Neousys Technology Inc.

Nuvo-4000 Series

Intel® 3rd-Gen Core™ i7/i5 Fanless Box-PC

with 4x PCIe/PCI Expansion Slots

Nuvo-4022 / Nuvo-4040

User's Manual

Rev. A1

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Contents

Declaimer

This manual is intended to be used as a practical and informative guide only and is subject to change without prior notice. It does not represent commitment from Neousys Technology Inc. Neousys shall not be liable for direct, indirect, special, incidental, or consequential damages arising out of the use of the product or documentation, nor for any infringements upon the rights of third parties, which may result from such use.

Declaration of Conformity

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 his 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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Chapter 1 Introduction

1.1 Overview.

Nuvo-4000 is a high-performance box-pc with fanless design and small footprint. It incorporates Intel® 3rd-Gen i7/i5 processor to offer extraordinary computing power, and fanless architecture to offer reliable operation in various environments.

The 4-slots expandability makes Nuvo-4000 very versatile. Nuvo-4022 features two Gen2 PCI Express slots and delivers a total of 6 GB/s bandwidth for applications demanding high-speed data transmission. A notable 48W power budget is dedicatedly supplied to the x16 PCIe slot for powering a high-watt PCIe card (e.g. a graphics card). Nuvo-4022/4040 also has PCI slots to accommodate up to 4 PCI cards for general industrial automation and test & measurement applications.

Nuvo-4000 features the smallest foot-print for a fanless box-pc with four expansion slots. It supports ample I/O interfaces for communication/control purpose, and implements DVI+DVI+VGA triple independent display outputs for video/image related applications. An option of smart fan is available for better operating reliability when high-watt cards installed.

The combination of high performance, small foot-print and versatility makes Nuvo-4000 not only an ideal application platform, but also a great replacement of traditional rack-mount or wall-mount IPC.

1.2 Product Specification

1.2.1 Specification of Nuvo-4022

System Core	
Processor	Intel® Core™ i7-3610QE (2.3/3.3 GHz, 6 MB cache) Intel® Core™ i5-3610ME (2.7/3.3 GHz, 3 MB cache) Intel® Celeron™ 1020E (2.2 GHz, 2 MB cache)
Chipset	Intel® HM76 Platform Controller Hub
Graphics	Integrated Intel® HD Graphics 4000 Controller
Memory	2x 204-pin SO-DIMM sockets, up to 16 GB DDR3 1333/1600 MHz SDRAM
Front-panel I/O Interface	
Ethernet	2x Gigabit Ethernet ports by Intel® I210
Video Port	1x DVI-I connector for VGA and DVI/HDMI outputs, supporting 1920x1080 resolution 1x DVI-D connectors for DVI/HDMI output, supporting 1920x1080 resolution (Supporting triple independent display outputs)
Serial Port	2x software-programmable RS-232/422/485 (COM1 & COM2) 1x RS-232 (COM3)
USB	4x USB 3.0 ports
Audio	1x Speaker-out
Expansion Bus	
PCI Express	1x PCIe x16 slot @ 8-lanes PCIe signal with dedicated 48W power budget 1x PCIe x4 slot with shared 48W power budget
PCI	2x 33MHz/32-bit 5V PCI slots
Internal I/O Interface	
USB	2x USB 2.0 ports via 10-pin box-header
Isolated DIO	Optional 8-CH isolated DI + 8-CH isolated DO
Storage Interface	
SATA HDD	2x Internal SATA ports for 2.5" HDD/SSD installation
CFast	1x CFast socket
Power Supply	
DC Input	1x 4-pin power connector for 8~25V DC input
Power Consumption	With i7-3610QE: 66.12W (3.48A@19V)* With i5-3610ME: 43.13W (2.27A@19V)*
Mechanical	
Dimension	164 mm (W) x 178 mm (D) x 225 mm (H)

Weight	4.0 kg (with one 2.5" HDD and DDR3 memory module)
Mounting	Wall-mounting (Standard) or DIN-Rail mounting (Optional)
Environmental	
Operating Temperature	-20°C ~ 60°C, 100% CPU loading **/***
Storage Temperature	-40°C ~85°C
Humidity	10%~90% , non-condensing
Vibration	Operating, 5Grms, 5-500 Hz, 3 Axes (w/ SSD, w/o add-on card, according to IEC60068-2-64)
Shock	Operating, 50Grms, Half-sine 11ms Duration (w/ SSD, w/o add-on card, according to IEC60068-2-27)
EMC	CE/FCC Class A, according to EN 55022 & EN 55024

** Full-loading power consumption is measured with 2GB DDR3 memory and one 2.5" SATA HDD installed under the following conditions:*

- *100% loading for CPU*
- *100% loading for 3D graphics*
- *100% loading for GbE port*

*** 100% CPU loading is applied using Intel® Thermal Analysis Tool. For detail testing criteria, please contact Neousys Technology*

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

1.2.2 Specification of Nuvo-4040

System Core	
Processor	Intel® Core™ i7-3610QE (2.3/3.3 GHz, 6 MB cache) Intel® Core™ i5-3610ME (2.7/3.3 GHz, 3 MB cache) Intel® Celeron™ 1020E (2.2 GHz, 2 MB cache)
Chipset	Intel® HM76 Platform Controller Hub
Graphics	Integrated Intel® HD Graphics 4000 Controller
Memory	2x 204-pin SO-DIMM sockets, up to 16 GB DDR3 1333/1600 MHz SDRAM
Front-panel I/O Interface	
Ethernet	2x Gigabit Ethernet ports by Intel® I210
Video Port	1x DVI-I connector for VGA and DVI/HDMI outputs, supporting 1920x1080 resolution 1x DVI-D connectors for DVI/HDMI output, supporting 1920x1080 resolution (Supporting triple independent display outputs)
Serial Port	2x software-programmable RS-232/422/485 (COM1 & COM2) 1x RS-232 (COM3)
USB	4x USB 3.0 ports
Audio	1x Speaker-out
Expansion Bus	
PCI	4x 33MHz/32-bit 5V PCI slots
Internal I/O Interface	
USB	2x USB 2.0 ports via 10-pin box-header
Isolated DIO	Optional 8-CH isolated DI + 8-CH isolated DO
Storage Interface	
SATA HDD	2x Internal SATA ports for 2.5" HDD/SSD installation
CFast	1x CFast socket
Power Supply	
DC Input	1x 4-pin power connector for 8~25V DC input
Power Consumption	With i7-3610QE: 66.12W (3.48A@19V)* With i5-3610ME: 43.13W (2.27A@19V)*
Mechanical	
Dimension	164 mm (W) x 225 mm (D) x 180 mm (H)
Weight	4.0 kg (with one 2.5" HDD and DDR3 memory module)
Mounting	Wall-mounting (Standard) or DIN-Rail mounting (Optional)
Environmental	
Operating Temperature	-20°C ~ 60°C, 100% CPU loading **/***

Storage Temperature	-40°C ~85°C
Humidity	10%~90% , non-condensing
Vibration	Operating, 5Grms, 5-500 Hz, 3 Axes (w/ SSD, w/o add-on card, according to IEC60068-2-64)
Shock	Operating, 50Grms, Half-sine 11ms Duration (w/ SSD, w/o add-on card, according to IEC60068-2-27)
EMC	CE/FCC Class A, according to EN 55022 & EN 55024

** Full-loading power consumption is measured with 2GB DDR3 memory and one 2.5" SATA HDD installed under the following conditions:*

- *100% loading for CPU*
- *100% loading for 3D graphics*
- *100% loading for GbE port*

*** 100% CPU loading is applied using Intel® Thermal Analysis Tool. For detail testing criteria, please contact Neousys Technology*

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

1.2.3 Specification of Optional Isolated DIO

Isolated Digital Input	
No. of Channel	8-CH Isolated Digital Input Channels
Logic Level	Logic High: 5 to 24V Logic Low: 0 to 1.5V
Isolated Voltage	2500 Vrms
Input Resistance	2.4kΩ
Isolated Digital Output	
No. of Channel	8-CH Isolated Digital Output Channels
Sink Current (per channel)	100 mA (sustained loading) 250 mA (peak loading)
Isolated Voltage	2500 Vrms
Output Type	Power MOSFET + Analog Device iCoupler®

Chapter 2 Getting to know your Nuvo-4000

2.1 Unpacking your Nuvo-4000

When you receive the package of Nuvo-4000 series, please check immediately if the package contains all the items listed in the following table. If any item is missing or damaged, please contact your local dealer or Neousys Technology Inc. for further assistance.

Item	Description	Qty
1	Nuvo-4022 or Nuvo-4040 fanless controller (According to the configuration you order, the Nuvo-4022/4040 may contain HDD and DDR3 SODIMM. Please verify these items if necessary.)	1
2	Accessory box, which contains	
	● SATA HDD bracket	1
	● Wall-mounting bracket	2
	● Neousys Drivers & Utilities DVD	1
	● Screw package	1

2.2 Front Panel I/O Functions

On Nuvo-4000, we design all general-purpose I/O functions on the front panel so you can easily access them. In this section, we'll illustrate each I/O function on the front panel.

2.2.1 Power Button

The power button is a non-latched switch for ATX mode on/off operation. To turn on the Nuvo-4000, press the power button and the PWR LED is lighted up. To turn off the Nuvo-4000, you can either issue a shutdown command in OS, or just simply press the power button. In case of system halts, you can press and hold the power button for 5 seconds to compulsorily shut down the system. Please note that a 5 seconds interval is kept by the system between two on/off operations (i.e. once turning off the system, you shall wait for 5 seconds to initiate another power-on operation).

2.2.2 Reset Button

The reset button is used to manually reset the system in case of any 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.

2.2.3 LED Indicators

There are four LED indicators on the front panel: PWR, UID, WDT and HDD. The descriptions of these three LED are listed in the following table.

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

2.2.4 USB 3.0 Connectors

Nuvo-4000 offers four USB 3.0 (SuperSpeed USB) ports on its front panel. By BIOS default, these USB ports are operated in XHCI (eXtensible Host Controller Interface) mode and are compatible with USB 3.0, 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. USB 3.0 driver is only available for Windows 7 or later version. For Windows XP, please refer to section 4.1.3 XHCI Support to disable XHCI mode to avoid possible issue of using USB3 devices in XP.

2.2.5 Gigabit Ethernet Port

Nuvo-4000 offers two Gigabit Ethernet ports using Intel® I210 GbE controller. Each port has one dedicated GbE controller and one dedicated PCI Express link to present maximal network performance. When plugging in the Ethernet cable, you can tell the Ethernet status and speed from the LED indicators on the RJ45 connector as following:

Active/Link LED

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

Speed LED

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

To utilize the GbE port, you need to install corresponding driver for Intel® I210 GbE controller. Please refer to section 4.3 for information regarding driver installation.

2.2.6 DVI-I Connector

Nuvo-4000 supports triple independent display outputs via a DVI-I and a DVI-D connector. The DVI-I connector on the front panel offers DVI/HDMI and VGA display outputs. The DVI/HDMI outputs are directly driven by HM76 PCH and support up to 1920 x 1080 resolution. The VGA output is implemented using an eDP-VGA converter and thus you need to configure the output resolution (up to 1920 x 1080) according to the display device. Please refer to section 4.1.5 for information about configuring VGA output resolution in BIOS. A DVI-I to DVI+VGA Y-cable is needed to have both VGA and DVI/HDMI outputs.

The feature of triple independent display outputs is only available in Windows XP/7/8 with corresponding graphics driver installed. Please refer to section 4.3 for information regarding driver installation.

2.2.7 DVI-D Connector

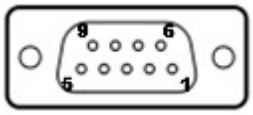
Nuvo-4000 supports triple independent display outputs via a DVI-I and a DVI-D connector. The DVI-D connector on the front panel offers DVI/HDMI signal output and supports up to 1920 x 1080 resolution. You shall need a DVI to HDMI cable when connecting to a HDMI display device.

The feature of triple independent display outputs is only available in Windows XP/7/8 with corresponding graphics driver installed. Please refer to section 4.3 for information regarding driver installation.

2.2.8 COM Ports

Nuvo-4000 provides three COM ports for communicating with external devices. These COM ports are implemented using industrial-grade ITE8783 Super IO chip (-40 to 85°C) and provide up to 115200 bps baud rate.

COM1 and COM2 are software-selectable RS-232/422/485 ports and COM3 supports RS-232 only. The operation mode of COM1 and COM2 can be set in BIOS setup utility (refer to section 4.1.1 for detail). The following table describes the pin definition of COM ports.



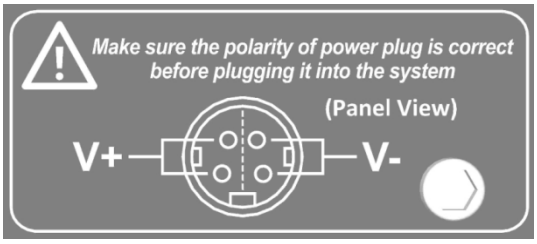
	COM1 & COM2			COM3
Pin#	**RS-232 Mode**	**RS-422 Mode**	**RS-485 Mode (Two-wire 485)**	**RS-232 Mode**
1	DCD			DCD
2	RX	422 TXD+	485 TXD+/RXD+	RX
3	TX	422 RXD+		TX
4	DTR	422 RXD-		DTR
5	GND	GND	GND	GND
6	DSR			DSR
7	RTS			RTS
8	CTS	422 TXD-	485 TXD-/RXD-	CTS
9	RI			RI

2.2.9 Speaker-Out Jack

Nuvo-4000 provides audio function using Intel® High Definition Audio (built-in in HM76) and Realtek ALC262 codec. There is an audio jack available on the front panel for speaker output. To utilize the audio function in Windows, you need to install corresponding drivers for both Intel® HM76 PCH and Realtek ALC262 codec. Please refer to section 4.3 for information regarding driver installation.

2.2.10 4-Pin Mini-DIN Power Connector

Nuvo-4000 allows a wide range of DC power input from 8 to 25V. The 4-pin mini-DIN power connector on the front panel is used to connect the power plug of an AC/DC adapter. It's convenient for indoor usage where AC power is usually available. Since there is no specific rule of pin definition for this type of connector, please always confirm the polarity of the power connector in prior to plug it into Nuvo-4000 if you're not using the power adapter provided from Neousys.



Caution

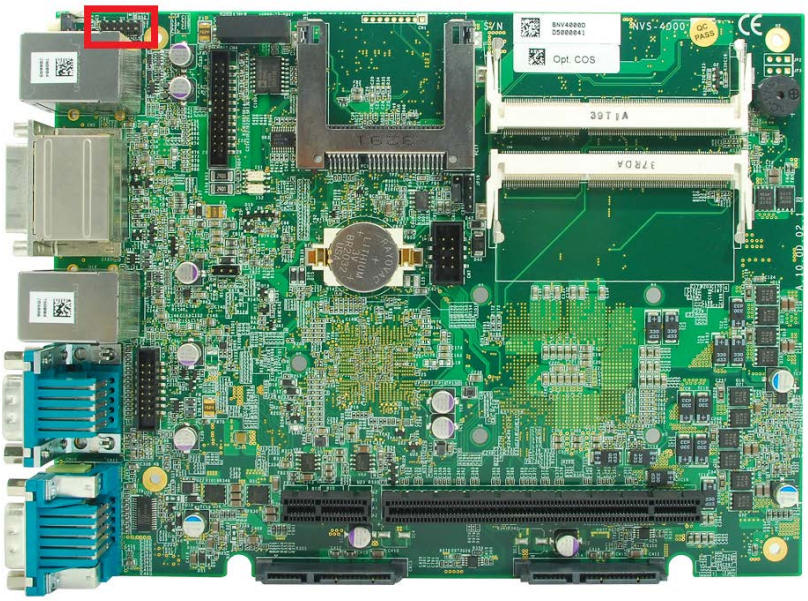
1. *Please make sure the voltage of DC power is correct before you connect it to Nuvo-4000. Supplying a voltage over 25V will damage the system.*

Neousys also offers an optional power cable for the deployment where DC is available. You can wire the cable to DC power source (red for V+, black for GND) and connect the power plug to the 4-pin mini-DIN connector on Nuvo-4000.

2.3 Internal I/O Functions

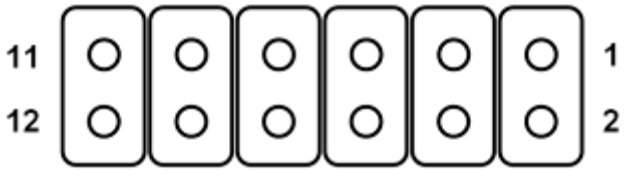
In addition to I/O connectors on the front panel, Nuvo-4000 provides more useful features via its on-board connectors, such as remote on/off control, LED status output, internal USB 2.0 ports, CFast and etc. In this section, we'll illustrate these internal I/O functions.

2.3.1 Status LED Output & Remote On/Off Control



For an application which places Nuvo-4000 inside a cabinet, it's useful to output the system status to external LED indicators so that users can check how the system's running. Nuvo-4000 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.



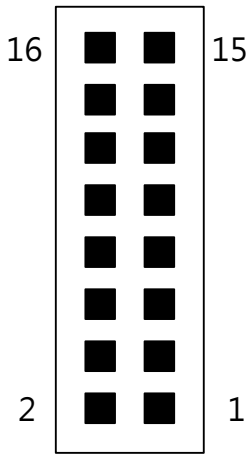
Pin#	Definition	Description
1	WDT_LED-	**[Output]** Watchdog timer indicator, flashing when watchdog timer is started.
2	WDT_LED+	
3	UID_LED-	**[Output]** User defined LED, reserved for future usage
4	UID_LED+	
5	HDD-	**[Output]** Hard drive indicator, flashing when SATA hard drive is active.
6	HDD+	
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.

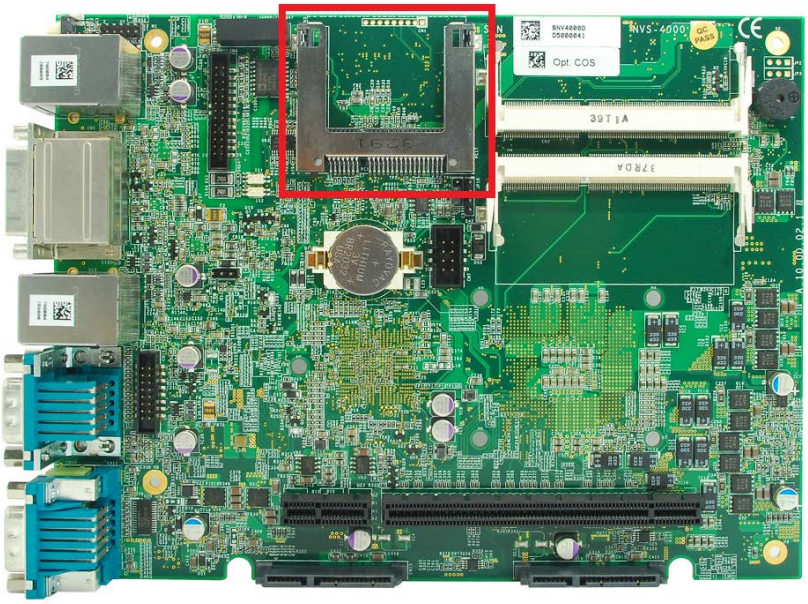
2.3.2 Internal USB2.0 Pin Header

Nuvo-4000 provides additional two USB 2.0 ports internally via a 2x8 pins, 2.0mm pitch box header. The internal USB ports are designed to allow users attaching a protection dongle inside the chassis. To use the internal USB port, you need a dedicated box-header to USB cable. Please contact Neousys for further information



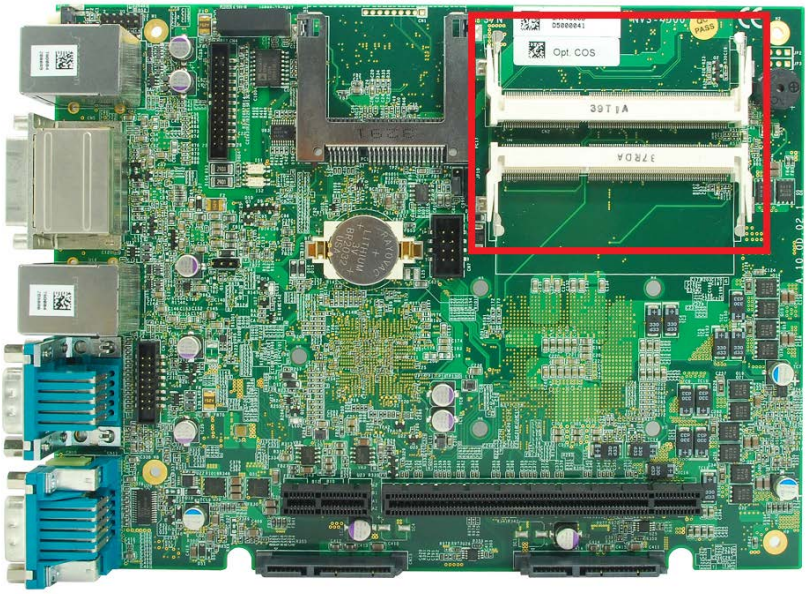
Pin#	Pin Definition
1	USB 5V Power, Max 500mA
2	USB 5V Power, Max 500mA
3	USB8 D-
4	USB9 D-
5	USB8 D+
6	USB9 D+
7	Ground
8	Ground
9 ~ 16	N/C

2.3.3 CFast Socket



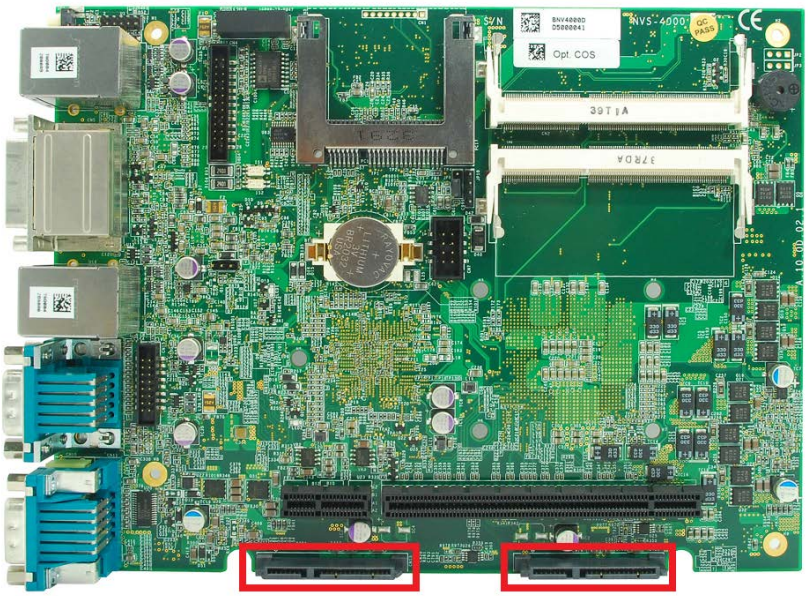
Nuvo-4000 provides a CFast socket on its SBC. CFast is a new interface for portable storage device. It shares a similar form-factor as CompactFlash but leverages Serial ATA interface to offer higher data transfer rate. The CFast socket on Nuvo-4000 is a push-push type. You can insert and push a CFast card to the end to install it, and push the installed CFast card again to eject it.

2.3.4 DDR3 SODIMM Socket



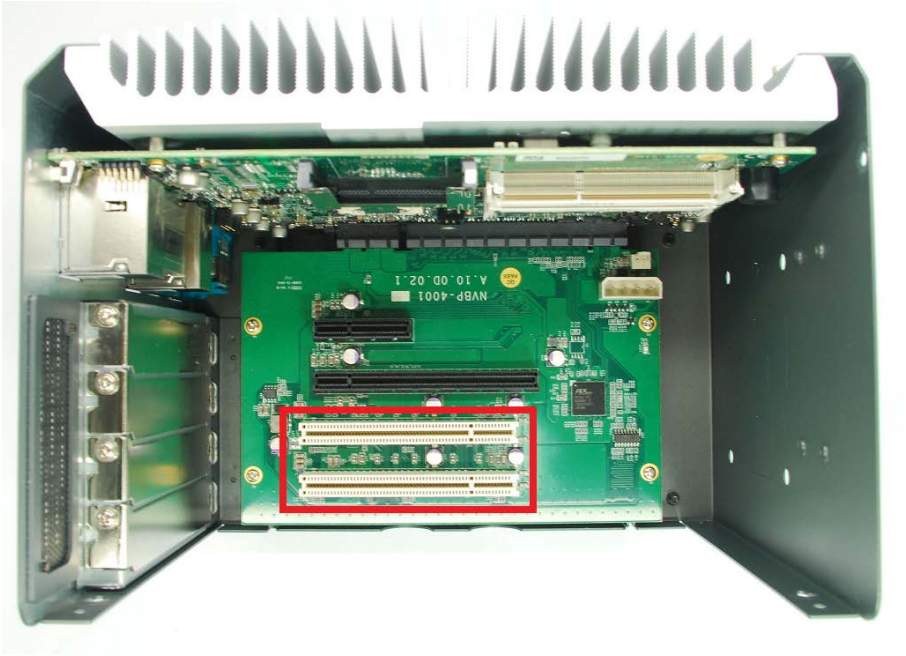
Nuvo-4000 provides two 204-pin, SODIMM sockets for installing DDR3 memory modules. It supports a maximal 16GB capacity by installing two 8GB DDR3 1600MHz SODIMM modules. For information of installing DDR3 memory modules, please refer to section 3.3 for detail.

2.3.5 SATA Connectors



Nuvo-4000 provides two SATA ports to accommodate two 2.5" SATA hard drives in its chassis. These SATA ports are located on the SBC via two 22-pin SATA connectors. With the HDD bracket shipped with Nuvo-4000, you can directly mount two 2.5" HDDs/SSDs to these ports. For information of installing HDD/SSD to the SATA port, please refer to section 3.1 for detail.

2.3.6 PCI Slots

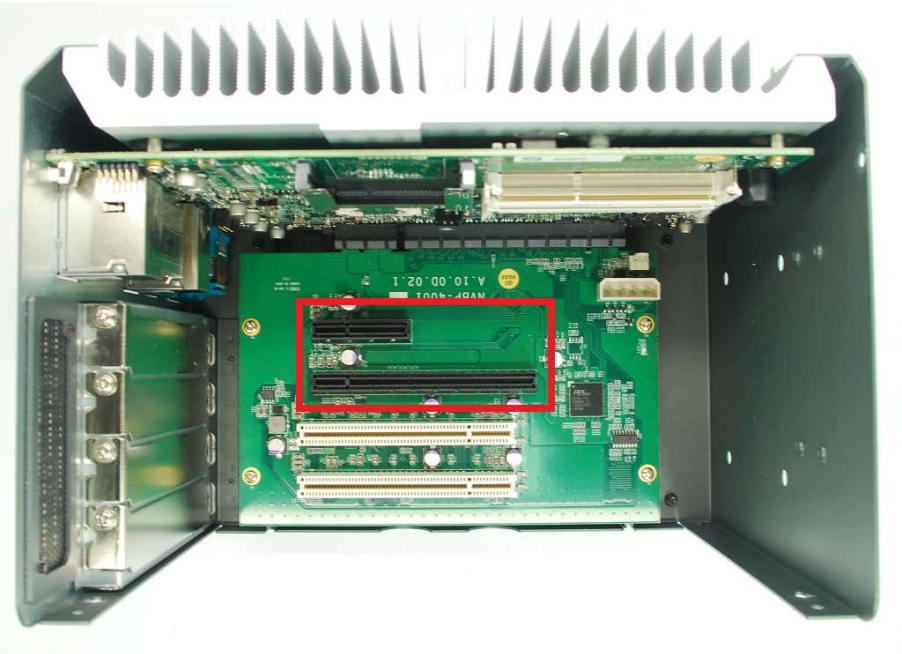


PCI slots are located on the backplane of Nuvo-4000. Nuvo-4022 provides two PCI slots, and Nuvo-4040 provides four PCI slots. These PCI slots support 5V, 32-bit/33MHz PCI bus and can accommodate the PCI card with a maximal dimension of 205mm x 105mm (PCB size, excluding connector). For information of installing PCI cards, please refer to section 3.4 for detail.

Note

1. *Due to the fanless feature, the total power consumption of installed PCI and PCIe cards should be confined to **16W** to limit the heat generated by add-on cards and maintain the system stability. For applications need add-on cards with higher power consumption, the fan option is suggested to maintain a reasonable temperature inside the chassis. Please contact Neousys Technology for the fan option.*
2. *The operating temperature of the whole system when cards installed is affected by the power consumption and operating temperature of add-on cards. Please consult your add-on card dealer or Neousys Technology for further information.*

2.3.7 PCI Express Slots (Nuvo-4022 Only)



Nuvo-4022 provides one x4 and one x16 PCI Express slot. As each PCI Express lane delivers 500 MB/s bandwidth, its x4 PCI Express slot delivers 2 GB/s bandwidth and x16 slot delivers 4 GB/s bandwidth*. In addition, a dedicated 48W (4A@12V) power rail is supplied to the x16 PCI Express slot for powering a high-watt PCIe card (e.g. a graphics card). Another 48W (4A@12V) power rail is shared by x4 PCIe Express slot and other peripheral devices.

These slots can accommodate PCIe card with a maximal dimension of 205mm x 105mm (PCB size, excluding connector). For information of installing PCIe cards, please refer to section 3.4 for detail.

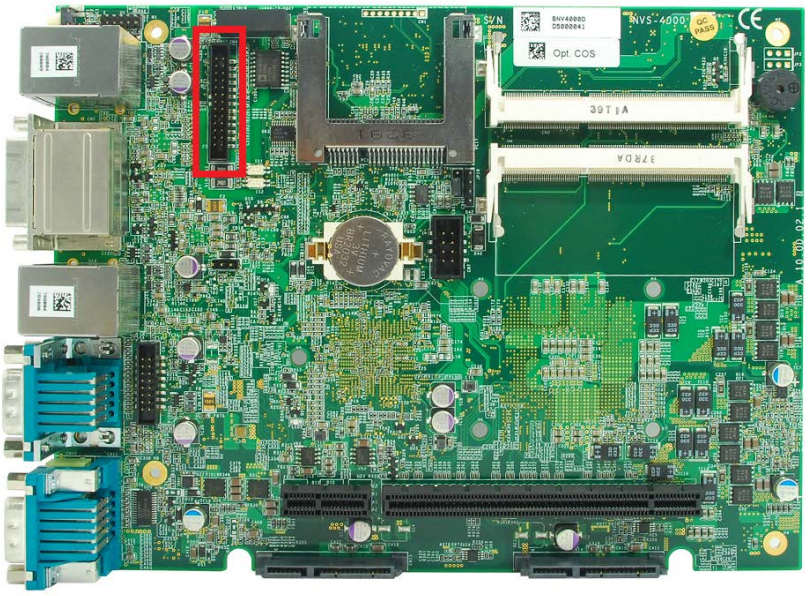
**The x16 PCIe slot on Nuvo-4022 is implemented with 8-lanes, Gen2 PCI Express link and delivers 4GB/s bandwidth. You can install a x16, x8, x4 or x1 PCI Express add-on card to the x16 slot.*

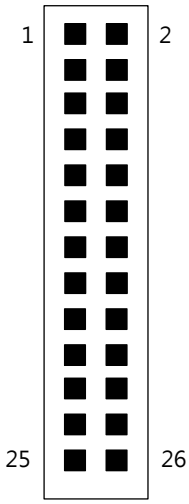
Note

1. *Due to the fanless feature, the total power consumption of installed PCI and PCIe cards should be confined to **16W** to limit the heat generated by add-on cards and maintain the system stability. For applications need add-on cards which consume more than 16W, the fan option is suggested to maintain a reasonable temperature inside the chassis. Please contact Neousys Technology for the fan option.*
2. *The operating temperature of the whole system when cards installed is affected by the power consumption and operating temperature of add-on cards. Please consult your add-on card dealer or Neousys Technology for further information.*

2.3.8 Optional Isolated DIO

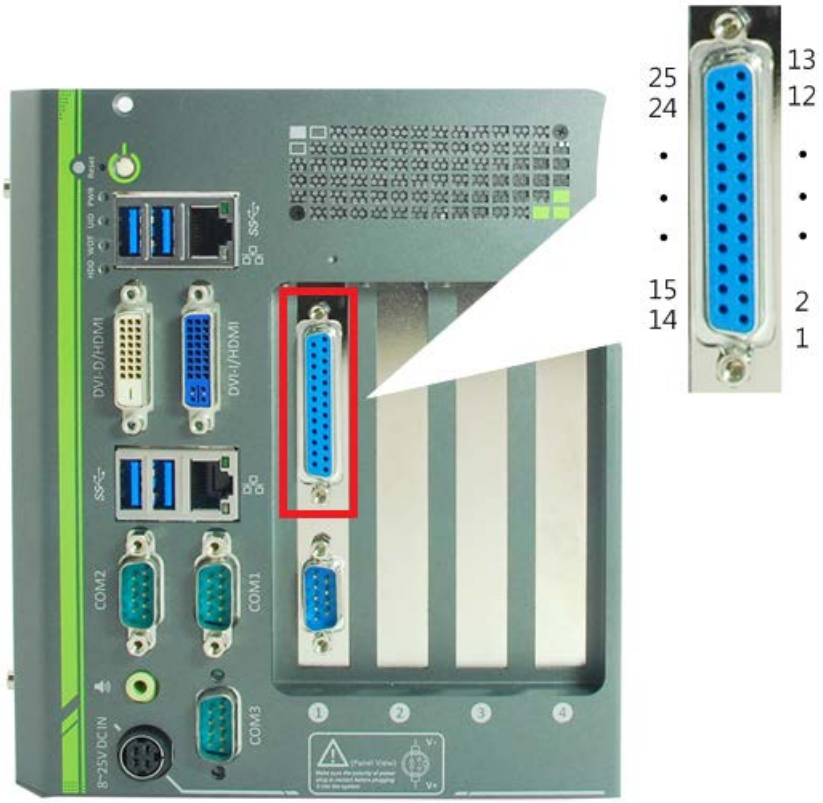
Nuvo-4000 offers an option of on-board 2500 Vrms isolated DIO for extending application range. This option provides 8 channels of isolated digital input and 8 channels of isolated digital output via an on-board 2x13 pins box header. Neousys also provides a flat cable and DSub 25-pin connector to allow front-panel access for the DIO function. In prior to use the DIO function, you need to install Neousys WDT_DIO driver package. Please refer to Appendix A for information of using DIO function.





Pin#	Pin Definition	Pin#	Pin Definition	Pin#	Pin Definition
1	VDD	2	Isolation 5V	3	D_OUT_0
4	DO _GND	5	D_OUT_3	6	D_OUT_1
7	DO _GND	8	D_OUT_2	9	D_OUT_5
10	D_OUT_4	11	D_OUT_7	12	D_OUT_6
13	DI_GND	14	DO_GND	15	D_IN_6
16	DI_GND	17	D_IN_1	18	D_IN_5
19	DI_GND	20	D_IN_3	21	D_IN_0
22	D_IN_7	23	D_IN_2	24	DI_GND
25	D_IN_4	26	N/C		

DIO Connector (box-header) on main board

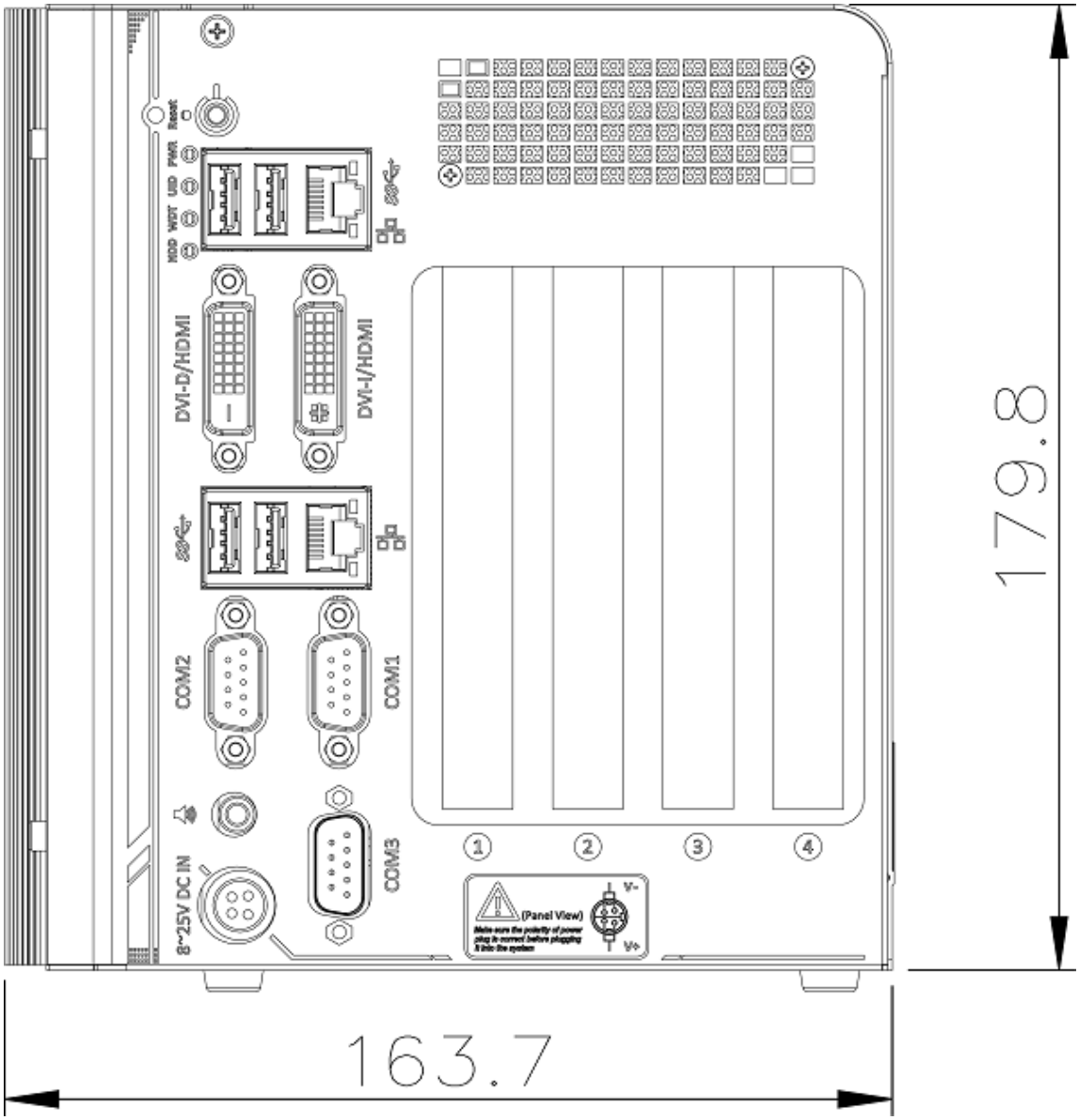


DIO Connector (DSub-25) on the front panel

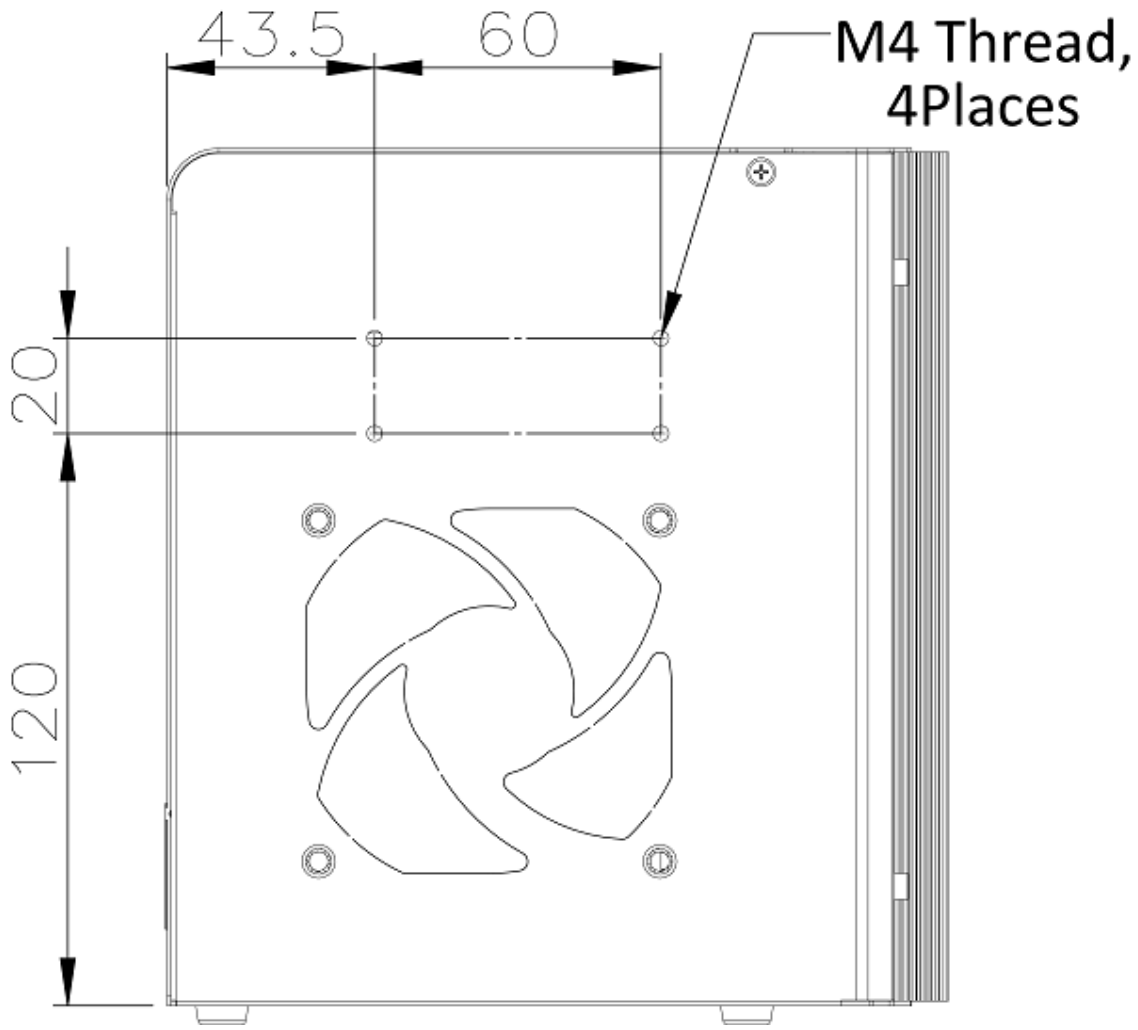
Pin#	Pin Definition	Pin#	Pin Definition
1	VDD	14	ISO_5V
2	DO_0	15	DO_GND
3	DO_3	16	DO_1
4	DO_GND	17	DO_2
5	DO_5	18	DO_4
6	DO_7	19	DO_6
7	DI_GND	20	DO_GND
8	DI_6	21	DI_GND
9	DI_1	22	DI_5
10	DI_GND	23	DI_3
11	DI_0	24	DI_7
12	DI_2	25	DI_GND
13	DI_4		

2.4 Mechanical Dimension

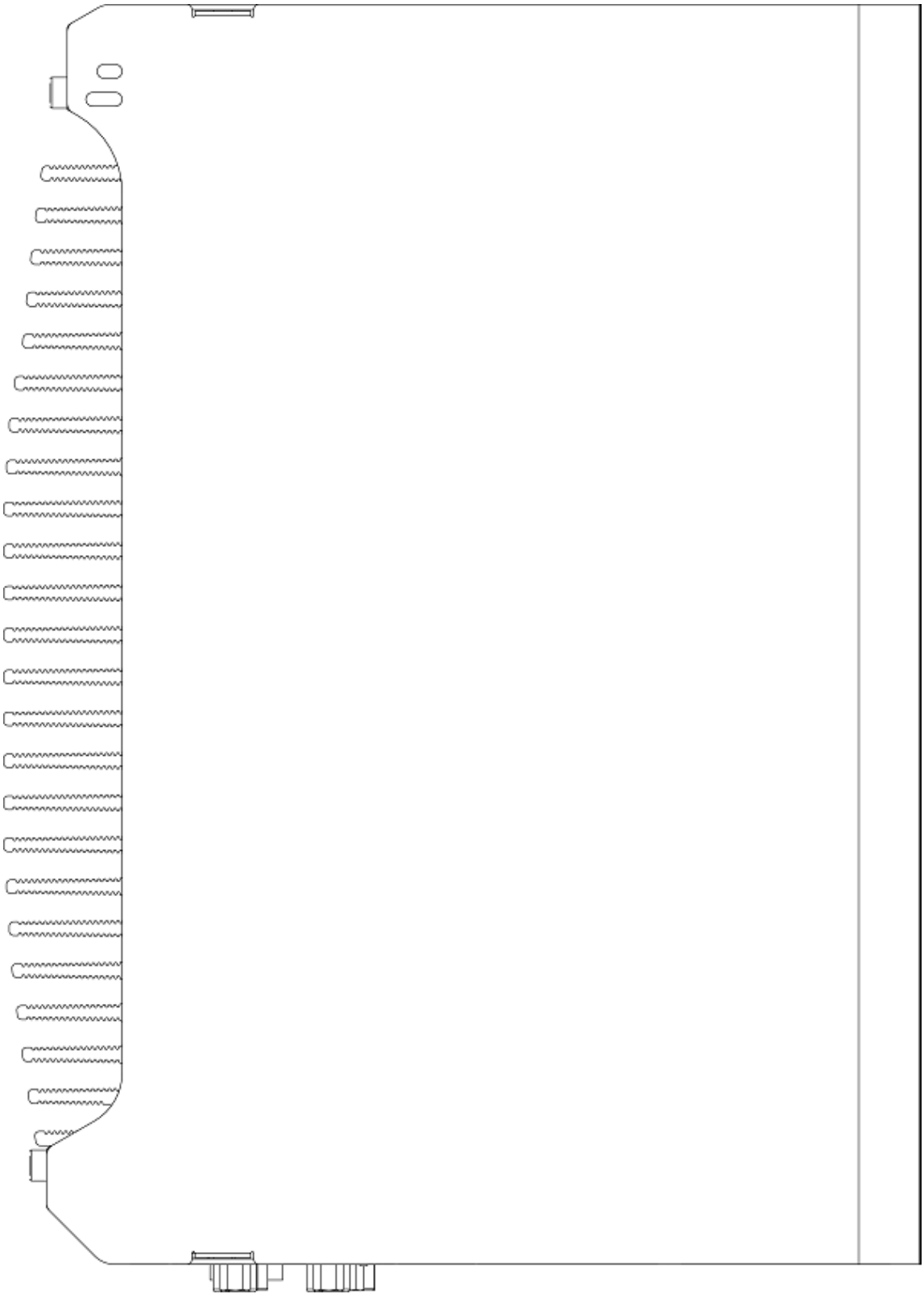
2.4.1 Front View



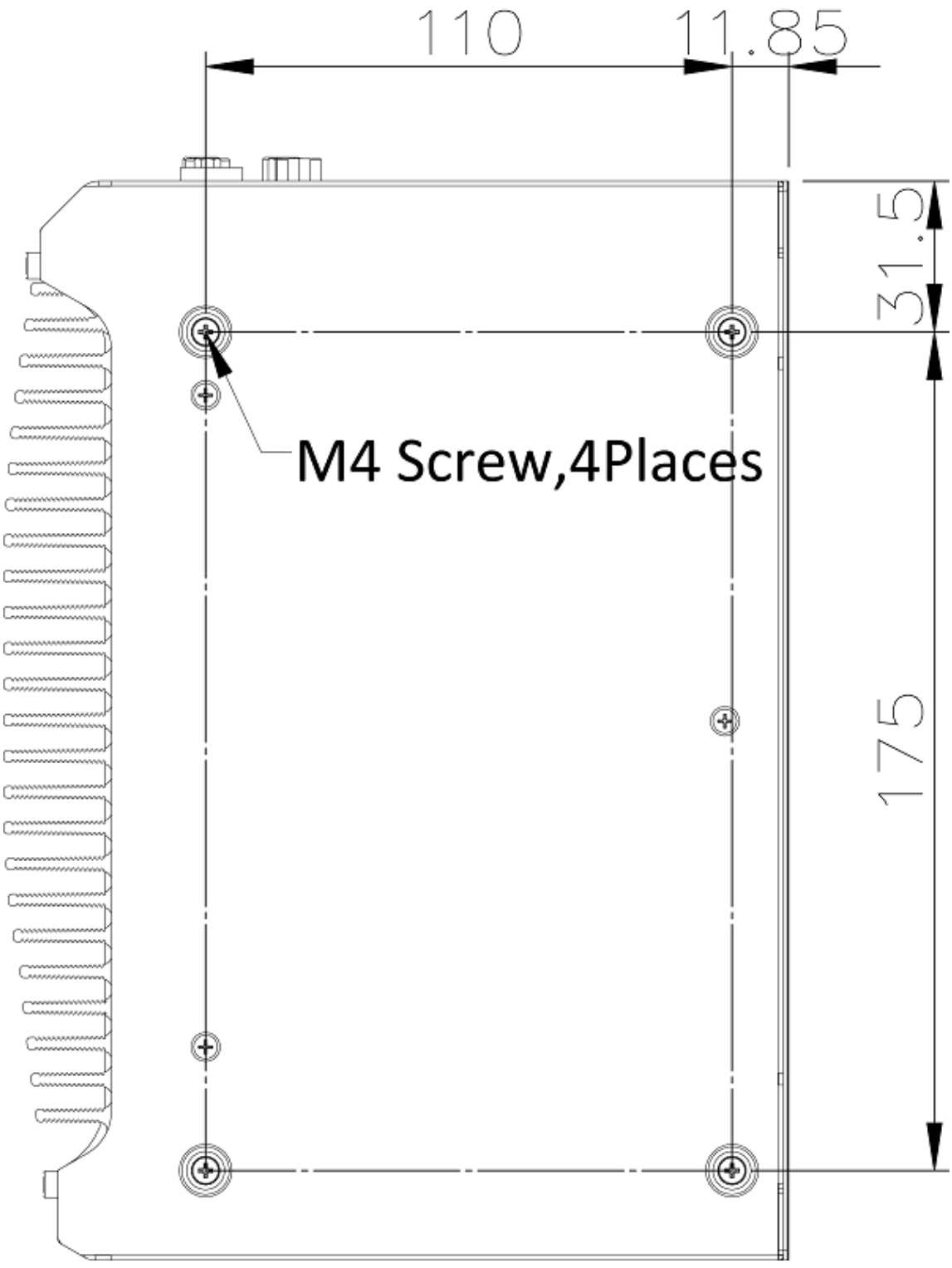
2.4.2 Back View



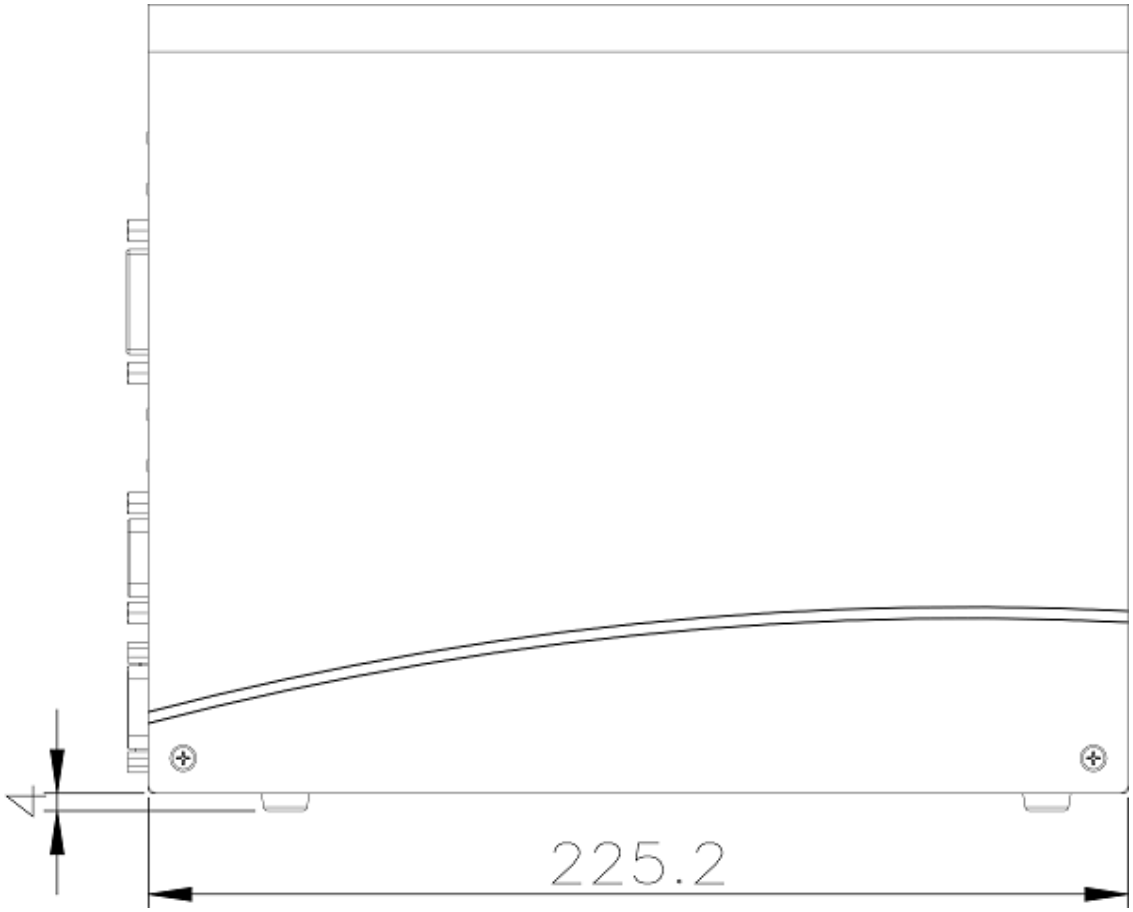
2.4.3 Top View



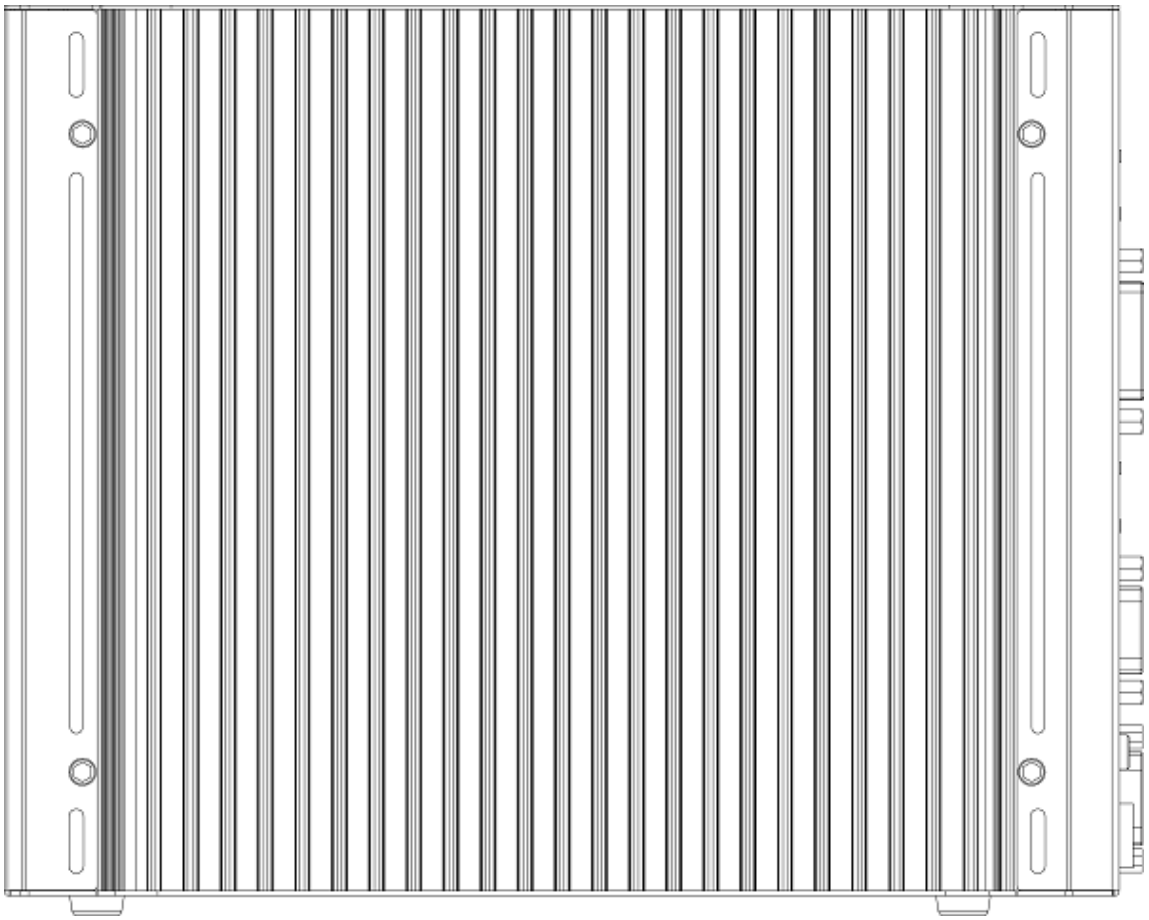
2.4.4 Bottom View



2.4.5 Right View



2.4.6 Left View



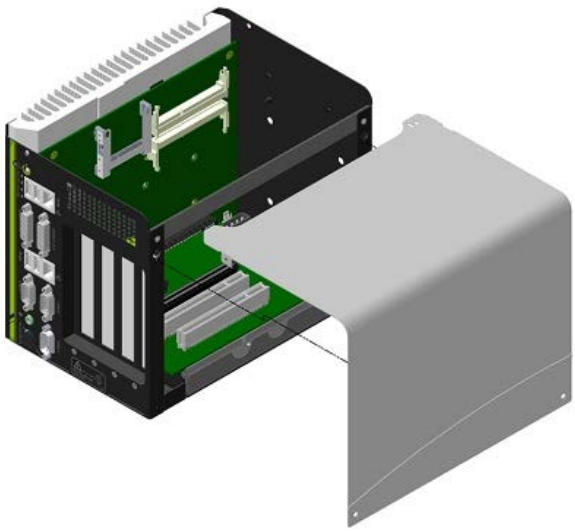
Chapter 3 Getting Start

3.1 Install the SATA HDD/SSD

Nuvo-4000 offers two SATA ports located on the SBC via two 22-pin SATA connectors. A dedicated bracket is included in its chassis assembly to hold two HDDs and connect them to SATA ports. To install HDD(s) on SATA port(s), please follow the steps listed below.

1. Loose 4 screws on the front, back and right side of the chassis.

2. Simply open the chassis by pushing its side cover toward top, then remove the side cover and the SBC is exposed.



3. Get the HDD bracket and eight M3 flat-head screws from the accessory box. And install your HDD(s) into the HDD bracket. Note that the HDD must be placed in a right direction.

4. Fasten the HDD(s) using M3 flat-head screws.

5. Smoothly push the HDD bracket assembly into the SATA slot at the bottom of Nuvo-4000 case until SATA HDD(s) firmly attached to SATA connector(s).

6. Fix the SATA HDD bracket to the bottom of chassis with three M3 flat-head screws.

3.2 Install a CFast card

Nuvo-4000 provides an on-board CFast socket. The CFast socket is directly connected to the SATA port of HM76 chipset and accordingly you can use a CFast card for installing operating system such as Windows XP, Windows 7, Linux and etc. To install a CFast card, please follow the steps listed below.

1. Open the chassis by following step #1 and #2 in section 3.1. You can see the CFast socket exposed.
2. Align your CFast card with the guide of the CFast socket. Note that you must have the obverse side toward the SBC.

3. Push down your CFast card until it's firmly contacted with pins of the CFast socket.

3.3 Install the DDR3 SODIMM Module

Nuvo-4000 provides two 204-pin, SODIMM sockets for installing DDR3 memory module(s). It supports maximal two 8GB, 1333/1600MHz DDR3 SODIMM modules. To install the DDR3 SODIMM module, please follow the steps listed below.

1. Open the chassis by following step #1 and #2 in section 3.1. The SODIMM sockets are exposed.
2. Tile the SODIMM module and insert it to the SODIMM socket on the SBC.

3. As the DDR3 SODIMM module is firmly contacted with socket connectors, press it down until the clamps of the socket snap into the latching position of SODIMM module.

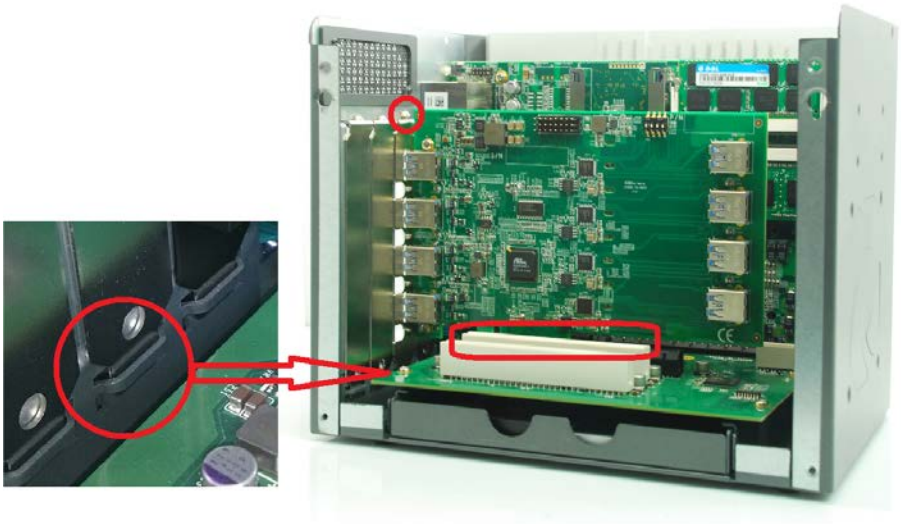
4. Repeat step#2 and step#3 if you want install second DDR3 SODIMM module.

3.4 Install the PCI/PCIe Add-on Card

Nuvo-4000 provides PCI and PCIe slots on its backplane. Nuvo-4040 provides four PCI slots, as Nuvo-4022 provides two PCI slots plus two PCI Express slots. Nuvo-4000 supports 5V, 33MHz/32-bit PCI bus and can accommodate PCI cards with a maximal dimension of 205mm x 105mm (PCB size, excluding connector).

To install the PCI/PCIe add-on card, please follow the steps listed below.

1. Open the chassis by following step #1 and #2 in section 3.1. The PCI/PCIe slots are exposed.
2. Install your add-on card into the PCI/PCIe slot. Make sure the "golden finger" connector is firmly contacted with PCI/PCIe connector and the faceplate of the add-on card is well inserted to the groove underneath.



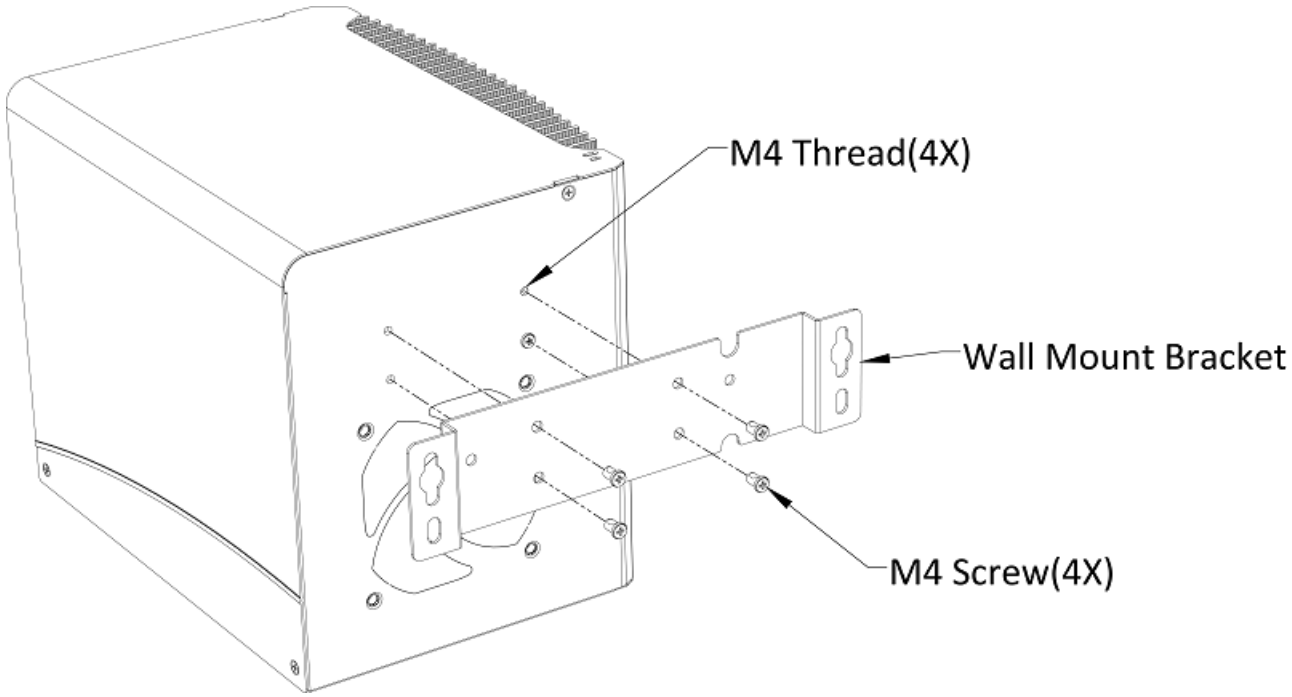
3. Get the M3 PW-head screw from the accessory box. And use it to fix your PCI/PCIe add-on card.

3.5 Mount your Nuvo-4000

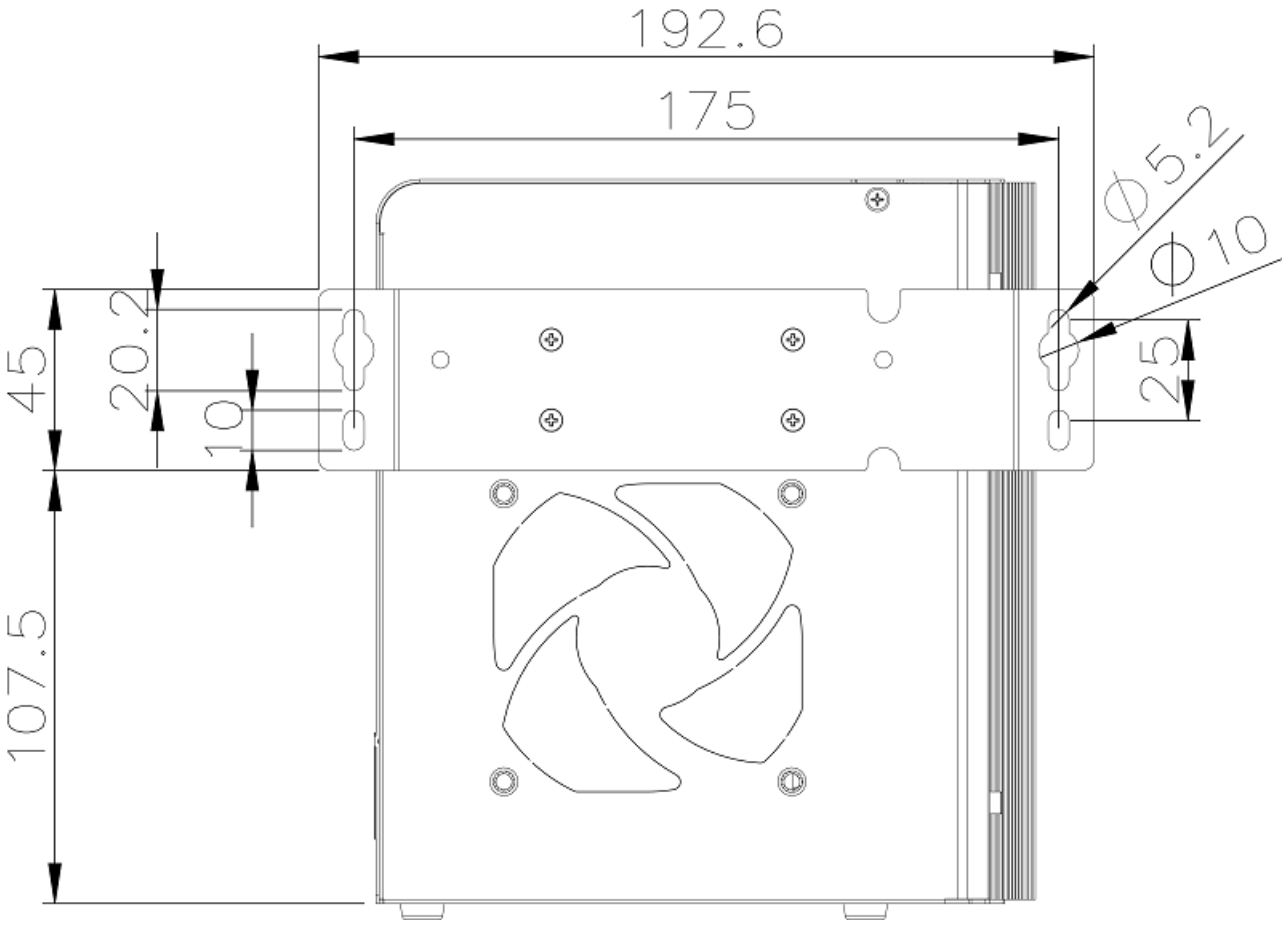
Nuvo-4000 provides versatile ways of mounting. You can use wall-mounting brackets shipped with Nuvo-4000 to mount it on the wall. Neousys also offers optional DIN rail clip to mount Nuvo-4000 on a DIN rail. To mount your Nuvo-4000, please refer to the information listed below.

3.5.1 Mount your Nuvo-4000 on the Wall

1. Get one wall-mounting bracket and four M4 screws from the accessory box. Fix the mounting bracket to the back side of Nuvo-4000 using M4 screws.

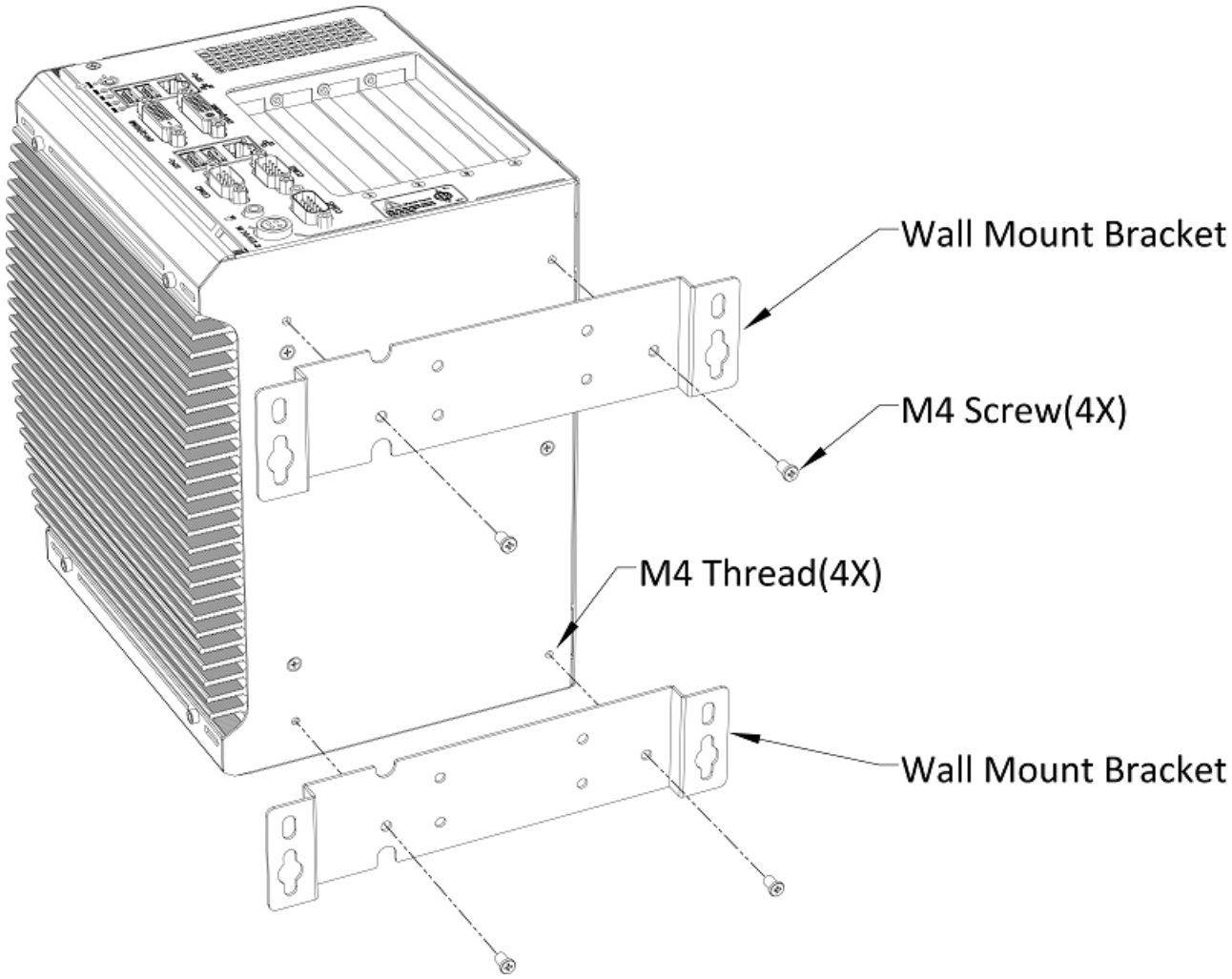


2. Fix Nuvo-4000 on the wall via the screw holes of the mounting bracket. You can also take advantage of the keyhole-shaped holes of the mounting bracket to suspend Nuvo-4000 on the Wall.

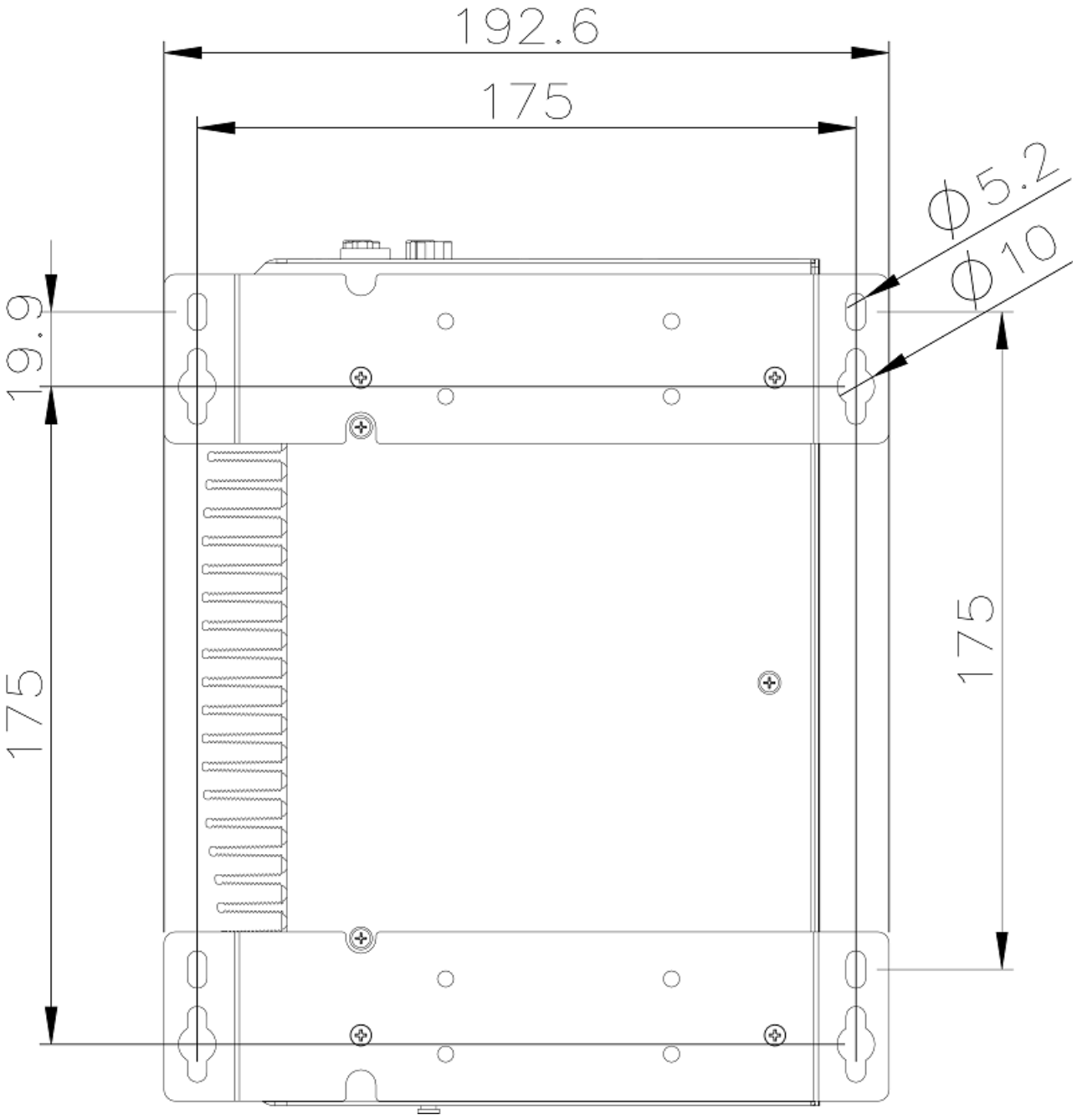


3.5.2 Mount your Nuvo-4000 on a Flat Surface

1. Get two wall-mounting brackets and four M4 screws from the accessory box. Fix the mounting brackets to the bottom side of Nuvo-4000 using M4 screws.

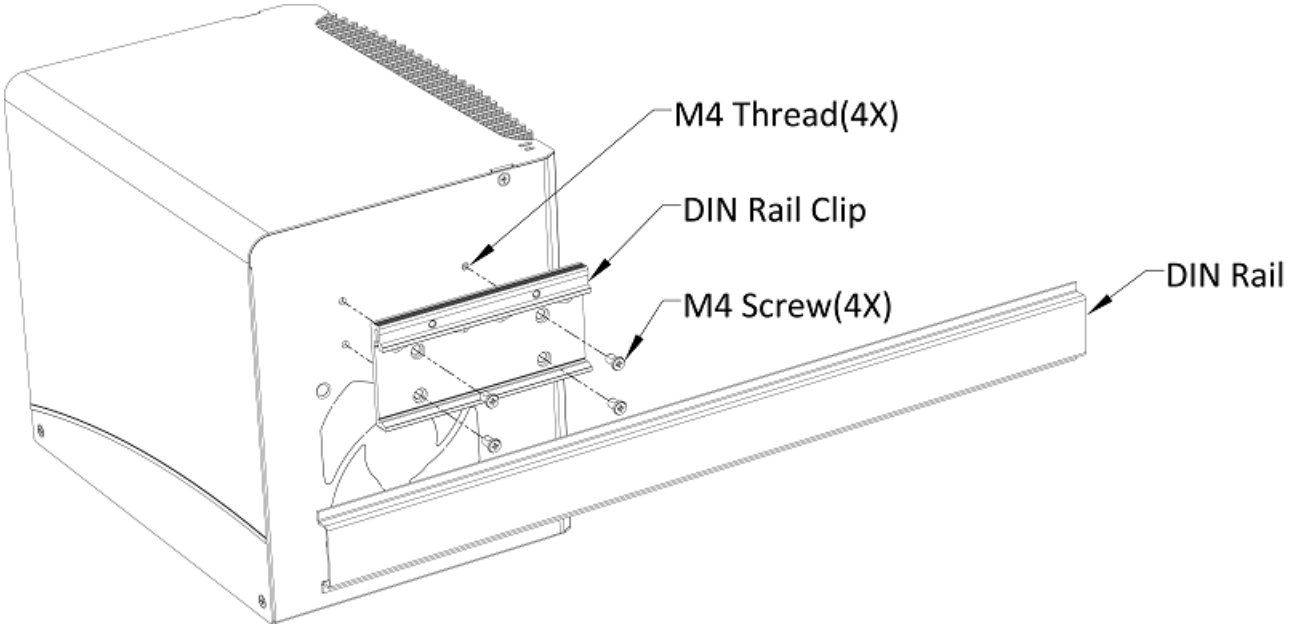


2. Fix Nuvo-4000 on a flat surface via the screw holes of two mounting brackets.



3.5.3 Mount your Nuvo-4000 on the DIN Rail

Neousys also provides the option of the DIN-rail mounting clip. You should fix the clip to Nuvo-4000 using four M4 flat-head screws before mount it to a DIN rail. This option can be useful if you want to deploy Nuvo-4000 inside an equipment cabinet where DIN rail is available.

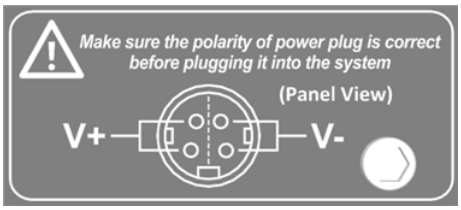


3.6 Connect DC power to you Nuvo-4000

Nuvo-4000 can be powered by 8~25V DC via the 4-pin mini-DIN power connector on the front panel. Neousys provides a matched AC/DC power adapter (for where AC is available) and an option of 4-pin mini-DIN power cable (for where DC is available) for powering your Nuvo-4000.

Caution

1. *Please make sure the voltage of DC power is correct before you connect it to Nuvo-4000. Supplying a voltage over 25V will damage the system.*
2. *Please always confirm the polarity of the power connector in prior to plug it into Nuvo-4000 if you're not using the power adapter provided from Neousys.*



To connect DC power via the 4-pin mini-DIN power connector, please follow the steps listed below.

1. Find your AC-DC adapter with a matched 4-pin mini-DIN power plug. Or use the optional 4-pin mini-DIN power cable for directly connecting to DC power source.
2. Make sure the AC-DC adapter or the DC source is off before you connect the power plug to your Nuvo-4000.
3. Insert the power plug of AC-DC adapter or power cable into the power connector and push it to the end. The power plug shall stay firmly with the 4-pin mini-DIN power connector.

3.7 Power on your Nuvo-4000

For better flexibility of operation, Nuvo-4000 provides alternatives to power on your Nuvo-4000. You can turn on your Nuvo-4000 by pressing the power button, or by sending a special LAN packet. In this section, we illustrate these ways to power on your Nuvo-4000.

3.7.1 Power on Nuvo-4000 using the power button on the front panel

This is the simplest way to turn on your Nuvo-4000. The power button on the front panel is a non-latched switch and behaves an ATX-mode on/off control. As DC power is provided, push the power button and then system is on as well as the PWR LED of power button is on. Push the button when system is on can turn off the system. If your operating system supports ATX power mode (i.e. Microsoft Windows or Linux), push the power button causes a pre-defined system behavior, such as shutdown or hibernation.

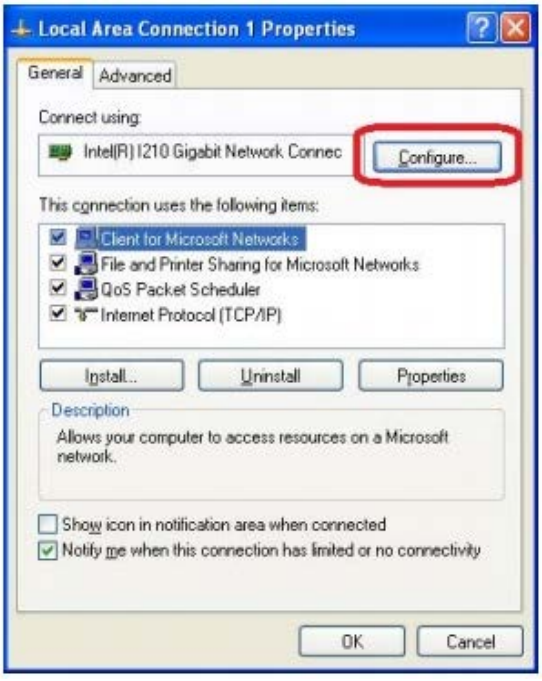
3.7.2 Power on Nuvo-4000 using Wake-on-LAN function

Wake-on-LAN (WOL) is a mechanism to wake up a computer system from a S3 (standby), S4 (Hibernate) or S5 (system off with standby power) state via issuing Subnet Directed Broadcasts (SDB) or a magic packet. Nuvo-4000 implements the Wake-on-LAN function on its first GbE port.

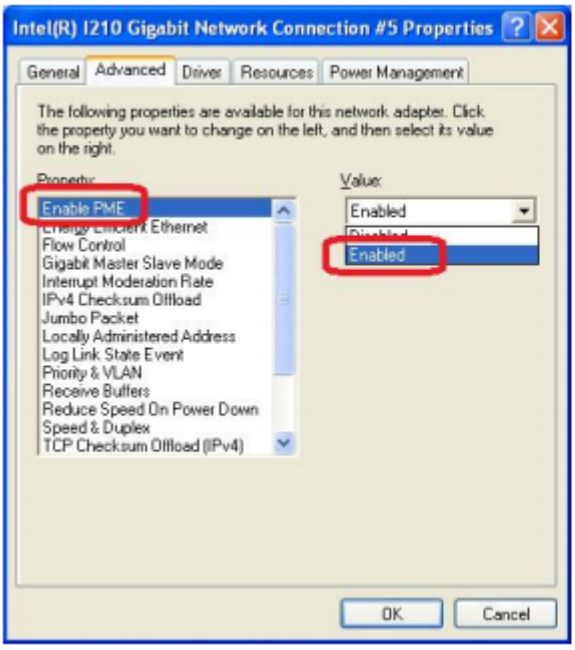
To enable WOL function and power on you Nuvo-4000, please follow the steps listed below.

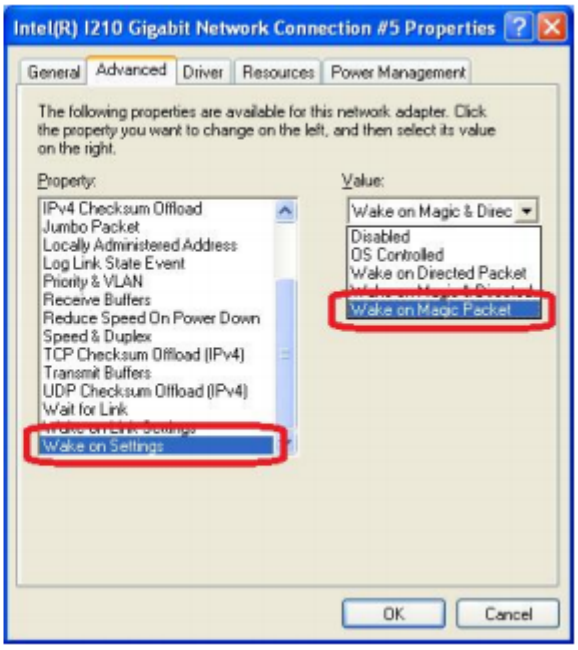
For Windows XP

1. When Nuvo-4000 boots up, press F2 to enter BIOS setup utility.
2. Enter the **[Power]** BIOS setting menu.
3. Configure the **[Wake On LAN]** BIOS option as **[Enabled]**. This setting enables the Wake-on-LAN function for Nuvo-4000. Please refer to section 4.1.8 for the instruction of configuring this option.
4. In Windows system, identify the Local Area Connection of Intel® I210 Gigabit Controller and click the **Configure** button.



5. Click the Advanced tag, and configure the following two options accordingly.





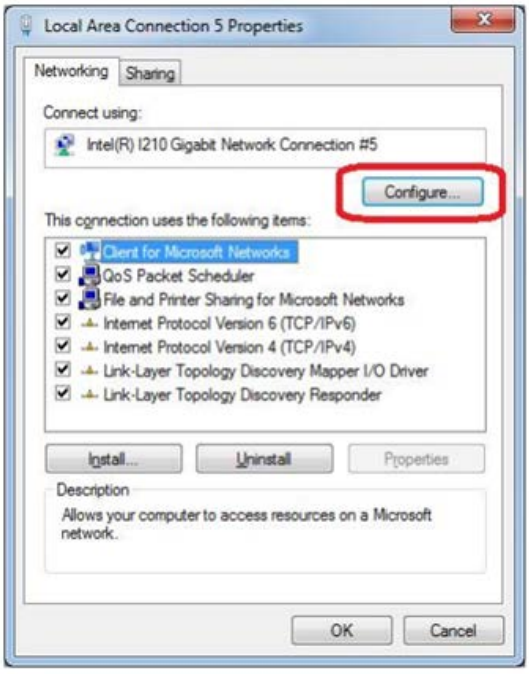
- **Enable PME**
  This option enables Intel® I210 to generate a power management event and signal the Nuvo-4000 to wake up from S5 state.
- **Wake on Magic Packet**
  Nuvo-4000 can wake from S5 state when receiving a magic packet. The magic packet is a broadcast frame containing anywhere within its payload 6 bytes of all 255 (FF FF FF FF FF FF in hexadecimal), followed by sixteen repetitions of the target computer's 48-bit MAC address.

  For example, NIC's 48-bit MAC Address is 78h D0h 04h 0Ah 0Bh 0Ch

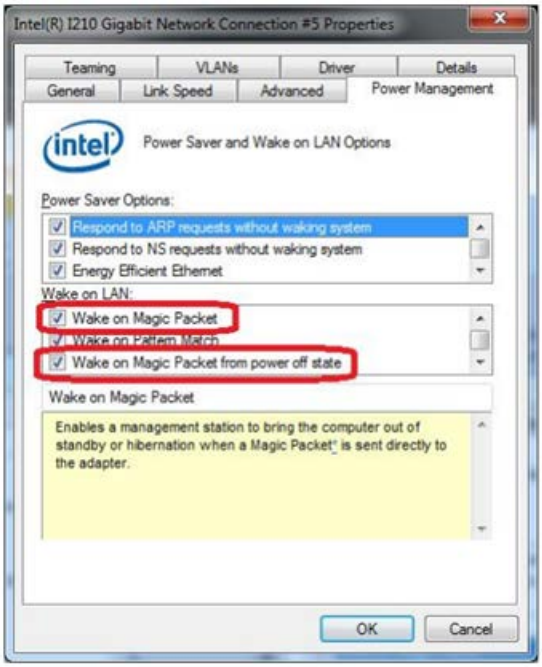
  DESTINATION SOURCE MISC FF FF FF FF FF FF
  78 D0 04 0A 0B 0C 78 D0 04 0A 0B 0C
  78 D0 04 0A 0B 0C 78 D0 04 0A 0B 0C
  78 D0 04 0A 0B 0C 78 D0 04 0A 0B 0C
  78 D0 04 0A 0B 0C 78 D0 04 0A 0B 0C
  78 D0 04 0A 0B 0C 78 D0 04 0A 0B 0C
  78 D0 04 0A 0B 0C 78 D0 04 0A 0B 0C
  78 D0 04 0A 0B 0C 78 D0 04 0A 0B 0C
  78 D0 04 0A 0B 0C 78 D0 04 0A 0B 0C
  MISC CRC
  There are some free tools available on Internet that can be used to send a magic packet. Please refer to the following link to understand more about Magic Packet.
  http://en.wikipedia.org/wiki/Wake-on-LAN

For Windows 7

1. When Nuvo-4000 boots up, press F2 to enter BIOS setup utility.
2. Enter the **[Power]** menu. And configure the **[Wake On LAN]** option as **[Enabled]**. This setting enables the Wake-on-LAN function for Nuvo-4000. Please refer to section 4.1.8 for the instruction of configuring this BIOS option.
3. In Windows 7 system, identify the Local Area Connection of corresponding Intel® I210 Gigabit Controller and click the **Configure** button.



4. Click the **Power Management tag**, and check the following two options accordingly



Chapter 4 BIOS and Driver

4.1 BIOS Settings

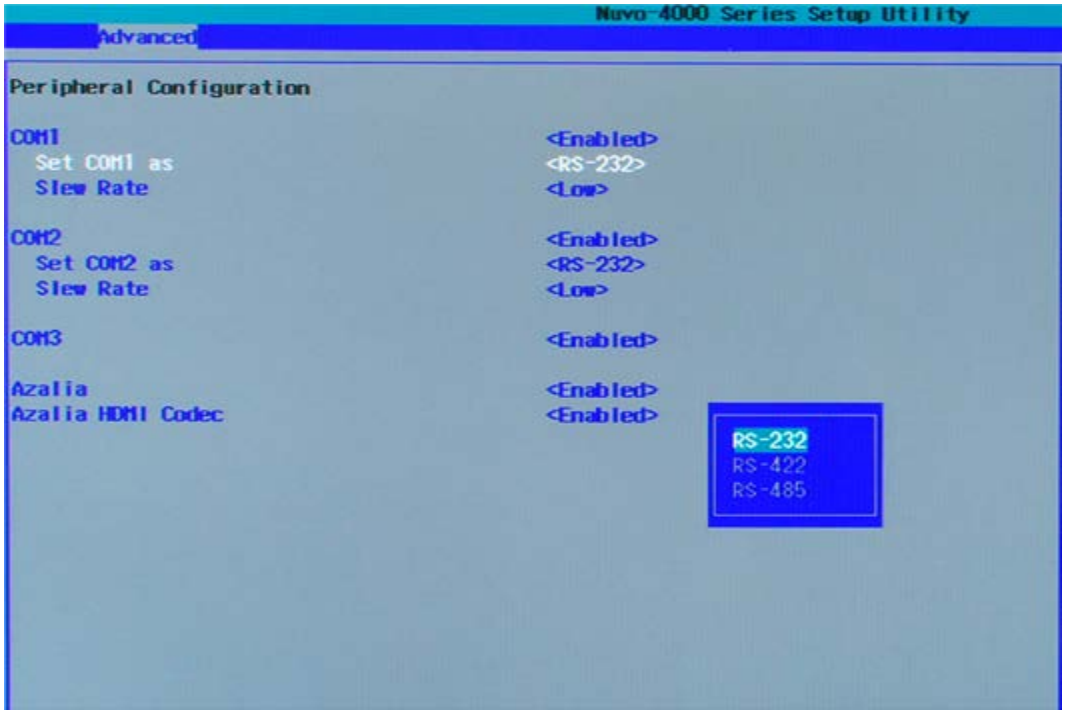
Nuvo-4000 is shipped with factory-default BIOS settings cautiously programmed for best performance and compatibility. In this section, we'll illustrate some of BIOS settings you may need to modify. Please always make sure you understand the effect of change before you proceed with any modification.

4.1.1 COM1 & COM2 Operating Mode

COM1/COM2 of Nuvo-4000 supports RS-232 (full-duplex), RS-422 (full-duplex) and RS-485 (half-duplex) mode. You can set the COM1/COM2 operating mode via BIOS settings. Another option in BIOS called "Slew Rate" defines how sharp the rising/falling 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.

To set COM1/COM2 operating mode:

1. When Nuvo-4000 boots up, press F2 to enter BIOS setup utility.
2. Go to **[Advanced]** → **[Peripheral Configuration]**.
3. Set the **[Set COM1 as]** to a proper mode for COM1 of your Nuvo-4000.
4. Set the **[Set COM2 as]** to a proper mode for COM2 of your Nuvo-4000.



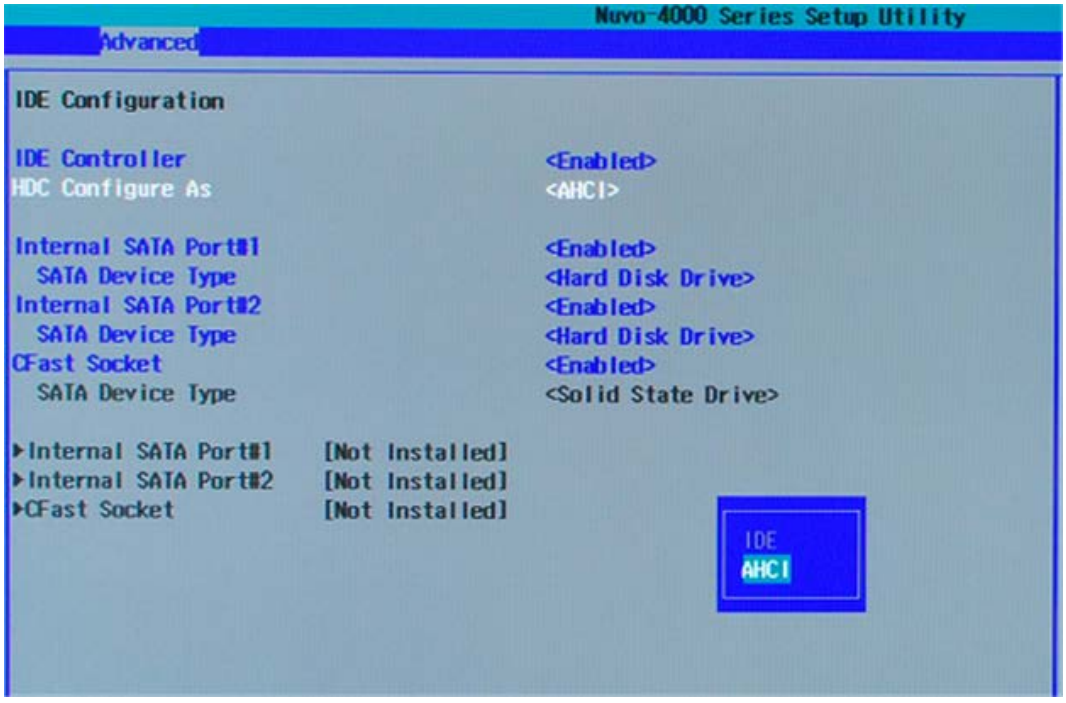
4.1.2 SATA Controller Mode

The SATA controller of Nuvo-4000 supports IDE (non-AHCI) and AHCI mode. IDE mode is a legacy interface and is compatible with most storage devices. AHCI mode, which exposes SATA's advanced capabilities such as hot swapping and native command queuing, are supported in several later version of operating systems.
Our suggestion of how to set SATA controller mode is

- If you're using Windows XP, Linux kernel earlier than 2.6.19, or you want to use a CF card, you should select IDE+SATA (Non-AHCI) mode.
- If you're using Windows Vista, Windows 7, or Linux kernel from 2.6.19 onward, you can select AHCI mode for better performance.

To set SATA controller mode:

1. When Nuvo-4000 boots up, press F2 to enter BIOS setup utility.
2. Go to **[Advanced]** → **[HDC Configure As]**.
3. Set the **[HDC Configure as]** to a proper mode for your Nuvo-4000.

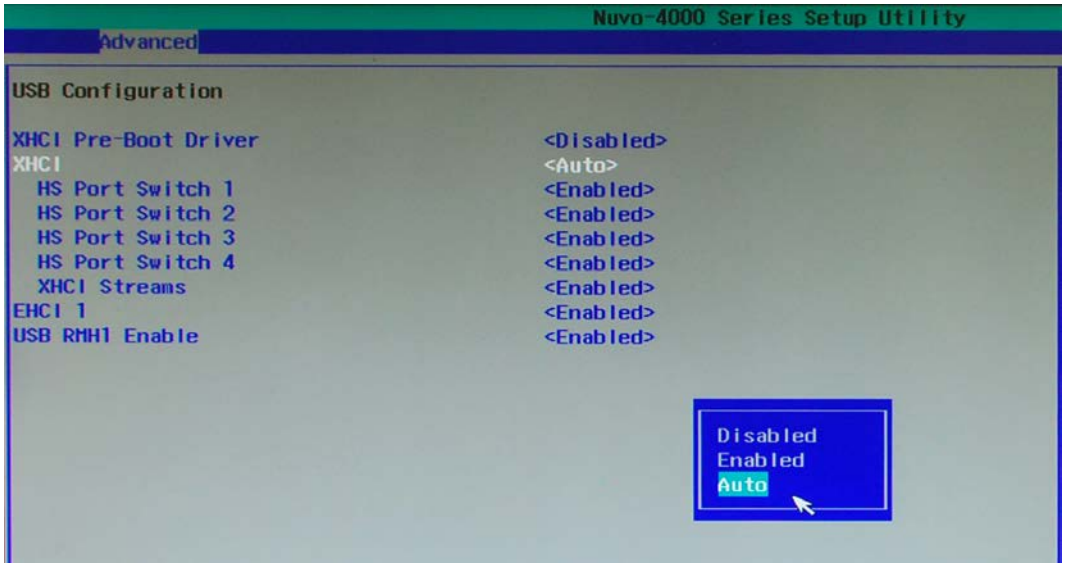


4.1.3 XHCI Support

Nuvo-4000 features XHC/EHCI controller and supports legacy USB devices such as USB keyboard and mouse. This option determines the enabling/disabling of XHCI controller. As USB 3.0 driver is not available for Windows XP, we suggest you set [XHCI] as "Disabled" to avoid issue when plugging a USB3 device in XP environment.

To select XHCI controller support:

1. When Nuvo-4000 boots up, press F2 to enter BIOS setup utility.
2. Go to **[Advanced]** → **[USB Configuration]**.
3. Set the **[XHCI]** to a proper mode for your Nuvo-4000.

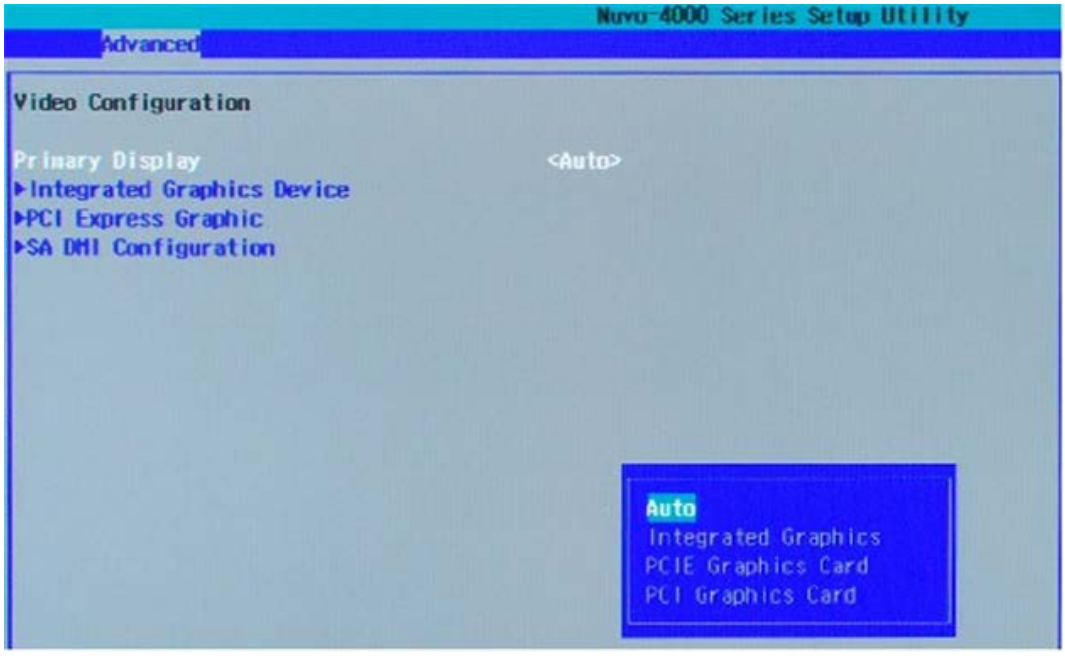


4.1.4 Video Configuration

Nuvo-4000 has an Integrated Intel® HD Graphics 4000 engine in its Core™i5/i7 processor. For some applications, you may need to install and use a stand-alone graphics card for display output. When using a PCI or PCI Express graphics card, you should set the primary display device in BIOS in advance.

To set the primary display device:

1. When Nuvo-4000 boots up, press F2 to enter BIOS setup utility.
2. Go to **[Advanced]** → **[Video Configuration]**.
3. Set the **[Primary Display]** to a proper device for your Nuvo-4000.
   - Select "Integrated Graphics Device" if using integrated Intel® HD Graphics 4000 graphics engine
   - Select "PCIe Graphics Card" if using a PCI Express graphics card
   - Select "PCI Graphics Card" if using a PCI graphics card
   - Select "Auto" will specify the following priority for primary display device PCIe Graphics (if installed) → PCI Graphics (if installed) → IGD

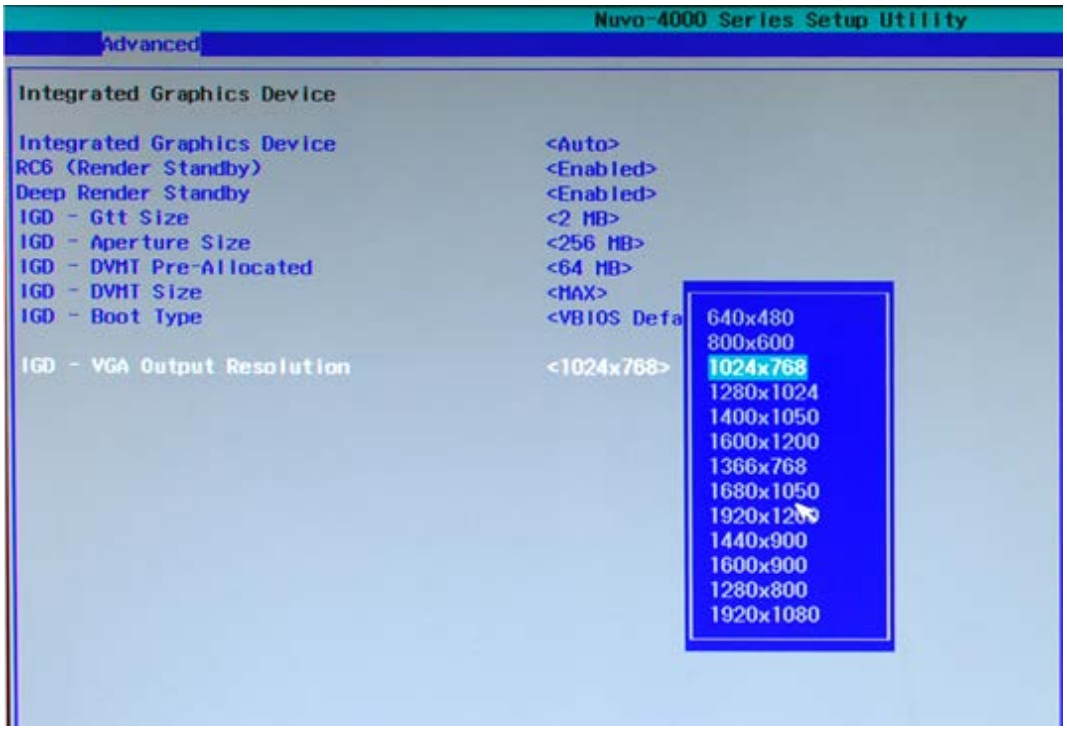


4.1.5 VGA Output Resolution

Nuvo-4000 offers both VGA and DVI display outputs on its DVI-I connector. For supporting triple independent display outputs, the VGA is implemented via a eDP-VGA converter chip. To obtain the optimal display performance, you should specify VGA output resolution according to the best resolution of your display device. Nuvo-4000 supports maximal 1920x1080 resolution for its VGA output.

To set the VGA output resolution:

1. When Nuvo-4000 boots up, press F2 to enter BIOS setup utility.
2. Go to **[Advanced]** → **[Video Configuration]** → **[Integrated Graphics Device]**.
3. Set the **[VGA Output Resolution]** to a proper value according to the best resolution of your display device.



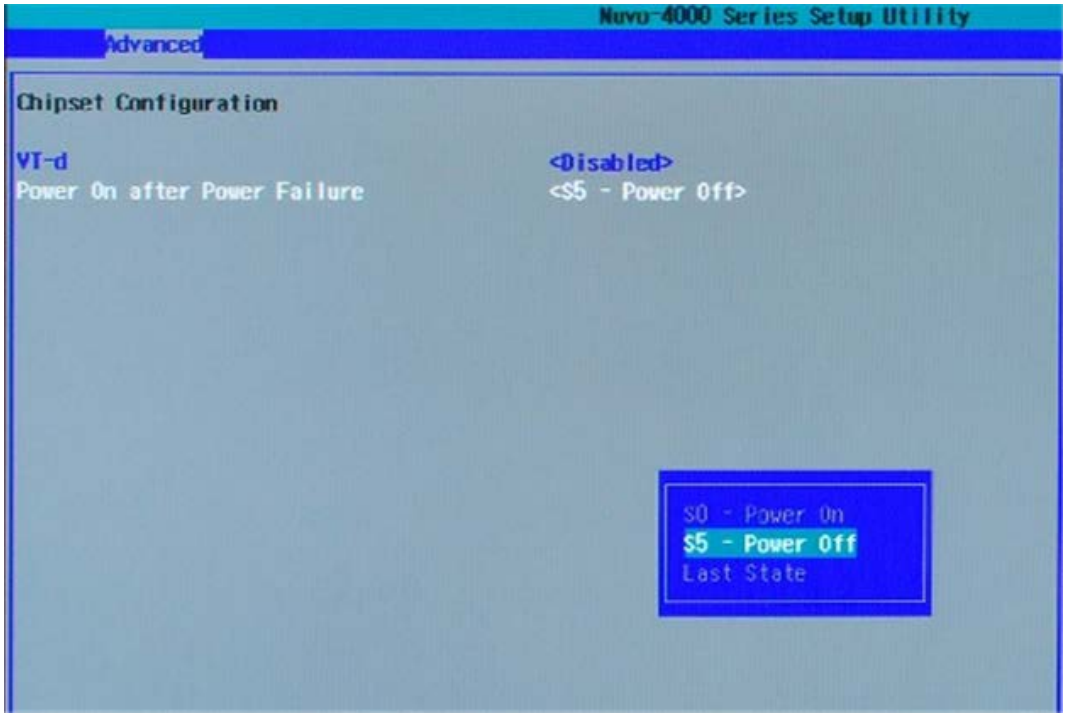
4.1.6 Power On after Power Failure Option

This option defines the behavior of Nuvo-4000 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.
Last State	The on/off state of the system is determined according to the last state when DC power is disconnected. For example, if system is still on but DC power is unplugged, the system is powered on next time when DC power is supplied.

To set "Power On after Power Failure" option:

1. When Nuvo-4000 boots up, press F2 to enter BIOS setup utility.
2. Go to **[Advanced]** → **[Chipset Configuration]**
3. Set the **[Power On after Power Failure]** to a proper value for your Nuvo-4000.

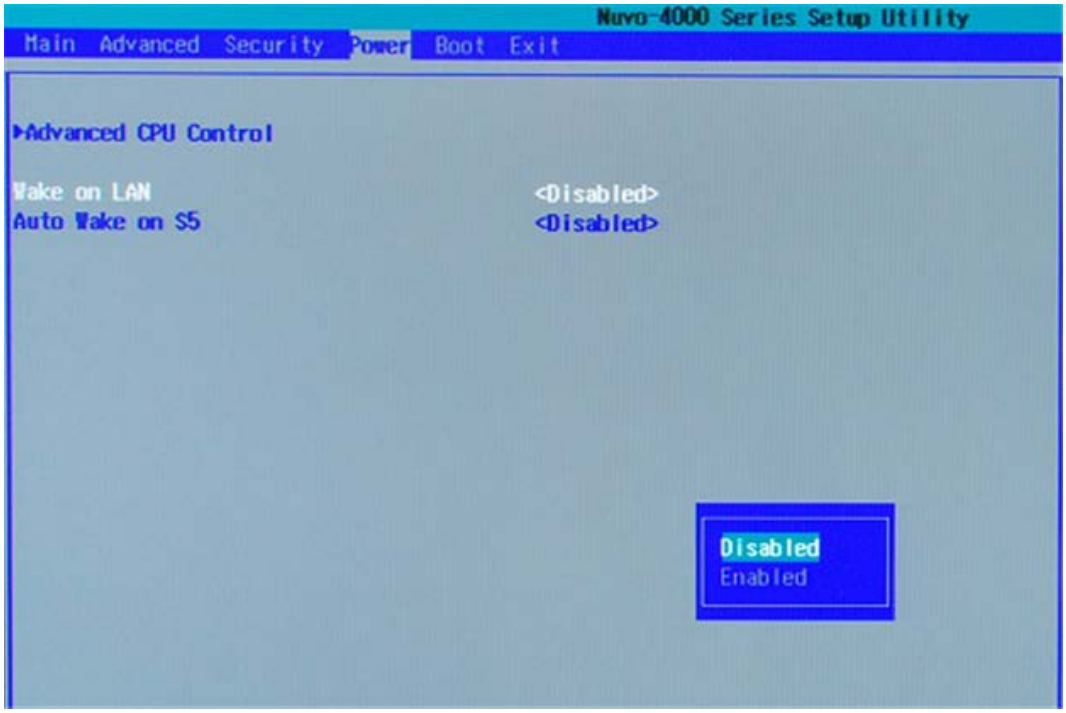


4.1.7 Wake-on-LAN Option

Wake-on-LAN (WOL) is a mechanism which allows you to turn on your Nuvo-4000 by sending a special Ethernet packet. To utilize Wake-on-LAN function, you have to enable this option first in BIOS settings. Please refer to section 3.7.2 for instructions of using WOL function.

To enable/disable "Wake on LAN" option:

1. When Nuvo-4000 boots up, press F2 to enter BIOS setup utility.
2. Go to **[Power]**.
3. Enable/disable the **[Wake on LAN]** option according to your application.

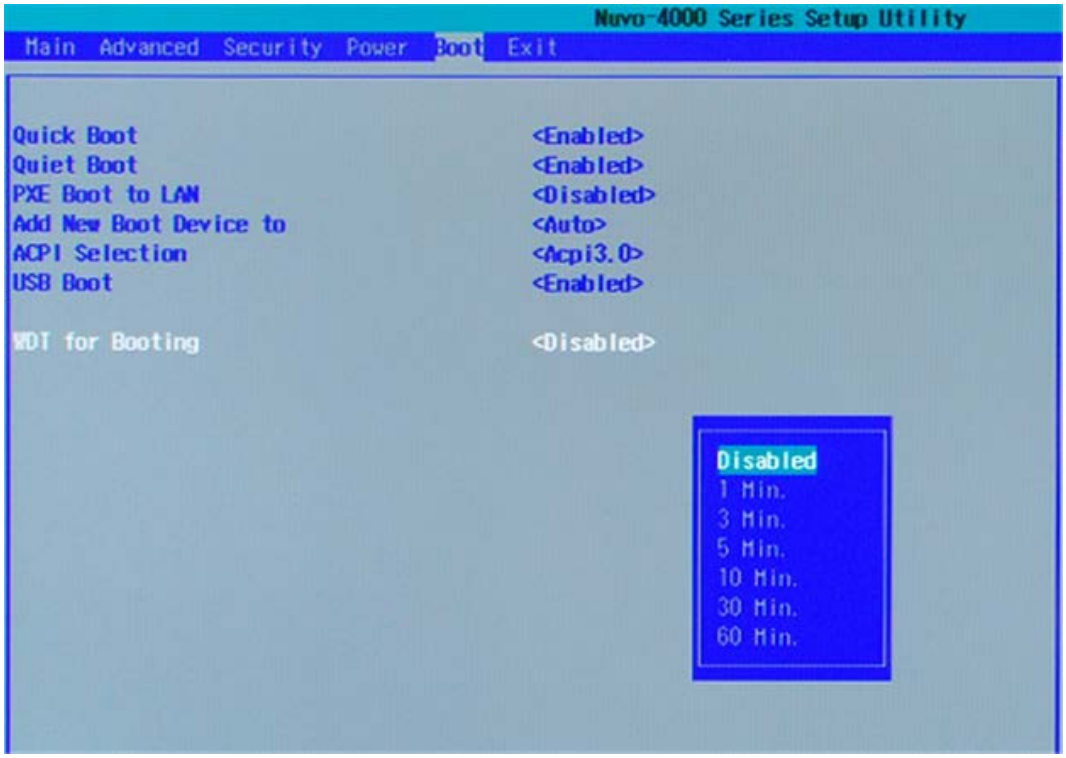


4.1.8 Watchdog Timer for Booting

The BIOS of Nuvo-4000 has a useful feature which allows users to use the watchdog timer to secure the booting process. You can specify the timeout value for watchdog timer. Once the watchdog timer expires, the BIOS issues a reset command to initiate another booting process. You can also set the behavior of how to stop the watchdog timer. 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 to OS, otherwise another booting process will be initiated. For information about programming watchdog timer, please refer to Appendix "A" Using Watchdog Timer & Isolated DIO.

To set the watchdog timer for boot in BIOS:

1. When Nuvo-4000 boots up, press F2 to enter BIOS setup utility.
2. Go to **[Boot]**.
3. Disable or select timeout value for **[WDT for Booting]** option.
4. Once you specify a timeout value, the **[WDT Stop Option]** option appears. You can select "Automatically after POST" or "Manually after Entering OS".

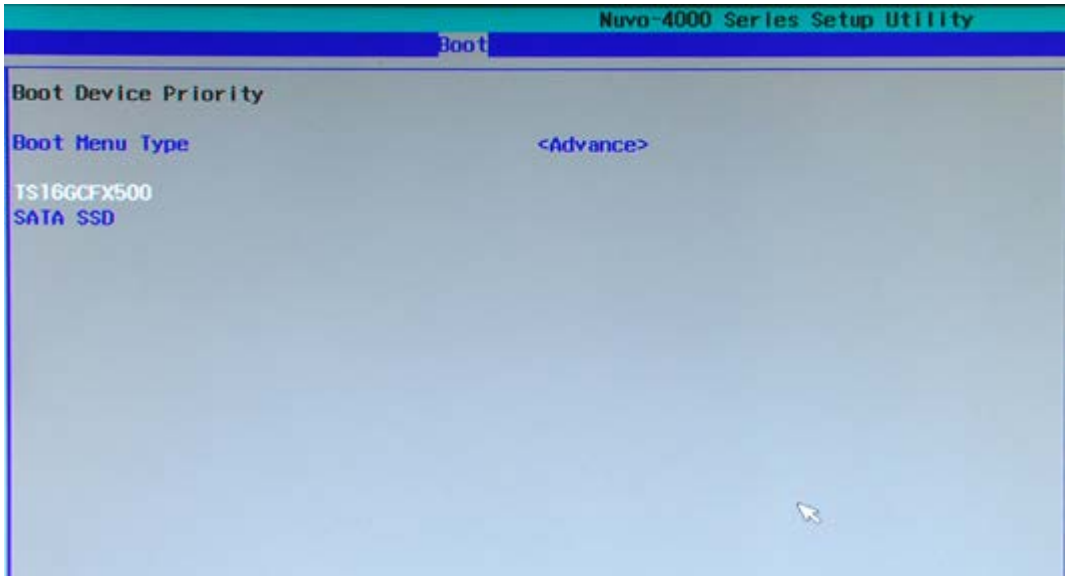


4.1.9 Select a Boot Device

When you have multiple bootable devices connected to your Nuvo-4000 (i.e. HDD, USB flash disk, USB DVD-drive), you may need to select one of them as the boot device. There are two ways to select the device. You can either, press F12 when system boots up to go to Boot Manager and then select one of the devices, or select the boot device in BIOS settings.

To select a boot device in BIOS:

1. When Nuvo-4000 boots up, press F2 to enter BIOS setup utility.
2. Go to **[Boot]** → **[Boot Device]**.
3. The **[Boot Menu Type]** option decides whether to list all bootable devices connected to your Nuvo-4000 according to device (Advanced mode) or device category (Normal mode). You can use F5/F6 or +/- to change the boot order of devices or device categories.



4.2 Operating System Support

Nuvo-4000 supports most operating system developed for Intel® x86 architecture. The following list contains the operating systems which have been tested in Neousys Technology Inc.

- Microsoft Window XP 32-bit
- Microsoft Window 7 32-bit
- Microsoft Window 7 64-bit
- Ubuntu (version later than 11.04 Desktop 64bit)*
- Ubuntu (version later than 10.10 Desktop 32bit)*
- Debian (version later than 6.0 64bit)*
- Fedora 14 i386 32bit*
- CentOS 6.4 32bit

**For Linux system, user may need to manually compile and install the driver for Intel I210 GbE controller if the driver is not included in the package. You can visit Intel website for further information.*

Neousys will keep this list updated as we continuously test other operating systems with Nuvo-4000. Please contact us for the latest OS support list.

4.3 Driver Installation

Neousys Technology Inc. provides a very convenient utility in "Drivers & Utilities DVD" to allow the "One-Click" driver installation. This utility automatically detects your Windows operating system and installs all necessary drivers to your Nuvo-4000 with just one mouse click.

4.3.1 Install all drivers using "One-Click" driver installation

1. Insert the "Drivers & Utilities DVD" into a USB DVD-drive attached to your Nuvo-4000. A setup utility launches and the following dialog appears.

1. Click on the **"Automatic Driver Installation"**. The setup utility will automatically detect your Windows operating system and install all necessary drivers. According to different versions of Windows, the installation process takes about 6~8 minutes. Once driver installation is done, the setup utility reboots your Windows and your system works normally afterward.

4.3.2 Install drivers manually

You can also manually install each driver for Nuvo-4000. Please refer to the following information about installing drivers for different operating system.

Windows XP SP3

1. The recommended driver installation sequence is
2. Chipset driver (x:\Driver_Pool\Chipset_7_Series\XP\infinst_autol.exe)
3. .NET Framework 3.5 (x:\Driver_Pool\DotNET35\XP\dotnetfx35.exe)
4. Graphics driver (x:\Driver_Pool\Graphics_3rd_i7_Vlv\XP\Setup.exe)
5. Audio driver (x:\Driver_Pool\Audio_ALC262\XP\Setup.exe)
6. LAN driver (x:\Driver_Pool\GbE_I210\XP\I210_XP_Install.exe)
7. ME driver (x:\Driver_Pool\ME_7_Series\ALL\Setup.exe)

Windows XP SP2

1. The recommended driver installation sequence is
2. Chipset driver (x:\Driver_Pool\Chipset_7_Series\XP\infinst_autol.exe)
3. Windows Installer 3.1 (x:\Driver_Pool\DotNET35\XP\WindowsInstaller-KB893803-v2-x86.exe)
4. .NET Framework 3.5 (x:\Driver_Pool\DotNET35\XP\dotnetfx35.exe)
5. Audio patch for HD audio (x:\Driver_Pool\Audio_ALC262\XP\MSHDQFE\Win2K_XP\us\kb888111xpsp2.exe)
6. Graphics driver (x:\Driver_Pool\Graphics_3rd_i7_Vlv\XP\Setup.exe)
7. Audio driver (x:\Driver_Pool\Audio_ALC262\XP\Setup.exe)
8. LAN driver (x:\Driver_Pool\GbE_I210\XP\I210_XP_Install.exe)
9. ME driver (x:\Driver_Pool\ME_7_Series\ALL\Setup.exe)

Windows 7 32-bit

1. The recommended driver installation sequence is
2. Chipset driver (x:\Driver_Pool\Chipset_7_Series\Win7_8_ALL\SetupChipset.exe)
3. Graphics driver (x:\Driver_Pool\Graphics_3rd_i7_Vlv\Win7_8_32\Setup.exe)
4. Audio driver (x:\Driver_Pool\Audio_ALC262\Win7_8_ALL\Setup.exe)
5. LAN driver (x:\Driver_Pool\GbE_I210\Win7_8_32\APPS\PROSETDX\Win32\DxSetup.exe)
6. USB 3.0 driver (x:\\Driver_Pool\USB3_7_Series\Win7_ALL\Setup.exe)
7. ME driver (x:\Driver_Pool\ME_7_Series\ALL\Setup.exe)

Windows 7 64-bit

1. The recommended driver installation sequence is
2. Chipset driver (x:\Driver_Pool\Chipset_7_Series\Win7_8_ALL\SetupChipset.exe)
3. Graphics driver (x:\Driver_Pool\Graphics_3rd_i7_Vlv\Win7_8_64\Setup.exe)
4. Audio driver (x:\Driver_Pool\Audio_ALC262\Win7_8_ALL\Setup.exe)
5. LAN driver (x:\Driver_Pool\GbE_I210\Win7_8_64\APPS\PROSETDX\Winx64\DxSetup.exe)
6. USB 3.0 driver (x:\Driver_Pool\USB3_7_Series\Win7_ALL\Setup.exe)
7. ME driver (x:\Driver_Pool\ME_7_Series\ALL\Setup.exe)

Appendix A Using Watchdog Timer & Isolated DIO

Neousys Nuvo-4000 series provide a watchdog (WDT) timer function to ensure a more reliable system operation. The WDT is a hardware mechanism to reset the system if the watchdog timer is expired. Users can start the WDT and keeping resetting the timer to make sure the system or program is running. Otherwise, the system shall be reset.

In addition to hardware watchdog function, an option of isolated digital I/O is available for extended range of applications. Nuvo-4000 feature the option of 8x DI channels and 8x DO channels via an internal 2x13 Pin Header. Neousys also provides a cable/panel kit with DSub-25 connector for front-panel access. The optional digital I/O supports standard polling mode I/O access so users' program can read or write DIO channel(s) using this function library. It also features an enhanced mode called "Change-of-State Interrupt". By detecting any change on digital input channel(s), an interrupt is generated according to a user-defined interrupt mask and level/edge setting, so user's program can react to the change.

In this document, we'll illustrate how to use the function library provided by Neousys to program the WDT and DIO functions. Currently, WDT & DIO driver library supports the following operating systems:

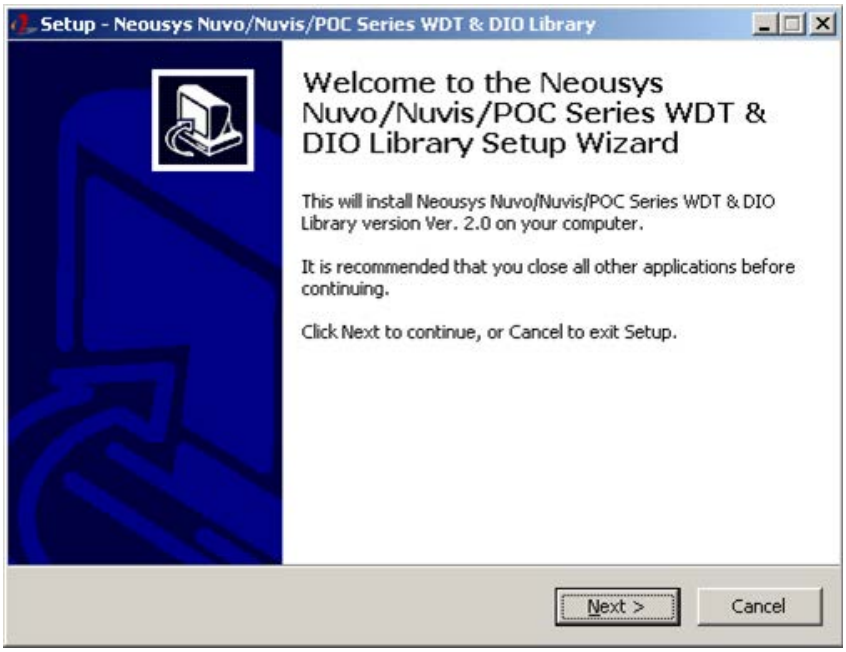
- Windows XP
- Windows Vista (32-bit)
- Windows 7 (32-bit & 64-bit)

For other OS support, please contact Neousys Technology for further information.

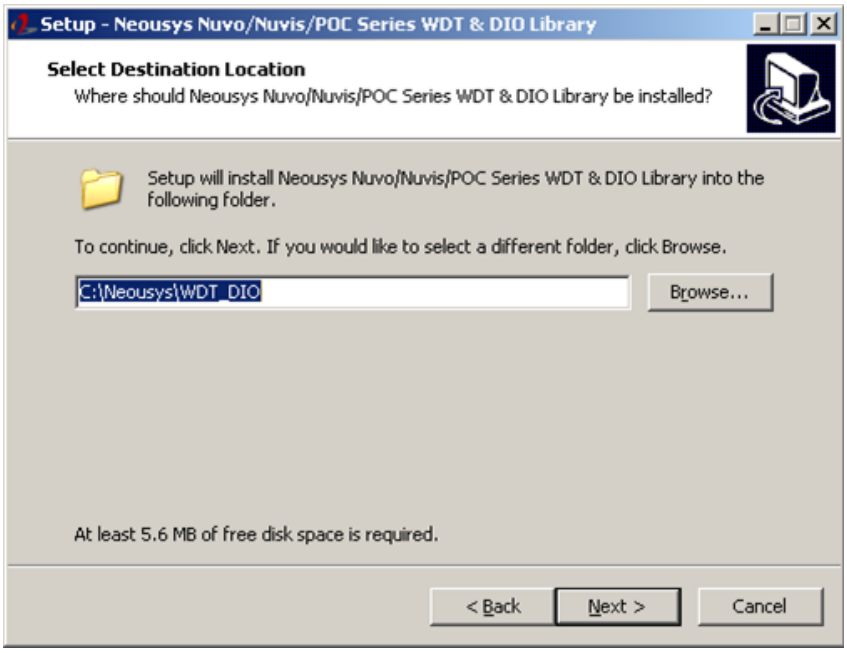
A.1 Install WDT and DIO Library

The WDT_DIO function library is delivered in the form of a setup package named WDT_DIO_Setup.exe. In prior to program WDT and DIO on Nuvo, Nuvis and POC series, you should execute the setup program and install the WDT and DIO library.

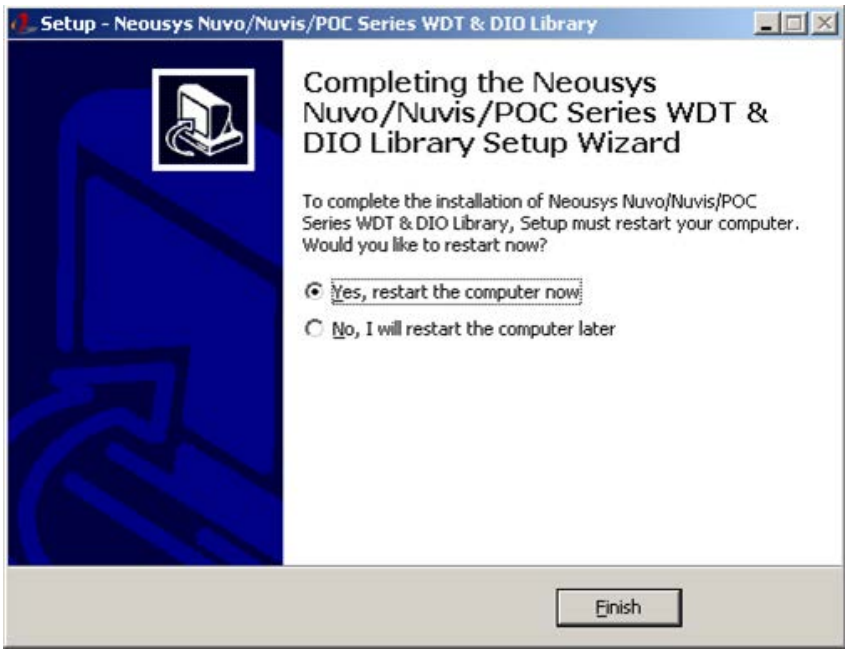
1. Execute WDT_DIO_Setup.exe. The following dialog appears.



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



2. Once the installation is finished, a dialog appears to prompt you to reboot the system. The WDT & DIO library will take effect after system rebooting.



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

- Header file: \Include
- Lib file: \Lib
- Function Reference: \Manual
- Sample Code: \Sample

A.2 Using WDT Function

WDT Function Reference

InitWDT

Description

Initialize the WDT function. You should always invoke InitWDT() before set or start watch-dog timer.

Parameter

None

Return Value

Always returns TRUE

Usage

```
BOOL    bRet = InitWDT()
```

SetWDT

Description

Set timeout value and unit for watch-dog 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

Description

Start countdown of WDT. When WDT is started, the WDT LED indicator starts to blink in a frequency of 1Hz. If no ResetWDT() or StopWDT is invoked before WDT is counted to 0, the WDT expires and system resets.

Parameter

None

Return Value

If the timeout value is given in correct format, this function returns TRUE, otherwise FALSE.

Usage

BOOL bRet = StartWDT()

ResetWDT

Description

Reset the timeout value to the value given by SetWDT(). If no ResetWDT() or StopWDT is invoked before WDT is counted to 0, the WDT expires and system resets.

Parameter

None

Return Value

Always returns TRUE;

Usage

BOOL bRet = ResetWDT()

StopWDT

Description

Stop the countdown of WDT. When WDT is stopped, the WDT LED indicator stops blinking.

Parameter

None

Return Value

Always returns TRUE;

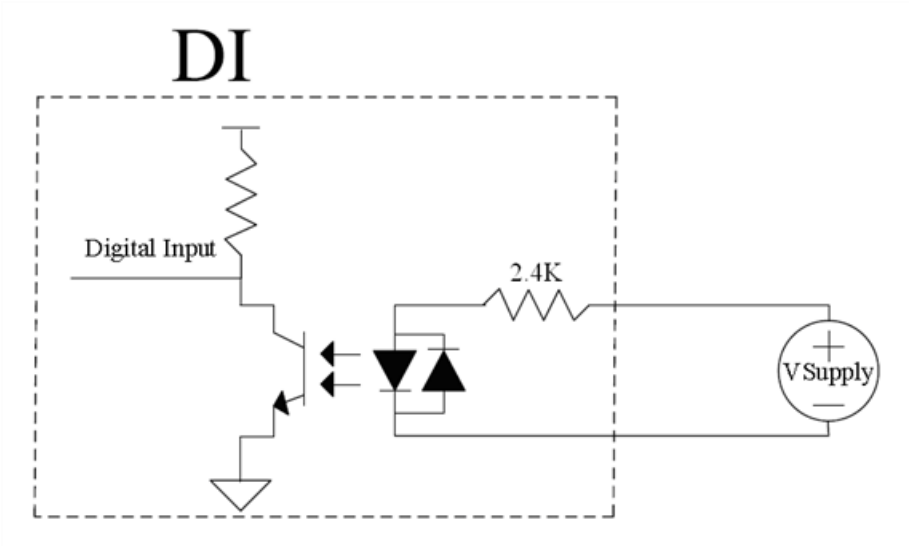
Usage

BOOL bRet = StopWDT()

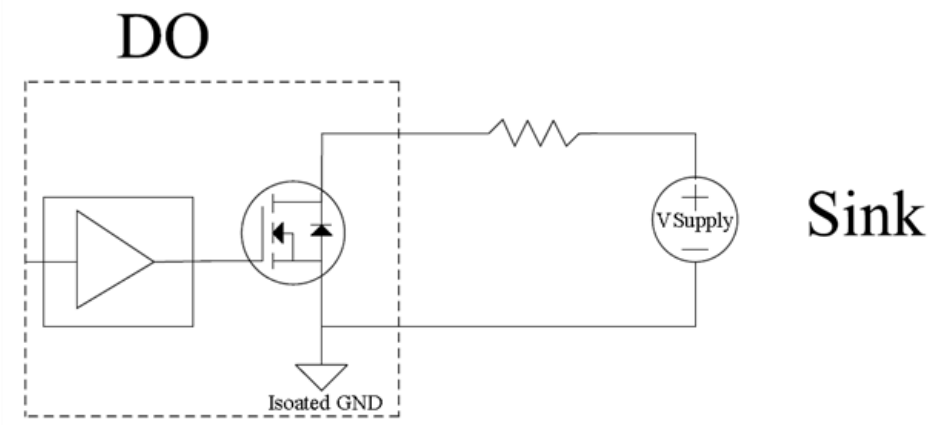
A.3 Using DIO Function

Wiring for DIO

The digital input function of Nuvo-4000 is implemented using a photo-coupler with a internally series-connected 4.7k ohm resistor. You need to provide a voltage to specify the logic high/low state. The input voltage for logic high is 5~24V, and the input voltage for logic low is 0~1.5V



The digital output function of Nuvo-4000 is implemented using Power MOSFET + Analog Device iCoupler® component. The DO channels are configured as NO (normally-open) configuration. When you turn on Nuvo-4000, all DO channels have a deterministic state of logic 0 (circuit disconnected from GND return). When logic 1 is specified, MOSFET is activated and GND return path is established. You should configure a sinking current connection for DO of Nuvo-4000. The following diagrams are the suggested wiring for DO:



DIO Function Reference

InitDIO

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

Description

Read a single channel of isolated digital input.

Parameter

ch

BYTE value specifies the DI channel to be read.

For Nuvo-4000, ch should be a value of 0 ~ 7.

Model Series	DO channel	Value
Nuvo-1000	8	000b ~111b
Nuvo-1300af	8	000b ~111b
Nuvo-2000+	8	000b ~111b
Nuvo-3000	8	000b ~111b
Nuvo-4000	8	000b ~111b
POC-100	4	00b~11b
POC-200	4	00b~11b

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

Description

Read the entire isolated digital input port (8 channels).

Parameter

None

Return Value

A WORD value indicates the status of DI port (8 DI channels).

Usage

WORD DIPortValue = DIReadPort ();

DOWriteLine

Description

Write a single channel of isolated digital output.

Parameter

ch

BYTE value specifies the DO channel to be written.

For Nuvo-4000, ch should be a value of 0 ~ 7.

Model Series	DO channel	Value
Nuvo-1000	8	000b ~111b
Nuvo-1300af	8	000b ~111b
Nuvo-2000+	8	000b ~111b
Nuvo-3000	8	000b ~111b
Nuvo-4000	8	000b ~111b
POC-100	4	00b~11b
POC-200	4	00b~11b

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

Description

Write the entire isolated digital output port (8 channels).

Parameter

value

WORD value specifies the status of the DO port.

For Nuvo-4000, *value* should be a value of 0~255.

Model Series	DO Port Number	Value
Nuvo-1000	8	00000000b ~11111111b
Nuvo-1300af	8	00000000b ~11111111b
Nuvo-2000+	8	00000000b ~11111111b
Nuvo-3000	8	00000000b ~11111111b
Nuvo-4000	8	00000000b ~11111111b
POC-100	4	0000b~1111b
POC-200	4	0000b~1111b

Return Value

None

Usage

```
WORD   DOPortValue=0x3F; //00111111b

DOWritePort(DOPortValue); //write DO port as 00111111b
```

A.4 Using COS Function

Change-of-State DIO Function Reference

SetupDICOS

Syntax

BOOL SetupDICOS(COS_INT_SETUP *lpSetup, DWORD cbSetup);

Description

Setup Digital-Input(DI) Change-of-State(COS) interrupt parameters.

Parameter

lpSetup [in]

A pointer to a **COS_INT_SETUP** structure that contains the COS configuration information for the DI device.

This data structure contains the following variables:

portMask

WORD value specifies the interrupt mask for corresponding channel(s).

edgeMode

WORD value specifies that interrupt is generated when level change (set to 0) or on rising/falling edge (set to 1) for the corresponding channel(s).

edgeType

WORD value specifies that interrupt is generated on rising edge (set to 0) or falling (set to 1) edge for corresponding channel(s). This value is neglected if *edgeMode* is set to 0 for the corresponding channel(s).

cbSetup [in]

The length of the structure, in bytes. The caller must set this member to sizeof(COS_INT_SETUP).

Return Value

Returns TRUE if setup successes, FALSE if setup failed.

Usage

```
COS_INT_SETUP    setup;

memset(&setup, 0, sizeof(setup));
setup.portMask = 0xff;    // enable ch.0~7
setup.edgeMode = 0;    // level
setup.edgeType = 0x00;    // Lo/Hi
BOOL    bRet = SetupDICOS(&setup, sizeof(setup));
```

RegisterCallbackDICOS

Syntax

BOOL RegisterCallbackDICOS(COS_INT_CALLBACK callback);

Description

Registers a callback function, which is called when the DICOS interrupt occurred.

Parameter

callback [in]

Specifies the callback function. The prototype for this function is descripted as follow.

void __stdcall callback_func(COS_INT_CALLBACK_ARG* arg);

Return Value

Returns TRUE if setup successes, FALSE if setup failed.

Usage

```
void __stdcall callback_func(COS_INT_CALLBACK_ARG* arg)
{
    printf("data=0x%02x, flag=0x%02x, seq=%02d\n",
    arg->portData, arg->intrFlag, arg->intrSeq);
}
BOOL    bRet = RegisterCallbackDICOS(callback_func);
```

StartDICOS

Syntax

BOOL StartDICOS(void);

Description

Start DI Change-of-State interrupt

Parameter

None

Return Value

Returns TRUE if start procedure successes, FALSE if start procedure failed.

Usage

```
BOOL    bRet = StartDICOS();
```

StopDICOS

Syntax

BOOL StopDICOS(void);

Description

Stop DI Change-of-State interrupt

Parameter

None

Return Value

Returns TRUE if stop procedure successes, FALSE if stop procedure failed.

Usage

BOOL bRet = StopDICOS();

Change-of-State DI Example

```
#include <stdio.h>
#include <stdlib.h>
#include <windows.h>
#include "WDT_DIO.h"

//Step 0, define a Change-of-State Interrupt callback function
void __stdcall callback_function(COS_INT_CALLBACK_ARG* arg)
{
    printf("data=0x%02x, flag=0x%02x, seq=%02d\n",
   arg->portData, arg->intrFlag, arg->intrSeq);
}

int main(int argc, char* argv[])
{
    //Step 1, initialize DIO library by invoking InitDIO()
    if ( ! InitDIO() )
    {
        printf("InitDIO --> FAILED\n");
        return -1;
    }
    printf("InitDIO --> PASSED\n");

    //Step 2, setup Change-of-State Interrupt mask and level/edge mode
```

```
COS_INT_SETUP    setup;

memset(&setup, 0, sizeof(setup));

setup.portMask = 0x0f;       // 00001111b, enable ch.0~3
setup.edgeMode = 0x00;    // generate interrupt on level change
setup.edgeType = 0x00;     // rising/falling edge, only effective when edgeMode = 1

if ( ! SetupDICOS(&setup, sizeof(setup)) )
{
      printf("SetupDICOS --> FAILED\n");
      return -2;
}
printf("SetupDICOS --> PASSED\n");

//Step 3, register the callback function
if ( ! RegisterCallbackDICOS(callback_function) )
{
      printf("RegisterCallbackDICOS --> FAILED\n");
      return -3;
}
printf("RegisterCallbackDICOS --> PASSED\n");

//Step 4, start the DI Change-of-State Interrupt
if ( ! StartDICOS() )
{
      printf("StartDICOS --> FAILED\n");
      return -4;
}
printf("StartDICOS --> PASSED\n");

printf("\npress any key to stop...\n");
system("pause >nul");

//Step 5, stop the DI Change-of-State Interrupt operation
if ( ! StopDICOS() )
{
      printf("StopDICOS --> FAILED\n");
      return -5;
}
```

```
        printf("StopDICOS --> PASSED\n");


        printf("\npress any key to exit...\n");
        system("pause >nul");
        return 0;
}
```