Neousys Technology Inc.

Nuvo-7501 Series

User Manual

Revision 1.0

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FCC	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 own expense.
CE	The product(s) described in this manual complies with all applicable European Union (CE) directives if it has a CE marking. For computer systems to remain CE compliant, only CE-compliant parts may be used. Maintaining CE compliance also requires proper cable and cabling techniques.

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Safety Precautions

- Read these instructions carefully before you install, operate, or transport the system.
- Install the system or DIN rail associated with, at a sturdy location.
- Install the power socket outlet near the system where it is easily accessible.
- Secure each system module(s) using its retaining screws.
- Place power cords and other connection cables away from foot traffic. Do not place items over power cords and make sure they do not rest against data cables.
- Shutdown, disconnect all cables from the system and ground yourself before touching internal modules.
- Ensure that the correct power range is being used before powering the device.
- Should a module fail, arrange for a replacement as soon as possible to minimize down-time.
- If the system is not going to be used for a long time, disconnect it from mains (power socket) to avoid transient over-voltage.

Service and Maintenance

- ONLY qualified personnel should service the system
- Shutdown the system, disconnect the power cord and all other connections before servicing the system
- When replacing/ installing additional components (expansion card, memory module, etc.), insert them as gently as possible while assuring proper connector engagement

ESD Precautions

- Handle add-on module, motherboard by their retention screws or the module's frame/ heat sink. Avoid touching the PCB circuit board or add-on module connector pins
- Use a grounded wrist strap and an anti-static work pad to discharge static electricity when installing or maintaining the system
- Avoid dust, debris, carpets, plastic, vinyl and styrofoam in your work area
- Do not remove any module or component from its anti-static bag before installation

About This Manual

This guide introduces Neousys Nuvo-7501 system. It is a compact fanless embedded controller with Intel® 8th/9th Gen Core™ i7/ i5/ i3 processor.

The guide also demonstrates the system's basic installation procedures.

Revision History

Version	Date	Description
1.0	Nov. 2019	Initial release

1 Introduction

Nuvo-7501 is a cost-effective, compact and yet powerful fanless embedded computer with a 255 x 173 x 76 mm footprint. Powered by an Intel® 9th/ 8th-Gen Core™ hexa/ octa core CPU, it offers more than 50% computation performance improvement over the previous generation.

Nuvo-7501 is designed to be simple and compact while retaining essential elements of a rugged embedded fanless solution. It features I/Os such as 2x GbE, 4x USB3.0 and 4x COM ports for common industrial applications. It features an M.2 2280 slot (SATA signal) and can also support a 2.5" SSD/ HDD or a 3.5" HDD. It's derivative model, Nuvo-7505D, offers isolated DIO and isolated COM (ports 1~4), which can protect the controller against ground loops in harsh environments.

The Nuvo-7501 has retained quality materials all Neousys systems utilize and the design flow/ stringent test procedures it must endure. It is a fanless embedded platform that has hit the sweet spot in terms of cost, size and performance. Nuvo-7501 is an ideal fanless embedded solution for various industrial applications.

PCIe-PoE550X 10GbE vision frame grabber card features Neousys' proven 802.3at PoE+ technology. It opens the door to new applications such as high-performance WiFi access points and high-speed/ high-definition industrial cameras over a single Ethernet cable.

1.1 Product Specifications

1.1.1 Nuvo-7501 Specifications

System Core	
Processor	Supporting Intel® 8th/ 9th-Gen Core™ CPU (LGA1151 socket) - Intel® Core™ i7-8700*/ i7-8700T/ i7-9700E*/ i7-9700TE - Intel® Core™ i5-8500*/ i5-8500T/ i5-9500*/ i5-9500TE - Intel® Core™ i3-8100*/ i3-8100T/ i3-9100E*/ i3-9100TE
Chipset	Intel® H310 platform controller hub
Graphics	Integrated Intel® UHD graphics 630
Memory	Up to 32 GB DDR4 2666/ 2400 SDRAM (one SODIMM slot)
I/O Interface	
Ethernet port	2x Gigabit Ethernet ports by I219 and I210
USB	4x USB3.0 ports
Video Port	1x VGA connector, supporting 1920 x 1200 resolution 1x DVI-D connector, supporting 1920 x 1200 resolution
Serial Port	2x software-programmable RS-232/ 422/ 485 ports (COM1/ COM2) 2x RS-232 ports (COM3/ COM4)
Audio	1x 3.5 mm jack for mic-in and speaker-out
Storage Interface	
SATA HDD	1x internal SATA port for 3.5" HDD or 2.5" HDD/ SSD
M.2	1x M.2 2280 (SATA signal)
Expansion Bus/ Internal I/O Interface	
mini-PCIe	1x full-size mini PCI Express socket
M.2	1x M.2 2242 B key socket for 3G/4G options with SIM socket
Power Supply	
DC Input	1x 3-pin pluggable terminal block for 8~35 VDC power input
Remote Ctrl & Status Output	1x 10-pin (2x5) pin header for remote on/off control and status LED output
Mechanical	
Dimension	255 mm (W) x 173 mm (D) x 76 mm (H)
Weight	2.68 kg (incl. CPU, memory and HDD)
Mounting	Wall-mount mounting bracket (standard) or DIN-rail mount (optional)
Environmental	
Temperature	Storage: -40°C ~ 85°C Operating: -25°C ~ 60°C*/**

Humidity	10%~90% , non-condensing
Vibration	Operating, MIL-STD-810G, Method 514.6, Category 4
Shock	Operating, MIL-STD-810G, Method 516.6, Procedure I, Table 516.6-II
EMC	CE/FCC Class A, according to EN 55032 & EN 55024

** Due to thermal limitations, 65W CPUs will be configured to operate in 35W mode by default.*

*** For sub-zero operating temperature, a wide temperature HDD or Solid State Disk (SSD) is required.*

**** For i7 CPUs, thermal throttling may occur when sustained full-loading applied at 60°C ambient temperature.*

1.1.2 Nuvo-7505D Specifications

System Core	
Processor	Supporting Intel® 8th/ 9th-Gen Core™ CPU (LGA1151 socket) - Intel® Core™ i7-8700*/ i7-8700T/ i7-9700E*/ i7-9700TE - Intel® Core™ i5-8500*/ i5-8500T/ i5-9500*/ i5-9500TE - Intel® Core™ i3-8100*/ i3-8100T/ i3-9100E*/ i3-9100TE
Chipset	Intel® H310 platform controller hub
Graphics	Integrated Intel® UHD graphics 630
Memory	Up to 32 GB DDR4 2666/ 2400 SDRAM (one SODIMM slot)
I/O Interface	
Ethernet port	2x Gigabit Ethernet ports by I219 and I210
USB	4x USB3.0 ports
Video Port	1x VGA connector, supporting 1920 x 1200 resolution 1x DVI-D connector, supporting 1920 x 1200 resolution
Serial Port	2x software-programmable isolated RS-232/ 422/ 485 ports (COM1/ COM2) 2x isolated RS-232 ports (COM3/ COM4) 2x RS-232 ports (COM5/ COM6)
Audio	1x 3.5 mm jack for mic-in and speaker-out
Isolated DIO	8-CH isolated DI and 8-CH isolated DO
Storage Interface	
SATA HDD	1x internal SATA port for 3.5" HDD or 2.5" HDD/ SSD
M.2	1x M.2 2280 (SATA signal)
Expansion Bus/ Internal I/O Interface	
mini-PCIe	1x full-size mini PCI Express socket
M.2	1x M.2 2242 B key socket for 3G/4G options with SIM socket
Power Supply	
DC Input	1x 3-pin pluggable terminal block for 8~35 VDC power input
Remote Ctrl & Status Output	1x 10-pin (2x5) pin header for remote on/off control and status LED output
Mechanical	
Dimension	255 mm (W) x 173 mm (D) x 76 mm (H)
Weight	2.68 kg (incl. CPU, memory and HDD)
Mounting	Wall-mount mounting bracket (standard) or DIN-rail mount (optional)
Environmental	
Temperature	Storage: -40°C ~ 85°C Operating: -25°C ~ 60°C*/**

Humidity	10%~90% , non-condensing
Vibration	Operating, MIL-STD-810G, Method 514.6, Category 4
Shock	Operating, MIL-STD-810G, Method 516.6, Procedure I, Table 516.6-II
EMC	CE/FCC Class A, according to EN 55032 & EN 55024

** Due to thermal limitations, 65W CPUs will be configured to operate in 35W mode by default.*

*** For sub-zero operating temperature, a wide temperature HDD or Solid State Disk (SSD) is required.*

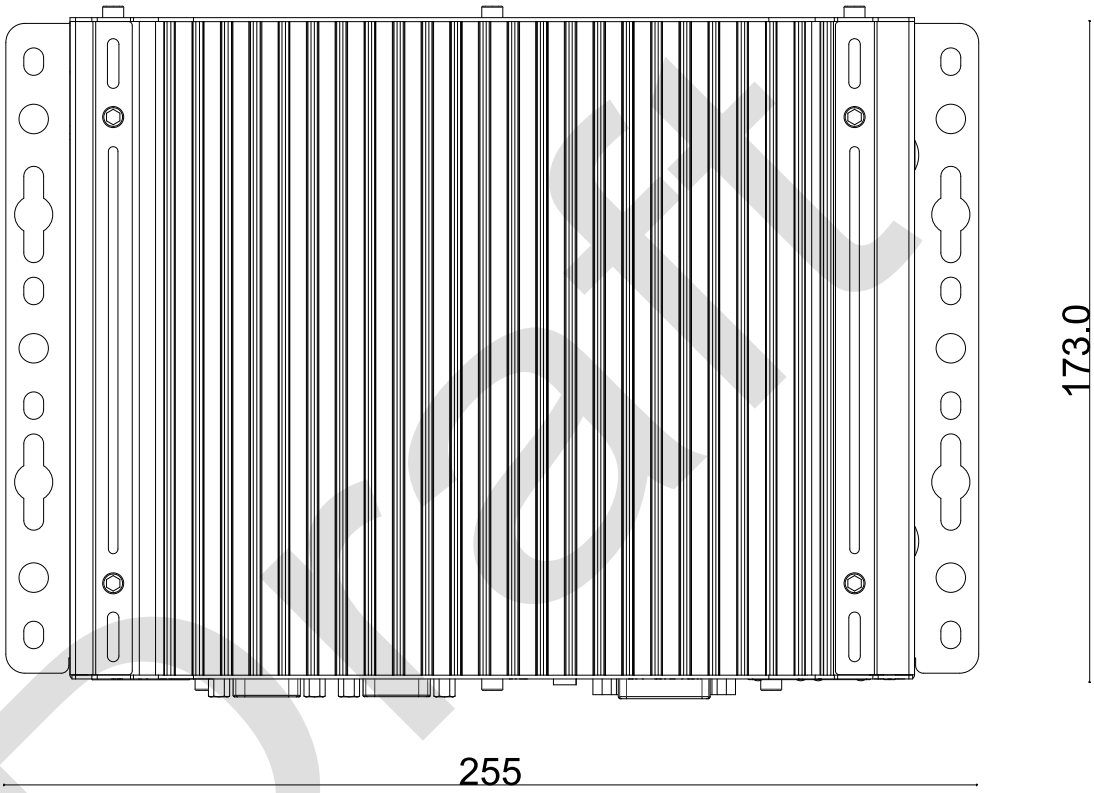
**** For i7 CPUs, thermal throttling may occur when sustained full-loading applied at 60°C ambient temperature.*

1.2 Dimension

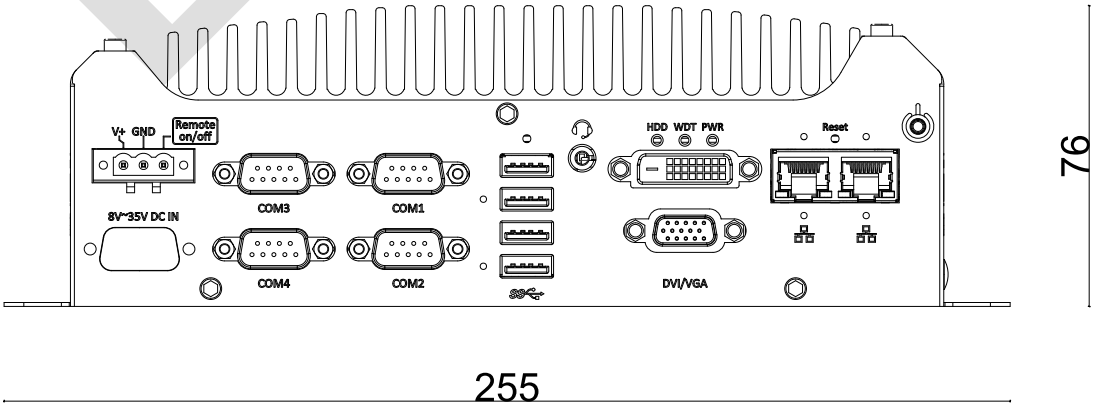
NOTE

All measurements are in millimeters (mm).

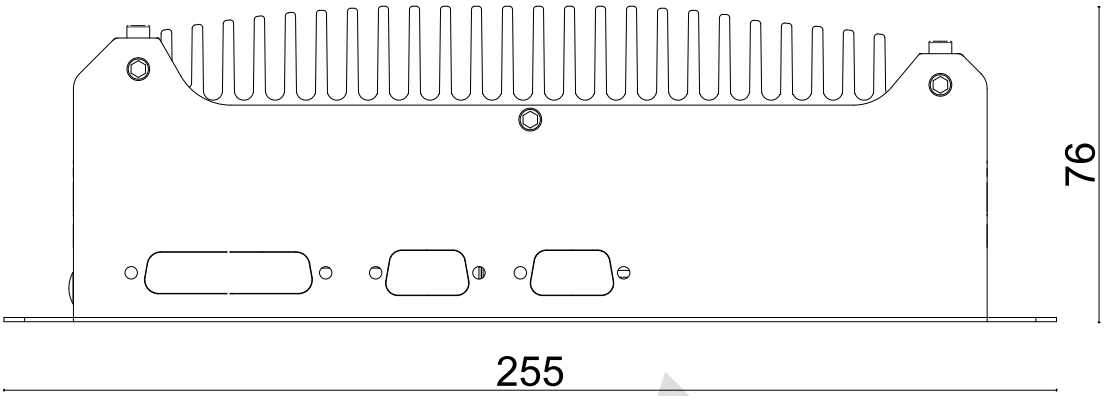
1.2.1 Top View of Nuvo-7501 Series



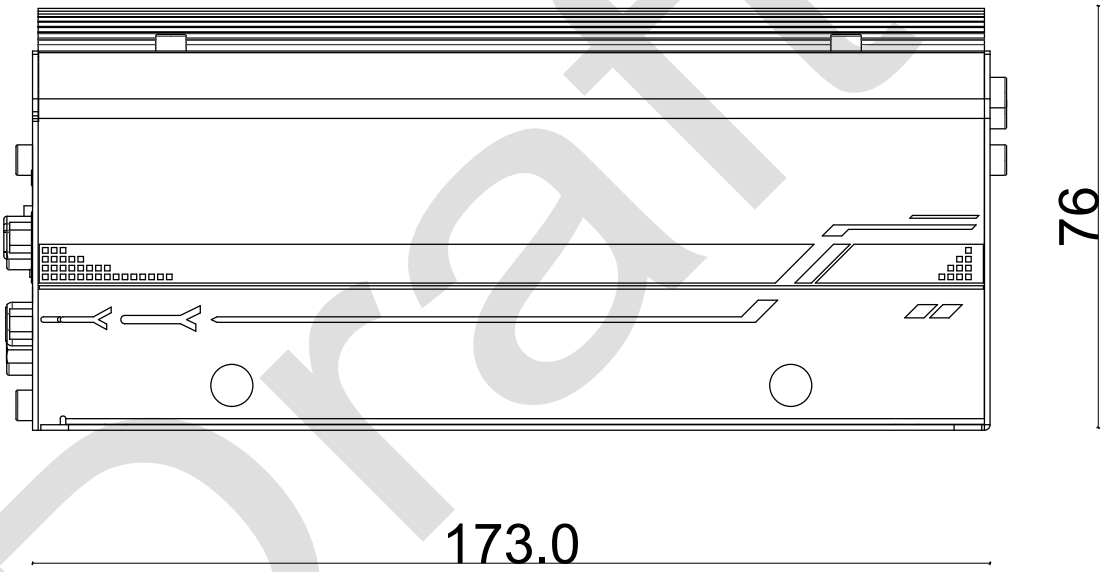
1.2.2 Front View of Nuvo-7501 Series



1.2.3 Back View of Nuvo-7501 Series



1.2.4 Side View of Nuvo-7501 Series



2 System Overview

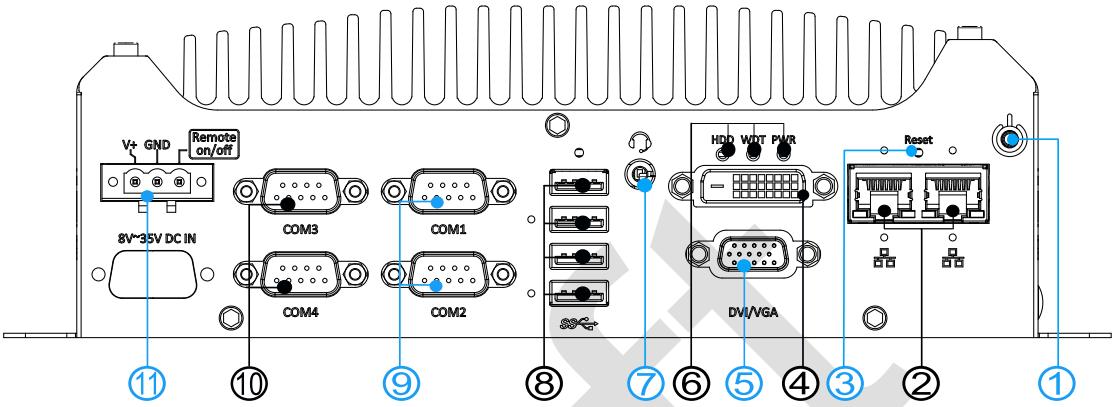
Upon receiving and unpacking your Nuvo-7501, please check immediately if the package contains all the items listed in the following table. If any item(s) are missing or damaged, please contact your local dealer or Neousys Technology.

2.1 Nuvo-7501 Series Packing List

System / Pack	Nuo-6108GC	Qty
1	Nuvo-7501 (If you ordered CPU/ RAM/ HDD, please verify these items)	1
2	Accessory box, which contains	
	● HDD/SSD bracket	1
	● CPU bracket	1
	● Neousys drivers & utilities DVD	1
	● 3-pin power terminal block	1
	● Screw pack	4

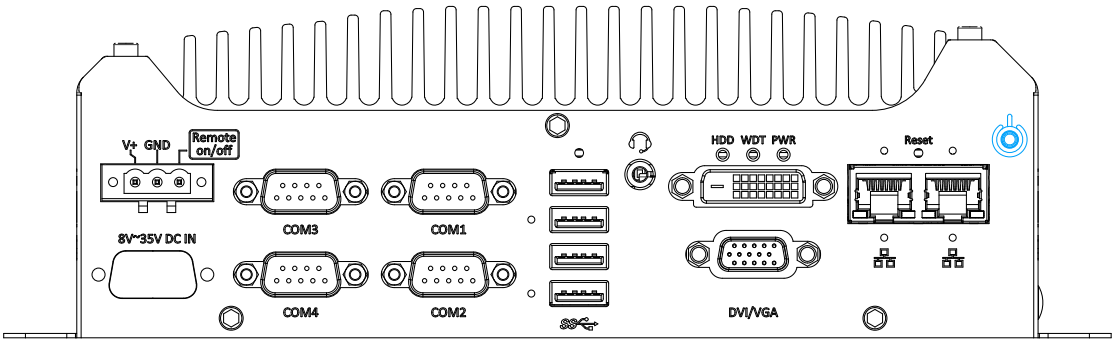
2.2 Front Panel I/O

The Nuvo-7501 I/O panel features three gigabit Ethernet ports, four USB3.0 ports, two USB2.0 ports, one VGA connector, one DVI-D connector and four serial ports.



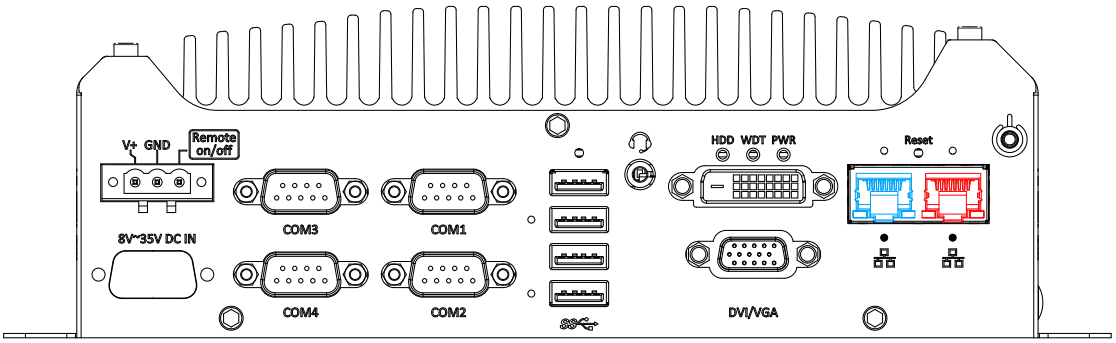
No.	Item	Description
1	Power button	Use this button to turn on or shutdown the system.
2	Ethernet port	The Ethernet ports support 10/ 100/ 1000Mbps network connections.
3	Reset button	Use this button to manually reset the system.
4	DVI-D port	DVI-D output supports resolution up to 1920x1200@60Hz and is compatible with other digital connections via an adapter.
5	VGA port	VGA output supports resolution up to 1920x1200@60Hz.
6	System status LEDs	Three system LEDs, Power (PWR), Watchdog Timer (WDT), and Hard Disk Drive (HDD).
7	4-pole 3.5mm headphone/ speaker jack	3.5mm jack for speaker-out or microphone-input.
8	USB 3.1 Gen1 port	USB 3.0 port supports up to 5 Gbit/s data transfer bandwidth.
9	COM port 1 & 2	COM ports 1 & 2 are software-configurable RS-232/422/485 ports. The ports are isolated on Nuvo-7505D system.
10	COM port 3 & 4	COM3 and COM4 are standard 9-wire RS-232 ports. The ports are isolated on Nuvo-7505D system.
11	3-pin terminal block (DC/ remote on/ off)	Compatible with DC power input from 8~35V, the terminal block is also used for remote on/ off control.

2.2.1 Power Button



The power button is a non-latched switch for ATX mode on/off operation. Press to turn on the system, PWR LED should light up and to turn off, you can either issue a shutdown command in the OS, or just press the power button. In case of system halts, you can press and hold the power button for 5 seconds to force-shutdown the system. Please note that there is a 5 seconds interval between two on/off operations (i.e. once turning off the system, you will need to wait for 5 seconds to initiate another power-on operation).

2.2.2 Ethernet Port



The system offers two GbE ports on its I/O panel. The GbE ports are marked in blue/ red and are implemented with Intel® I219-LM/ Intel® I210-IT controllers, respectively. Each port has one dedicated PCI Express link for maximum performance. When an Ethernet connection is established, the LED indicators on the RJ45 connector represents the following connection statuses:

Active/Link LED

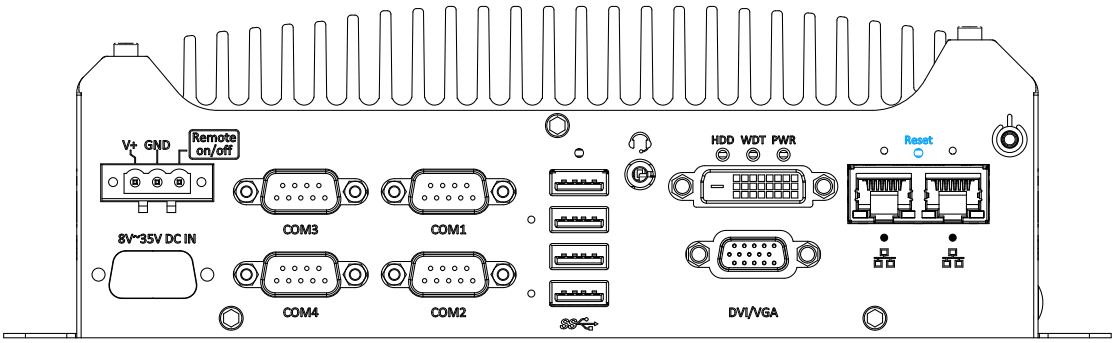
LED Color	Status	Description
Green	Off	Ethernet port is disconnected
	On	Ethernet port is connected and no data transmission
	Flashing	Ethernet port is connected and data is transmitting/receiving

Speed LED

LED Color	Status	Description
Green or Orange	Off	10 Mbps
	Green	100 Mbps
	Orange	1000 Mbps

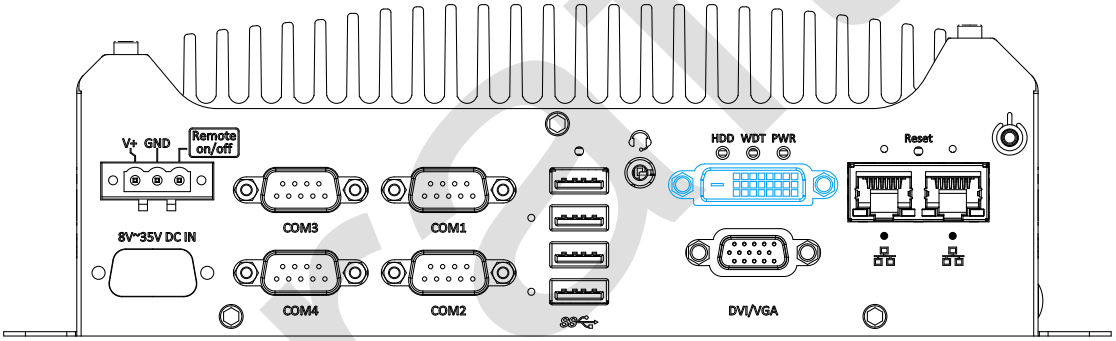
The port implemented using Intel® I219-LM (in blue) supports Wake-on-LAN function. Drivers may be required to utilize the GbE port in Windows environment.

2.2.3 Reset Button



The reset button can be used to manually reset the system in case of abnormal condition. To avoid unexpected operation, the reset button is hidden behind the front panel. You need to use a pin-like object to push the reset button.

2.2.4 DVI Port

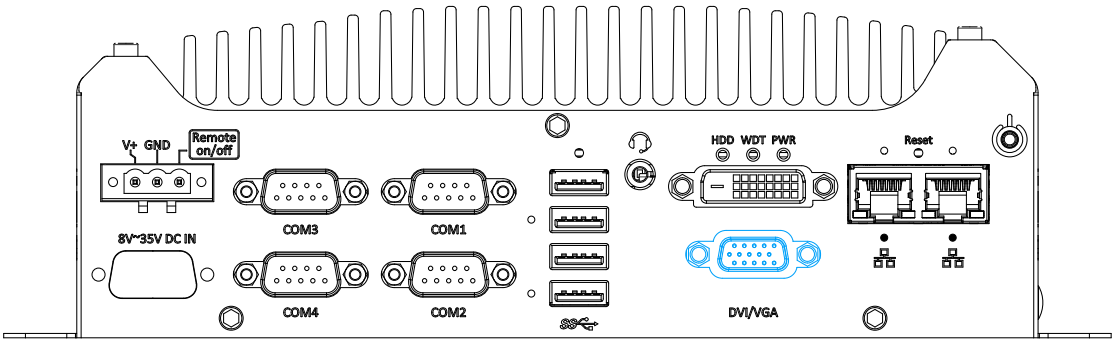


The system has one DVI-D connector on its I/O panel to support independent display output. DVI transmits graphics data in digital format and therefore can deliver better image quality at high resolutions. The DVI connector can output DVI or other digital signals via an adapter or dedicated cable up to 1920 x 1200 resolution.

DVI to HDMI cable

DVI-VGA adapter

2.2.5 VGA Port

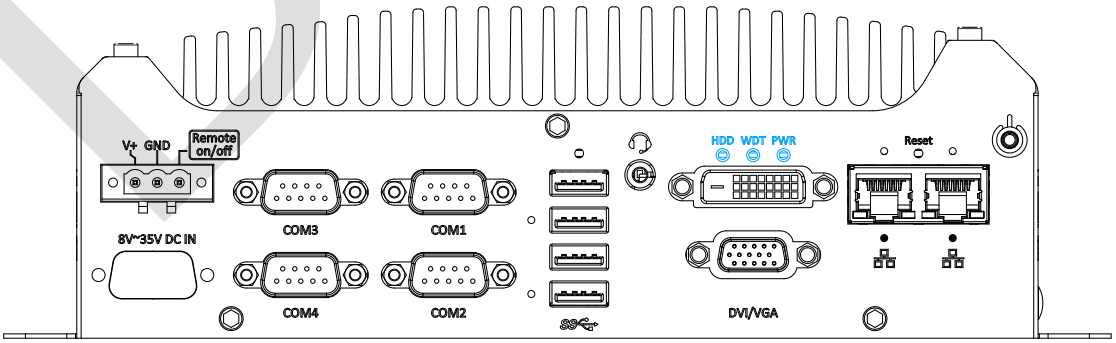


Nuvo-7501 series has dual display outputs on its front panel for connecting different displays according to your system configuration. VGA connector is the most popular way for connecting a display. The VGA output on Nuvo-7501 series supports up to 1920 x 1200 resolution. To support multiple display outputs and achieve best DVI output resolution in Windows, you need to install corresponding graphics driver. Please refer to section 5.5 for information on driver installation.

NOTE

Please make sure your VGA cable includes SDA and SCL (DDC clock and data) signals for correct communication with monitor to get resolution/timing information. A cable without SDA/SCL can cause blank screen on your VGA monitor due to incorrect resolution/timing output.

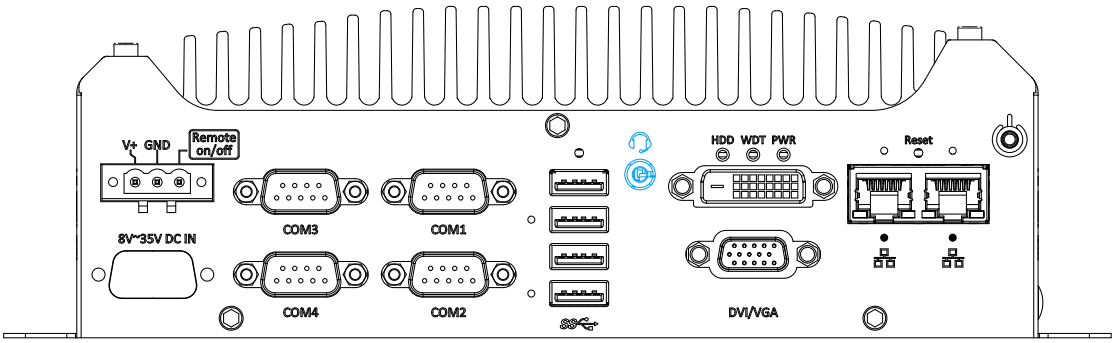
2.2.6 System Status LED



There are three LED indicators on the I/O panel: PWR, WDT and HDD. The descriptions of these three LED are listed in the following table.

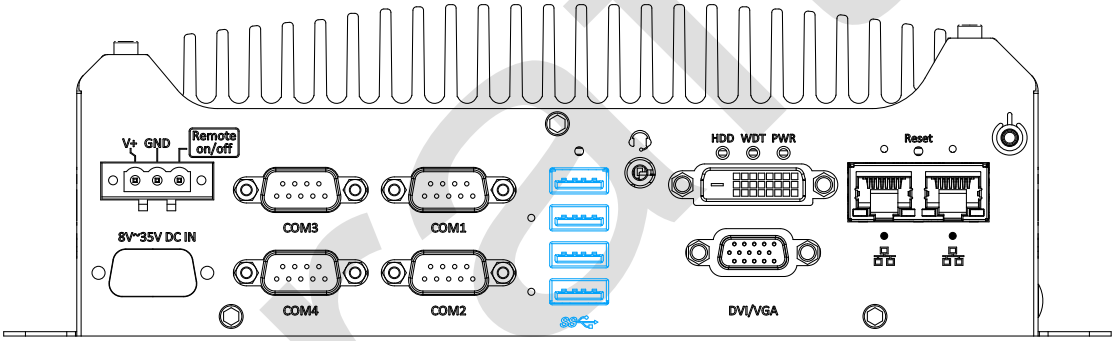
Indicator	Color	Description
PWR	Green	Power indicator, lighted-up when system is on.
WDT	Yellow	Watchdog timer LED, flashing when watchdog timer is started.
HDD	Red	Hard drive indicator, flashing when SATA HDD is active.

2.2.7 4-Pole 3.5mm Microphone-in/ Speaker-out Jack



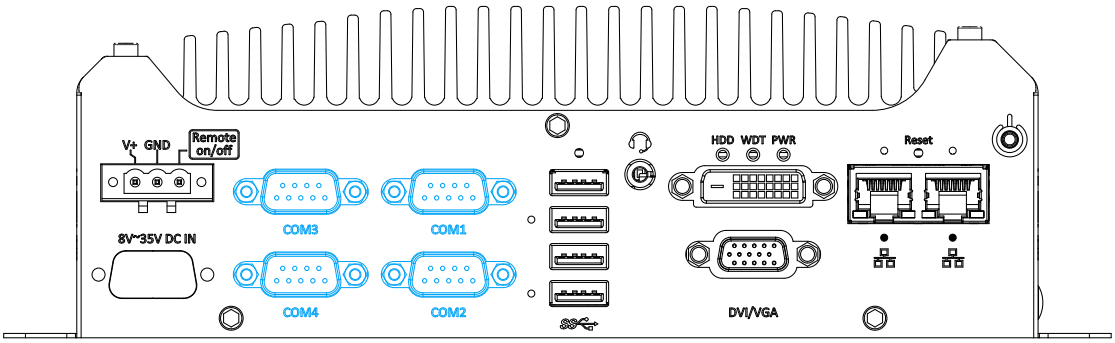
There is a female 4-pole audio jack for headphone (speaker) output and microphone input. To utilize the audio function in Windows, you need to install corresponding drivers. Please refer to the section, Driver Installation.

2.2.8 USB 3.1 Gen1 Port



The system offers four USB 3.1 Gen1 (SuperSpeed USB) ports on its front panel. They are backward compatible with USB 2.0, USB 1.1 and USB 1.0 devices. Legacy USB support is also provided so you can use USB keyboard/mouse in DOS environment while USB 3.1 Gen1 driver is supported natively in Windows 10.

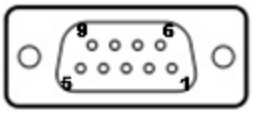
2.2.9 COM Port



The system provides four COM ports for communicating with external devices. These COM ports are implemented using industrial-grade ITE8786 Super IO chip (-40 to 85°C) and provide up to 115200 bps baud rate.

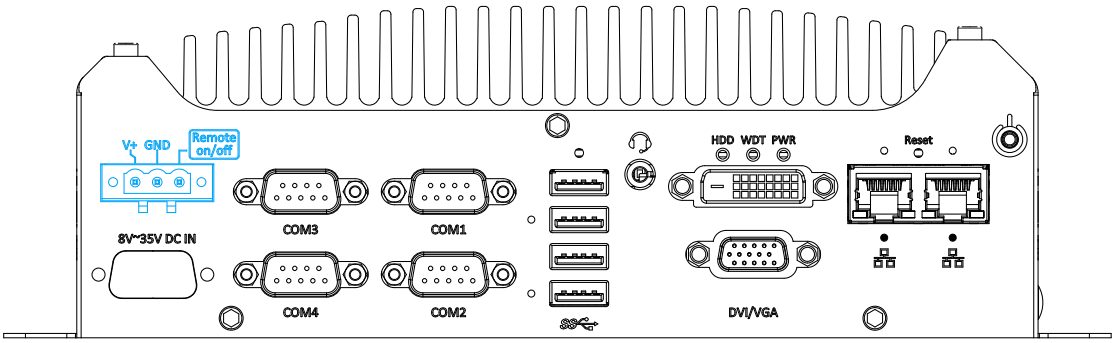
COM1 and COM2 are software-configurable RS-232/422/485 ports. COM3 and COM4 are standard 9-wire RS-232 ports. The operation mode of COM1 and COM2 can be set in BIOS setup utility. The following table describes the pin definition of COM ports.

COM Port Pin Definition



	COM1 & COM2			COM3 & COM4
Pin#	**RS-232 Mode**	**RS-422 Mode**	**RS-485 Mode (Two-wire 485)**	**RS-232 Mode**
1	DCD			DCD
2	RX	422 TXD+	485 TXD+/RXD+	RX
3	TX	422 RXD+		TX
4	DTR	422 RXD-		DTR
5	GND	GND	GND	GND
6	DSR			DSR
7	RTS			RTS
8	CTS	422 TXD-	485 TXD-/RXD-	CTS
9	RI			RI

2.2.10 3-Pin Terminal Block for DC Input

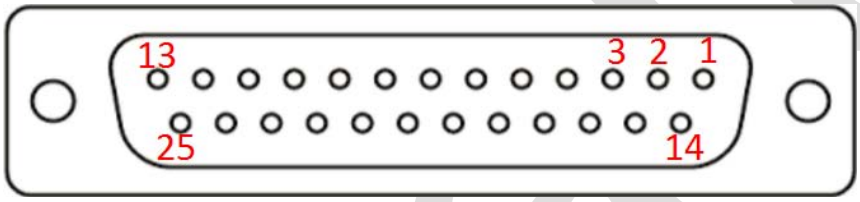


The system allows DC power input from 8 to 35V via a 3-pin pluggable terminal block, which is ideal for field usage where DC power is provided. The screw clamping mechanism of the terminal block offers utmost reliability when wiring DC power.

Symbol	Description
Remote on/off	Connecting to an external switch to turn on/off the system.
GND	Negative polarity (ground) of DC input
V+	Positive polarity of DC input

2.3 Rear Panel DIO Port (Nuvo-7505D Only)

The digital input (DI) and digital output (DO) function provides eight isolated DI and eight isolated DO on the back panel of the system via DB25 female connector.



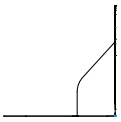
Pin Definition

Pin #	Signal	Pin #	Signal
1	VDD	**14**	DOGND
2	DO0*	**15**	DO1 *
3	DO2 *	**16**	DO3 *
4	DO4	**17**	DO4GND
5	DO5	**18**	DO5GND
6	DO6	**19**	DO6GND
7	DO7	**20**	DO7GND
8	DIGND	**21**	DI0
9	DI4	**22**	DI1
10	DI5	**23**	DIGND
11	DIGND	**24**	DI2
12	DI6	**25**	DI3
13	DI7		

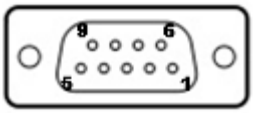
* When using DO0 ~ DO3, DOGND is the ground should be used.

2.4 Rear Panel COM Ports (Nuvo-7505D Only)

There are two additional RS-232 COM ports on the back panel of the system via standard 9-wire connectors.



COM Port Pin Definition



	COM5 & COM6
Pin#	**RS-232 Mode**
1	DCD
2	RX
3	TX
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	RI

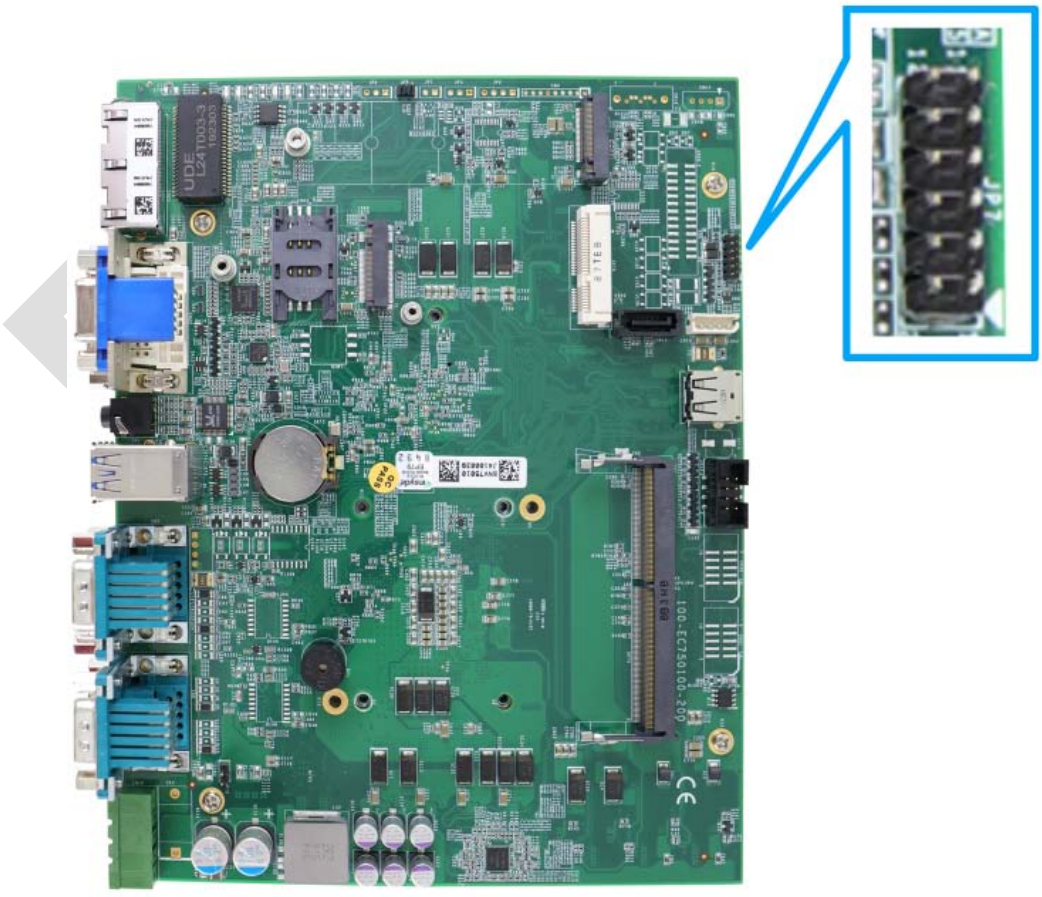
2.5 Internal I/O Functions

In addition to I/O connectors on the front panel, the system also provides internal on-board connectors, such as remote on/off control, LED status output, internal USB 2.0 ports and etc. In this section, we'll illustrate these internal I/O functions.

2.5.1 Status LED Output & Remote On/ Off Control

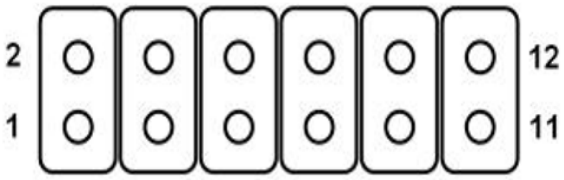
For an application which places the system inside a cabinet, it's useful to have an external system status LED indicators. The system provides a 2x6, 2.0mm pitch pin header to output system status such as power, HDD, watchdog timer, and control system on/ off remotely.

The status LED output has a built-in series-resistor and provides 10mA current to directly drive the external LED indicators. System on/ off control is also provided so you can use an external non-latched switch to turn on/ off the system exactly the same as the power button on the front panel. The following table describes the pin definition of the status LED output.



Location of status LED output & remote on/ off control

Pin Definition

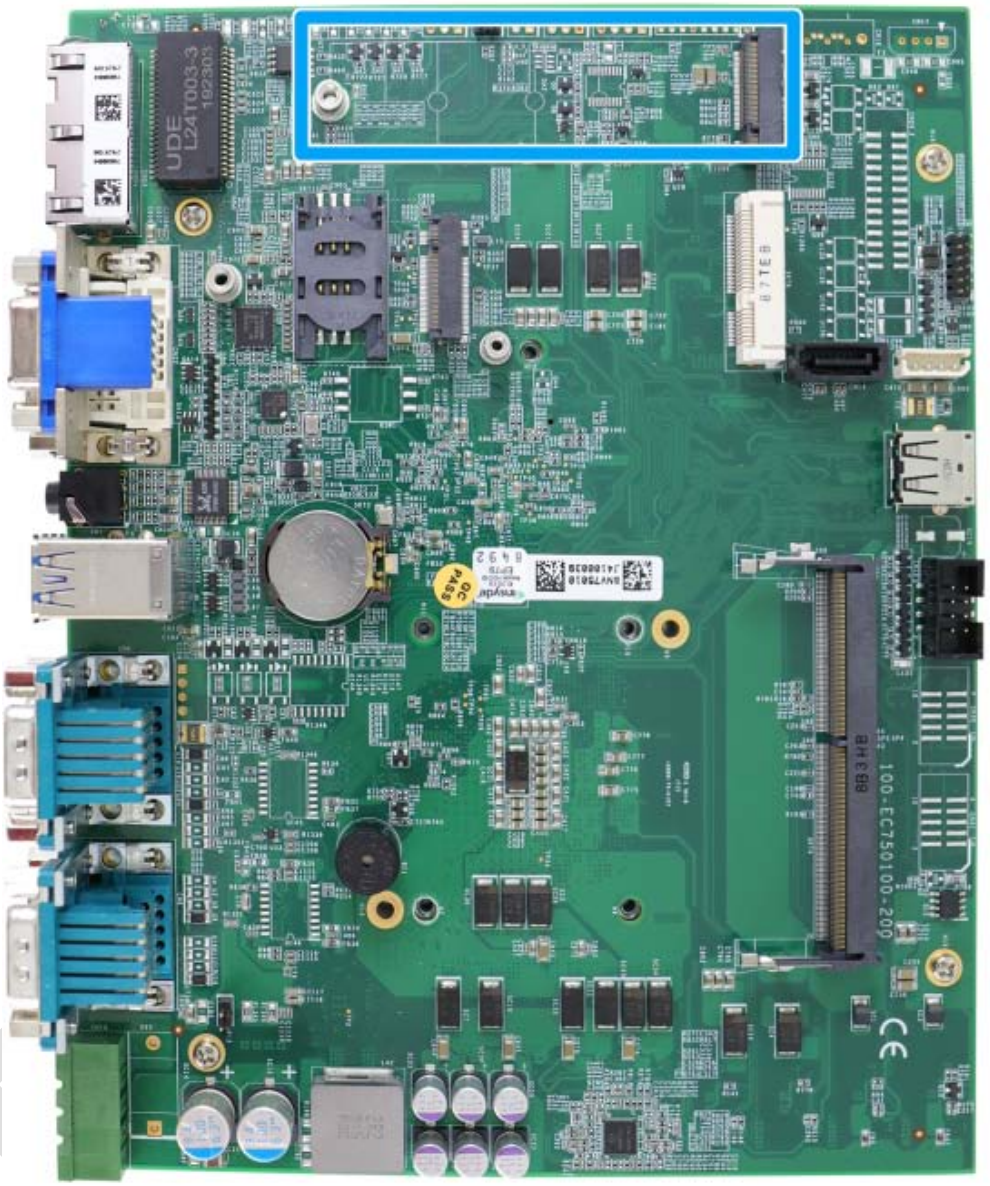


Pin#	Definition	Description
1	WDT_LED-	**[Output]** Watchdog timer indicator, flashing when watchdog timer is started.
2	WDT_LED+	
3	NA	Un-used pin
4	NA	
5	HDD-	**[Output]** Hard drive indicator, flashing when SATA hard drive is active.
6	HDD+	
7	Power_LED-	**[Output]**System power indicator, on if system is turned on, off if system is turned off.
8	Power_LED+	
9	Ctrl-	**[Input]** Remote on/off control, connecting to an external switch to turn on/off the system. (polarity is negligible).
10	Ctrl+	
11	NA	Un-used pin
12	NA	

NOTE

Please make sure the polarity is correct when you connect the external LED indicator to the Status LED Output.

2.5.2 M.2 2280 (M Key) Slot for SSD (SATA Signal Only)

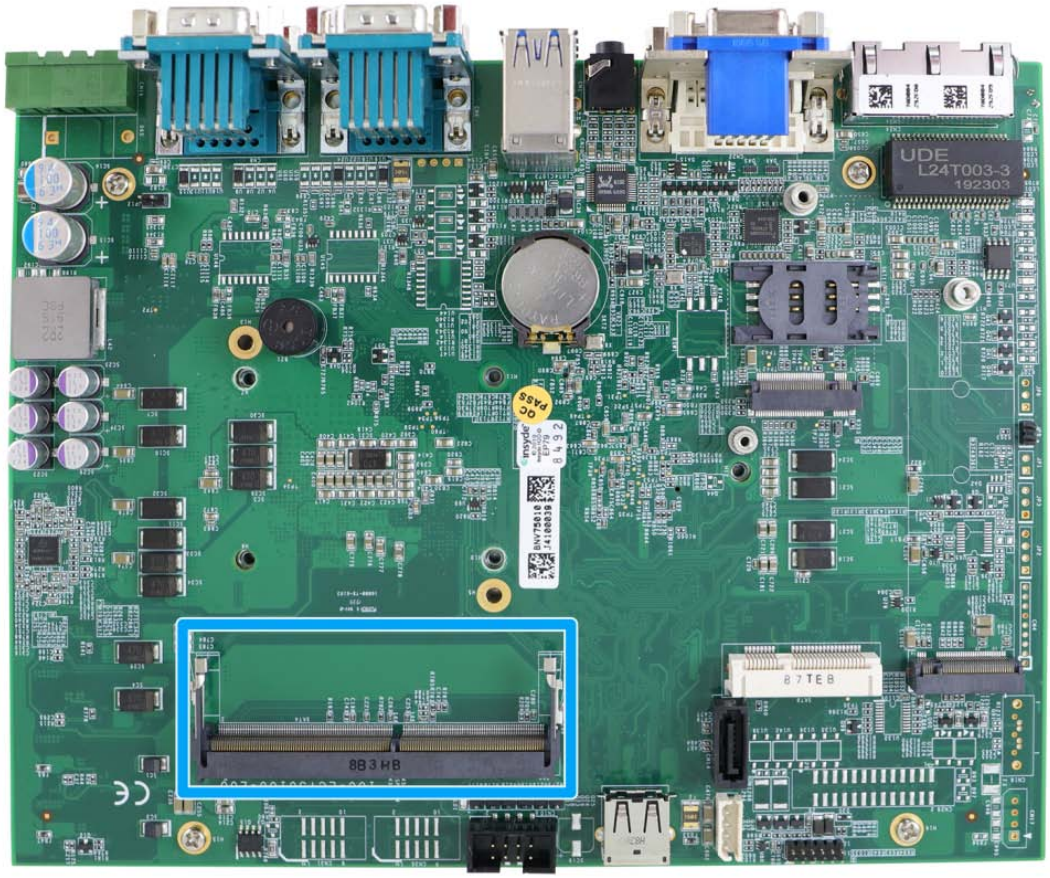


The system has an M.2 2280 slot (SATA signal only) for you to install an M.2 SATA SSD for the fast read and write performance.

NOTE

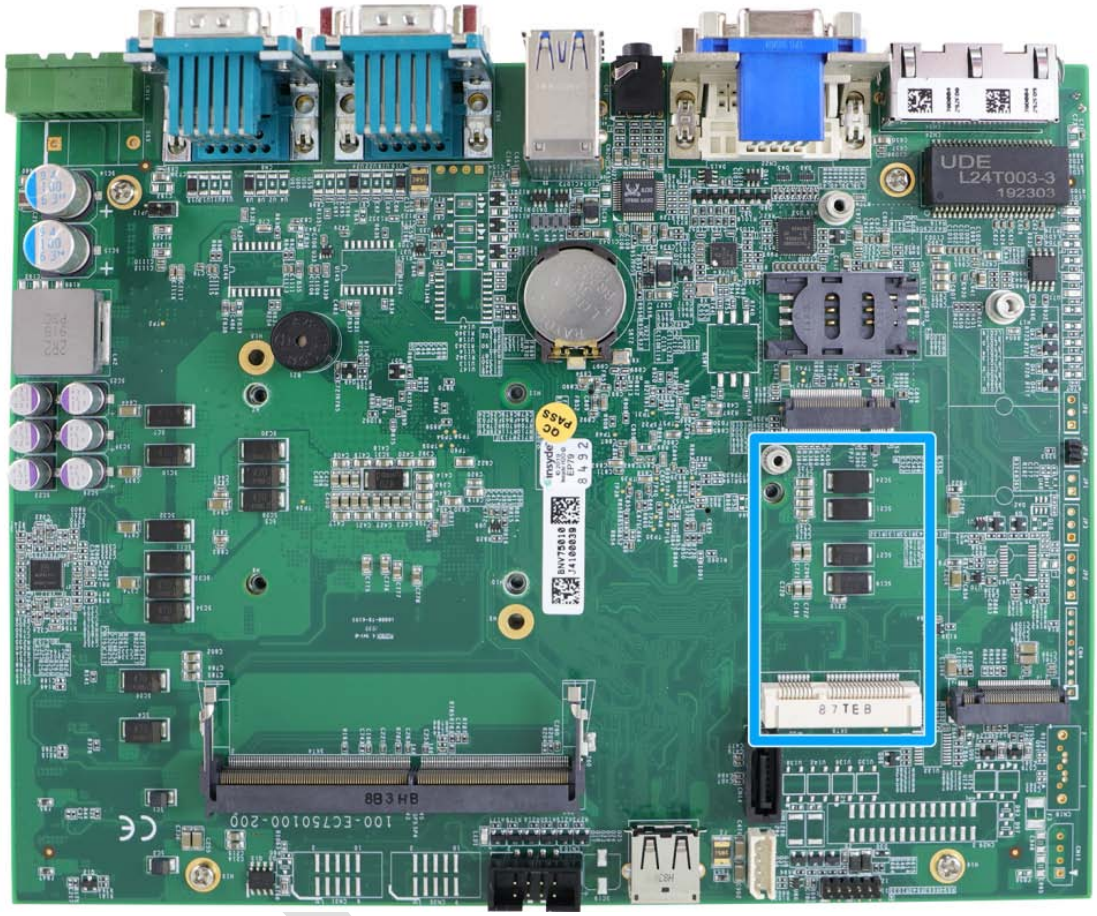
The M.2 slot is only compatible with SATA signal M.2 SSD only.

2.5.3 Single DRAM SO-DIMM Slot



The system motherboard supports one 260-pin SODIMM socket for installing one DDR4-2666/ 2400 memory module up to 32GB capacity.

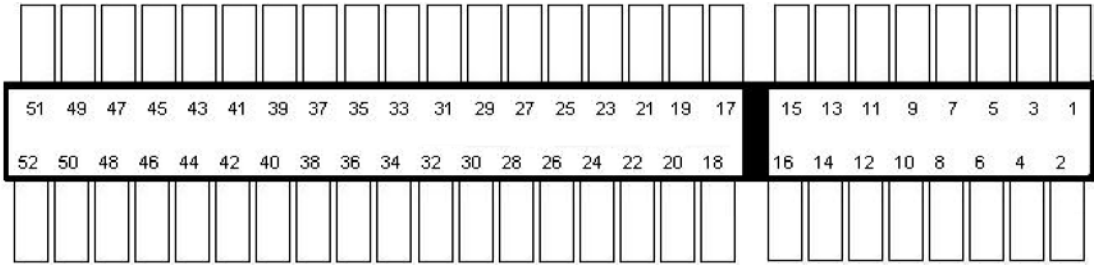
2.5.4 mini-PCIe Slot



The system provides a mini-PCIe socket compliant with mini-PCIe specification rev. 1.2. There are plenty of off-the-shelf mini-PCIe modules with versatile capabilities. By installing a mini-PCIe module, your system can have expanded features such as WIFI, GPS, CAN bus, analog frame grabber, etc.

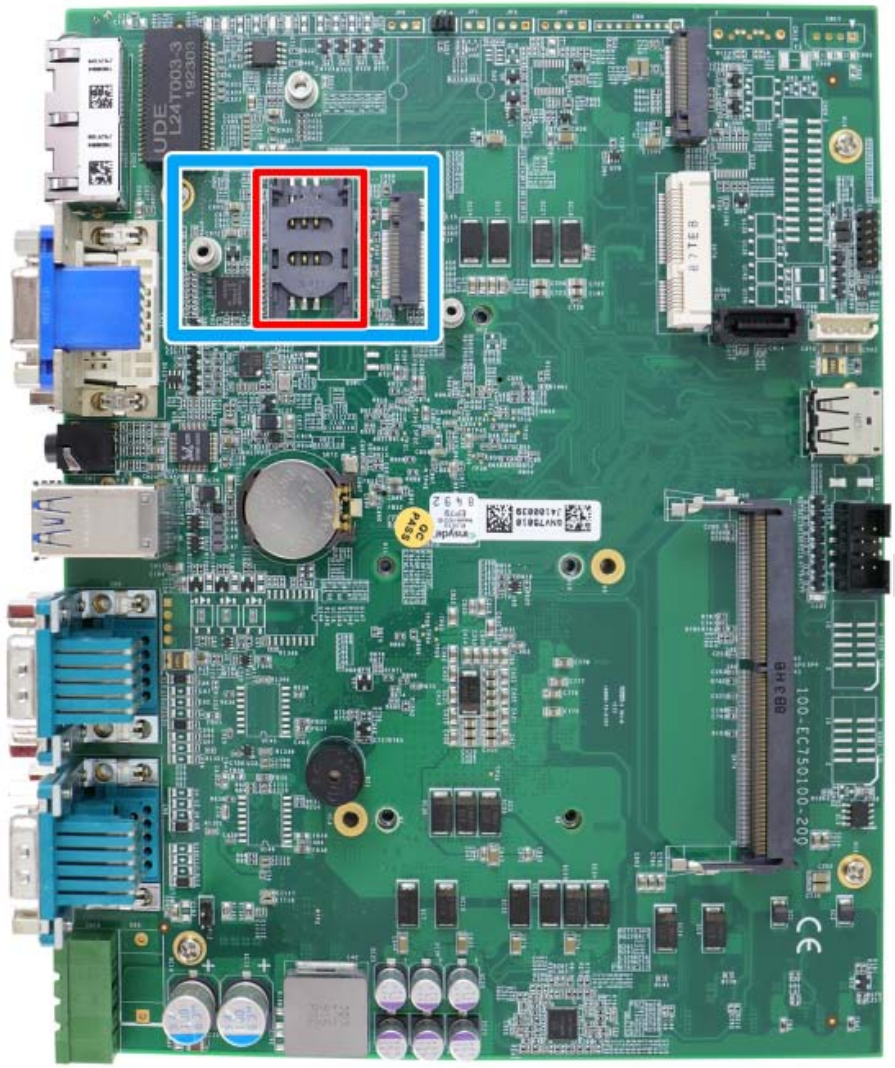
For SMA antenna installation, there are dedicated openings located on the side of the chassis.

mini-PCIe slot definition



Pin #	Signal	Pin #	Signal
1	WAKE#	**2**	+3.3Vaux
3	COEX1	**4**	GND
5	COEX2	**6**	+1.5V
7	CLKREQ#	**8**	UIM_PWR
9	GND	**10**	UIM_DATA
11	REFCLK-	**12**	UIM_CLK
13	REFCLK+	**14**	UIM_RESET
15	GND	**16**	UIM_VPP
Mechanical Key			
17	Reserved* (UIM_C8)	**18**	GND
19	Reserved* (UIM_C4)	**20**	W_DISABLE#
21	GND	**22**	PERST#
23	PERn0	**24**	+3.3Vaux
25	PERp0	**26**	GND
27	GND	**28**	+1.5V
29	GND	**30**	SMB_CLK
31	PETn0	**32**	SMB_DATA
33	PETp0	**34**	GND
35	GND	**36**	USB_D-
37	GND	**38**	USB_D+
39	+3.3Vaux	**40**	GND
41	+3.3Vaux	**42**	LED_WWAN#
43	GND	**44**	LED_WLAN#
45	Reserved	**46**	LED_WPAN#
47	Reserved	**48**	+1.5V
49	Reserved	**50**	GND
51	Reserved	**52**	+3.3Vaux

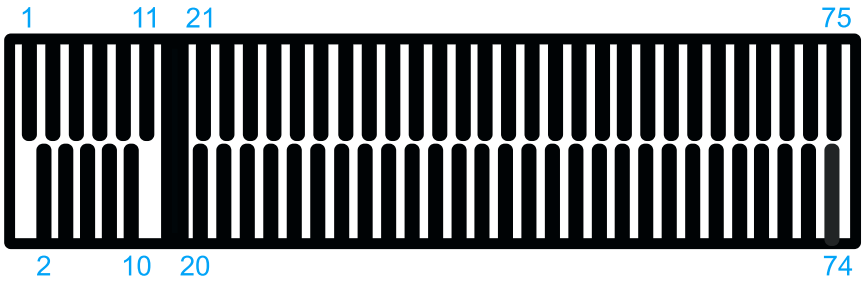
2.5.5 M.2 2242 and SIM Card Slot



The system has a M.2 2242 (indicated in **blue**) slot that works in cooperation with a SIM slot (indicated in **red**). By installing a M.2 module, you can install a 3G/ 4G module with a SIM card for internet access via your service provider's 3G/ 4G network.

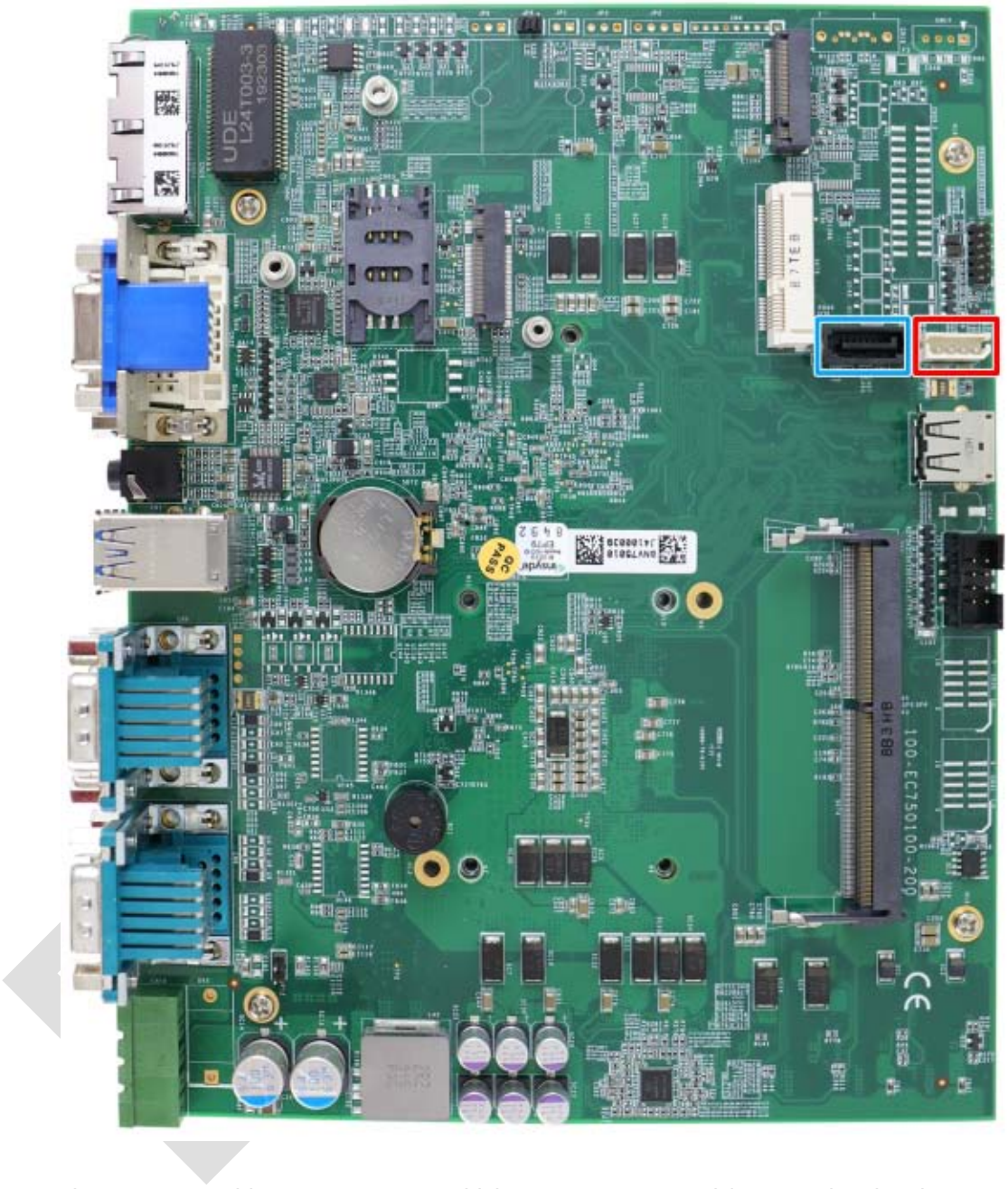
For SMA antenna installation, there are dedicated openings located on the side of the chassis.

M.2 Slot Pin Definition



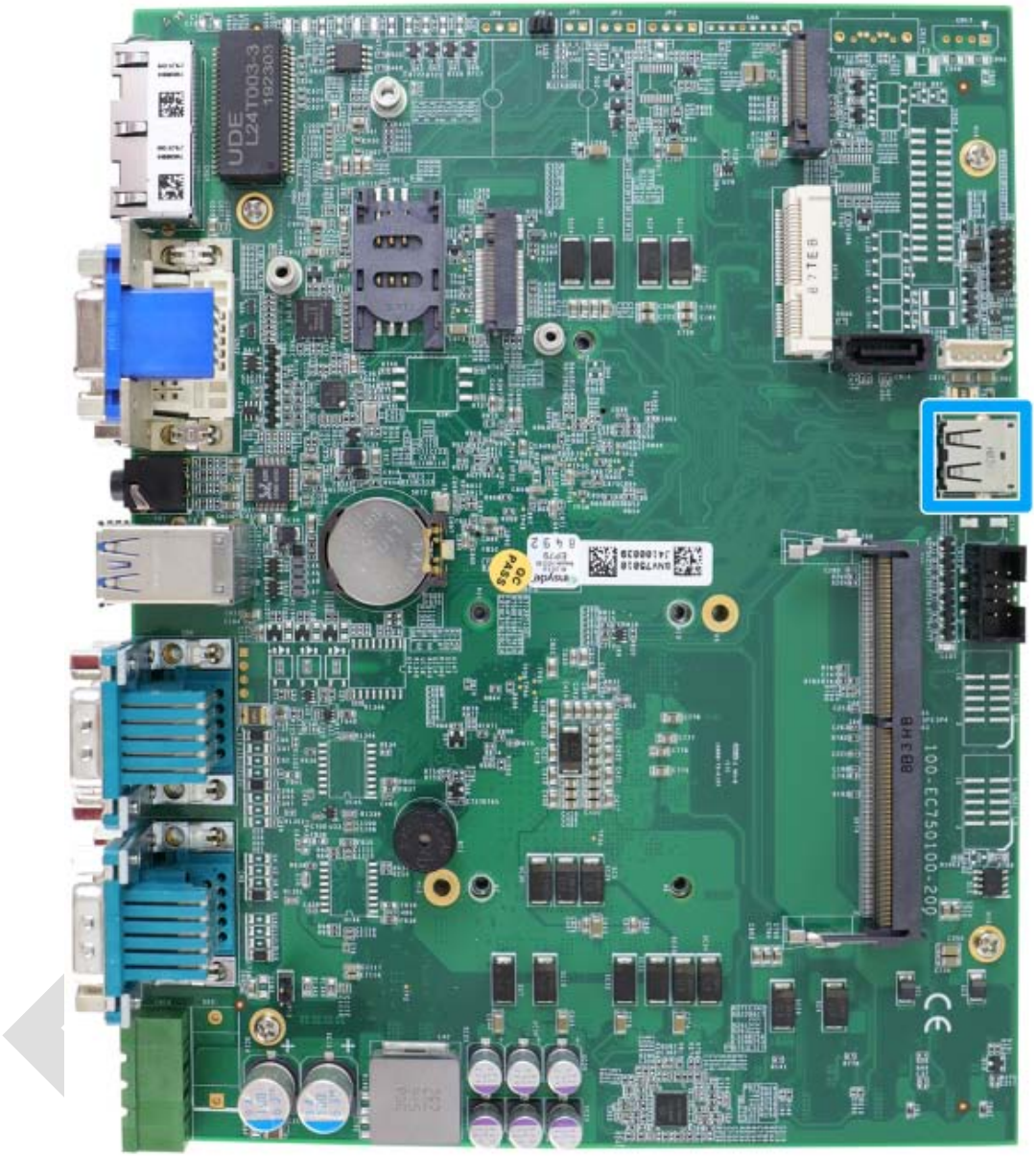
Pin #	Signal	Pin #	Signal
1	-	2	P3V3
3	GND	4	P3V3
5	GND	6	-
7	USB_D+	8	-
9	USB_D-	10	-
11	GND	12	KEY
13	KEY	14	KEY
15	KEY	16	KEY
17	KEY	18	KEY
19	KEY	20	-
21	-	22	-
23	-	24	-
25	-	26	-
27	GND	28	-
29	-	30	UIM_RST
31	-	32	UIM_CLK
33	GND	34	UIM_DATA
35	-	36	UIM_PWR
37	-	38	-
39	GND	40	-
41	-	42	-
43	-	44	-
45	GND	46	-
47	-	48	-
49	-	50	PLTRST
51	GND	52	-
53	-	54	-
55	-	56	-
57	GND	58	-
59	-	60	-
61	-	62	-
63	-	64	-
65	-	66	-
67	PLTRST	68	-
69	-	70	P3V3
71	GND	72	P3V3
73	GND	74	P3V3
75	-		

2.5.6 SATA Port



The system provides one SATA port which support Gen3, 6 Gb/s SATA signals. The SATA port is composed of a 7-pin SATA connector (indicated in blue) and a 4-pin power connector (indicated in red). A dedicated cable is shipped with the system to provide a standard 22-pin SATA connector to the installed device.

2.5.7 Internal USB Port



The system provides one additional USB port internally on the PCBA. It supports standard USB 2.0 signals. You can utilize this USB port to connect a USB protection dongle inside the chassis of the controller.

> **WARNING**
>
> ***DO NOT*** *use a USB flash drive with a metallic enclosure that conducts electricity which may short-circuit the motherboard!*

3 System Installation

Before disassembling the system enclosure and installing components and modules, please make sure you have done the following:

- It is recommended that only qualified service personnel should install and service this product to avoid injury or damage to the system.
- Please observe all ESD procedures at all times to avoid damaging the equipment.
- Before disassembling your system, please make sure the system has powered off, all cables and antennae (power, video, data, etc.) are disconnected.
- Place the system on a flat and sturdy surface (remove from mounts or out of server cabinets) before proceeding with the installation/ replacement procedure.

3.1 Disassembling the System

To access system internal components, the system needs to be disassembled. To disassemble the system enclosure, you need to remove screws on the I/O panel, removable and side panel.

1. On the I/O panel side, unscrew the three (3) screws shown below.

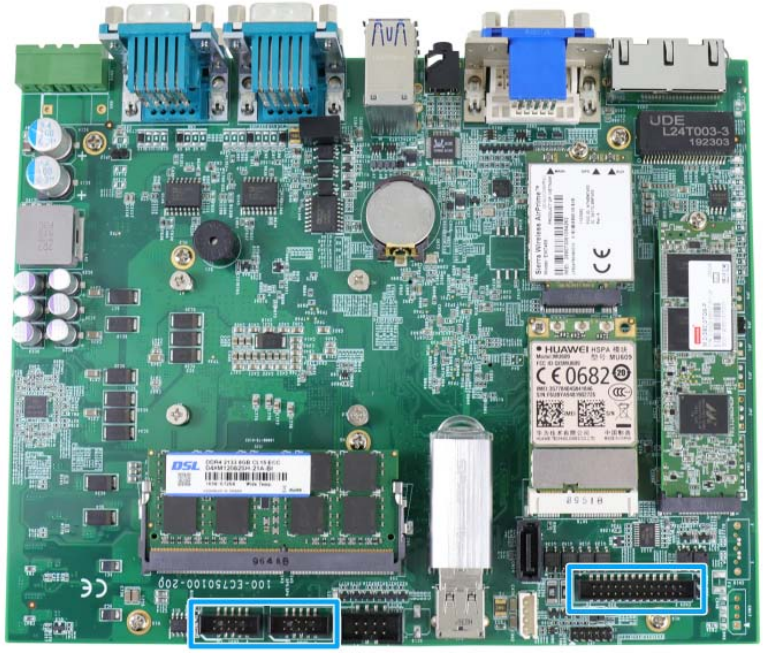
2. Unscrew the four (4) screws shown on top of the enclosure.

3. Unscrew the three (3) screws (indicated in blue) to remove the rear panel.

4. Unscrew the four (4) screws at the bottom of the system.

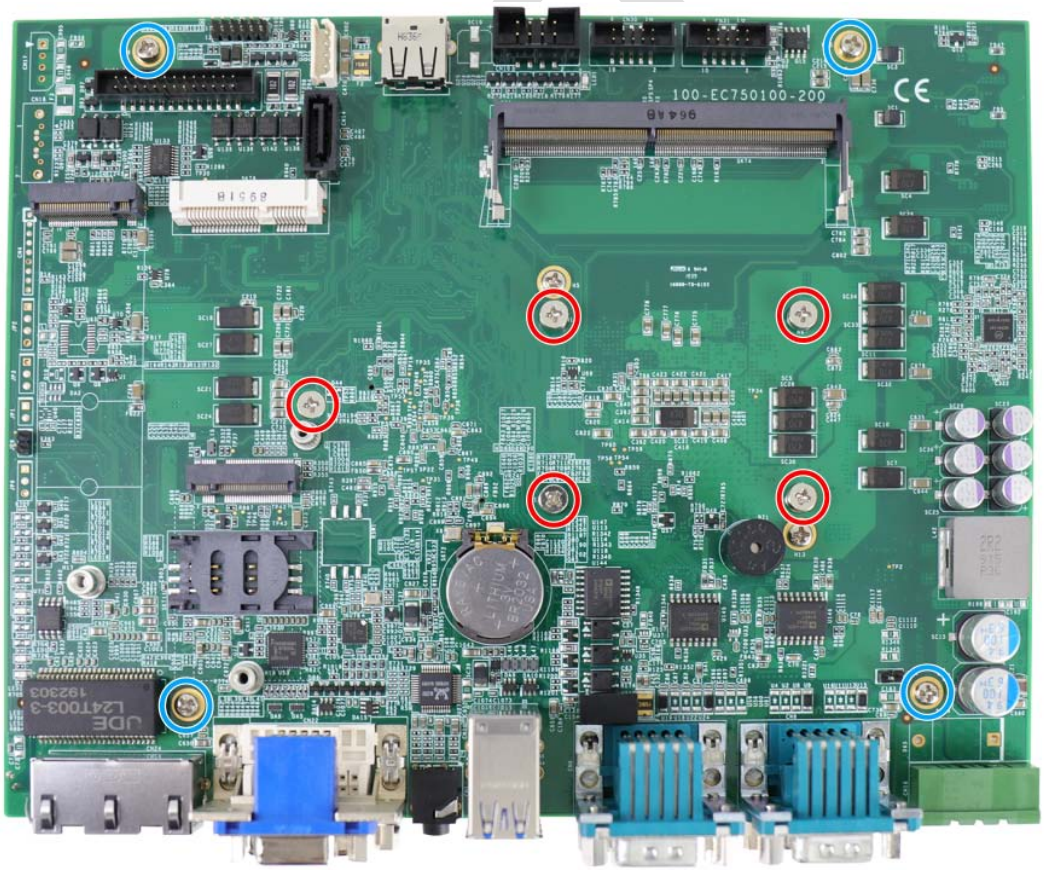
5. Gently lift and remove the bottom panel.

6. For Nuvo-7501-DIO, you must disconnect the DIO and COM port connections to the motherboard before removing the enclosure.



3.2 CPU Installation

1. **DO NOT** remove the CPU from its container / tray before it is ready to be installed.
2. With the enclosure panels removed, to access the CPU socket, please do the following:
   i. If you are installing a CPU for the first time, remove the four (4) screws indicated in **blue**.
   ii. If you see the five (5) screws indicated in **red**, the system may already have a CPU installed. To gain access to the CPU socket, you will also need to remove the five (5) screws indicated in **red**.



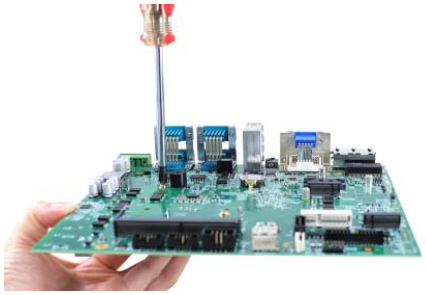
3. Between the motherboard and the heatsink, you'll see the CPU socket protective cover, place finger tips underneath the sign "REMOVE" for leverage and gently lift the cover.

> **WARNING**
>
> *With the protective cover removed, please be careful when handling the motherboard. DO NOT touch the pins in the LGA socket!*

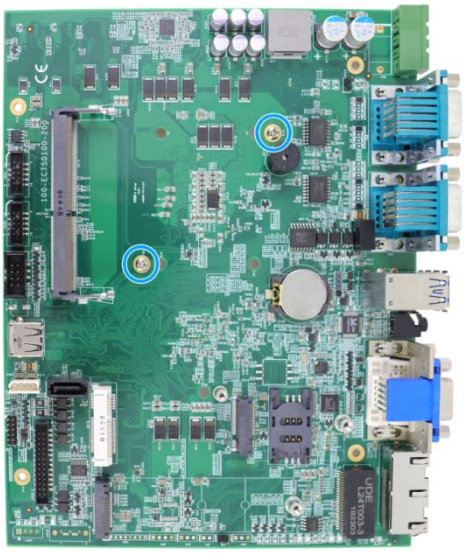
4. Remove the CPU from its container/ tray. Match the two notches on the side to the protrusions in the socket, gently lower the CPU into the socket.

5. Locate the CPU retention bracket from the accessory box. Place the retention bracket on the CPU and hold it in place.

6. Turn the motherboard around and secure the bracket by tightening two M3 P-head screws.

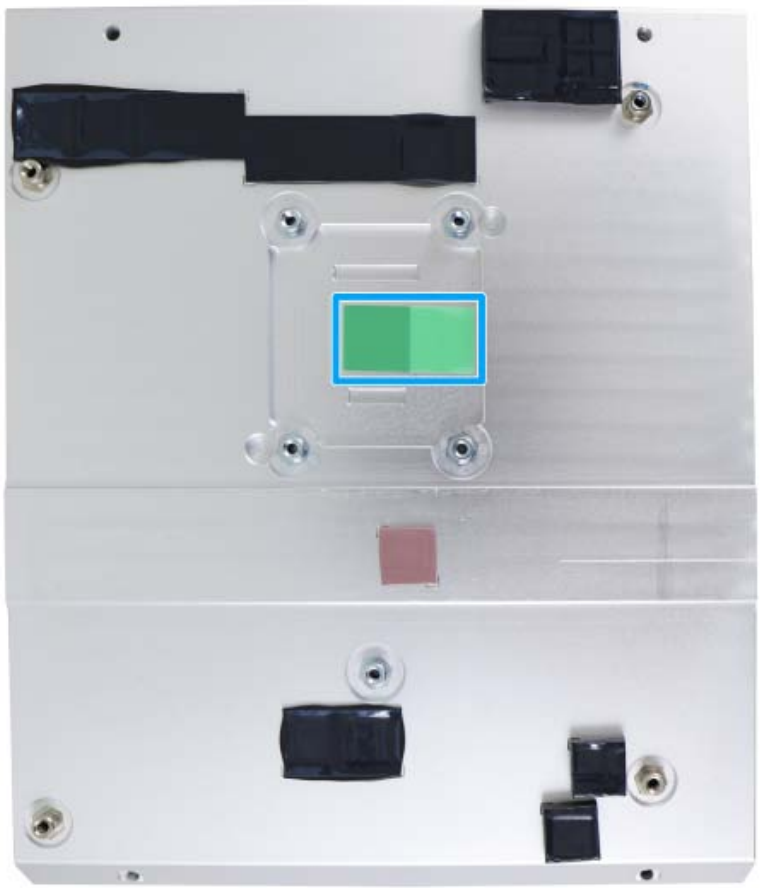


Hold CPU bracket firmly and turn the motherboard around

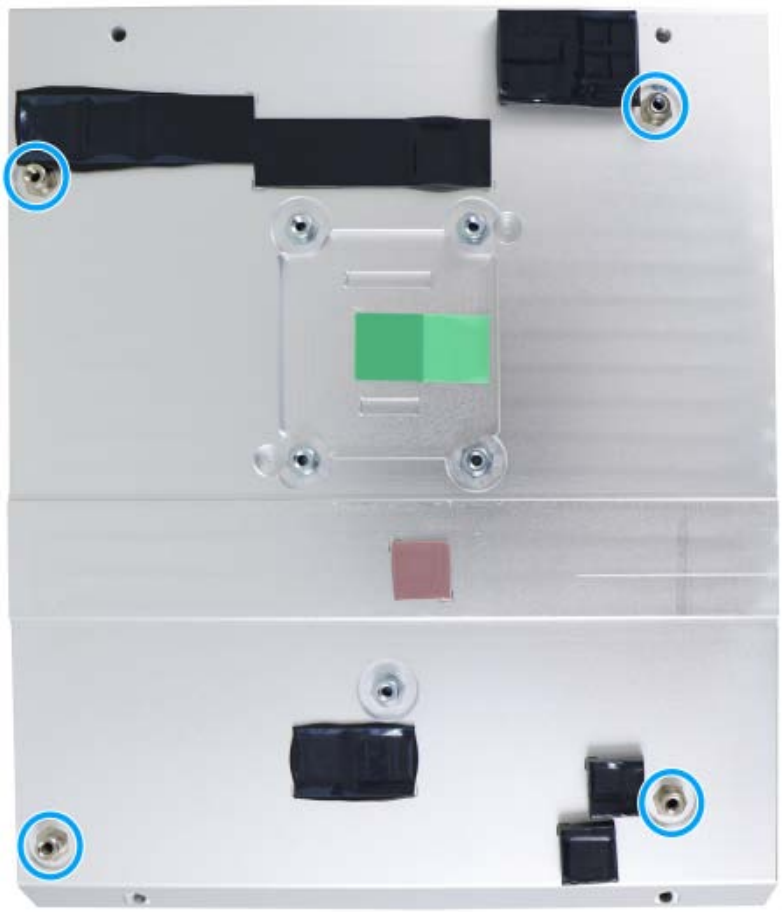


Secure two M3 P-head screws

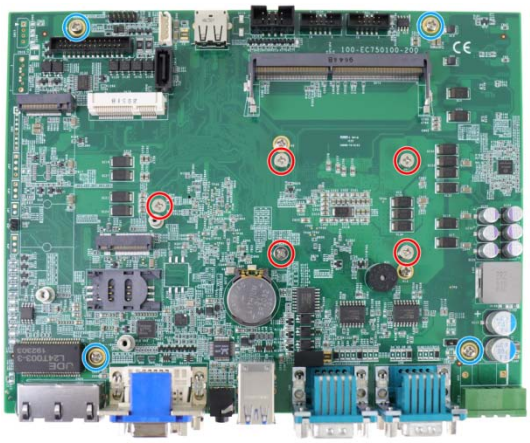
7. Remove the CPU's thermal pad protective film on the heatsink.



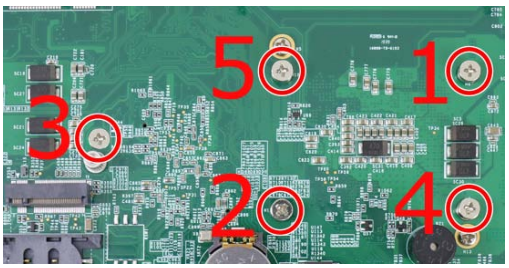
8. With the four motherboard standoffs aligned, gently lower the motherboard onto the heatsink.



9. Secure the four (4) M3 P-head motherboard screws (indicated in **blue**) and from the accessory box, five (5) M3 spring screws (indicated in **red**). Gradually tighten the five screws in the following order for even pressure.



Securing the motherboard



Secure five CPU/ heatsink spring screws in order

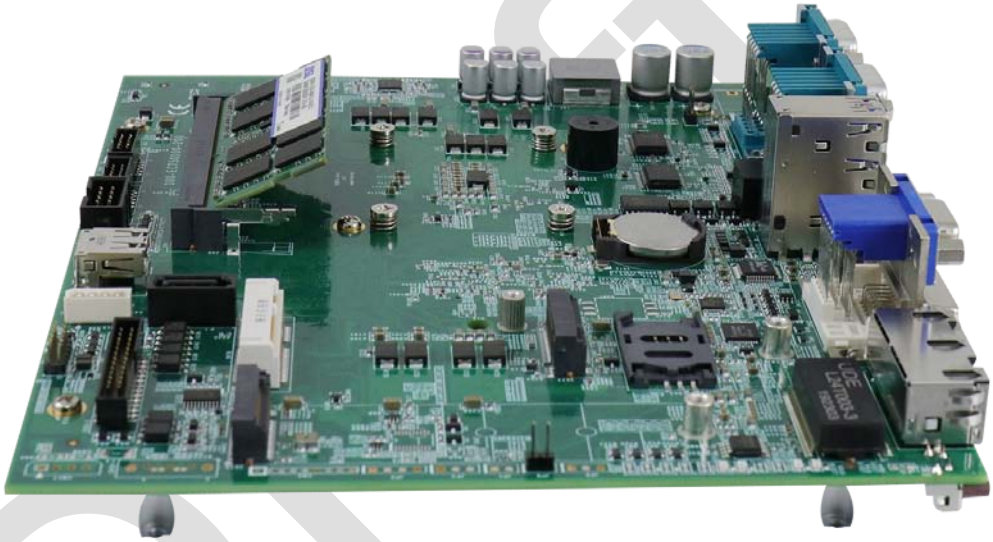
10. Reinstall the system enclosure and panel when done.

If you need to install other components, please refer to respective sections.

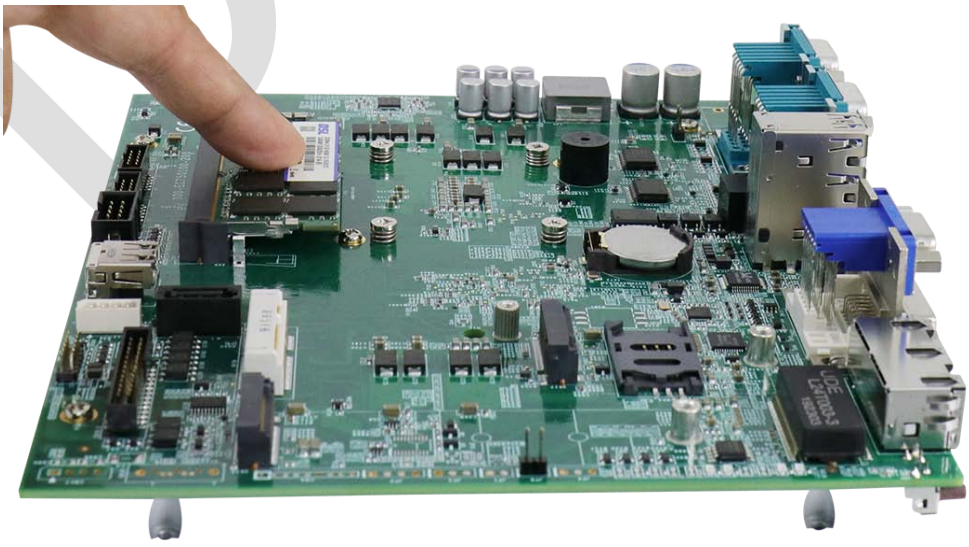
3.3 DDR4 SO-DIMM Installation

There is a single memory SO-DIMM slot on the motherboard that supports up to 32GB DDR4-2666/ 2400. Please follow the procedures below to replace or install the memory modules.

1. Please refer to the section "Disassembling the System", you may not need to completely dismantle the system to gain access to the memory module slots.
2. Locate the SODIMM memory module slot on the motherboard.
3. To install the memory module, insert gold fingers of the module into the slot at 45 degree angle, push down on the edge of the module and the clips on the side should clip the module into position.



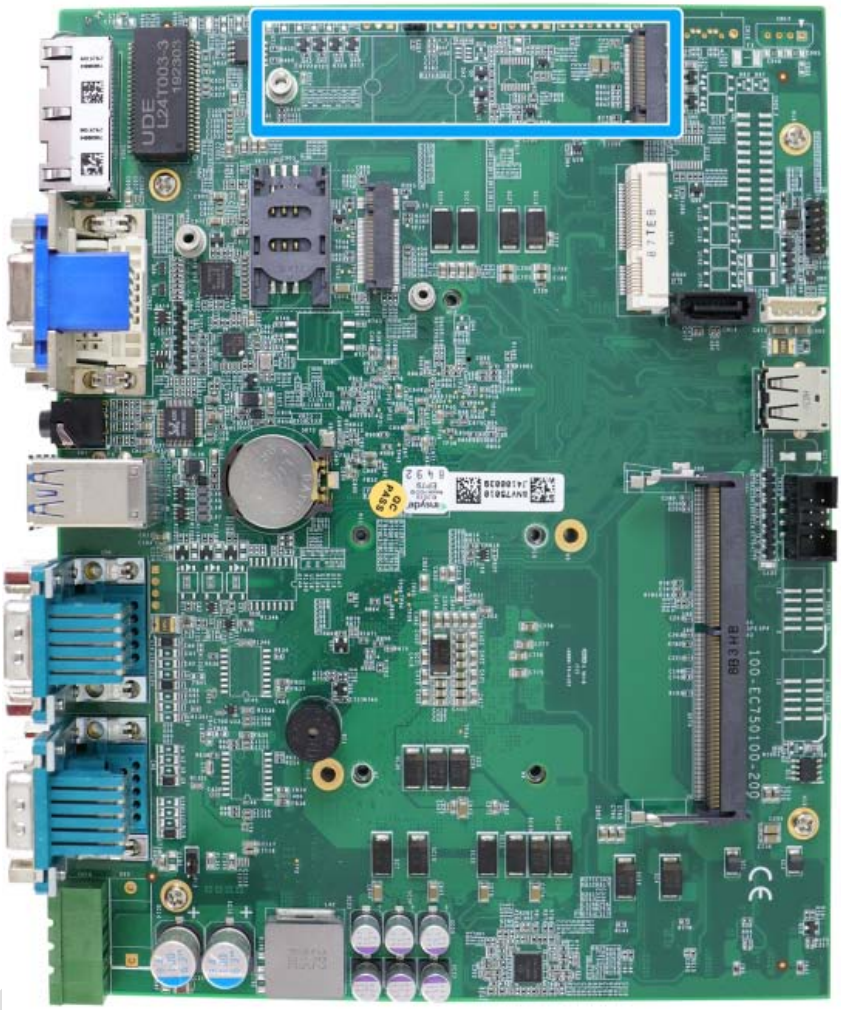
4. Push the memory module down until it is clipped-in.



5. Reinstall the system enclosure and panel when done.

If you need to install other components, please refer to respective sections.

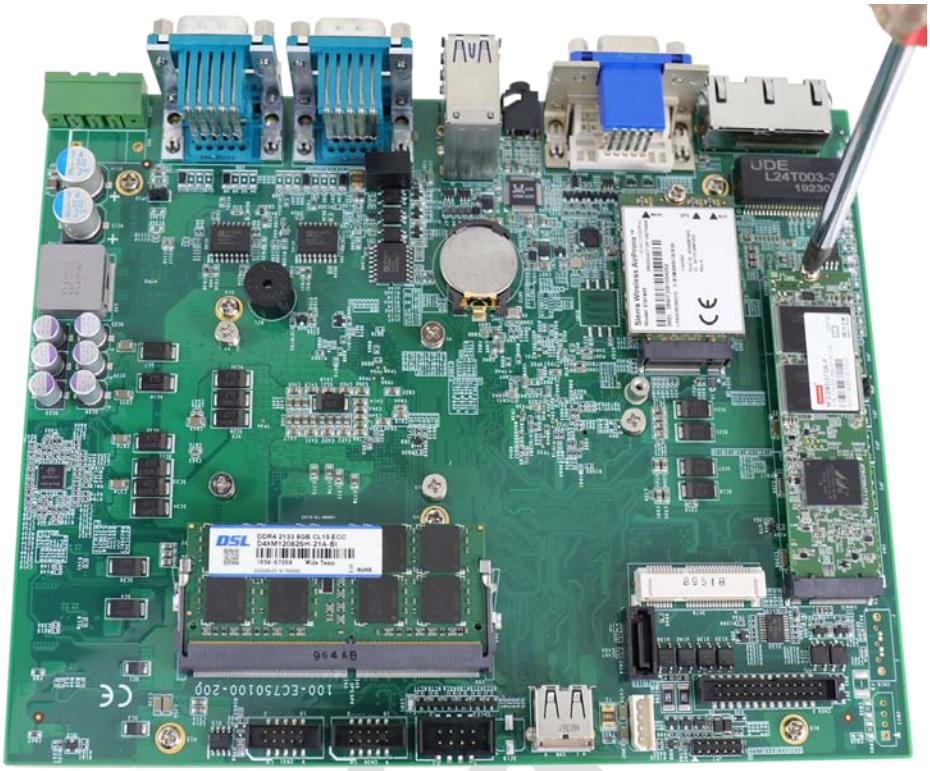
3.4 SATA M.2 2280 SSD Installation



The system has an SATA signal M.2 2280 slot for you to install an SATA M.2 SSD for fast read and write performance. For installation, please refer to the following instructions.

1. Please refer to the section “Disassembling the System”, you may not need to completely dismantle the system to gain access to the M.2 slot.
2. Insert the module on a 45 degree angle.

3. Gently press down and secure the module with an M2.5 P-head screw.

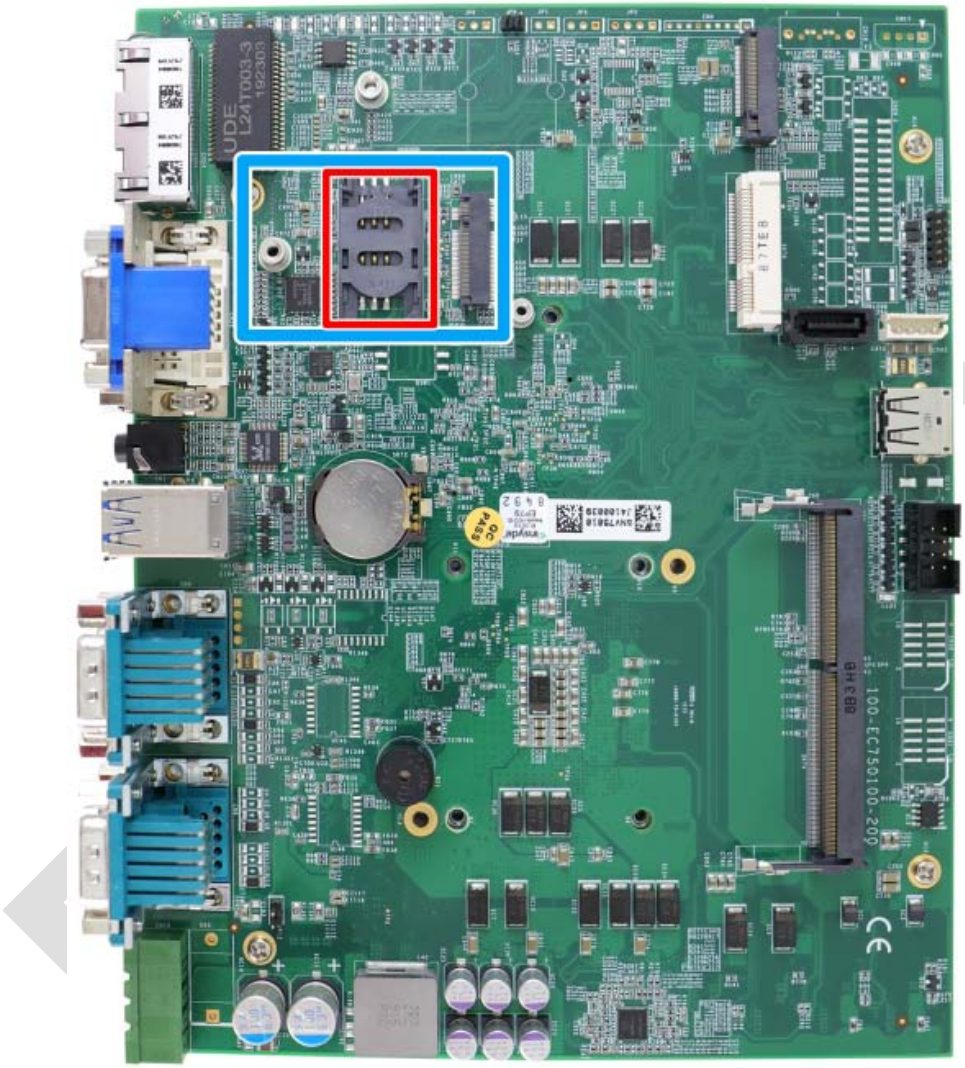


4. Reinstall the system enclosure and panel when done.

5. If you need to install other components, please refer to respective sections.

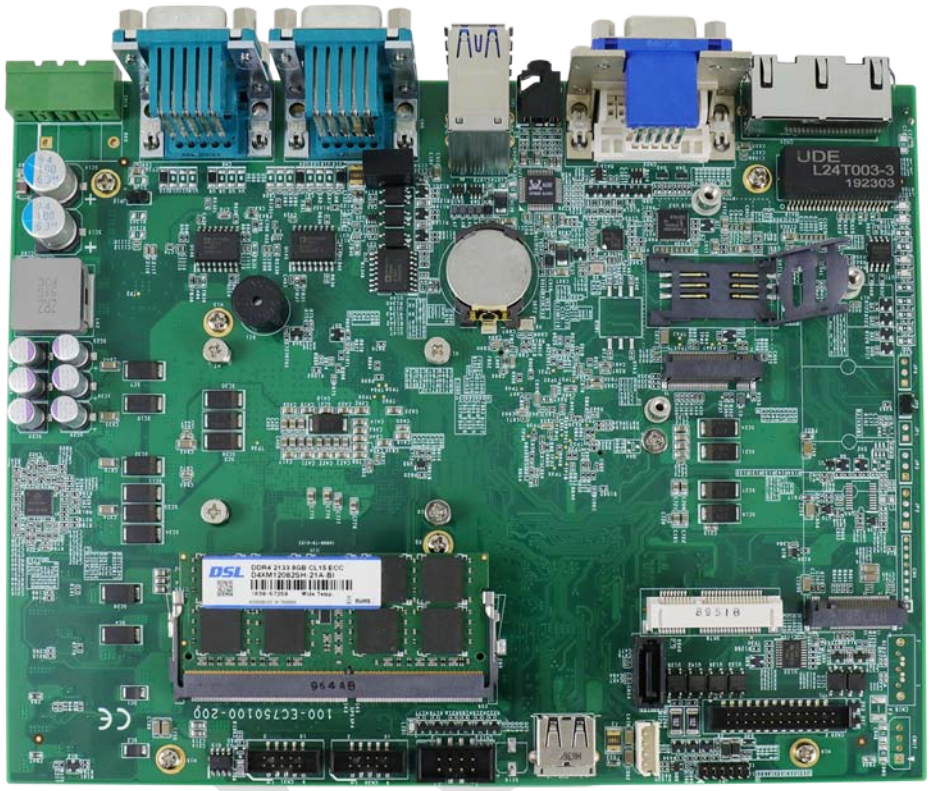
3.5 M.2 Module Installation

The system has a M.2 slot (indicated in **blue**) coupled with SIM socket (indicated in **red**) for installing 3G/ 4G module. For installation, please refer to the following instructions.



1. Please refer to the section “Disassembling the System”, you may not need to completely dismantle the system to gain access to the M.2 slot and SIM socket.

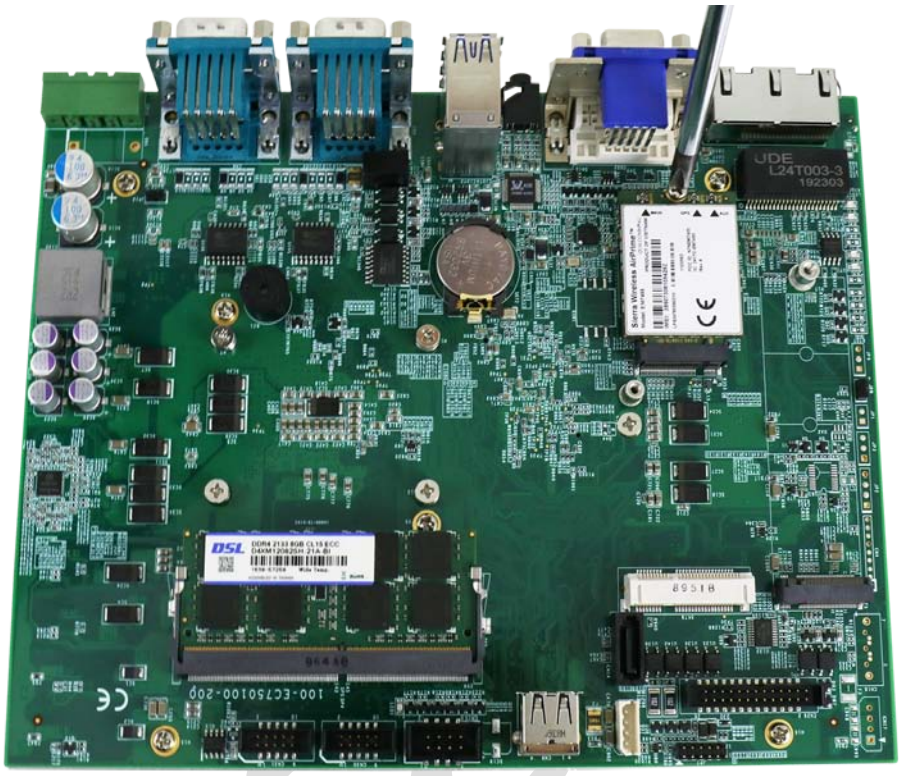
2. Before installing the M.2 module, you need to insert the SIM card. Slide the SIM slot towards the outside of the motherboard and lift the SIM card holder. Insert the SIM card (pins facing up), and slide it towards the left to lock the SIM card in-place.



3. Shut the SIM holder and secure it by sliding the holder towards the center of the motherboard.

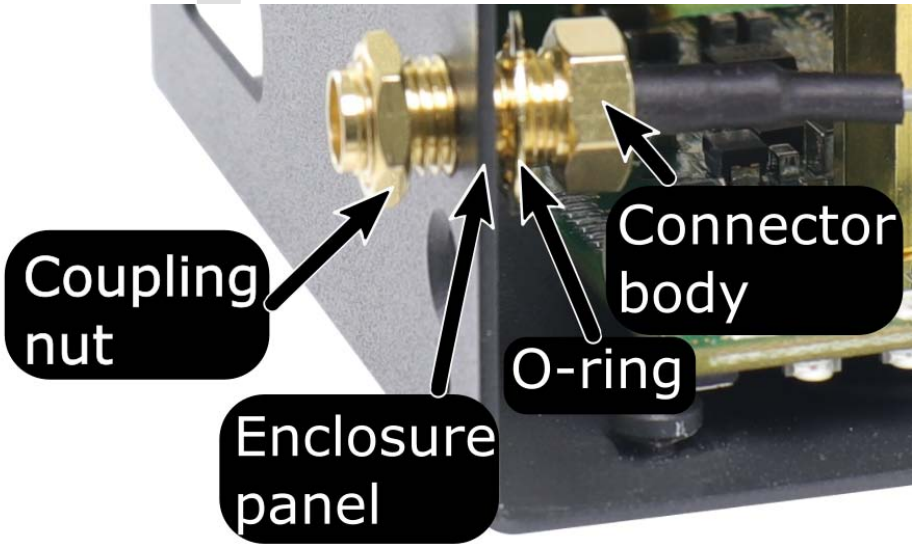
4. Insert the M.2 module on a 45 degree angle into the M.2 slot.

5. Secure the M.2 module.



6. Clip on the IPEZ-to-SMA cable to the module (please refer to the module's user manual on antennae cable connection)

7. Secure the antenna to the enclosure panel.

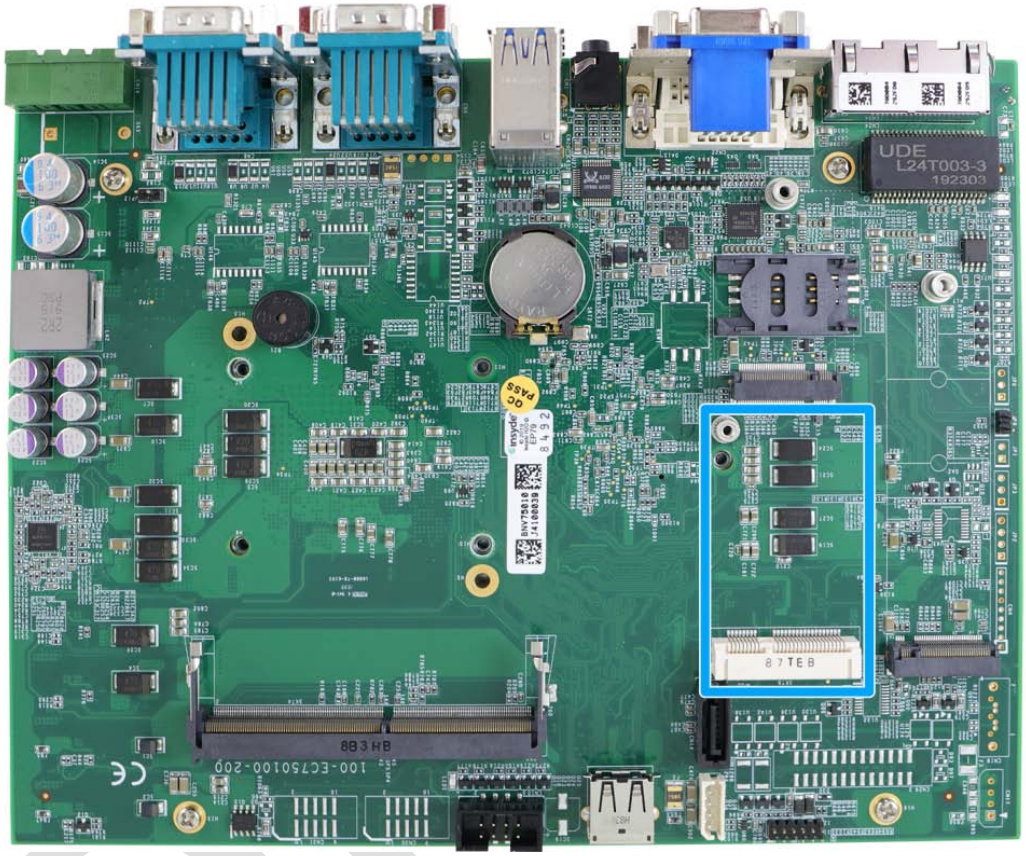


8. Reinstall the system enclosure, panel and attach the external antenna.

If you need to install other components, please refer to respective sections.

3.6 mini-PCIe Module Installation

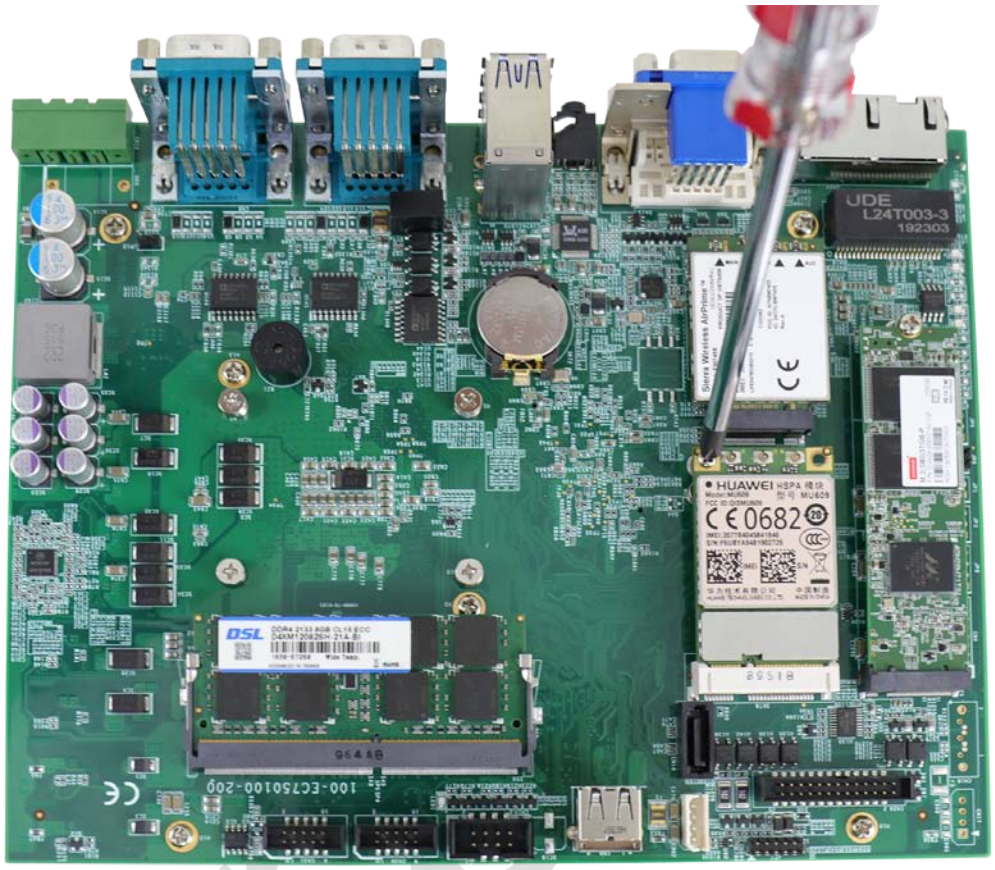
The system has one mini-PCIe slot. To install a mini-PCIe module, please refer to the following instructions.



1. Please refer to the section “Disassembling the System”, you may not need to completely dismantle the system to gain access to the mini-PCIe slot.

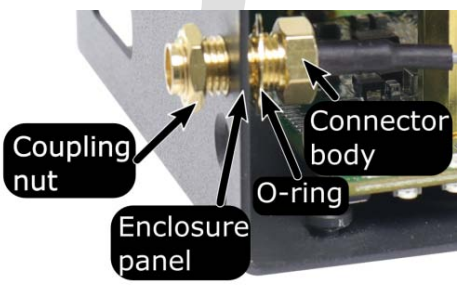
2. Insert the module on a 45 degree angle.

3. Gently press down and secure the module with two M2.5 P-head screws



4. Clip on the IPEZ-to-SMA cable to the module and secure the antenna to the side panel. Please refer to the module's manual for clip-on connection.

5. Secure antenna to side panel



Secure on side panel **Antenna installation**

6. Reinstall the system enclosure, panel and external antenna.

If you need to install other components, please refer to respective sections.

3.7 HDD/ SSD Installation

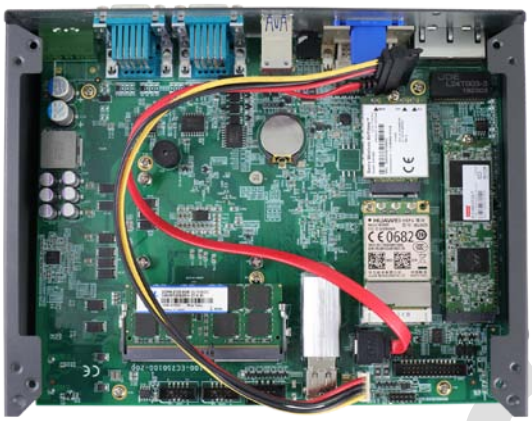
The system has one SATA port, you can install a 2.5” HDD/ SSD or a 3.5” HDD into the system. Please refer to the following instructions:

3.7.1 2.5” HDD/ SSD Installation

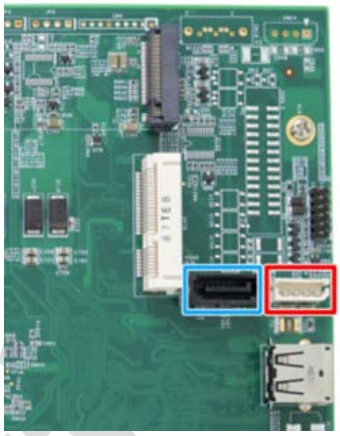
1. Please refer to the section “Disassembling the System” to gain access to SATA port.
2. Secure 2.5” HDD/ SSD on the HDD/SSD bracket with 4 M3 flat-head screws.

3. Secure 2.5” HDD/ SSD and the bracket onto the chassis with M3 flat head screw.

4. Connect 2.5" HDD/ SSD to the motherboard with SATA (indicated in **blue**) and power (indicated in **red**) cable.



Cable connections



SATA/ power connectors

5. Reinstall the system enclosure and panel when done.

If you need to install other components, please refer to respective sections.

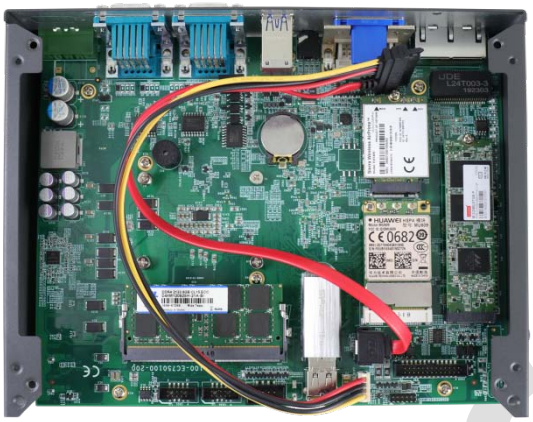
3.7.2 3.5” HDD Installation

1. Please refer to the section “Disassembling the System” to gain access to SATA port.

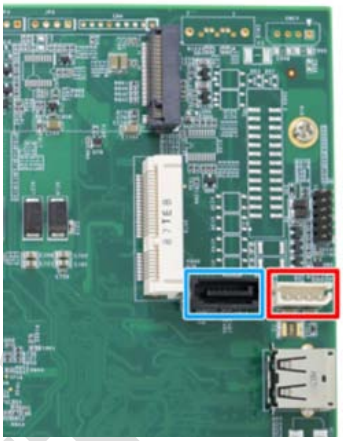
2. Secure 3.5” HDD on the HDD/SSD bracket with #6-32 flat-head screws.

3. Secure 3.5” HDD and the bracket on the chassis with M3 flat head screw.

4. Connect 3.5" HDD/ SSD to the motherboard with SATA (indicated in **blue**) and power (indicated in **red**) cable.



Cable connections



SATA/ power connectors

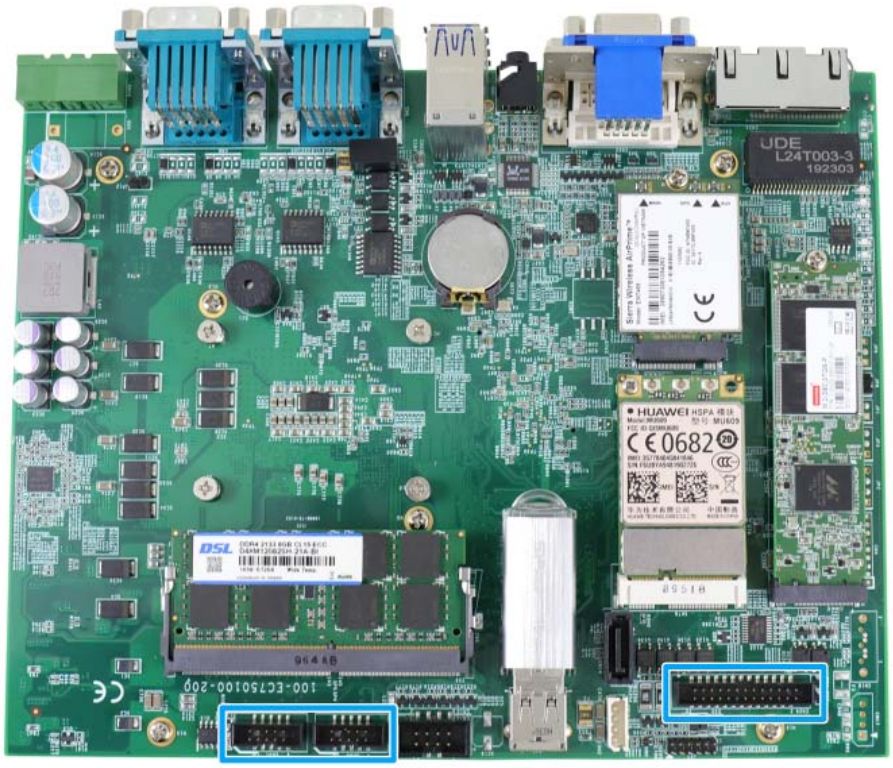
5. Reinstall the system enclosure and panel when done.

If you need to install other components, please refer to respective sections

3.8 Installing the System Enclosure

To reinstall the system enclosure, please follow the steps below:

1. For Nuvo-7505D system, connect the DIO and COM port cable onto the motherboard connector (indicated in **blue**).



2. With the heatsink upside-down, gently lower the enclosure.

3. Place the four rubber stand and secure the four (4) screws at the bottom of the system panel.

4. Secure the three (3) screws on the rear panel.

5. Turn the system around with the heatsink on top, secure the four(4) screws at the top of the enclosure.

6. Secure the three(3) screws on the IP panel to complete the enclosure installation procedure.

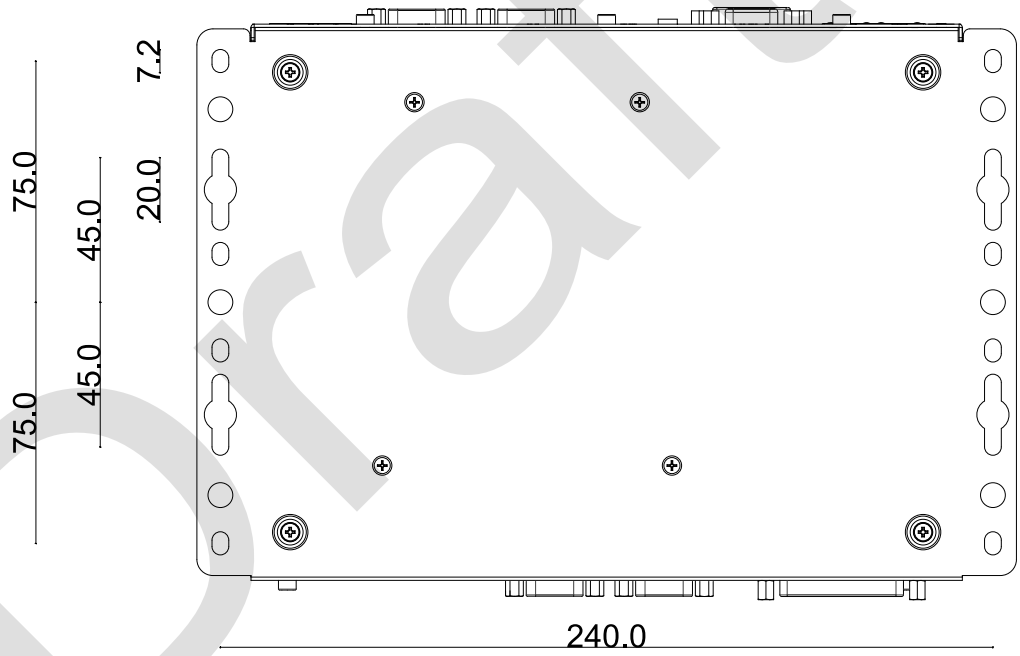
3.9 Mounting Nuvo-7501 Series

Neousys provides versatile mounting methods for Nuvo-7501 series systems. You can use built-in wall-mounting brackets to mount it on the wall. Neousys also offers optional DIN-rail mounting kit to mount it on a DIN-rail. To mount your Nuvo-7501 controller, please refer to the instructions listed below.

3.9.1 Wall-mounting Nuvo-7501 Series

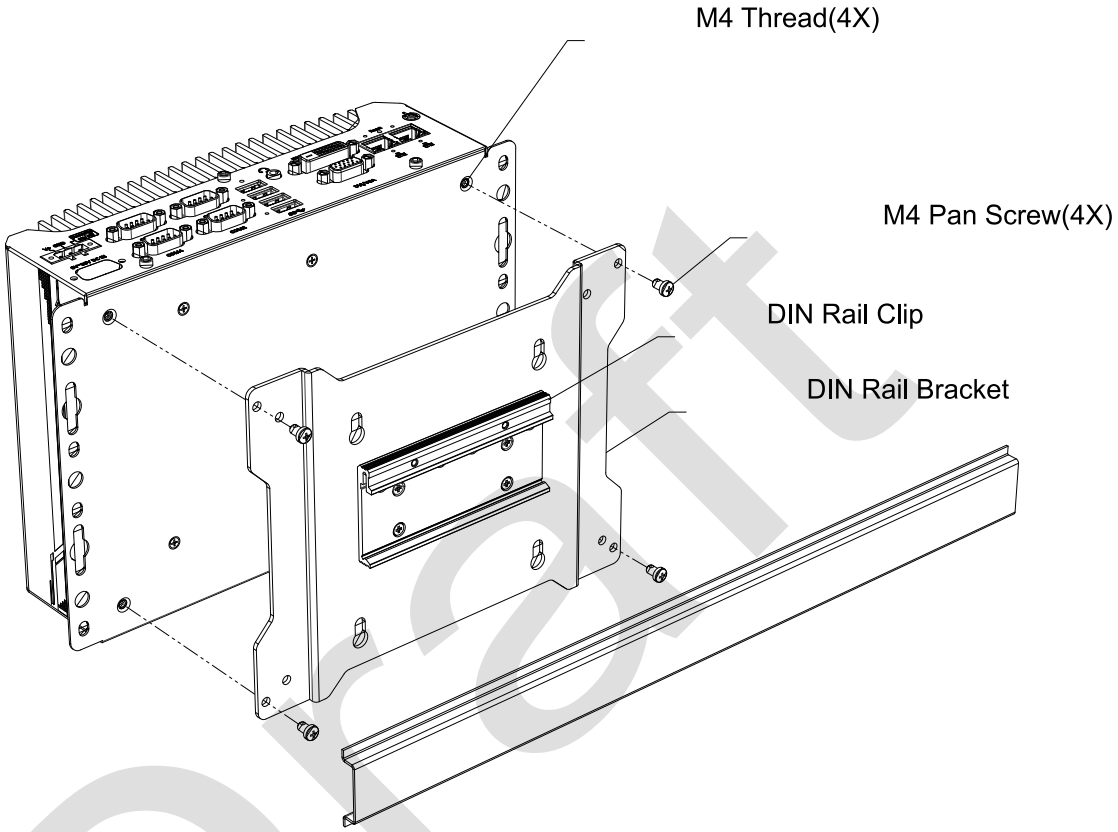
Nuvo-7501 systems have built-in wall-mounting brackets as the standard mounting option. Please follow steps below to mount your Nuvo-7501 controller on a flat surface.

1. Please refer to the following wall-mount screw hole measurements and fix it on a flat surface.



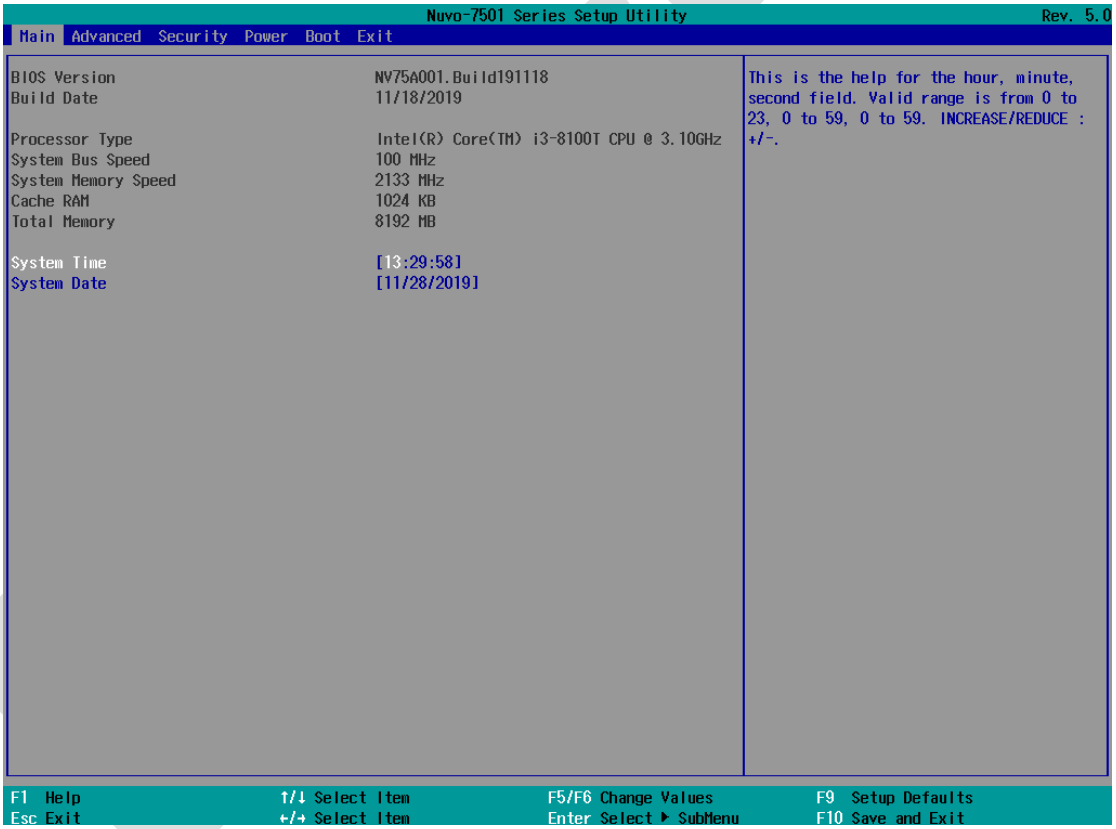
3.9.2 Installing DIN-Rail Mounting Kit (Optional)

The kit includes a bracket and a DIN-rail mounting clip. You should fix the clip to the bracket using four M4 flat-head screws first, and then fix the bracket assembly to the Nuvo-7501 controller with another four M4 screws. This option can be useful if you want to deploy it inside an equipment cabinet where DIN-rail is available.



4 BIOS Settings

The system is shipped with factory-default BIOS settings meticulously programmed for optimum performance and compatibility. In this section, we'll illustrate some of BIOS settings you may need to modify. Please always make sure you understand the effect of change before you proceed with any modification. If you are unsure of the function you are changing, it is recommended to change one setting at a time to see its effect(s).

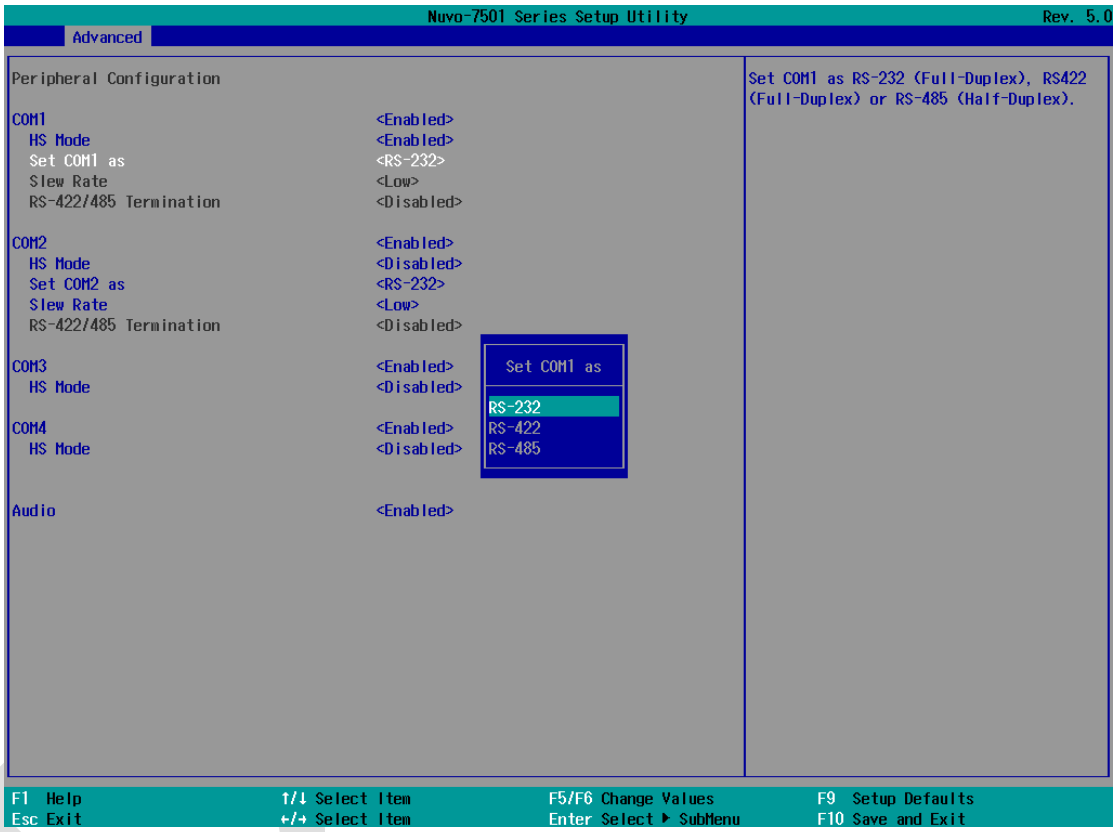


NOTE

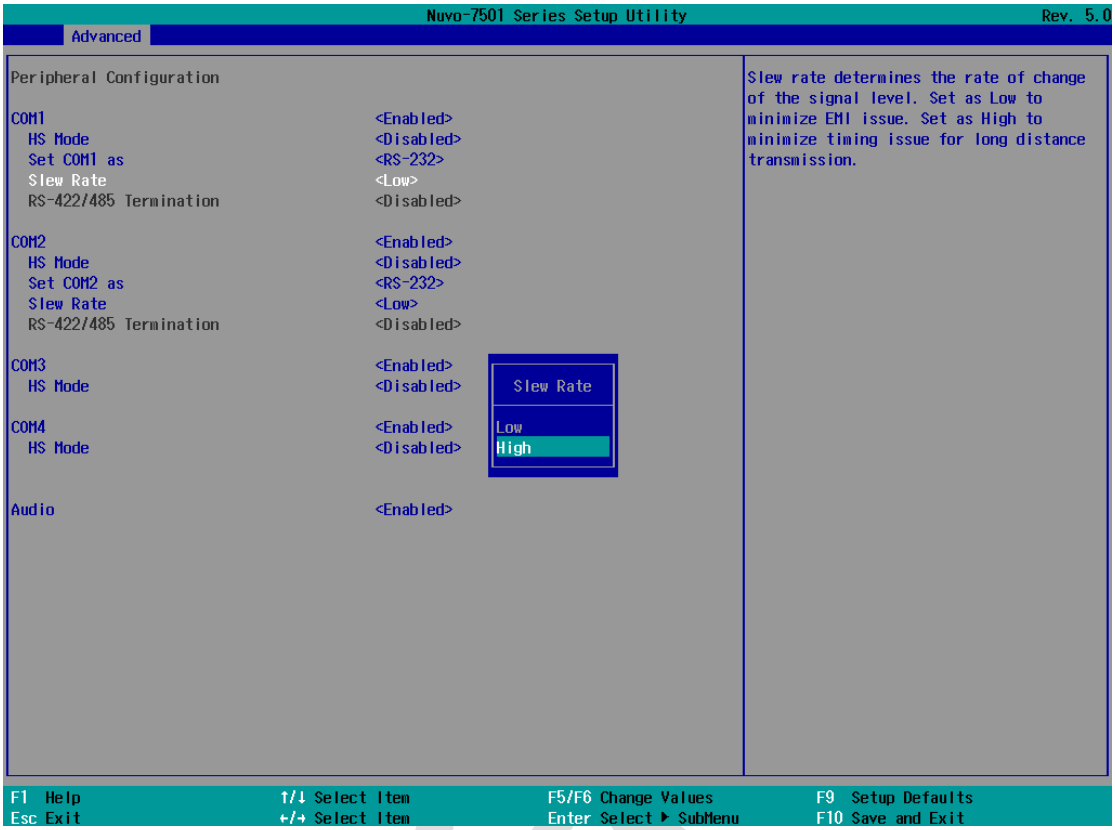
Not all BIOS settings will be discussed in this section. If a particular setting/ function you are after requires specific BIOS settings but is not discussed in this section, please contact Neousys Technical Support staff.

4.1 COM1 & COM2 Configuration

There are a total of four COM ports implemented on Nuvo-7501 series. The system's COM1 and COM2 support RS-232 (full-duplex), RS-422 (full-duplex) and RS-485 (half-duplex) mode, while COM3 and COM4 support RS-232 mode only. You can set the COM1/ COM2 operating mode via BIOS settings.



Another option in the BIOS called "***Slew Rate***" defines how sharp the rise/ fall edge is for the output signal of COM1/ COM2. For long-distance RS-422/ 485 transmission, you may set the "***Slew Rate***" option as "High" to improve signal quality.



For RS-422/485 communication, the "**RS-422/485 Termination**" option determines whether to enable/disable internal termination of RS-422/485 transceiver according to your wiring configuration (e.g. with or without external termination).

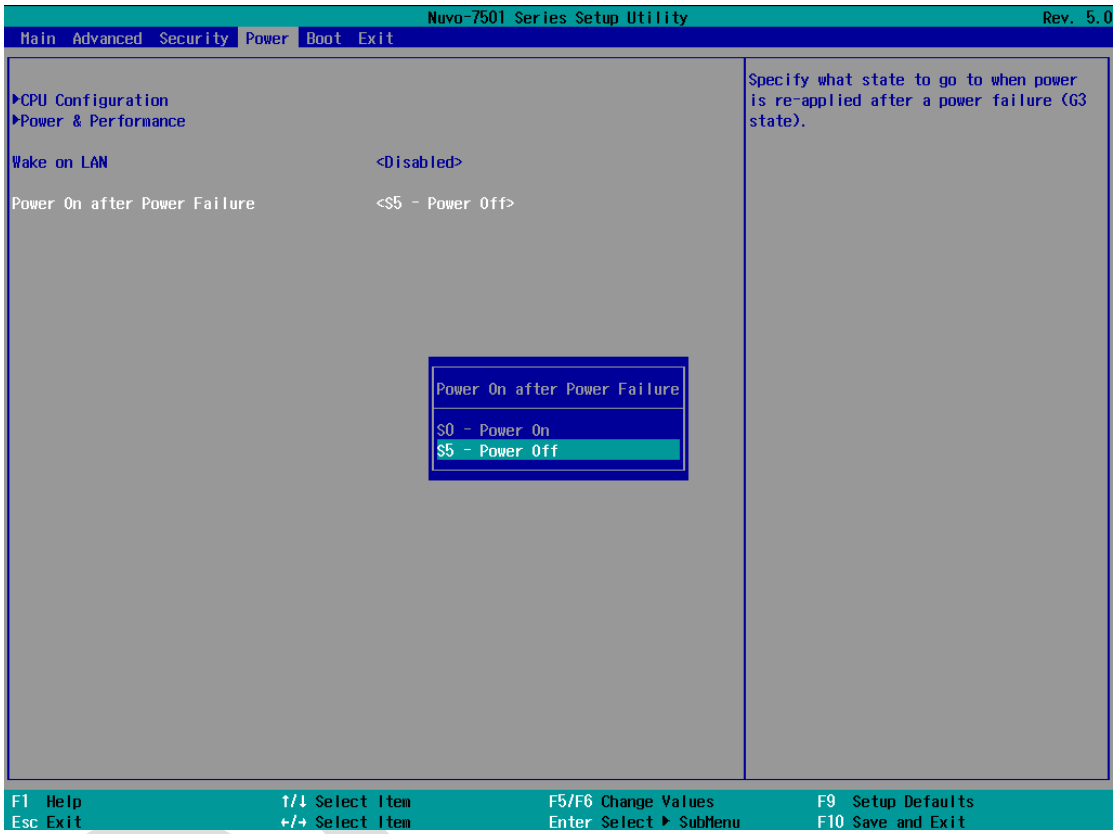
To set COM port operating mode:

1. When system boots up, press F2 to enter BIOS setup utility.
2. Go to **[Advanced] > [Peripheral Configuration]**.
3. Highlight the COM port you wish to set and press Enter to bring up setting options. Scroll to and highlight the setting you wish to set and press Enter.
4. Repeat step 2 to set other COM ports.

Press F10 to "Exit Saving Changes".

4.2 Power On After Power Failure Option

This option defines the behavior of system when DC power is supplied.



Value	Description
S0 – Power On	System is powered on when DC power is supplied.
S5 – Power Off	System is kept in off state when DC power is supplied.

To set “Power On after Power Failure” option:

1. When system boots up, press F2 to enter BIOS setup utility.
2. Go to **[Power] > [Power On after Power Failure]**.
3. Scroll down to highlight **[Power On after Power Failure]**, press Enter to bring up setting options, S0 – Power On or S5 – Power Off, and press Enter to select the setting.
4. Press F10 to “Exit Saving Changes”.

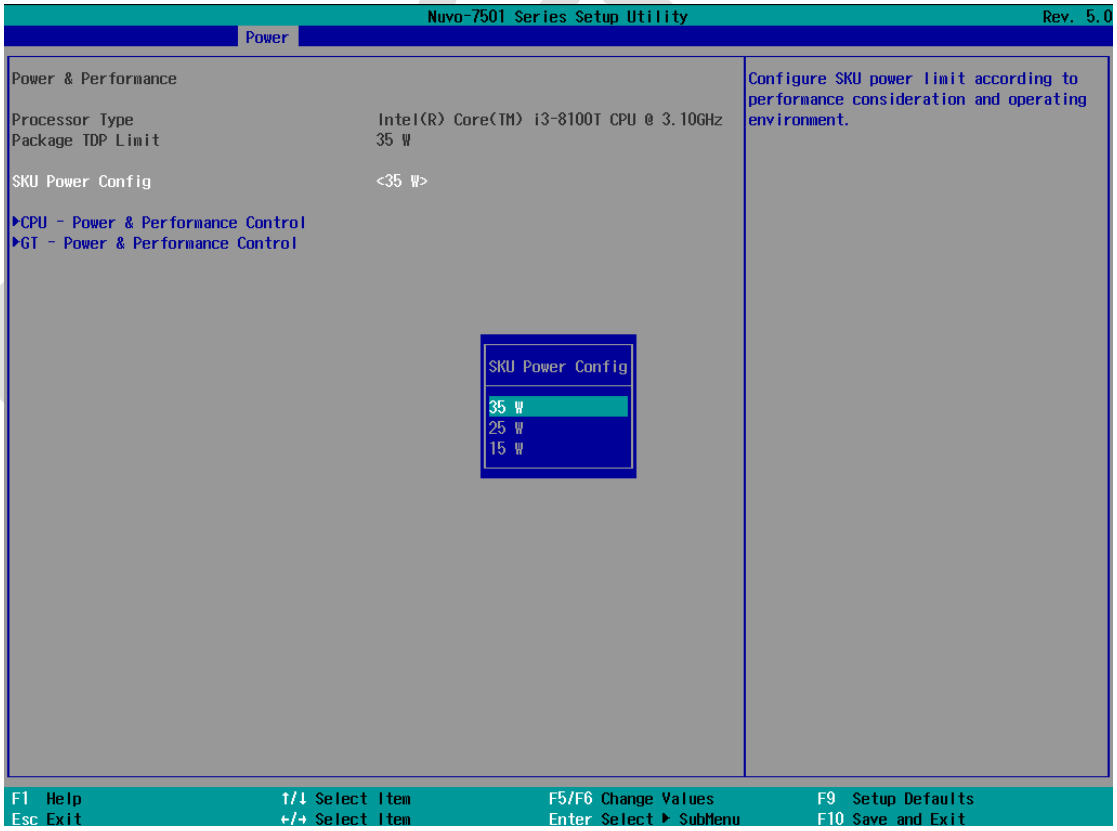
4.3 Power & Performance (CPU SKU Power Configuration)

The system supports various 6th-Gen Skylake LGA1151 CPUs. A unique feature, "**SKU Power Config**" is implemented in BIOS to allow users to specify user-defined SKU power limit. Although the system is designed to have best thermal performance with CPUs of 35W TDP, you can install a 65W CPU and limit its SKU power (to35W) to obtain more computing power. This feature gives you the flexibility of CPU selection and great balance between computing power and operating temperature range.

To configure the CPU SKU power limit:

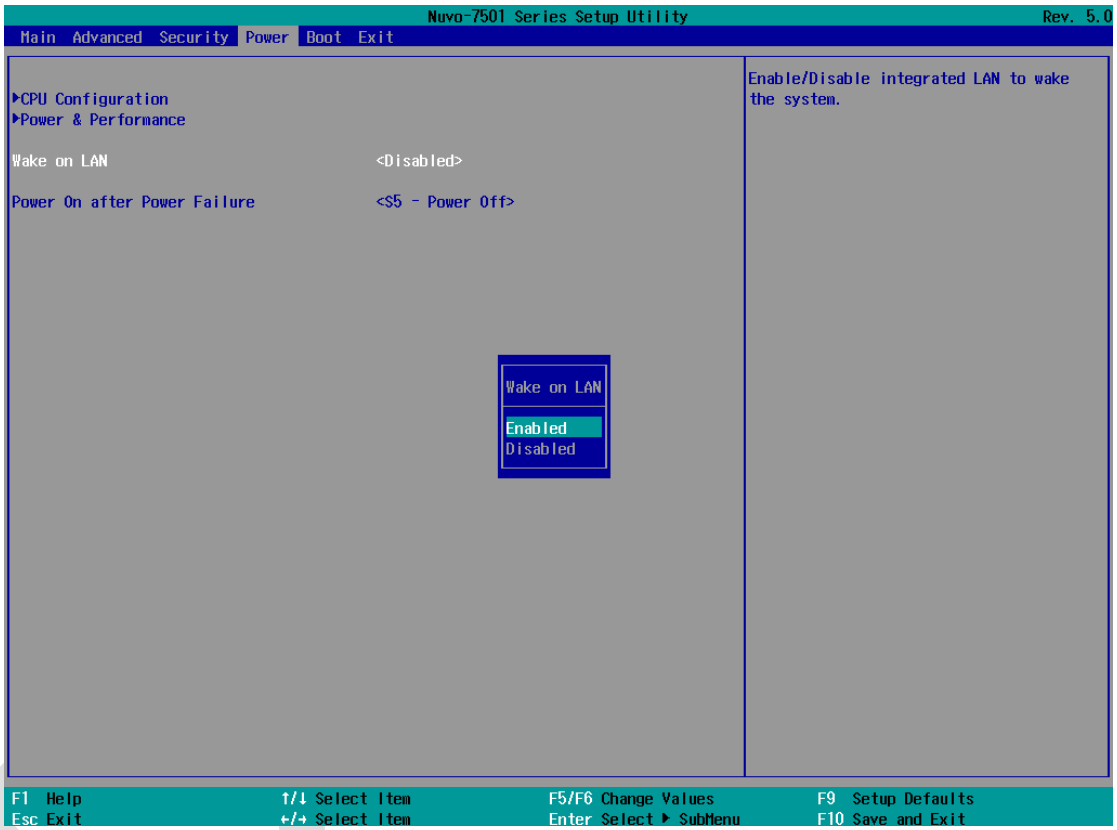
1. When the system boots up, press F2 to enter BIOS setup utility.
2. Go to **[Power]** → **[Power & Performance]**.

Select a proper value of SKU power limit for **[SKU Power Config]** option.



4.4 Wake on LAN Option

Wake-on-LAN (WOL) is a mechanism which allows you to turn on your system via Ethernet connection. To utilize Wake-on-LAN function, you have to enable this option first in BIOS settings. Please refer to “Powering On Using Wake-on-LAN” to set up the system.

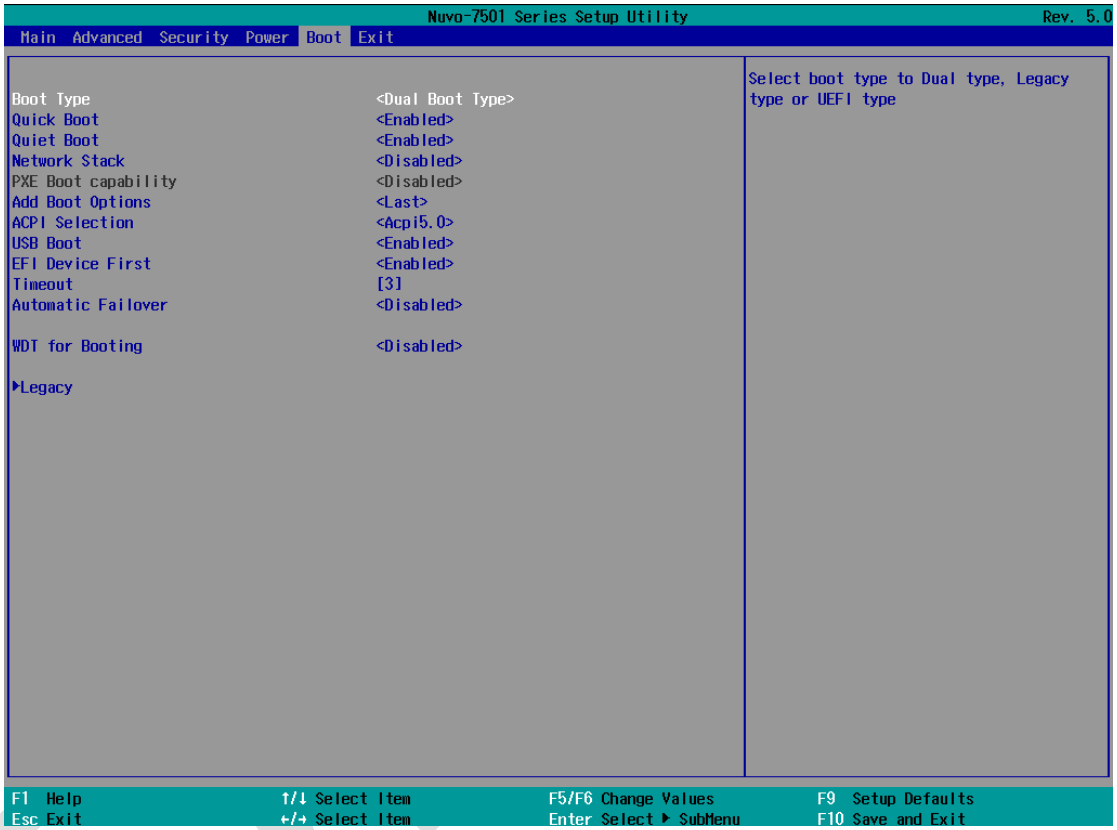


To enable/disable “Wake on LAN” option:

1. When system boots up, press F2 to enter BIOS setup utility.
2. Go to **[Power] > [Wake on LAN]**.
3. Press Enter to bring up setting options, scroll to the setting you desire and press Enter to set.
4. Press F10 to “Exit Saving Changes.

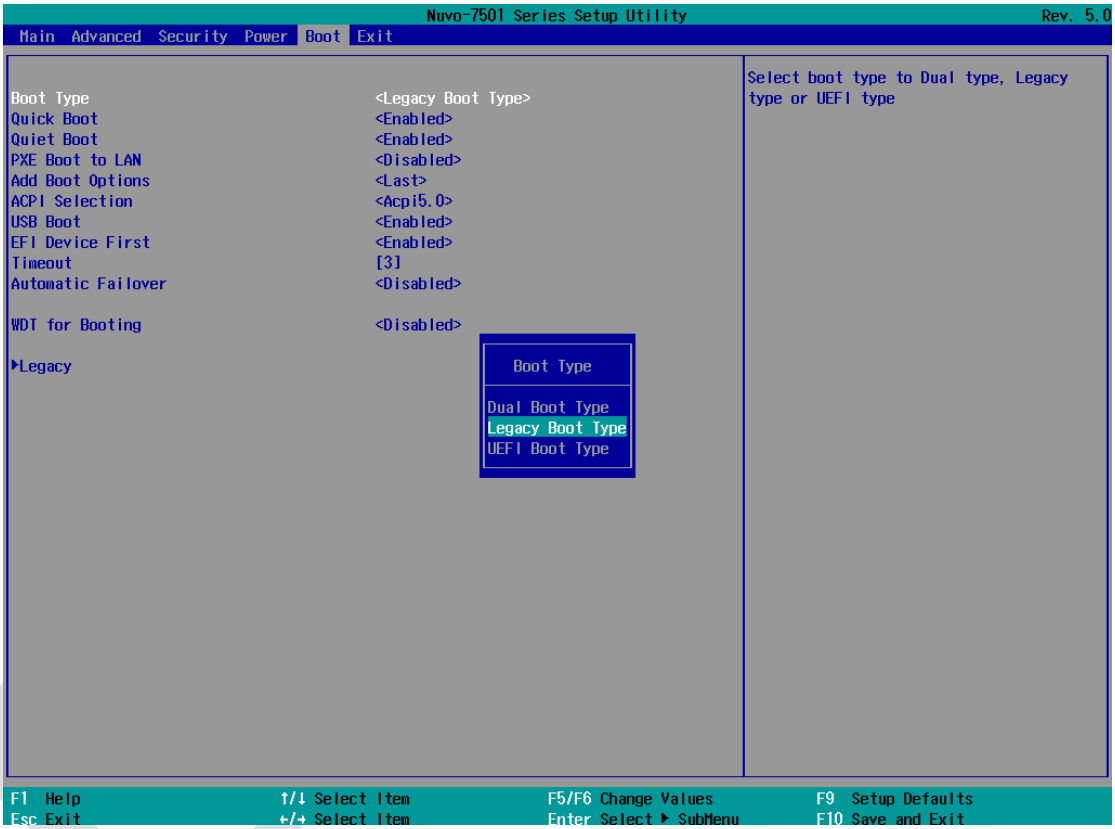
4.5 Boot Menu

The Boot menu in BIOS allows you to specify the system's boot characteristics by setting bootable device components (boot media) and method. Or, you may press F12 upon system start up and select a device you wish boot from.



4.5.1 Boot Type (Legacy/ UEFI)

The system supports both Legacy and Unified Extensible Firmware Interface (UEFI) boot modes. UEFI is a specification proposed by Intel to define a software interface between operating system and platform firmware. Most modern operating systems, such as Windows 7/8/10 and Linux support both Legacy and UEFI boot modes. The Legacy boot mode uses MBR partition for disk and VBIOS for video initialization, the UEFI boot mode uses GPT partition which supports greater than 2TB partition size and GOP driver for faster video initialization.



It is recommended that:

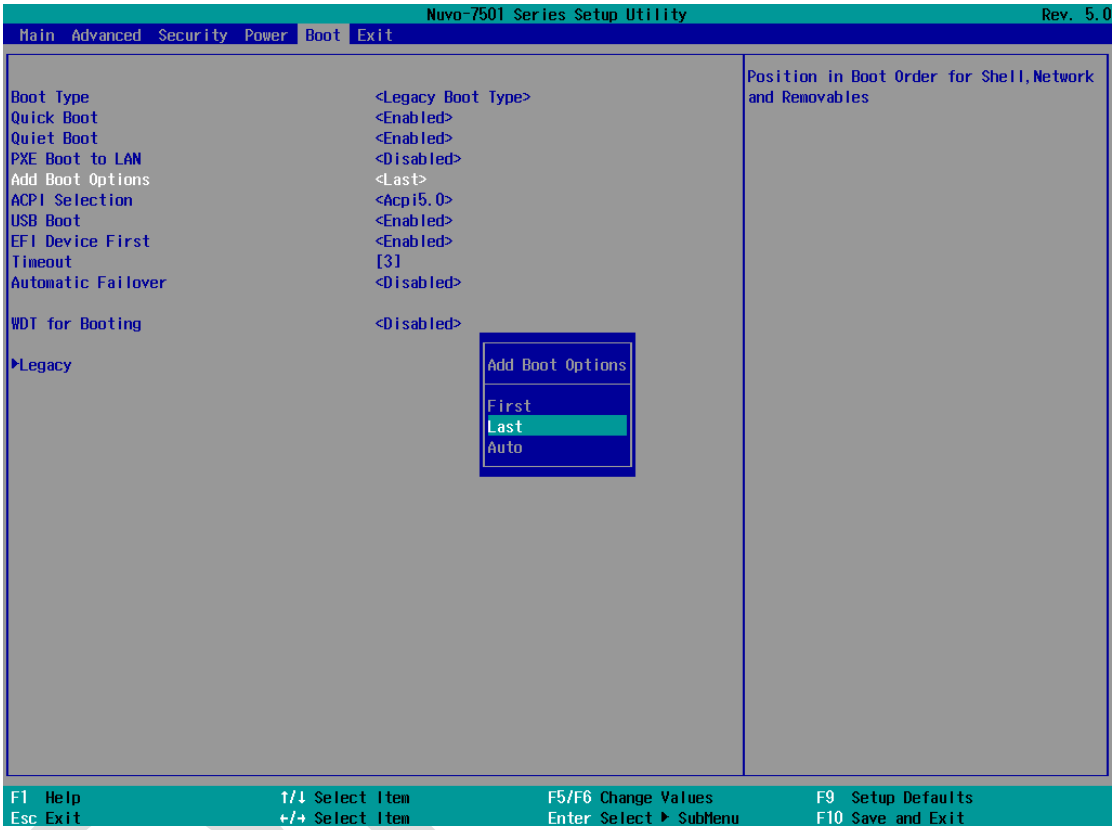
- If you need greater than 2TB disk partition, you shall choose UEFI boot mode and install operating system accordingly.
- Choose Legacy boot mode if the installed HDD/ SSD capacities are under 2TB

To configure Boot Type:

1. When system boots up, press F2 to enter BIOS setup utility.
2. Go to **[Boot] > [Boot Type]**, press Enter to bring up options, Dual Boot (Legacy+UEFI), Legacy Boot Type, UEFI Boot Type.
3. Highlight your selection and press Enter.
4. Press F10 to “Exit Saving Changes”.

4.5.2 Add Boot Options

The Add Boot Options dedicates the boot sequence order of a newly added device (eg. USB flash drive). The setting allows you to set the newly added device to boot first or as the last device on the list.



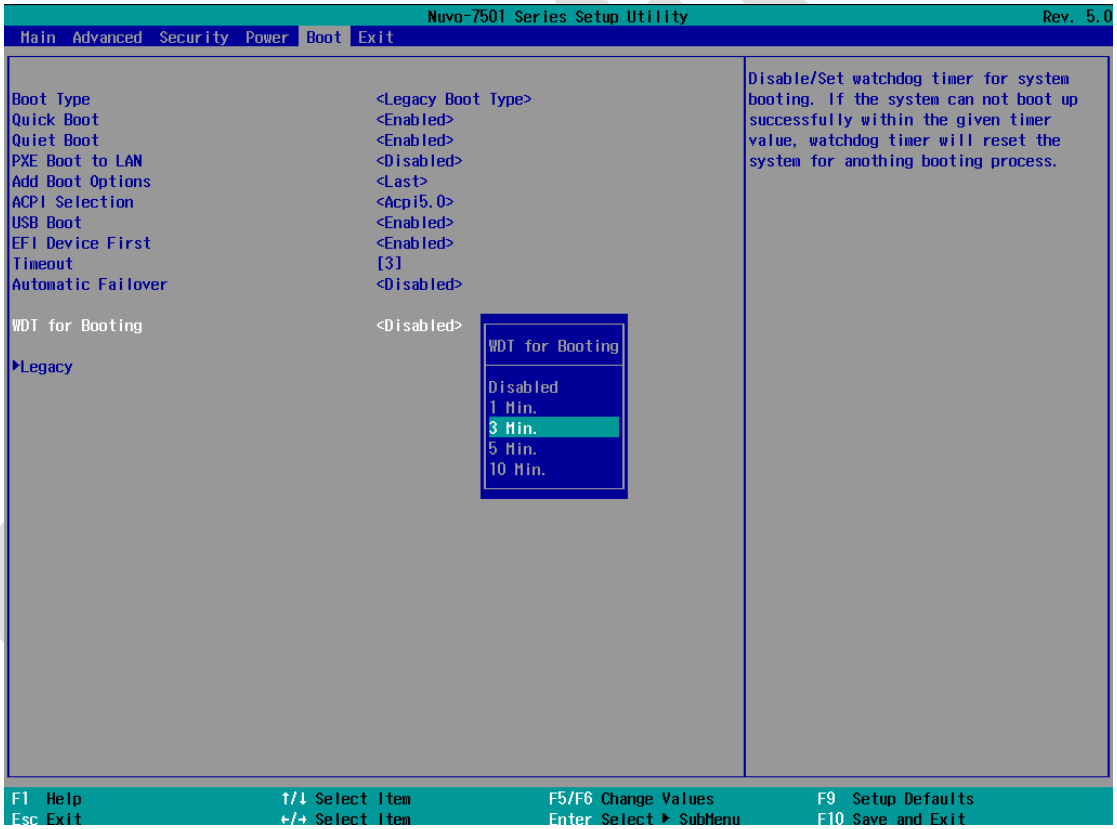
To set Add Boot Options:

1. When system boots up, press F2 to enter BIOS setup utility.
2. Go to [Boot] > [Add Boot Option], press Enter to bring up options, First or Last.
3. Highlight your selection and press Enter, press F10 to “Exit Saving Changes”.

4.5.3 Watchdog Timer for Booting

The Watchdog timer setting in the BIOS ensures a successful system boot by specifying a timeout value. If the Watchdog timer is not stopped and expires, the BIOS will issues a reset command to initiate another boot process. There are two options in BIOS menu, "**Automatically after POST**" and "**Manually after Entering OS**". When "**Automatically after POST**" is selected, the BIOS automatically stop the watchdog timer after POST (Power-On Self Test) OK. When "**Manually after Entering OS**" is selected, it's user's liability to stop the watchdog timer when entering OS. This guarantees the system can always boot into OS, otherwise another booting process will be initiated.

For information about programming watchdog timer, please refer to **Appendix A Watchdog Timer & Isolated DIO.**

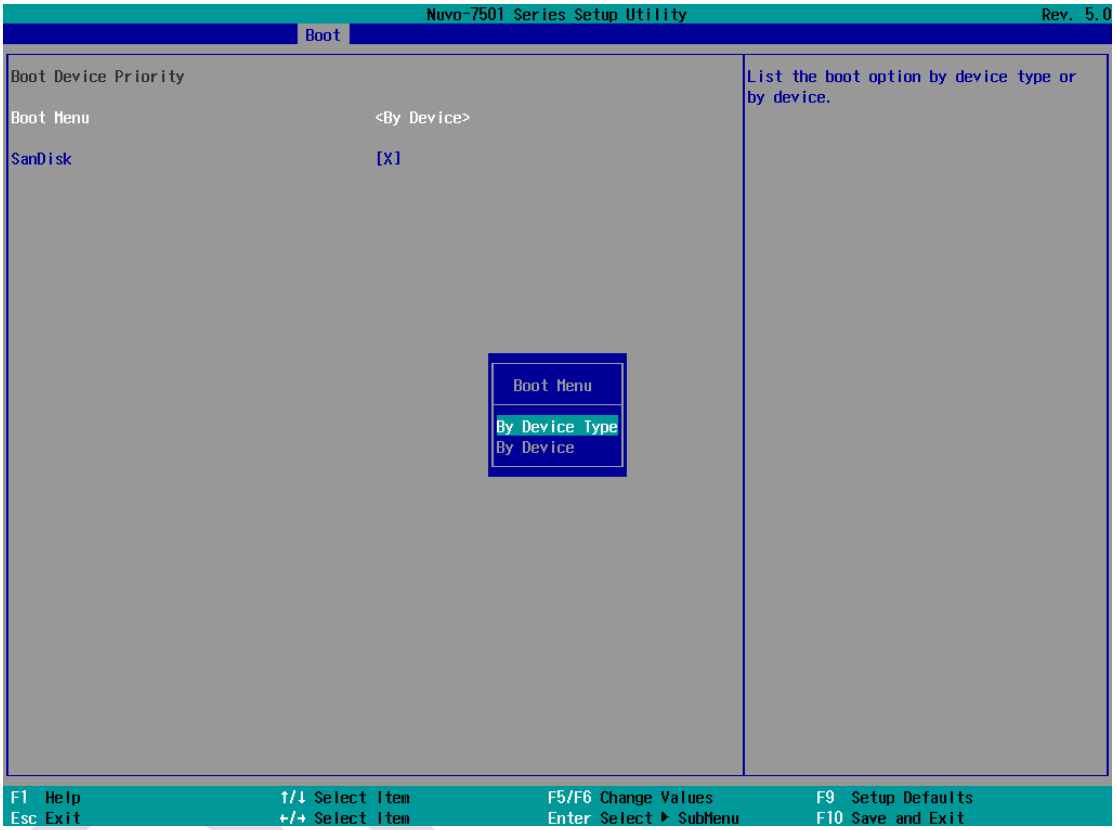


To set the watchdog timer for boot in BIOS:

1. When system boots up, press F2 to enter BIOS setup utility.
2. Go to **[Boot]** menu.
3. Disable or select timeout value for **[WDT for Booting]** option.
4. Once you give a timeout value, the **[WDT Stop Option]** option appears. You can select *"Automatically after POST"* or *"Manually after Entering OS"*.
5. Press F10 to "Exit Saving Changes.

4.5.4 Legacy/ UEFI Boot Device

When you wish to set a designated boot device, you may set it as the first device to boot in Legacy or UEFI Boot Device setting. Or if you wish to manually select a boot device, you may do so by pressing F12 when the system boots up.



To set boot order for devices in UEFI Boot Device:

1. When system boots up, press F2 to enter BIOS setup utility
2. Go to **[Boot] > [UEFI Boot Device]**
3. Highlight the device you wish to make boot order changes to and press F5/ F6 or +/ - to change device boot order.

To select boot order for devices in Legacy Boot Device:

1. When system boots up, press F2 to enter BIOS setup utility
2. Go to **[Boot] > [Legacy Boot Device]**, you can choose the type of device to list by selecting "**By Device** or **By Device Type**".
3. Highlight the device you wish to make boot order changes to and press F5/ F6 or +/ - to change device boot order.

5 OS Support and Driver Installation

5.1 Operating System Compatibility

The system supports most operating system developed for Intel® x86 architecture. The following list contains operating systems that have been tested by Neousys Technology.

- Microsoft Window 10 (x64)
- CentOS 7
- Debian 8.7
- Fedora 24
- OpenSUSE 42.1
- Ubuntu 14.04.4 LTS and 16.04 LTS

NOTE

** Due to xHCI driver is not included natively in Windows 7, you may encounter Keyboard/ mouse issues when installing Windows 7. Neousys offers a Windows-based batch file and step-by-step installation guide.*

Neousys may remove or update operating system compatibility without prior notice. Please contact us if your operating system of choice is not on the list.

5.2 xHCI Driver Support in Microsoft OS

Intel Skylake platform supports USB 2.0 and USB 3.0 connectivity through its xHCI controller. For **Windows10**, xHCI controller is natively supported.

5.3 Install Drivers Automatically

The system comes with a “Drivers & Utilities” DVD that offers “one-click” driver installation process. It automatically detects your Windows operating system and installs all necessary drivers for you system with a single click.

To install drivers automatically, please refer to the following procedures.

1. Insert the “Drivers & Utilities” DVD into a USB DVD-drive connect to your system. A setup utility launches and the following dialog appears.

Click on **“Automatic Driver Installation”** and the setup utility will automatically detect your Windows operating system and install all necessary drivers. The installation process takes about 6~8 minutes depending on your Windows version. Once driver installation is done, the setup utility reboots your Windows and you may begin using your system.

5.4 Install Drivers Manually

You can also manually install each driver for the system. Please note when installing drivers manually, you need to install the drivers in the following sequence mentioned below.

5.4.1 Windows 10 (x64)

The recommended driver installation sequence is

1. Chipset driver (x:\Driver_Pool\Chipset_10_Series\Win_ALL\SetupChipset.exe)
2. Graphics driver (x:\Driver_Pool\Graphics_6th_i7\Win_7_8_10_64\Setup.exe)
3. Audio driver (x:\Driver_Pool\Audio_ALC262\Win_ALL_64\Setup.exe)
4. LAN driver (x:\Driver_Pool\GbE_I210_I350\Win_ALL_64\APPS\PROSETDX\Winx64\DxSetup.exe)
5. ME driver (x:\Driver_Pool\ME_10_Series\Win_ALL_AMT\SetupME.exe)

5.5 Driver Installation for Watchdog Timer Control

Neousys provides a driver package which contain function APIs for Watchdog Timer control function. You should install the driver package (WDT_DIO_Setup.exe) in prior to use these functions. Please note that you must install WDT_DIO_Setup_v2.2.7 or later versions.

5.5.1 Windows 10 (x64)

Please execute the driver setup program in the following directory.

x:\Driver_Pool\WDT_DIO\Win7_8_64\WDT_DIO_Setup_v2.2.7(x64).exe

5.5.2 Windows 10 (WOW64)

Please execute the driver setup program in the following directory.

x:\Driver_Pool\WDT_DIO\Win7_8_WOW64\WDT_DIO_Setup_v2.2.7(wow64).exe

Appendix A Using WDT & DIO

Watchdog Timer

The watchdog timer (WDT) function ensures reliable system operation. The WDT is a hardware mechanism to reset the system if the watchdog timer expires. Users can start the WDT and keep resetting the timer to make sure the system or program is running. Otherwise, the system shall be reset.

In this section, we'll illustrate how to use the function library provided by Neousys to program the WDT functions. Currently, WDT driver library supports Windows 7/ 8.1/ 10 32-bit and 64-bit versions. For other OS support, please contact Neousys Technology for further information.

Isolated DIO (Nuvo-7501-DIO Only)

The system also features isolated digital I/O is available for extended range of applications. Nuvo-7501-DIO features 8x DI channels and 8x DO channels via a DSub-25 connector. The digital I/O supports standard polling mode I/O access so users' program can read or write DIO channel(s) using the function library.

WDT and DIO Library Installation

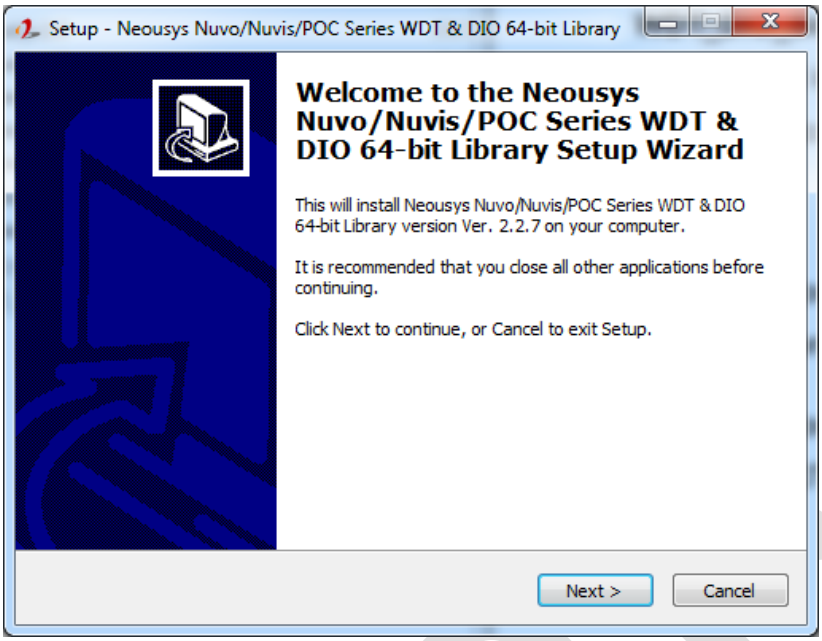
Installing WDT_DIO Library

The WDT_DIO function library is delivered in the form of a setup package named **WDT_DIO_Setup.exe**. Prior to programming WDT, you should execute the setup program and install the WDT library. Please use the following WDT_DIO_Setup packages according to your operating systems and application.

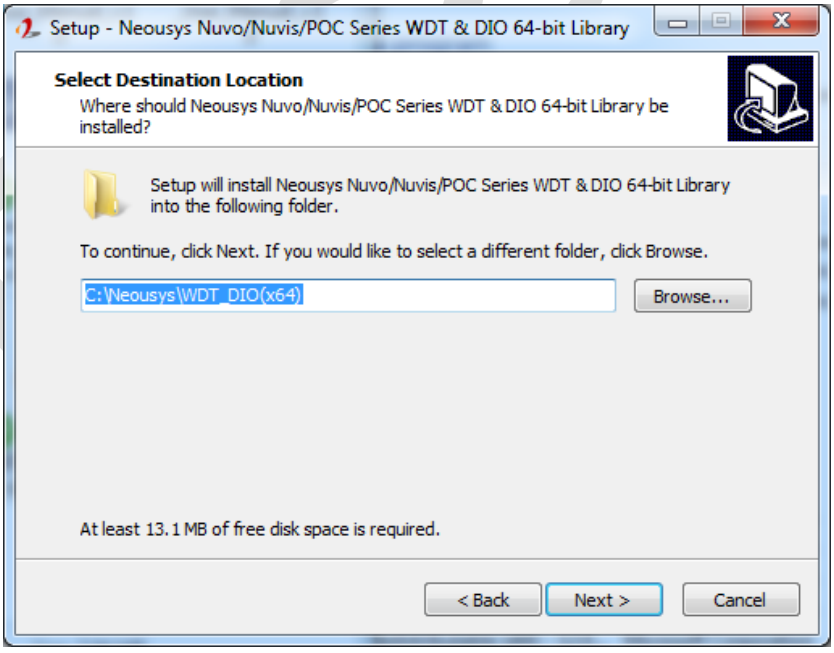
- For Windows 10 64-bit OS with 64-bit application (x64 mode), please install WDT_DIO_Setup_v2.2.9.x(x64).exe or later version.
- For Windows 10 64-bit OS with 32-bit application (WOW64 mode), please install WDT_DIO_Setup_v2.2.9.x(wow64).exe or later version.

To setup WDT & DIO Library, please follow instructions below.

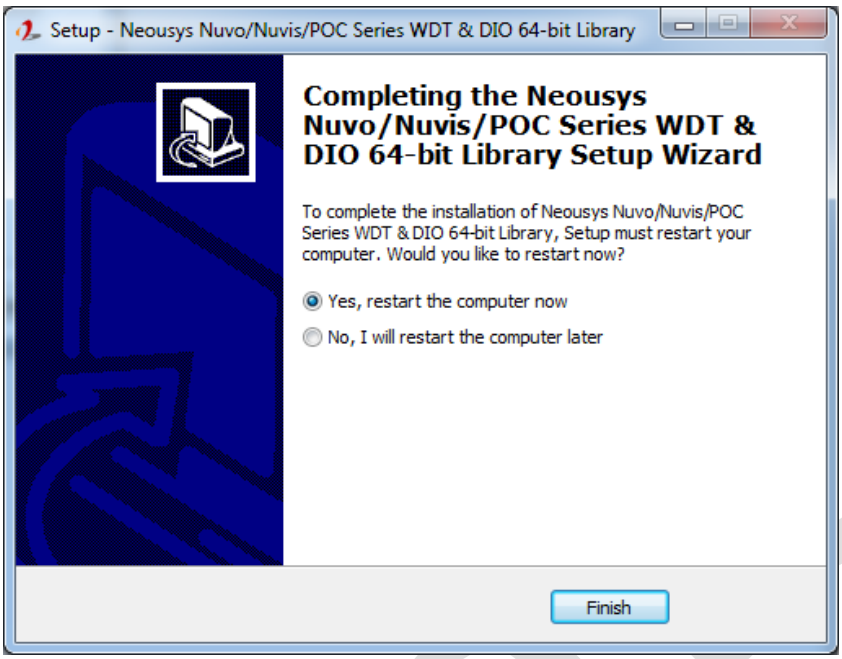
1. Execute **WDT_DIO_Setup.2.2.9.1.exe**. and the following dialog appears.



2. Click “Next >” and specify the directory of installing related files. The default directory is *C:\Neousys\WDT_DIO*.



3. Once the installation has finished, a dialog will appear to prompt you to reboot the system. The WDT & DIO library will take effect after the system has rebooted.



4. When programming your WDT or DIO program, the related files are located in

Header File:	\Include
Library File:	\Lib
Function Reference:	\Manual
Sample Code:	\Sample\ WDT_Demo (Demo for Watchdog Timer) \Sample\ DIO_Demo (Demo for Polling I/O)

WDT Functions

InitWDT

Syntax	BOOL InitWDT(void);
Description:	Initialize the WDT function. You should always invoke InitWDT() before set or start watchdog timer.
Parameter	None
Return Value	**TRUE:** Successfully initialized **FALSE:** Failed to initialize
Usage	BOOL bRet = InitWDT()

SetWDT

Syntax	BOOL SetWDT(WORD tick, BYTE unit);
Description	Set timeout value and unit for watchdog timer. When InitWDT() is invoked, a default timeout value of 255 seconds is assigned.
Parameter	***tick*** WORD value (1 ~ 65535) to indicate timeout ticks. ***unit*** BYTE value (0 or 1) to indicate unit of timeout ticks. 0 : unit is minute 1: unit is second
Return Value	If value of unit is correct (0 or 1), this function returns TRUE, otherwise FALSE.

Usage	WORD tick=255;
	BYTE unit=1; //unit is second.
	BOOL bRet = SetWDT(tick, unit); //timeout value is 255 seconds

StartWDT

Syntax	BOOL StartWDT(void);
Description	Starts WDT countdown. Once started, the WDT LED indicator will begin blinking. If ResetWDT() or StopWDT is not invoked before WDT countdowns to 0, the WDT expires and the system resets.
Parameter	None
Return Value	If the timeout value is given in correct format (WDT started), this function returns TRUE, otherwise FALSE
Usage	BOOL bRet = StartWDT()

ResetWDT

Syntax	BOOL ResetWDT(void);
Description	Reset the timeout value to the value given by SetWDT().If ResetWDT() or StopWDT is not invoked before WDT countdowns to 0, the WDT expires and the system resets.
Parameter	None
Return Value	Always returns TRUE
Usage	BOOL bRet = ResetWDT()

StopWDT

Syntax	BOOL StopWDT(void);
Description	Stops the countdown of WDT. When WDT has stopped, the WDT LED indicator stops blinking.
Parameter	None
Return Value	Always returns TRUE
Usage	BOOL bRet = StopWDT()

DIO Functions

InitDIO

Syntax	BOOL InitDIO(void);
Description	Initialize the DIO function. You should always invoke InitDIO() before write/read any DIO port/channel.
Parameter	None
Return Value	Returns TRUE if initialization successes, FALSE if initialization failed.
Usage	BOOL bRet = InitWDT()

DIReadLine

Syntax	BOOL DIReadLine(BYTE ch);
Description	Read a single channel of isolated digital input.
Parameter	***ch*** BYTE value specifies the DI channel to be read. C*h* should be a value of 0 ~ 7.
Return Value	The status (TRUE or FALSE) of the specified DI channel.

Usage	BYTE ch=3; //DI channel #3
	BOOL DIChValue = DIReadLine(ch); //read DI channel #3

DIReadPort

Syntax	WORD DIReadPort(void);
Description	Read the entire isolated digital input port (8 channels).
Parameter	None
Return Value	A WORD value (0~255) indicates the status of DI port (8 DI channels).
Usage	WORD DIPortValue = DIReadPort ();

DOWriteLine

Syntax	void DOWriteLine(BYTE ch, BOOL value);
Description	Write a single channel of isolated digital output.
Parameter	***ch*** BYTE value specifies the DO channel to be written. C*h* should be a value of 0 ~ 7. ***value*** BOOL value (TRUE or FALSE) specifies the status of DO channel.
Return Value	None

Usage	BYTE ch=3; //DI channel #3
	BOOL DOChValue=TRUE;
	
	DOWriteLine(ch, DOChValue); //write DO channel #3 as TRUE

DOWritePort

Syntax	void DOWritePort(WORD value);
Description	Write the entire isolated digital output port (8 channels).
Parameter	***value*** WORD value specifies the status of the DO port. V*alue* should be a value of 0~255.
Return Value	None
Usage	WORD DOPortValue=0XFF; //11111111b DOWritePort(DOPortValue); //write DO port as 11111111b