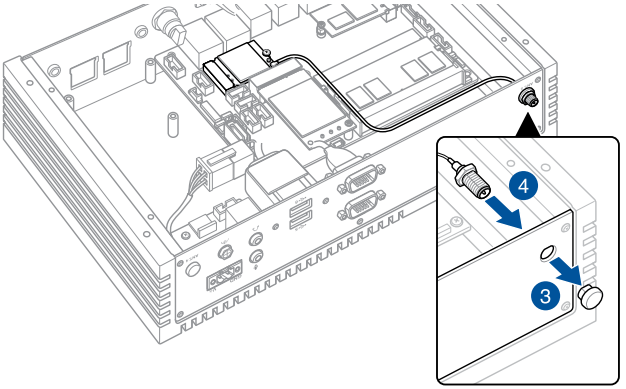
3.9 Installing antennas (optional)

You may install antennas to the five (5) antenna jacks located on the front and rear panels. The installed antennas can be connected to an LTE module installed in the Mini PCIe/mSATA slot or to a wireless card installed in the M.2 Wi-Fi slot.

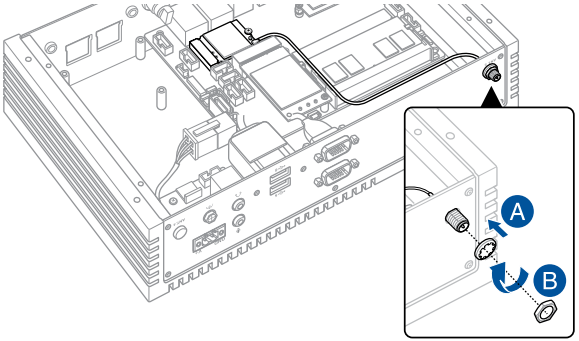
To install an antenna:

NOTE: If your Embedded Computer came pre-installed with wireless card antenna jacks, skip to step 8.

1. Remove the bottom cover. Refer to **Removing the bottom cover** for details.
2. Prepare the RF connector and cable.
3. Remove the rubber caps from the antenna holes.
4. Insert the antenna jack end of the RF connector and cable into the antenna hole from within the chassis outwards.



5. Insert the bundled O-ring over the antenna jack (A), then secure the antenna jack using one of the bundled hex screws (B).



6. Connect the other end of the RF connector and cable to your wireless card (refer to **Installing a wireless card to the M.2 (E-key) slot** for details) or to your WWAN card (refer to **Installing an mPCIe / mSATA module** for details).

7. Replace the bottom cover. Refer to **Replacing the bottom cover** for details.

8. Screw the external Wi-Fi antennas onto their corresponding antenna jacks on the front and rear panels by turning them in a clockwise direction.

9. Position the antennas for optimal signal reception.

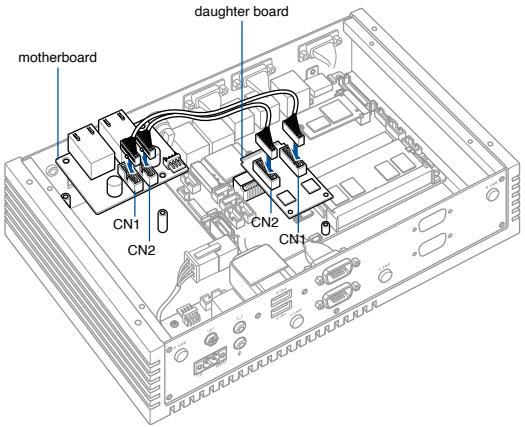
3.10 Installing the PoE LAN module (on selected models)

NOTE:

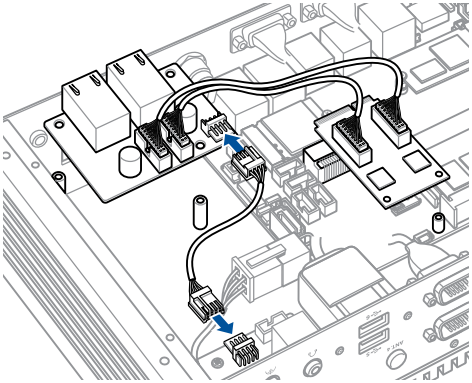
- The PoE LAN module supports up to 15W per port for powering IEEE802.3af.
- Operating temperature when using PoE with your device: -20°C~50°C.

1. Connect the **CN1** and **CN2** connectors on the PoE LAN module's daughter board to the **CN1** and **CN2** connectors on the PoE LAN module's motherboard using the two (2) bundled LAN signal cables.

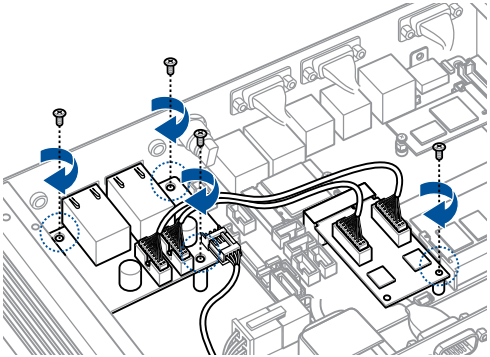
NOTE: Make sure to connect the **CN1** connector on the daughter board to the **CN1** connector on the motherboard, and the **CN2** connector on the daughter board to the **CN2** connector on the motherboard.



2. Connect the power connector on the daughter board to the power connector on the power board.



3. Secure the motherboard and daughter board using the bundled screws.

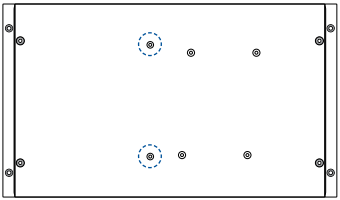


3.11 Installing the VESA mount (optional)

You may install a VESA mount to your Embedded Computer which allows you to install your Embedded Computer to a VESA mount-compatible device.

1. Place your Embedded Computer upside down on a flat and stable surface.

2. Attach the bundled two (2) 12mm screws into the screw holes at the bottom of your Embedded Computer.

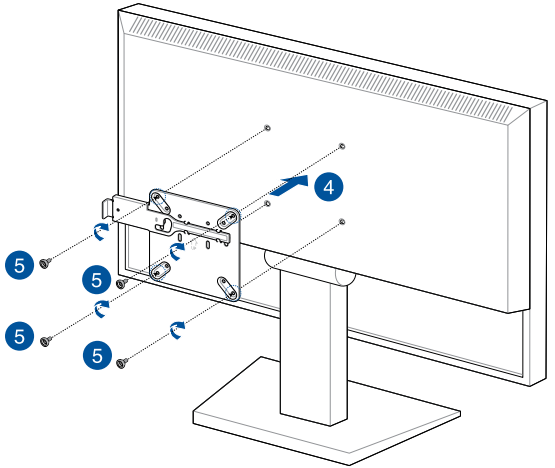


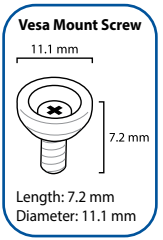
3. Remove the screw hole covers at the back of your VESA mount-compatible device, if any.

4. With the arrow on the VESA mounting plate pointing upward, align its screw holes to the screw holes of the VESA mount-compatible device.

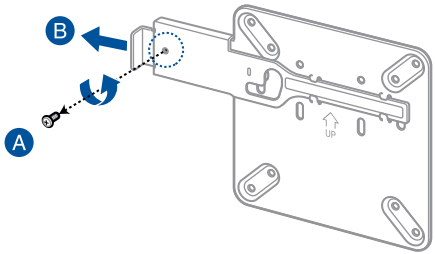
5. Secure the VESA mounting plate to the VESA mount-compatible device using the bundled screws.

WARNING! Do not overtighten the screws as it may cause damage to your VESA mount-compatible device.

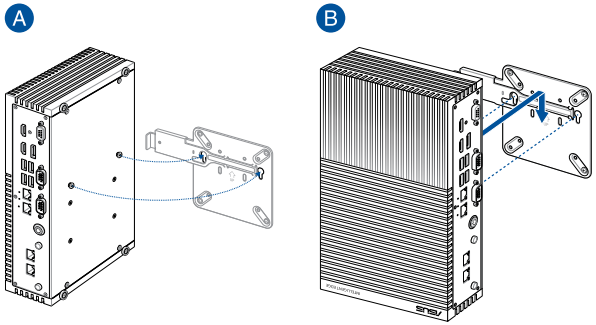




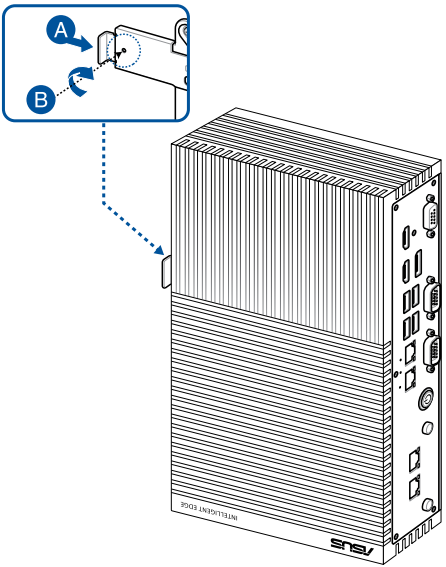
6. Remove the screw on the metal lock of the VESA mounting plate (A), and pull the metal lock outwards (B).



7. Position the Embedded Computer and insert the screws attached on the Embedded Computer to the mounting holes of the VESA mounting plate (A), then gently push the Embedded Computer down in the angle shown in the illustration to secure it in place (B).

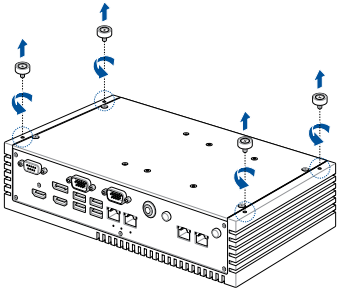


8. Push the metal lock back towards the Embedded Computer (A), and then secure it using the screw previously removed (B).

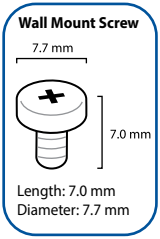


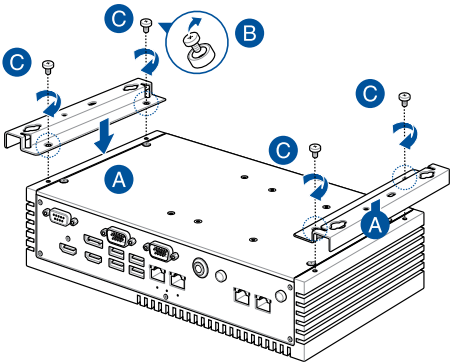
3.12 Installing wall mount brackets

1. Remove the four (4) rubber feet screws.



2. Align the wall mount with the rubber feet screw holes (A), then remove the rubber feet from the rubber feet screws (B) and secure the wall mount brackets to your Embedded Computer using the rubber feet screws (C).





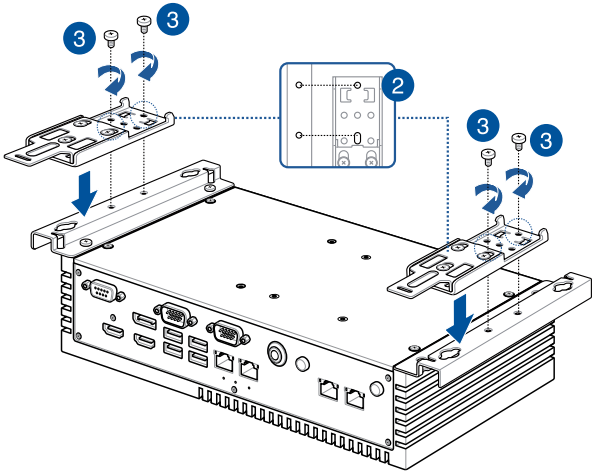
NOTE: The rubber feet and wall mount screws are the same screws.

3.13 Installing DIN rail clips (optional)

1. Make sure that the wall mount brackets are already installed. Refer to the section **Installing wall mount brackets** for installation instructions.

2. Align the screw holes on the DIN rail clips to the ones on the wall mount brackets as shown below.

3. Secure the DIN rail clips to the wall mount brackets using the screws bundled with the DIN rail clips.



4. Clip the final assembly to a DIN rail by hooking the DIN rail clips to the top of the DIN rail and then pressing down until you hear the clips snap into place.

4

Watchdog Timer

4.1 Watchdog Timer implementation

There are two watchdog timer implementations designed on this product, the HW and POST watchdog timers. The watchdog timer circuit is in SuperIO and can be controlled by a hardware jumper and BIOS setup menu through the system BIOS for different boot phases.

Please refer to the table below for the different implementations of the Watchdog Timer.

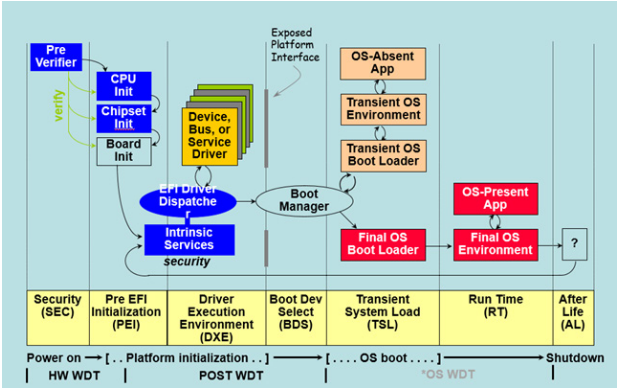
Watchdog timer	Implementation	Default Timeout
HW Watchdog Timer	This Watchdog Timer can prevent the system from failing before BIOS takeover. After the system is powered on, the watchdog timer will start automatically through the jumper setting. **NOTE:** • Refer to the HW WDT enable jumper in the section **Motherboard Overview** for more information. • The default setting for this jumper is set to **HW WDT enabled** with a jumper cap attached.	6 seconds.

(continued on the next page)

Watchdog timer	Implementation	Default Timeout
POST Watchdog Timer	This Watchdog Timer is for recovering the system from crashes during BIOS takeover to OS. After system BIOS takeover, the BIOS will stop the HW watchdog timer and start the POST watchdog timer on the same hardware watchdog circuit. **NOTE:** The default setting for the BIOS item is set to enabled.	The timeout value is determined by the BIOS settings.
*OS Watchdog Timer	No implementation. User needs to write software in OS to keep updating the watchdog timer to prevent it from timing out. The application is executed on payload. **NOTE:** Please refer to the section **Watchdog Timer Programming** for more information.	N/A

4.2 Watchdog Timer flowchart

Please refer to the Watchdog Timer initialization flowchart below:



4.3 Watchdog Timer Programming

Please refer to the pseudo code for the NCT6116D watchdog timer programming below:

SIO_INDEX_PORT is 0x2E

SIO_DATA_PORT is 0x2F

1. Set WDT Time Unit

```
Outportb(SIO_INDEX_PORT, 0x87); // Unlock SIO
Outportb(SIO_INDEX_PORT, 0x87); // Unlock SIO

Outportb(SIO_INDEX_PORT, 0x07);
Outportb(SIO_DATA_PORT, 0x08);
Outportb(SIO_INDEX_PORT, 0xF0);
val = Inportb(SIO_DATA_PORT) // Read current WDT setting

val = val | 0x08; // minute mode, val = val & 0xF7 if second mode
Outportb(SIO_INDEX_PORT, 0xF0);
Outportb(SIO_DATA_PORT, val); // Write back WDT setting

Outportb(SIO_INDEX_PORT, 0xAA); // Lock SIO
```

2. Set WDT Time

```
Outportb(SIO_INDEX_PORT, 0x87); // Unlock SIO
Outportb(SIO_INDEX_PORT, 0x87); // Unlock SIO

Outportb(SIO_INDEX_PORT, 0x07);
Outportb(SIO_DATA_PORT, 0x08);
Outportb(SIO_INDEX_PORT, 0xF1);
Outportb(SIO_DATA_PORT, Time); // Write WDT time, value 1 to 255

Outportb(SIO_INDEX_PORT, 0xAA); // Lock SIO
```

3. Enable WDT

```
Outportb(SIO_INDEX_PORT, 0x87); // Unlock SIO
Outportb(SIO_INDEX_PORT, 0x87); // Unlock SIO

Outportb(SIO_INDEX_PORT, 0x07);
Outportb(SIO_DATA_PORT, 0x08);
Outportb(SIO_INDEX_PORT, 0x30);
val = Inportb(SIO_DATA_PORT) // Read current WDT status

val = val | 0x01; // Enable WDT Timer
Outportb(SIO_INDEX_PORT, 0x30);
Outportb(SIO_DATA_PORT, val); // Write back WDT status

Outportb(SIO_INDEX_PORT, 0xAA); // Lock SIO
```

4. Disable WDT

```
Outportb(SIO_INDEX_PORT, 0x87); // Unlock SIO
Outportb(SIO_INDEX_PORT, 0x87); // Unlock SIO

Outportb(SIO_INDEX_PORT, 0x07);

Outportb(SIO_DATA_PORT, 0x08);

Outportb(SIO_INDEX_PORT, 0xF1);

Outportb(SIO_DATA_PORT, 0x00); // Clear WDT time, it means WDT Time-
    Out disable

Outportb(SIO_INDEX_PORT, 0x30);

val = Inportb(SIO_DATA_PORT) // Read current WDT status

val = val & 0xFE; // Disable WDT Timer

Outportb(SIO_INDEX_PORT, 0x30);

Outportb(SIO_DATA_PORT, val); // Write back WDT status

Outportb(SIO_INDEX_PORT, 0xAA); // Lock SIO
```

Appendix

Safety information

Your Embedded Computer is designed and tested to meet the latest standards of safety for information technology equipment. However, to ensure your safety, it is important that you read the following safety instructions.

Setting up your system

- Read and follow all instructions in the documentation before you operate your system.
- Do not use this product near water or a heated source.
- Set up the system on a stable surface.
- Peripherals with extended tolerance (such as industrial grade mSATA, and micro SD card) will allow this product to be used in environments with ambient temperatures between -20˚C and 60˚C, with a 0.1m/s air flow.
- The product should be used in environments with an ambient temperature of 60˚C when using the 90 W / 120 W power adapter.
- If you use an extension cord, make sure that the total ampere rating of the devices plugged into the extension cord does not exceed its ampere rating.
- This equipment should be installed and operated with a minimum distance of 20cm between the radiator and your body.
- Restricted Access Location:

  The equipment should only be installed in a Restricted Access Area where both these conditions apply:

  – access can only be gained by USERS who have been instructed about the reasons for the restrictions applied to the location and about any precautions that shall be taken; and

  – access is through the use of a TOOL or lock and key, or other means of security, and is controlled by the authority responsible for the location.
- This device shall not be connected to an Ethernet network with outside plant routing.

Care during use

- Do not walk on the power cord or allow anything to rest on it.
- Do not spill water or any other liquids on your system.
- When the system is turned off, a small amount of electrical current still flows. Always unplug the power cord from the power outlets before cleaning the system.
- Use this product with care when operating at full load, as the product may reach temperatures of up to 60˚C and the outer casing may reach temperatures of up to 73˚C.
- If you encounter the following technical problems with the product, unplug the power cord and contact a qualified service technician or your retailer.
  - The power cord or plug is damaged.
  - Liquid has been spilled into the system.
  - The system does not function properly even if you follow the operating instructions.
  - The system was dropped or the cabinet is damaged.
  - The system performance changes.

Safety Precautions

Accessories that came with this product have been designed and verified for the use in connection with this product. Never use accessories for other products to prevent the risk of electric shock or fire.

Lithium-Ion Battery Warning

CAUTION: Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

NO DISASSEMBLY

The warranty does not apply to the products that have been disassembled by users

Regulatory notices

COATING NOTICE

IMPORTANT! To provide electrical insulation and maintain electrical safety, a coating is applied to insulate the device except on the areas where the I/O ports are located.

Federal Communications Commission Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference, and
- This device must accept any interference received including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

IMPORTANT! Outdoor operations in the 5.15~5.25 GHz band is prohibited. This device has no Ad-hoc capability for 5250~5350 and 5470~5725 MHz.

CAUTION! Any changes or modifications not expressly approved by the grantee of this device could void the user's authority to operate the equipment.

RF exposure warning

This equipment must be installed and operated in accordance with provided instructions and the antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter. End-users and installers must be provide with antenna installation instructions and transmitter operating conditions for satisfying RF exposure compliance.

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following:

Contains FCC ID: TX2-RTL8822CE and Contains IC:6317A-RTL8822CE

ISED Radiation Exposure Statement for Canada

This equipment complies with ISED radiation exposure limits set forth for an uncontrolled environment. To maintain compliance with ISED RF exposure compliance requirements, please avoid direct contact to the transmitting antenna during transmitting. End users must follow the specific operating instructions for satisfying RF exposure compliance.

Operation is subject to the following two conditions:

- This device may not cause interference and
- This device must accept any interference, including interference that may cause undesired operation of the device.

Compliance Statement of Innovation, Science and Economic Development Canada (ISED)

This device complies with Innovation, Science and Economic Development Canada licence exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

CAN ICES-003(A)/NMB-003(A)

Déclaration de conformité de Innovation, Sciences et Développement économique Canada (ISED)

Le présent appareil est conforme aux CNR d'Innovation, Sciences et Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

CAN ICES-003(A)/NMB-003(A)

Wireless Operation Channel for Different Domains

N. America	2.412-2.462 GHz	Ch01 through CH11
Japan	2.412-2.484 GHz	Ch01 through Ch14
Europe ETSI	2.412-2.472 GHz	Ch01 through Ch13

KC: Korea Warning Statement

Class A:

사용자 안내문

이 기기는 업무용 환경에서 사용할 목적으로 적합성평가를 받은 기기로서 가정용 환경에서 사용하는 경우 전파간섭의 우려가 있습니다.

VCCI: Japan Compliance Statement

Class A ITE

この装置は、クラスA機器です。この装置を住宅環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

VCCI ー A

Japan RF Equipment Statement

屋外での使用について

本製品は、5GHz帯域での通信に対応しています。電波法の定めにより5.2GHz、5.3GHz帯域の電波は屋外で使

用が禁じられています。

法律および規制遵守

本製品は電波法及びこれに基づく命令の定めるところに従い使用してください。日本国外では、その国の法律ま

たは規制により、本製品の使用ができないことがあります。このような国では、本製品を運用した結果、罰せられ

ることがありますが、当社は一切責任を負いかねますのでご了承ください。

HDMI Trademark Notice

The terms HDMI, HDMI High-Definition Multimedia Interface, and the HDMI Logo are trademarks or registered trademarks of HDMI Licensing Administrator, Inc.

Declaration of compliance for product environmental regulation

ASUS follows the green design concept to design and manufacture our products, and makes sure that each stage of the product life cycle of ASUS product is in line with global environmental regulations. In addition, ASUS disclose the relevant information based on regulation requirements.

Please refer to http://csr.asus.com/Compliance.htm for information disclosure based on regulation requirements ASUS is complied with:

EU REACH and Article 33

Complying with the REACH (Registration, Evaluation, Authorization, and Restriction of Chemicals) regulatory framework, we publish the chemical substances in our products at ASUS REACH website at http://csr.asus.com/english/REACH.htm

EU RoHS

This product complies with the EU RoHS Directive. For more details, see http://csr.asus.com/english/article.aspx?id=35

Japan JIS-C-0950 Material Declarations

Information on Japan RoHS (JIS-C-0950) chemical disclosures is available on http://csr.asus.com/english/article.aspx?id=19

India RoHS

This product complies with the "India E-Waste (Management) Rules, 2016" and prohibits use of lead, mercury, hexavalent chromium, polybrominated biphenyls (PBBs) and polybrominated diphenyl ethers (PBDEs) in concentrations exceeding 0.1% by weight in homogenous materials and 0.01% by weight in homogenous materials for cadmium, except for the exemptions listed in Schedule II of the Rule.

Vietnam RoHS

ASUS products sold in Vietnam, on or after September 23, 2011,meet the requirements of the Vietnam Circular 30/2011/TT-BCT.

Các sản phẩm ASUS bán tại Việt Nam, vào ngày 23 tháng 9 năm2011 trở về sau, đều phải đáp ứng các yêu cầu của Thông tư 30/2011/TT-BCT của Việt Nam.

Türkiye RoHS
AEEE Yönetmeliğine Uygundur

ASUS Recycling/Takeback Services
ASUS recycling and takeback programs come from our commitment to the highest standards for protecting our environment. We believe in providing solutions for you to be able to responsibly recycle our products, batteries, other components as well as the packaging materials. Please go to http://csr.asus.com/english/Takeback.htm for detailed recycling information in different regions.

Ecodesign Directive
European Union announced a framework for the setting of ecodesign requirements for energy-related products (2009/125/EC). Specific Implementing Measures are aimed at improving environmental performance of specific products or across multiple product types. ASUS provides product information on the CSR website. The further information could be found at https://csr.asus.com/english/article.aspx?id=1555.

低功率電波輻射性電機管理辦法

第十二條： 經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

第十四條： 低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。

Taiwan NCC Warning Statement

Article 12: Without permission, any company, firm or user shall not alter the frequency, increase the power, or change the characteristic and functions of the original design of the certified lower power frequency electric machinery.

Article 14: The application of lower power frequency electric machineries shall not affect the navigation safety nor interfere alegal communication, if an interference is found, the service will be suspended until improvement is made and theinterference no longer exists.

甲類警語

警告使用者：此為甲類資訊技術設備，於居住環境中使用時，可能會造成射頻擾動，在此種情況下，使用者會被要求採取某些適當的對策。

Taiwan BSMI Class A Notice

This product is Class A. In a domestic environment, this product may cause radio interference. You may be required to take adequate measures.

「產品之限用物質含有情況」之相關資訊，請參考下表：
Taiwan Declaration of Restricted Substances Marking

單元 (Unit)	限用物質及其化學符號 (Restricted substances and its chemical symbols)					
	鉛 Lead (Pb)	汞 Mercury (Hg)	鎘 Cadium (Cd)	六價鉻 Hexavalent chromium (Cr^{+6})	多溴聯苯 Polybrominated biphenyls (PBB)	多溴二苯醚 Polybrominated diphenyls ethers (PBDE)
印刷電路板及電子組件 PCB	—	○	○	○	○	○
外殼 Chassis	—	○	○	○	○	○
硬碟 Disk drive	—	○	○	○	○	○
散熱設備 Thermal solutions	—	○	○	○	○	○
其他及其配件（線材等） Accessories (e.g., cables)	—	○	○	○	○	○

備考 1. “○”係指該項限用物質之百分比含量未超出百分比含量基準值。

備考 2. “—”係指該項限用物質為排除項目。

Note 1 “○” indicates that the percentage content of the restricted substance does not exceed the percentage of reference value of presence.

Note 2 The “—” indicates that the restricted substance corresponds to the exemption.

ENERGY STAR complied product

ENERGY STAR is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy helping us all save money and protect the environment through energy efficient products and practices.

All ASUS products with the ENERGY STAR logo comply with the ENERGY STAR standard, and the power management feature is enabled by default. The monitor is automatically set to sleep within 10 minutes of user inactivity; the computer is automatically set to sleep within 30 minutes of user inactivity. To wake your computer, click the mouse, press any key on the keyboard, or press the power button.

Please visit http://www.energystar.gov/powermanagement for detail information on power management and its benefits to the environment. In addition, please visit http://www.energystar.gov for detail information on the ENERGY STAR joint program.

NOTE: Energy Star is NOT supported on FreeDOS and Linux-based products.

Service and Support

Visit our multi-language website at https://www.asus.com/support/.

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