MVS900-511-FL series
MVS900-512-FL series

Fanless Vision System

User's Manual

USER'S MANUAL

AXIOMTEK

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ESD Precautions

The boards have integrated circuits sensitive to static electricity. To avoid damaging chipsets from electrostatic discharge, observe the following precautions:

- Do not remove boards or integrated circuits from their anti-static packaging until you are ready to install them.

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

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

Trademarks Acknowledgments

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Section 1
Introduction

This section contains general information and detailed specifications of the MVS900 Series Vision System, including the following sections:

- General Description
- Features
- Specifications
- Dimensions

1.1 General Description

The MVS900-511/512-FL integrates camera interfaces and various I/O features for machine vision applications, including GigE camera support, trigger input and output with microsecond-scale real-time control, as well as LED lighting output with constant current control. It also provides an encoder input function suited for conveyor applications in factory automation. The system is compatible with any vision control system to simplify deployment of your machine vision fields.

The MVS900-511/512-FL fanless system comes with an LGA1151 socket that supports Intel® 6th/7th generation CoreTM i7/i5/i3 processors. The MVS900-511/512-FL supports Windows® 7 and Windows® 10 and has a rugged design suitable for the most endurable operation.

- In terms of storage capacity, the MVS900-511/MVS900-512 Series has two 2.5" HDD drive bays, which make system installation and maintenance easy for customers. Especially, MVS900-512-FL has M.2 2280 key M slot for NVMe SSD.
- Embedded O.S. Supported:

  The MVS900-511/512 Series supports not only Windows® 7 and Windows® 10 but also embedded OS, such as Windows® 7 embedded.

- **Features**
  - Integrated vision I/O
    - 4 CH trigger input
    - 4 CH trigger output
    - 4 CH LED lighting control (strobe/ trigger mode)

- 2 CH quadrature encoder input
- 16 CH isolated DI; 16 CH isolated DO

➢ Supports camera interfaces

- 4 IEEE802.3at GbE LAN ports (PoE)
- 4 USB 3.0 ports

➢ Power input: 24 VDC (uMin=19V/uMax=30V)

➢ -10°C to +60°C operating temperature range with W.T. SSD

➢ Supports 2 swappable 2.5" HDD

➢ Supports TPM 2.0 function

1.2 System Specifications

1.2.1 Main CPU Board

- **CPU**
  - Socket LGA1151 supports 6th /7th Generation Intel® Core™ i7/i5/i3 processors up to 65W. CPU support list is as below.

Processor	TDP	Core number	Thread number
I7-7700	65W	4	8
I5-7500	65W	4	4
I3-7101E	54W	2	4
i7-7700T	35W	4	8
I3-7101TE	35W	2	4
G3930TE	35W	2	2
I7-6700	65W	4	8
i5-6500	65W	4	4
i3-6100	51W	2	4
i7-6700TE	35W	4	8
i5-6500TE	35W	4	4
i3-6100TE	35W	2	4
G4400TE	35W	2	2

- **System chipset**
  - Intel® H110 chipset (MVS900-511-FL)
  - Intel® Q170 chipset (MVS900-512-FL)
- **BIOS**
  - AMI BIOS, with Smart View and Customer CMOS Backup

- **System memory**
  - Two DDR4-2133/2400 un-buffered SO-DIMM max. up to 32GB

1.2.2 I/O System

- **Standard I/O interface**
  - One ATX power on/off switch
  - One ATX/AT Mode switch
  - One Reset switch
  - One 2-pin connector output for remote power on/off switch
  - DC to SC power supply, supports 24VDC (uMin=19V/uMax=30V with phoenix power plug
  - Four USB 3.0 ports
  - HDD access/Power LEDs
  - Two G.E. LAN ports (i211AT)
  - One VGA supports resolution up to 1920 x 1200 @60Hz
  - One HDMI.4b supports resolution up to 4096 x 2304 @60MHz
  - 1 x Audio (MIC-in/Line-out)
  - 2 x RS-232/422/485 with isolated 1.5kVDC protection
- **Isolated digital input**
  - Number of channels: 8
  - Input type: wet contact, sink/source and dry contact
  - Input level for wet contact:

    Close to ground (Logic 1), Open (Logic 0)
  - Input level for wet contact:

    Input voltage: on (logic 1): 10~30VDC, off (logic 0): 0~3VDC

    Isolation voltage: 1.5kVDC
- **Isolated digital output**
  - Number of channels: 8
  - Output type: sink, open collector
  - Supply voltage: 12-24VDC
  - Output current: Max. 200mA per channel
  - Isolation voltage: 1.5kVDC
- **Expansion interface**
  - 1 x Full-size PCI Express Mini Card slot with USB signal (MVS900-511-FL)
  - 1 x Full-size PCI Express Mini Card slot with USB & PCIe x1 signal (MVS900-512-FL)

- 1 x M.2 M key slot 2280 with PCIe x4 signal (only for MVS900-512-FL)

- **Camera interface**
  - 4 x IEEE802.3at GbE LAN port (PoE, Intel® i210-AT, IEEE802.3at compliant, total max. power output 30W)

1.2.3 Vision I/O (D-sub 44-pin connetor)

- **Isolated digital input**
  - Number of channels: 8
  - Input type: sink/source
  - Input voltage: on (logic 1): 10~30VDC, off (logic 0): 0~3VDC
  - Impedance: 7.5kΩ
  - Isolation voltage: 1.5kVDC
- **Isolated digital output**
  - Number of channels: 8
  - Output type: sink, open collector
  - Supply voltage: 5-30VDC
  - Output current: Max. 200mA per channel
  - Isolation voltage: 1.5kVDC
- **Isolated trigger input**
  - Number of channels: 4
  - Type: sink
  - Input voltage: on (logic 1): 3.3~30VDC, off (logic 0): 0~2VDC
  - Response time: <1us (from trigger input to trigger output)
  - Input filter: supports programmable de-bounce filter (disable, 100us, 500us, 1ms, 5ms)
  - Isolation voltage: 1.5kVDC
- **Isolated encoder input**
  - Number of channel: 2
  - Support mode: incremental quadrature encoder input (A/B/Z phase, x1/4 x1/3 x1/2 x1 x2 x4 mode)
  - Type of wiring: differential or single-ended 5V, 12V open collector
  - Frequency input: Max. 1MHz
  - Data length: 32-bit
  - Digital filter: supports programmable de-bounce filter (disable, 500ns, 1us, 2us, 4us)
  - Operating mode: Linear function, FIFO, Position latch
  - Isolation voltage: 1.5kVDC

- **Encoder FIFO**
  - Number of channel: 2
  - FIFO depth: 1024x32-bit
  - Interrupt type: Empty/ Almost Empty

    (Almost empty: FIFO data number is less than 1/3)
  - Auto reload: Yes. After compared, the next FIFO data will reload to FIFO storage.
- **Encoder Linear Function**
  - Number of linear: 4

    Two linear functions per encoder channel
  - Start point: 32-bit
  - Repeat Times: Trigger repeat times. (31-bit)
  - Interval: The linear interval (15-bit)
  - Direction: 1-bit
  - Auto reload: Yes. After compared, the next data will reload to linear storage.
- **Isolated trigger output**
  - Number of channels: 4
  - Output voltage: 0-30VDC, sink, open collector
  - Output current: Max. 100mA per channel
  - Response time: <1us (from trigger input to trigger output)
  - Configuration: Derived from 4CH trigger input or encoder input. The user can set the pulse delay time and duration time.
  - Trigger sources: 4CH trigger input/ encoder: 4x Linear function, 2x FIFO

    (Each channel supports two sources.)
- **Interrupt**
  - Sources: Provides two interrupt sources from DI 0~1, trigger/Latch input 0~1, encoder Z phase 0~1, FIFO empty 0~1, almost empty 0~1, encoder overflow 0~1 and encoder linear function 0~3 (when repeat times count to 0)
- **LED lighting control**
  - Number of channels: 4
  - Constant current control
  - Operating mode: strobe; trigger
  - Strobe mode: 24VDC; Max. 1A per channel

    Delay time: 1 μs to 65ms; 1ms to 65s (time unit: 1us, 16bit/ 1ms, 16bit)

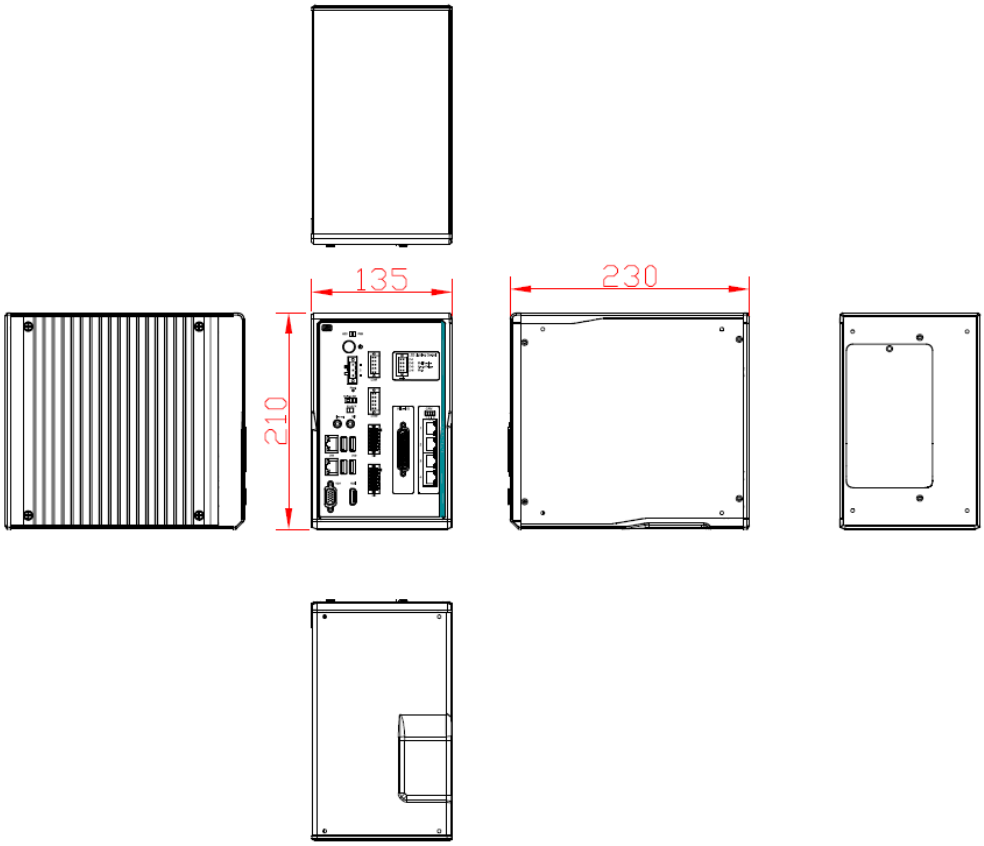
    Duration time: 10 μs to 10ms (time unit: 1us)
  - Trigger mode: 24VDC; Max. 0.5A per channel

    Delay time: 1 μs to 65ms; 1ms to 65s (time unit: 1us, 16bit/ 1ms, 16bit)

    Duration time: 10 μs to 65ms; 1ms to 65s (time unit: 1us, 16bit/ 1ms, 16bit)
  - Output current step size: 50mA by software

- Connector: 4CH LED lighting control via an 8-pin terminal connector

1.3 Dimensions



1.4 I/O Outlet

The following figure shows you the I/O outlets on the front and rear panels of the MVS900 Series.

1. Reset switch
2. Remote switch
3. Mic-in & Line-out
4. 2 x LAN
5. Power switch
6. Terminal block
7. 2 x RS-232/422/485
   1 x 8-in/8-out DIO with isolated 1.5 kVDC protection
8. VGA
9. 4 x USB 3.0
10. HDMI
11. Vision I/O: 4-in/4-out trigger I/O, 8-in/8-out DIO, 2 x encoder
12. LED lighting control: trigger and strobe mode
13. 4 x IEEE802.3at GbE LAN port

1.5 Packing List

The package bundled with your IMVS900 Series should contain the following items:

- **MVS900 Series unit x 1**
- **Screw pack x 1**
- **Foot pad x 4**
- **CPU grease x 1**
- **Power connector x 1**
- **Terminal block x 5**
- **Remote switch cable x 1**

If you cannot find this package or any items are missing, please contact Axiomtek distributor immediately.

1.6 Jumper Settings

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

Note: ***How to setup Jumpers***

Illustrations below show that a cap on a jumper is to “close” the jumper, whereas that off a jumper is to “open” the jumper.

[Open]

[Closed]

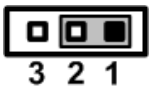
[Pin1-2 Closed]

Jumper	Descriptions	Setting
JP1	Clear RTC : Normal	Short 1-2

1.6.1 Restore BIOS Optimal Defaults

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

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



1.7 Connectors

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

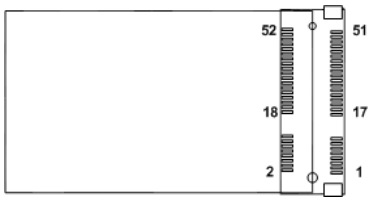
Here is a table summarizing all connectors on the board.

Connector	Section
MINI Card slot	1.8.1
LAN+USB3.0	1.8.2
VGA connector	1.8.3
Audio connector	1.8.4
DC-in Phoenix power connector	1.8.5
HDMI connector	1.8.6
SATA Power connector	1.8.7
SATA III connector	1.8.8
ATX Power on/off button	1.8.9
AT/ATX power switch	1.8.10
Reset button	1.8.11
Remote power switch connector	1.8.12
8-Pin terminal connector for LED lighting control	1.8.13
44-Pin female I/O connector	1.8.1 `
Flexible IO – Isolated COM x2 (RS232/422/485) & 8in/8out DIO	1.8.15
PD power indicator & LAN1 ~ LAN4 connector (PoE function)	1.8.16
M.2 2280 Key M slot NVMe SSD	1.8.17

1.7.1 MINI CARD SLOT

There is a PCI-Express Mini Card connector on the top side. It supports a USB signal for MVS900-511-FL. In addition, MVS900-512-FL can support USB and PCIe signals.

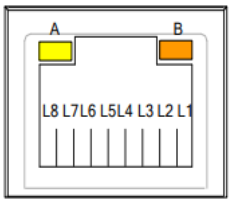
Pins	Signals	Pins	Signals
1	WAKE#	2	+3.3VSB
3	No use	4	GND
5	No use	6	+1.5V
7	CLKREQ#	8	No use
9	GND	10	No use
11	REFCLK-	12	No use
13	REFCLK+	14	No use
15	GND	16	No use
17	No use	18	GND
19	No use	20	W_DISABLE#
21	GND	22	PERST#
23	PE_RXN3/	24	+3.3VSB
25	PE_RXP3/	26	GND
27	GND	28	+1.5V
29	GND	30	SMB_CLK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



1.7.2 LAN+USB3.0

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

Pins	1000 Base-T	100/10 Base-T	Descriptions
L1	BI_DA+	TX+	Bidirectional or transmit data+
L2	BI_DA-	TX-	Bidirectional or transmit data-
L3	BI_DB+	RX+	Bidirectional or receive data+
L4	BI_DC+	N.C.	Bidirectional or not connected
L5	BI_DC-	N.C.	Bidirectional or not connected
L6	BI_DB-	RX-	Bidirectional or receive data-
L7	BI_DD+	N.C.	Bidirectional or not connected
L8	BI_DD-	N.C.	Bidirectional or not connected
A	Active link LED (Yellow) Off: No link Blinking: Data activity detected		
B	Speed LED 1000: Orange 100: Green 10: OFF		



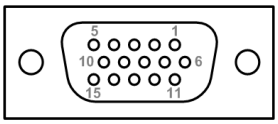
The Universal Serial Bus connectors are compliant with USB 3.0 (5Gb/s), ideal for connecting USB peripherals to the system, such as scanners, cameras and USB devices, etc.

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

1.7.3 VGA Connector

The connector is a 15-pin D-Sub connector which is commonly used for a CRT monitor.

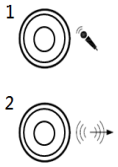
Pins	Signals	Pins	Signals
1	Red	2	Green
3	Blue	4	N.C.
5	GND	6	DETECT
7	GND	8	GND
9	+5V	10	GND
11	N.C.	12	DDC DATA
13	Horizontal Sync	14	Vertical Sync
15	DDC CLK		



1.7.4 DC-in Phoenix Power Connector

These two audio jacks are used for Audio Mic-In and Audio Line-out.

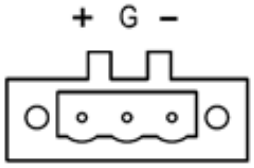
Pins	Signals
1	Line out
2	Microphone In



1.7.5 DC-in Phoenix Power Connector

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

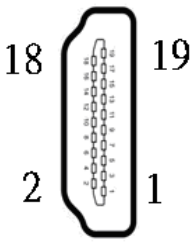
Pins	Signals
1	DC+
2	GND
3	DC-



1.7.6 HDMI Connector

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

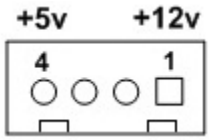
Pins	Signals	Pins	Signals
1	HDMI OUT_DATA2+	11	GND
2	GND	12	HDMI OUT Clock-
3	HDMI OUT_DATA2-	13	N.C.
4	HDMI OUT_DATA1+	14	N.C.
5	GND	15	HDMI OUT_SCL
6	HDMI OUT_DATA1-	16	HDMI OUT_SDA
7	HDMI OUT_DATA0+	17	GND
8	GND	18	+5V
9	HDMI OUT_DATA0-	19	HDMI_HTPLG
10	HDMI OUT Clock+		



1.7.7 SATA Power connector

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

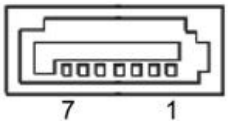
Pins	Signals
1	+12V level
2	GND
3	GND
4	+5V level



1.7.8 SATA Connector (SATA1、SATA2)

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

Pins	Signals
1	GND
2	SATA_TX+
3	SATA_TX-
4	GND
5	SATA_RX-
6	SATA_RX+
7	GND



1.7.9 ATX Power On/OFF Button

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

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

1.7.10 AT/ATX Switch

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

1.7.11 Reset Button

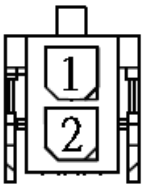
The Reset button allows users to reset the system.

Function	Description
On	Reset system
Off	Keep system status

1.7.12 Remote Power Switch Connector

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

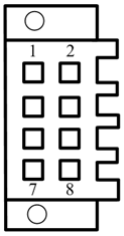
Function	Description
Short (1-2)	Turn on/off system
Open	Keep system status



1.7.13 8-Pin Terminal Connector for LED Lighting Control

The 8-pin terminal connector supports 4CH LED output for a variety of illumination.

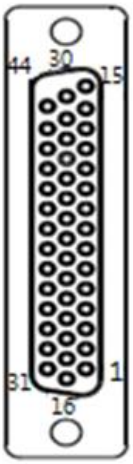
Pin	Description	Pin	Description
1	LED1 -	2	LED1 +
3	LED2 -	4	LED2 +
5	LED3 -	6	LED3 +
7	LED4 -	8	LED4 +



1.7.14 44-Pin Female I/O Connector

The 44-pin D-SUB female I/O connector has special I/O functions, including encoder input, trigger I/O, DIO. (Refer to website about SDK, driver and test tool.)

Pin	Description	Pin	Description	Pin	Description
1	I_GND	16	DI_COM	31	I_GND
2	Encoder 0 A+	17	DI 0	32	DO 0
3	Encoder 0 A-	18	DI 1	33	DO 1
4	Encoder 0 B+	19	DI 2	34	DO 2
5	Encoder 0 B-	20	DI 3	35	DO 3
6	Encoder 0 Z+	21	DI 4	36	DO 4
7	Encoder 0 Z-	22	DI 5	37	DO 5
8	I_GND	23	DI 6	38	DO 6
9	Encoder 1 A+	24	DI 7	39	DO 7
10	Encoder 1 A-	25	I_GND	40	I_GND
11	Encoder 1 B+	26	Trigger/Latch input 0	41	Trigger output 0
12	Encoder 1 B-	27	Trigger/Latch input 1	42	Trigger output 1
13	Encoder 1 Z+	28	Trigger input 2	43	Trigger output 2
14	Encoder 1 Z-	29	Trigger input 3	44	Trigger output 3
15	I_GND	30	I_GND		



1.7.15 Isolated COM & DIO I/O

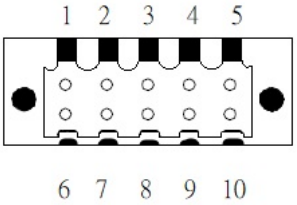
The system has two serial ports & DIO, including COM1~COM2* with isolated 1.5KVDC protection and DIO1~DIO2 8-in/8-out isolated 1.5KVDC DIO ports.

*RS-232/422/485 can be configured via BIOS settings

(Refer to website about SDK, driver and test tool.)

※COM1,COM2,DIO1,DIO2

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



Note: The RS-485 only support below communicate data format:

8 data bits + 1 stop bit

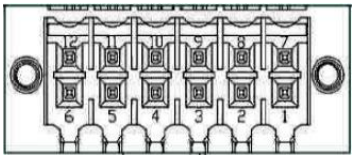
8 data bits + 1 parity bit + 1 stop bit

8 data bits + 1 parity bit + 2 stop bits

8 data bits + 2 stop bits

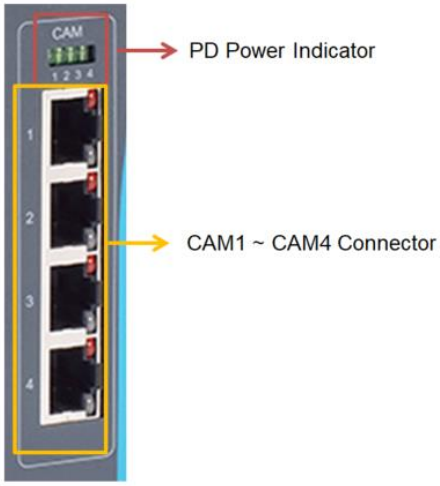
7 data bits + 1 parity bit (even or odd) + 2 stop bits

CN3(DIO1)		CN4(DIO2)	
Pin	**Function**	**Pin**	**Function**
1	Common1 PWR+	1	Common2 PWR+
2	DO10	2	DO20
3	DO11	3	DO21
4	DO12	4	DO22
5	DO13	5	DO23
6	Common 1 PWR-	6	Common 2 PWR-
7	External 1 Power	7	External 2 Power
8	DI10	8	DI20
9	DI11	9	DI21
10	DI12	10	DI22
11	DI13	11	DI23
12	Isolation 1 GND	12	Isolation 2 GND



1.7.16 PD Power Indicator & CAM1 ~ CAM4 connector

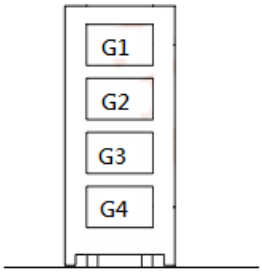
The system has four camera interfaces with PoE functions for industrial cameras.



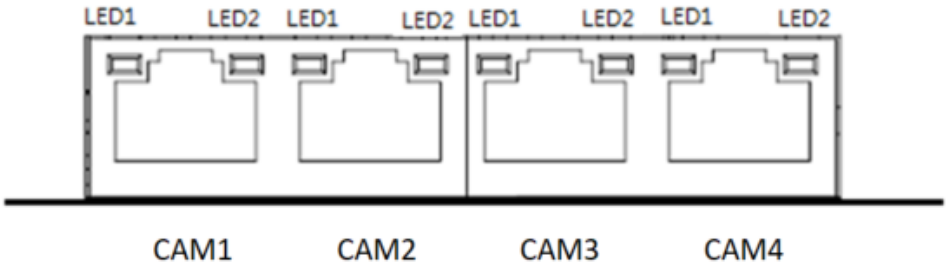
PD Power Indicator

When a CAM port is currently active, its corresponding PD power indicator will light up.

Pin	Signal
G1	CAM Port1
G2	CAM Port2
G3	CAM Port3
G4	CAM Port4



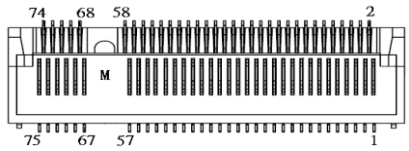
CAM1 ~ CAM4 Connector



Pin	Description
LED1	Active LED: Amber Off: No link Blinking: Data activity detected
LED2	Link LED (10/100-Green; 1000-Amber)

1.7.17 M.2 2280 Key M slot NVMe SSD

The MVS900-512-FL comes with one M.2 2280 Key M slot (Gen.3 PCIex4 signal) for storage.



Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
1	GND	2	+3.3V	3	GND	4	+3.3V
5	PERn3	6	NC	7	PERp3	8	NC
9	GND	10	LED_1#	11	PETn3	12	+3.3V
13	PETp3	14	+3.3V	15	GND	16	+3.3V
17	PERn2	18	+3.3V	19	PERp2	20	NC
21	GND	22	NC	23	PETn2	24	NC
25	PETp2	26	NC	27	GND	28	NC
29	PERn1	30	NC	31	PERp1	32	NC
33	GND	34	NC	35	PETn1	36	NC
37	PETp1	38	NC	39	GND	40	NC
41	PERn0	42	NC	43	PERp0	44	NC
45	GND	46	NC	47	PETn0	48	NC
49	PETp0	50	PERST#	51	GND	52	CLKREQ#
53	REFCLKn	54	PEWAKE#	55	REFCLKp	56	NC
57	GND	58	NC	59	CONNECTOR Key M	60	CONNECTOR Key M
61	CONNECTOR Key M	62	CONNECTOR Key M	63	CONNECTOR Key M	64	CONNECTOR Key M
65	CONNECTOR Key M	66	CONNECTOR Key M	67	NC	68	NC
69	NC	70	+3.3V	71	GND	72	+3.3V
73	GND	74	+3.3V	75	GND		

Note: ***M.2 2280 Key M is only available for MVS900-512-FL***

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Section 2
Hardware Installation

The MVS900 Series is convenient for your various hardware configurations, including the CPU (Central Processing Unit), memory module, HDD (Hard Disk Drive) and PCIe/PCI card. Section 2 will show you how to install the hardware.

2.1 Installing the Processor

The Intel® Core™ i7/i5/i3 processors are available as a boxed processor for the MVS900 system. Intel recommends the processors should be installed by a qualified computer professional since this electronic device may cause serious damage to the installer, system and processor if installed improperly.

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

Instructions:

1. Make sure that your system can accommodate the Intel® Core™ i7/i5/i3/Celeron® processors that you want to install. Check for CPU Card, BIOS, and thermal compatibility by using the manufacturer's documentation for the system, or by contacting the vendor if necessary. The processor should only be installed in systems supporting the Intel® Core™ i7/i5/i3/Celeron® processors.
2. Obtain access to your processor socket as described in the documentation for your system.
3. If the cooling solution prevents you from accessing the processor socket, you may need to remove it. Instructions on how to remove your cooling solution should be provided in the documentation that came with the system.

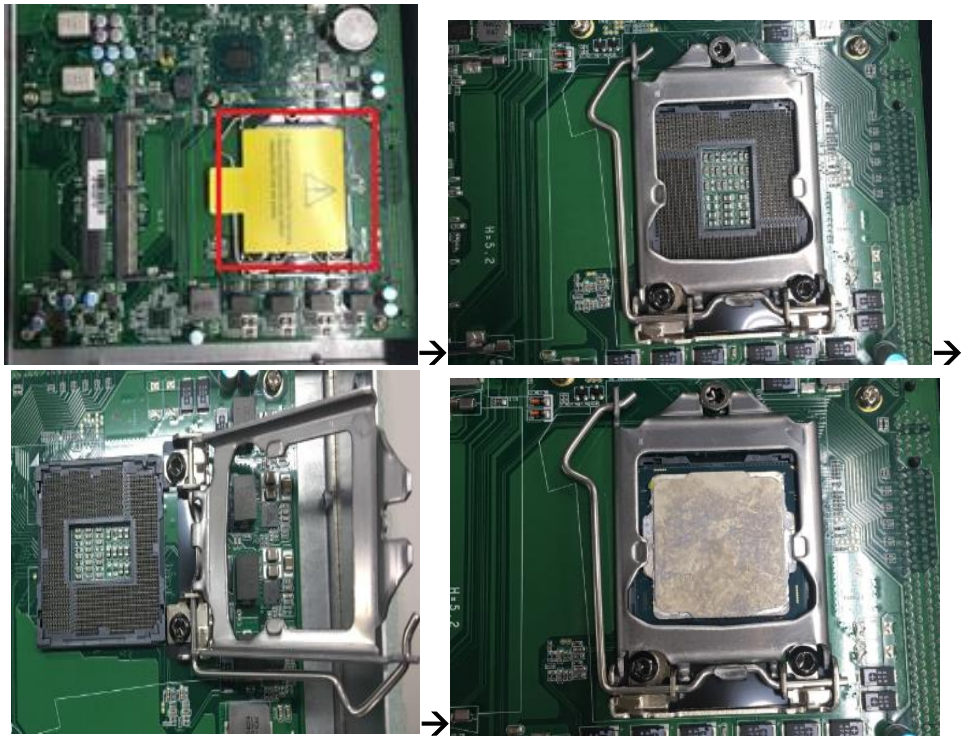
Procedure of Installation:

Step 1 Turn off the system.

Step 2 Disconnect the power connector.

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

Step 4 After opening the heatsink cover, you can locate the CPU socket as marked. Align pins of the CPU with pin holes of the socket. Pay attention to the CPU's orientation by aligning the arrow mark on the CPU with the arrow key on the socket. Please remove the Mylar before you install the CPU into the socket.



Step 5 Apply thermal grease on top of the CPU

Step 6 After installing all components, close the heatsink cover back to the chassis and fasten all screws.

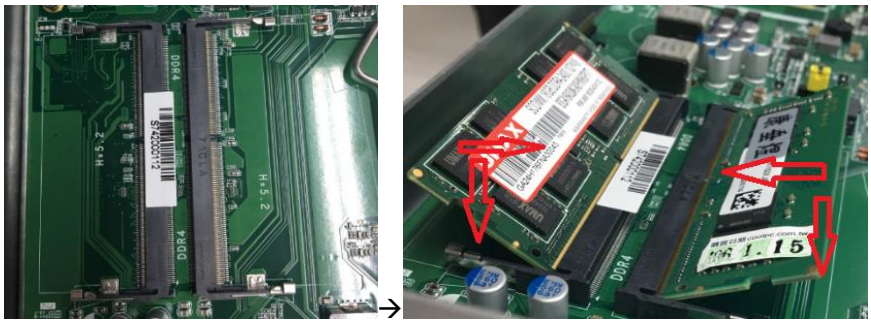
2.2 Installing the Memory Module

Step 1 Turn off the system.

Step 2 Disconnect the power connector.

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

Step 4 Install the SO-DIMM (small outline dual in-line memory module) into the socket and push it firmly down until it is fully seated. The socket latches are clipped on to the edges of the memory module.



Step 5 After installing the memory modules, please close the heatsink cover back to the chassis and fasten all screws.

2.3 Installing the Hard Disk Drive

The MVS900 Series offers a convenient drive bay for users to install HDD. The system offers users two 2.5” Hard Disk Drives for installation. Please follow the steps:

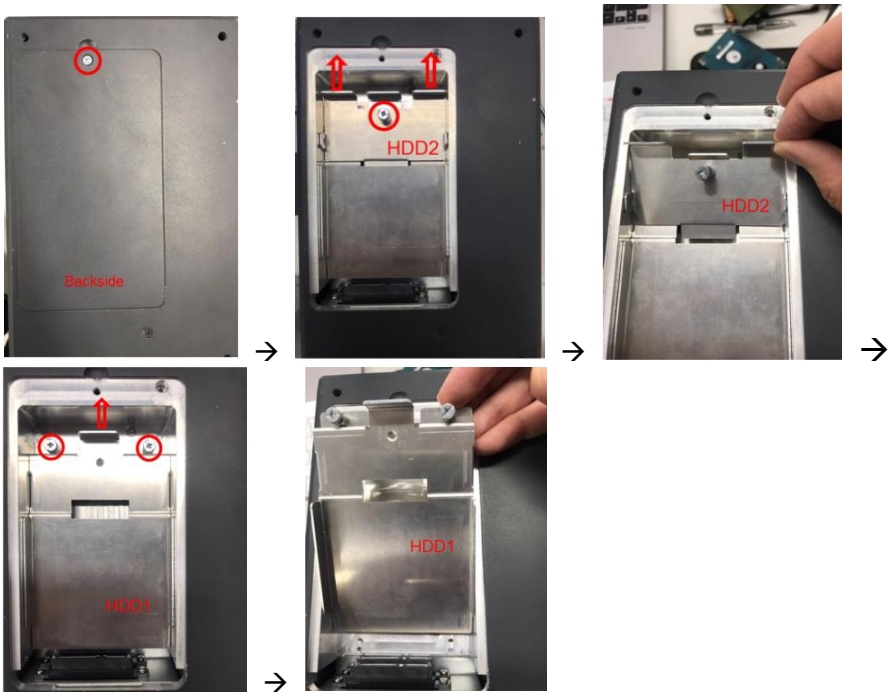
Step 1 Turn off the system.

Step 2 Disconnect the power connector.

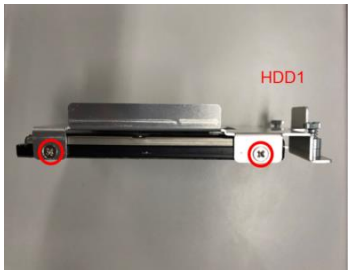
Step 3 Unscrew and remove the backplane of the HDD bay on the backside.

Step 4 Unscrew the thumbscrew and separate the HDD2 bracket from the HDD bay.

Step 5 Unscrew the HDD1 bracket and separate the HDD1 bracket from the HDD bay.



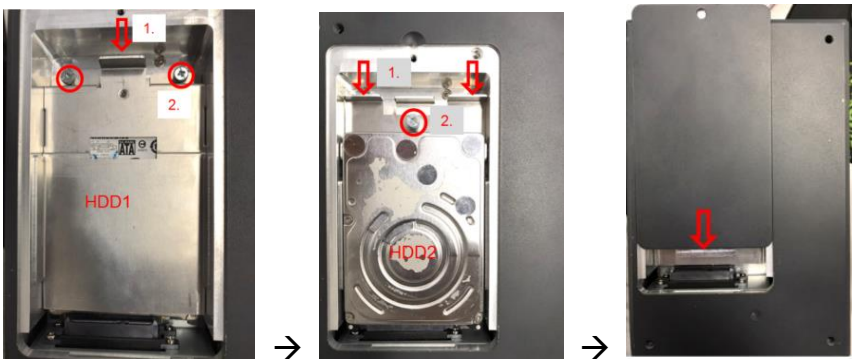
Step 6 Fix the HDD onto the HDD1 bracket with four screws and HDD2 bracket with two screws.



Step 7 Insert and screw the HDD1 module into the HDD bay.

Step 8 Insert and screw the HDD2 module, on top of the HDD1 module.

Step 9 Screw the backplane back to the system.



2.4 Installing foot pad

The MVS900 series provides four foot pad.

Step 1 Turn off the system.

Step 2 Disconnect the power connector.

Step 3 Take the foot pads from the accessory pack. Turn the system upside and then screw the foot pads into system.

2.5 Installing M.2 2280 Key M SSD Module

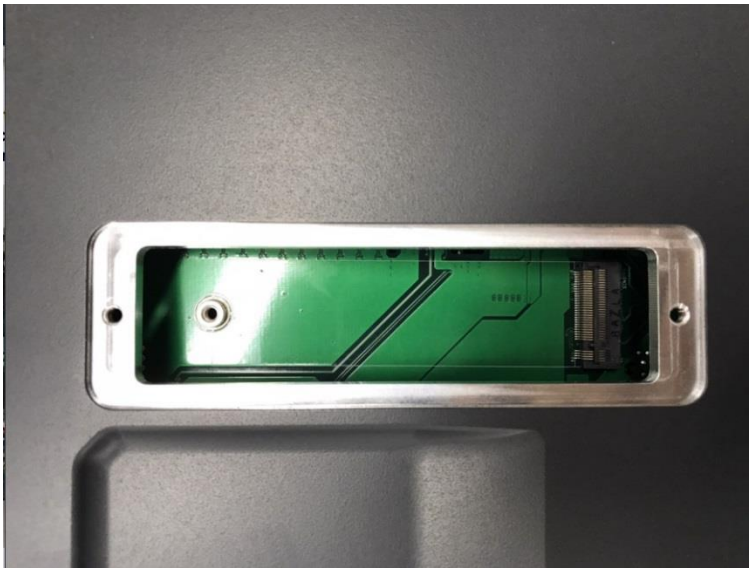
The MVS900-512-FL provides M.2 2280 Key M slot for SSD storage.

Step 1 Turn off the system.

Step 2 Disconnect the power connector.

Step 3 Turn the system upside down to locate and then unscrew the screws at the bottom side.

Step 4 Remove the bottom cover, and locate the M.2 2280 Key M slot on the board.



Step 5 Hold the M.2 2280 Key M SSD storage module at 30 degree up from horizontal direction and inset the golden finger into the slot until fully inserted.

Step 6 Fix the SSD storage onto the board with one screw.

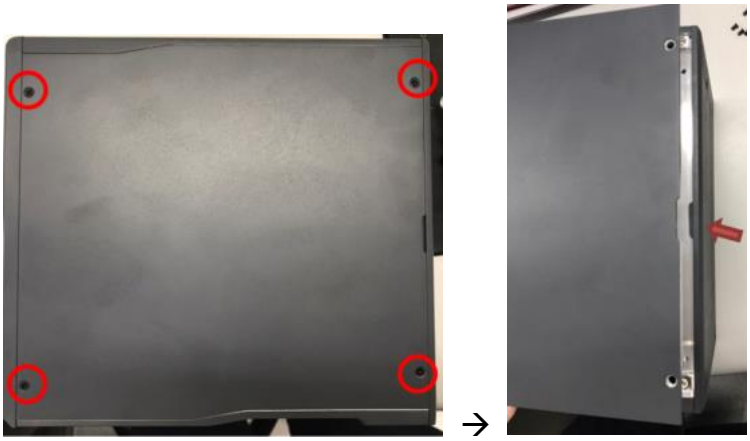
2.6 Installing internal USB dongle (Option)

The MVS900 series support internal USB2.0 slot for software dongle.

Step 1 Turn off the system.

Step 2 Disconnect the power connector.

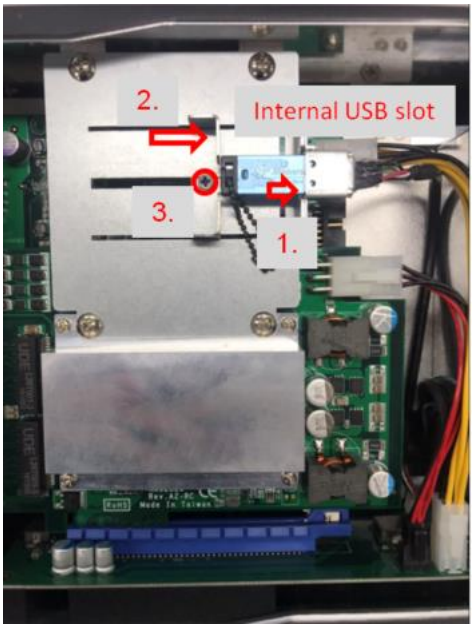
Step 3 Turn the left side of the system to locate and then unscrew the screws; furtherly, open the cover.



Step 4 Insert the USB dongle.

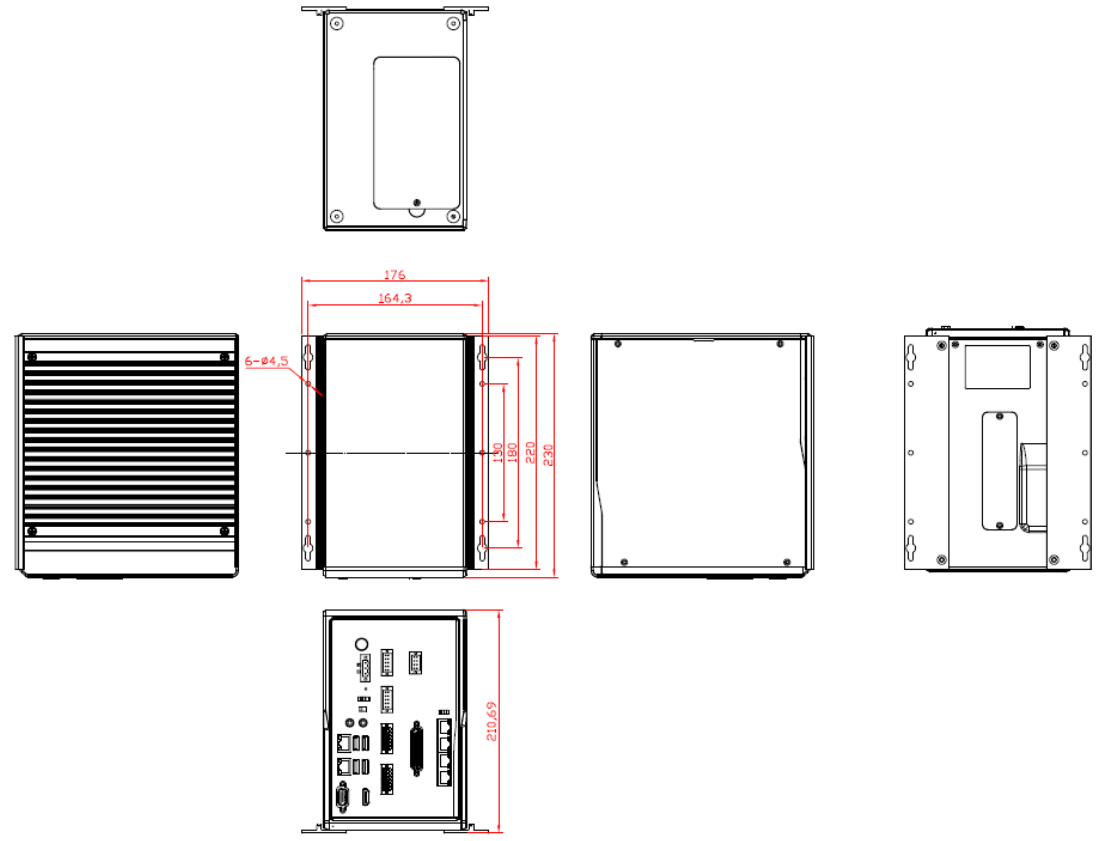
Step 5 Push the bracket to the appropriate location.

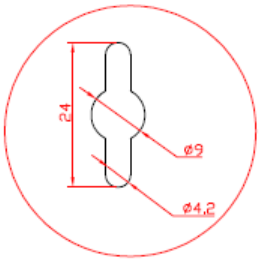
Step 6 Fix the bracket.



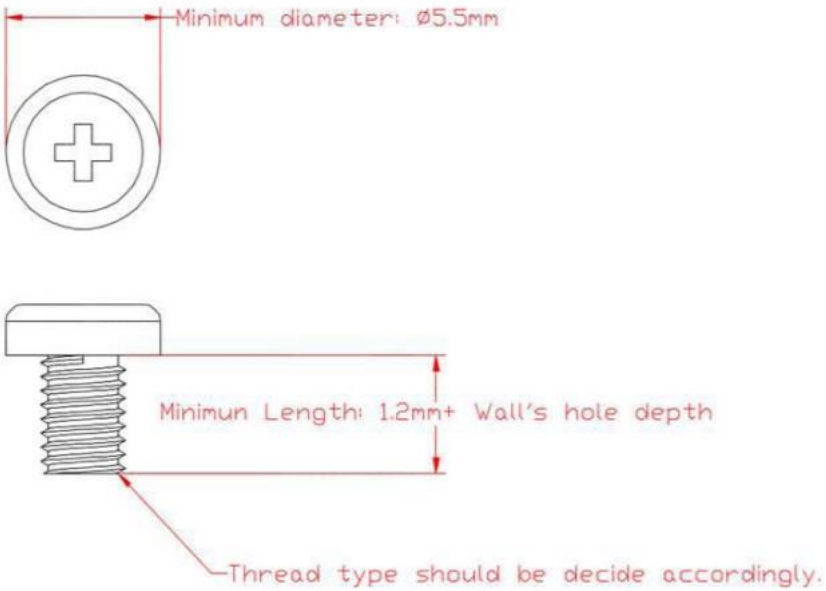
2.7 Wall-mount bracket kit

Get 4pcs truss head M4*6L screws to fix the wall-mount kit from optional wall-mount kit.



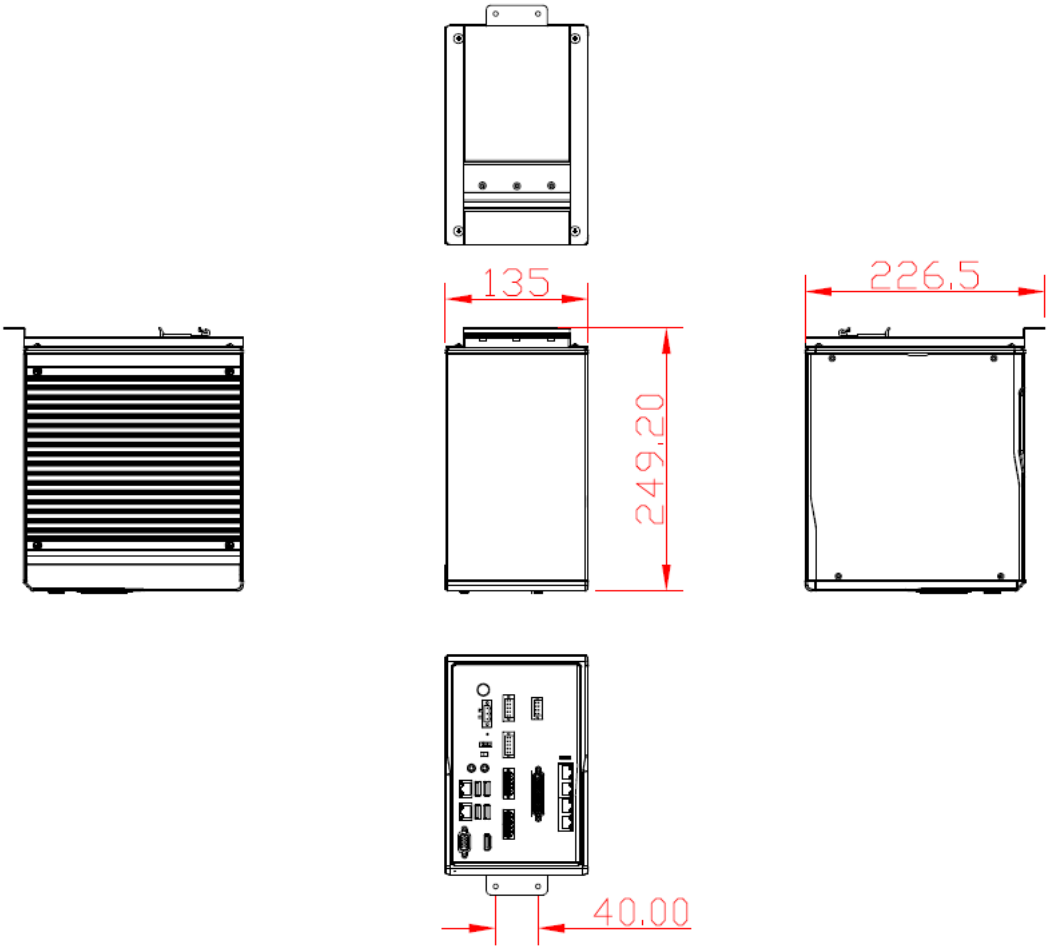


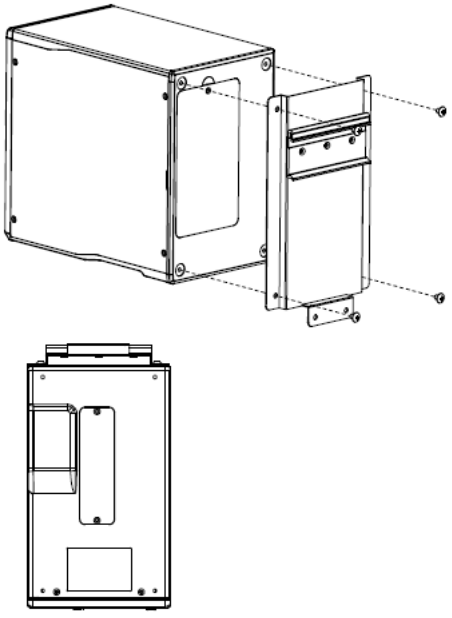
Note: If you install the screws in drywall, use the hollow wall anchors to ensure that unit does unit pull away from the wall due to prolonged strain the cable and power connector.



2.8 Din-rail bracket kit

Get 4pcs truss head M3*5L screws to fix the wall-mount kit from optional din-rail kit.





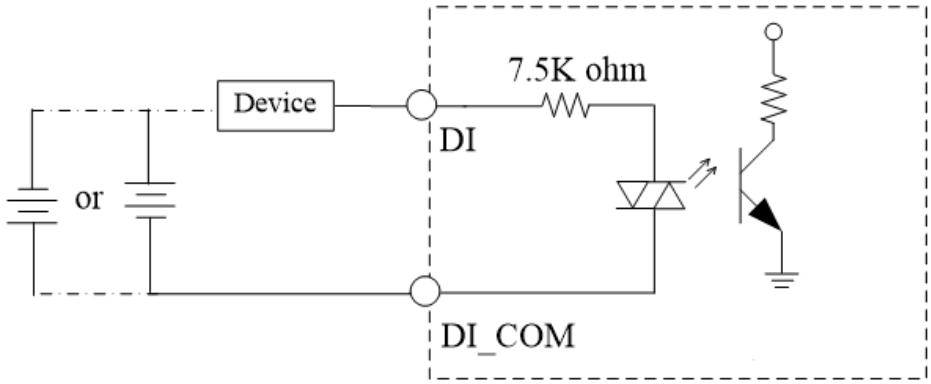
Section 3
I/O Connection

3.1 I/O Connection (44-pin female I/O connector)

Refer to this section to connect any cables between the system and other devices.
Each of the following I/O figures illustrates their respective connection on the MVS900.

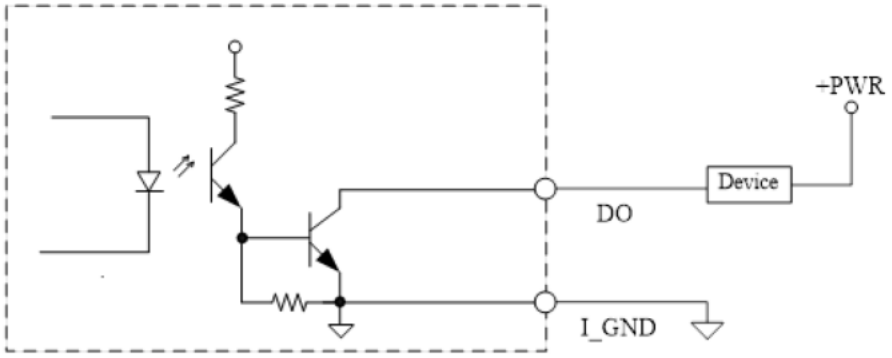
3.1.1 Isolated Digital Input

The figure shows how to connect between external input source and the system.
Each of the isolated digital input channels accepts 0~30 VDC with sink type and source type.



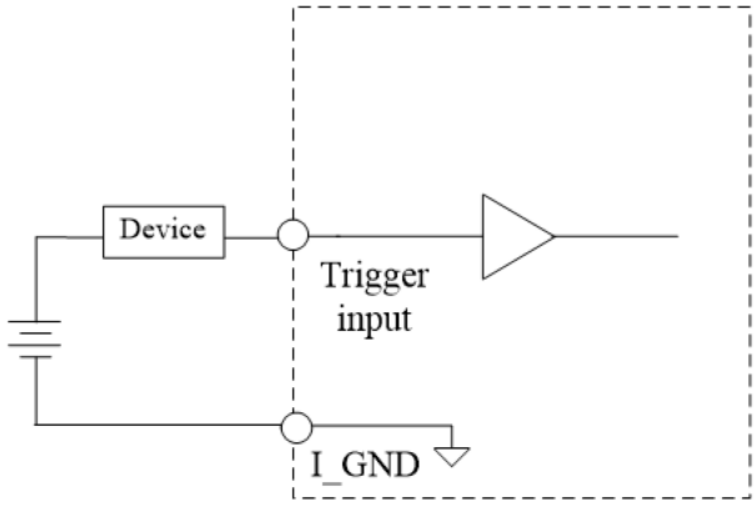
3.1.2 Isolated Digital Output

The figure shows how to connect between an output channel and the system.
If an external voltage 5~30 VDC is applied to an isolated output channel, the current will flow from the external voltage source to the system.
Please note that the current through each DO channel should not exceed 200 mA.



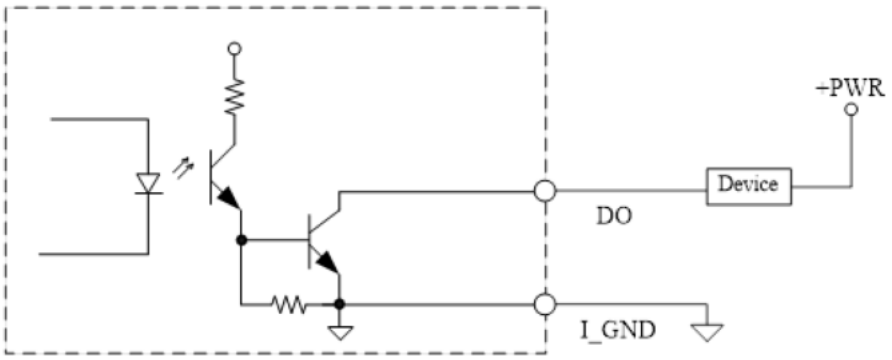
3.1.3 Isolated Trigger/Latch Input

The figure shows how to connect between external input source and the system.
Each of the isolated trigger input channels accepts 0~30 VDC with sink type.



3.1.4 Isolated Trigger Output

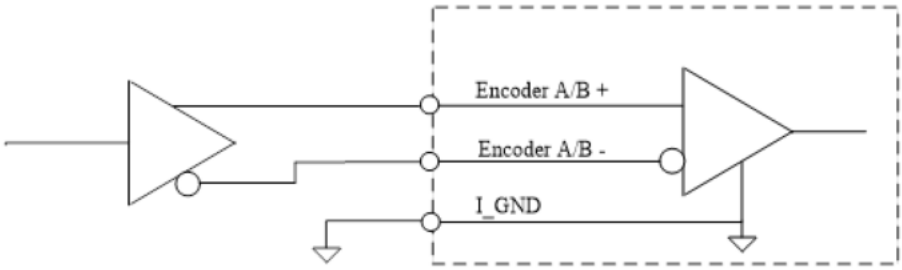
The figure shows how to connect between an output channel and the system.
If an external voltage 5~30 VDC is applied to an isolated output channel, the current will flow from the external voltage source to the system.
Please note that the current through each trigger output channel should not exceed 100 mA.



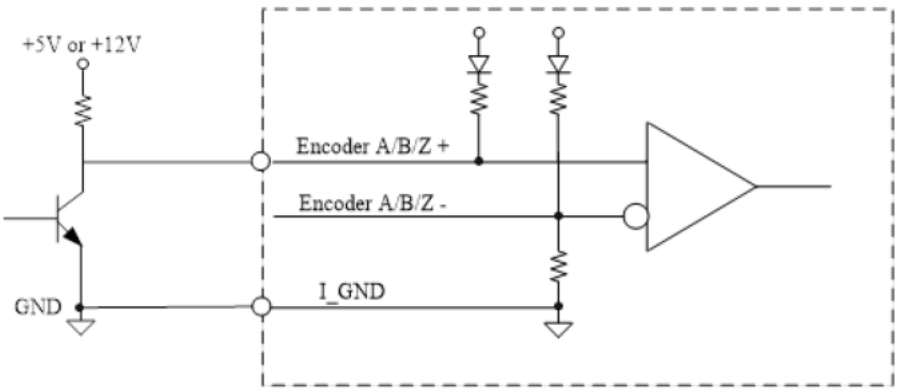
3.1.5 Isolated Encoder Input

The figure shows how to connect between an input channel and the system.

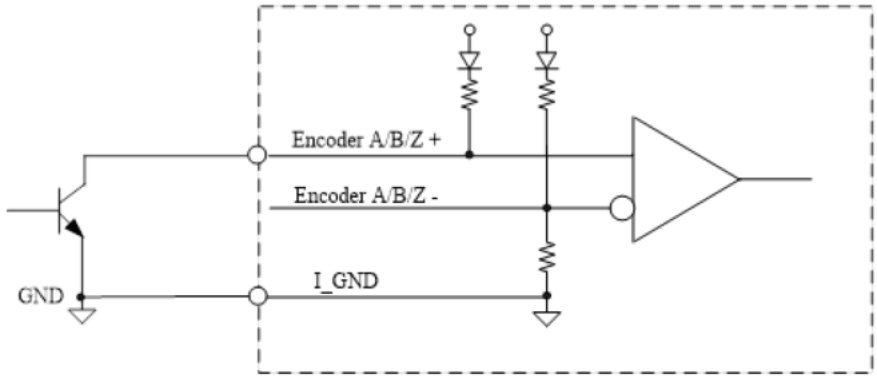
Differential type:



5V or 12V Voltage Type:



Open Collector Type:

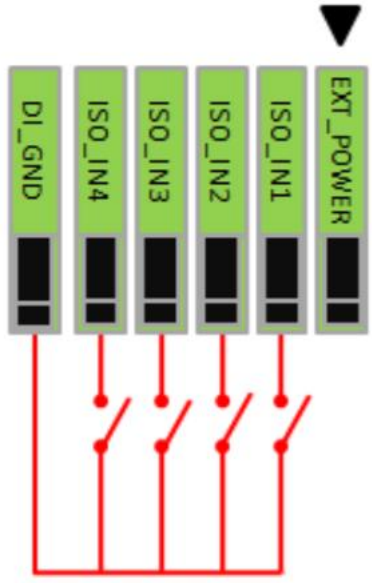
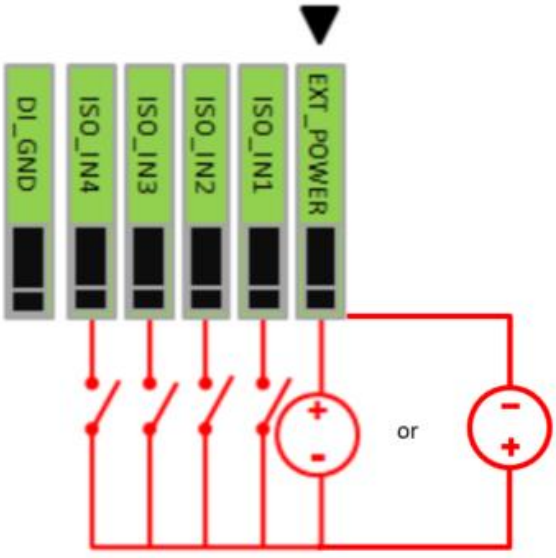


3.2 I/O Connection

The system offers 8-in/8-out DIO ports with isolated 1.5KVDC as the red box of the figure below. Refer to this section to connect any cables between the flexible I/O and other devices.

3.2.1 Isolated Digital Input

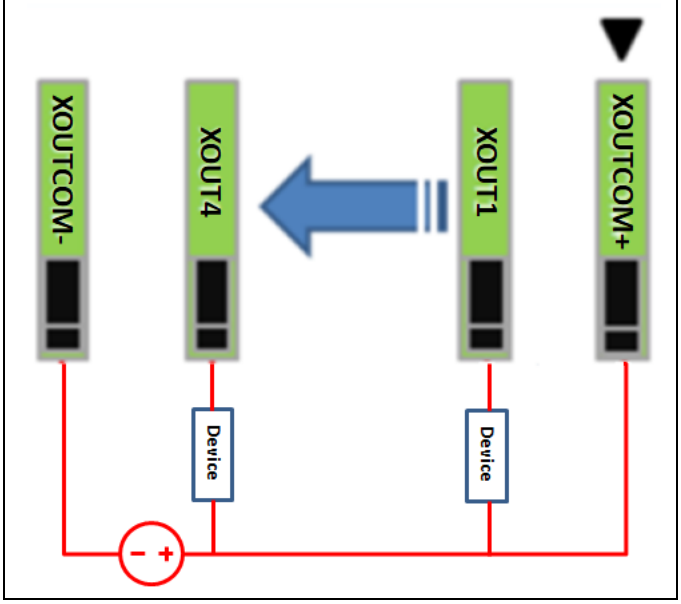
The figure shows how to connect between external input source and the system.
Each of the isolated digital input channels accepts 0~30 VDC with dry and wet contact.

Dry Contact Wiring	Wet Contact Wiring (Sink or Source)
	

3.2.2 Isolated Digital output

The figure shows how to connect between an output channel and the system.
If an external voltage 12~24 VDC is applied to an isolated output channel, the current will flow from the external voltage source to the system.
Please note that the current through each DO channel should not exceed 200 mA.

DO Contact Wiring



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Section 4
Operating

4.1 Operating

This section describes the detail operation of the MVS900.

4.1.1 Encoder function

The MVS900 supports 2CH 32-bit incremental quadrature encoder input for the ABZ signal by a mode x1, x2 or x4, which is used for applications where direction sensing is required. This mode consists of two square-wave pulse signals known as Phase A and Phase B, which are generated by a rotating encoder. Phase A and Phase B signals are coded 90° out of phase from each other: Phase A is either 90° phase leading or lagging behind Phase B. The MVS900 is able to count square-wave pulses of Phase A and Phase B, and then determine the rotating direction of motor movement by comparing the phase relationship between Phase A and B:

- When the quadrature encoder is rotating in a clockwise direction, its signal will show a positive direction of Phase A leading Phase B.
- When the quadrature encoder rotates counterclockwise, its signal will show a negative direction of Phase A lagging behind Phase B.

Besides direction, the quadrature encoder can generate another signal named Phase Z, which is produced once per complete rotation of the quadrature encoder. Phase Z is used by the MVS900 to locate a position of the motor when the quadrature encoder completes a 360° rotation, so that the counter value of Phase Z can reset to zero if the configuration set the homing conditions.

- Counter mode

x1 mode: The counter value will increment or decrement when a rising edge happens on Phase A.

x2 mode: The counter value will increment or decrement when a rising edge or a falling edge happens on Phase A.

x4 mode: The counter value will increment or decrement when a rising edge or a falling edge happens on Phase A or B.

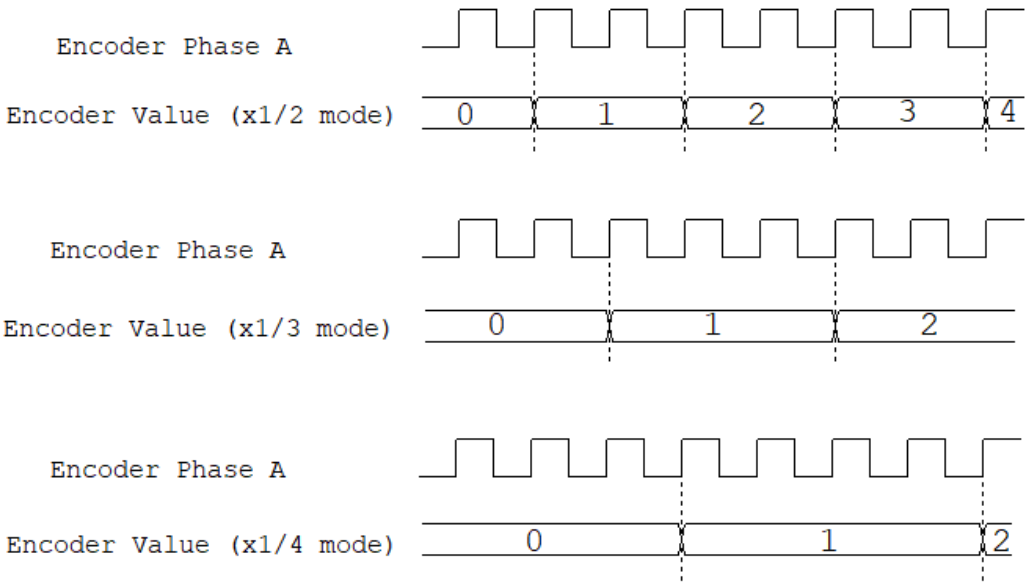
In most cases, the x4 Phase AB signal mode is applied to incremental encoder devices. For example, when a motor completes a 360° rotation, an incremental encoder will generate 1000 pulses per phase (A or B phase), but the count will show 4000 pulses.

1/2 mode: The counter value will increment or decrement when a rising edge happens twice on phase A.

1/3 mode: The counter value will increment or decrement when a rising edge happens three times on phase A.

1/4 mode: The counter value will increment or decrement when a rising edge happens Four times on phase A

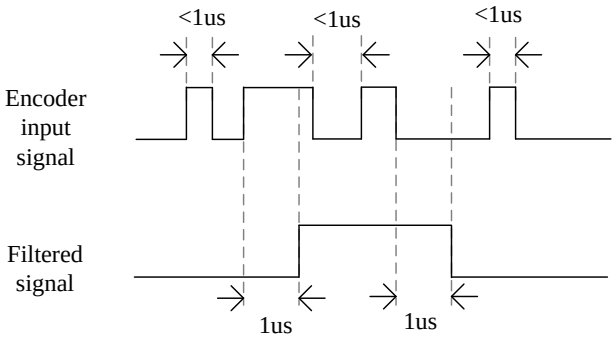
The figure below depicts a case where a valid encoder value is pulse edge from phase A encoder signal. The 1/2, 1/3 or 1/4 mode defines the number of pulses to skip between valid acquisition. After the following pulses meet mode setting, the encoder value will be increasing (As defined by the selection of 1/2, 1/3 or 1/4 mode).



4.1.2 De-bounce filter

Each encoder channel supports de-bounce filter function to reject noise. The de-bounce filter can define the interval width for high/low signals. Signals with interval width less than the defined value will be filtered out.

Below is a diagram illustrating the case of a filter timer set with a duration time of 1 microsecond:



4.1.3 Encoder Homing

This function can clear the counter value when Phase Z has a rising edge or when the user gives the command. Further, the user can configure a specific value by software. When a current value equals a value of setting, the counter value will reset zero.

4.1.4 Encoder Linear Trigger

This function is able to compare counter value by an encoder linear function. Each encoder supports two linear functions and has four parameters of configuration as below: Start Point, Repeat Times, Interval and Direction.

- Trigger Point (N+1) = Trigger Point N + Interval

(N = Repeat Times, the first trigger condition is start point.)

Trigger output will generate an output signal when Trigger Point equals the current counter value of a selected encoder channel.

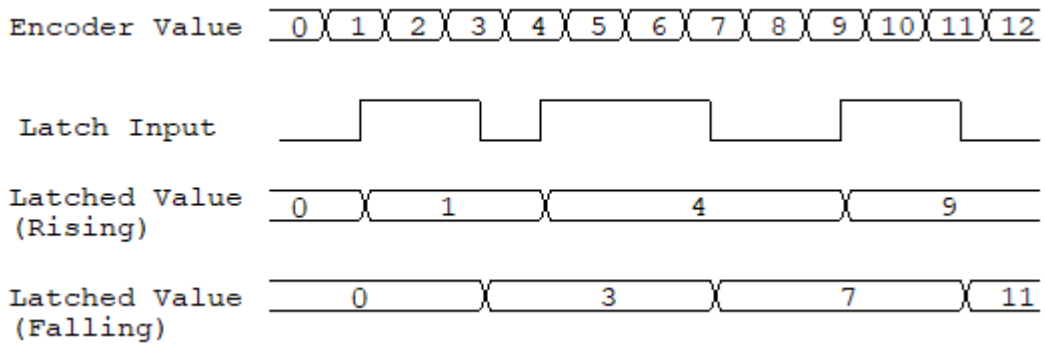
4.1.5 Encoder FIFO Trigger

Encoder FIFO trigger function is used for memory preset position data, and FIFO is first-in and first-out storage. Furthermore, each encoder supports one encoder FIFO trigger function. After the preset position is compared, trigger output will generate a output signal. Meanwhile, the user also can input a new data into FIFO.

4.1.6 Encoder Counter Value Latch

Encoder counter value latch function is used by Latch input signal. The user can set rising or falling trigger. When the signal is triggered, the encoder counter value will be saved to latch register. Further, the user can read this value to apply different cases.

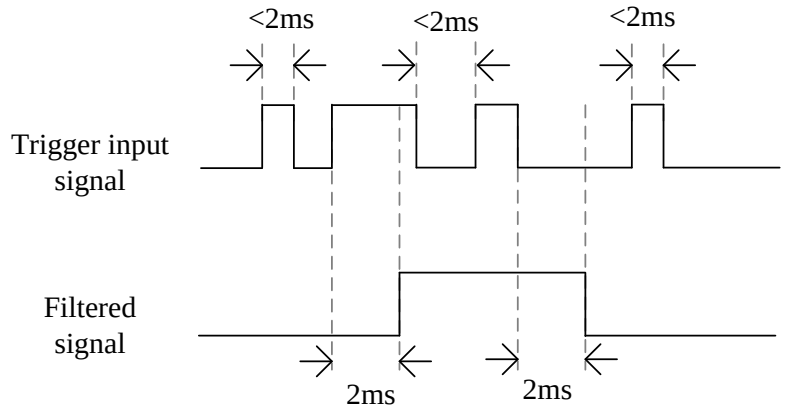
The diagram shows the case of position latch.



4.1.7 Trigger Input/ Output

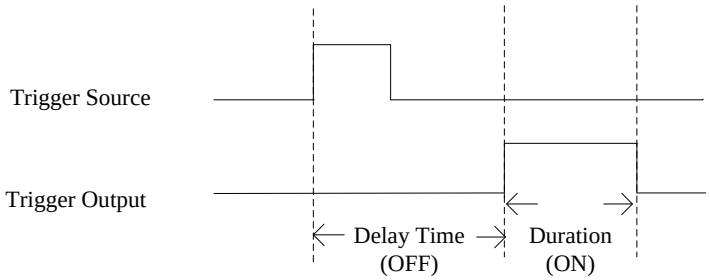
Trigger input supports de-bounce filter function to help filter out environmental noise that can mix with normal encoder signals and affect the accuracy of the pulse count. The de-bounce filter defines the interval width for high/low signals. Signals with interval width less than the defined value will be filtered out.

Below is a diagram illustrating the case of filter timer set with a duration time of 2 milliseconds:

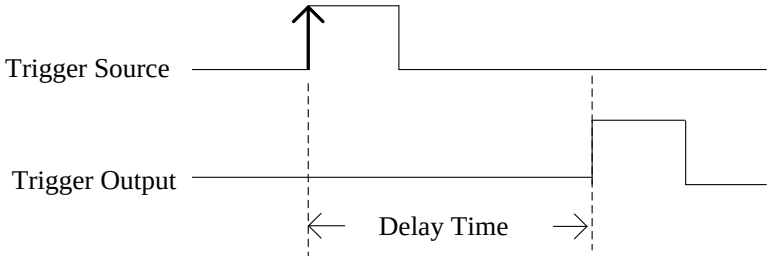


Trigger Output CH 0~4 provides the following parameters to configure:

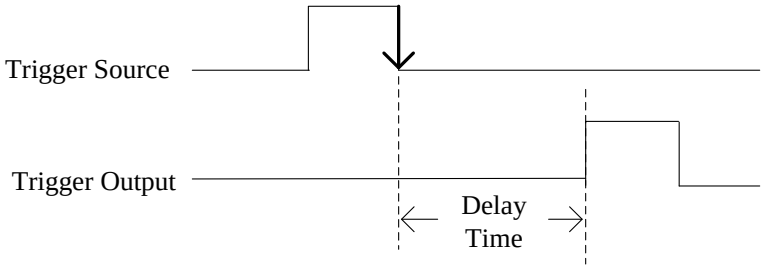
- **Trigger source**
  The user can select any of the following items as a triggering condition that prompts the MVS900 to generate a trigger output: Trigger Input CH 0~3, Encoder 0_Linear 0, Encoder 0_Linear 1, Encoder 0_FIFO, Encoder 1_Linear 0, Encoder 1_Linear 1, Encoder 1_FIFO
  Note: One trigger source can be set to activate multiple trigger outputs.
- **Delay time function**
  The user can set the delay time that the system waits before it sends a trigger output.
- **Duration time**
  The user can adjust pulse width for the output signal.
  (Definitions of delay time and duration time are illustrated below):



- **Invert**
  Trigger source mode can be set as rising trigger or falling trigger.



Rising Trigger



Falling Trigger

4.1.8 LED Lighting Control

LED lighting output can be set to use Trigger or Strobe mode. Further, based on a variety of conditions, trigger LED output, duration time, delay time and dimming control are all programmable to help identify object characteristics and meet high image requirements in different inspections.

4.1.9 Interrupt

This function can send an interrupt signal to the host PC.

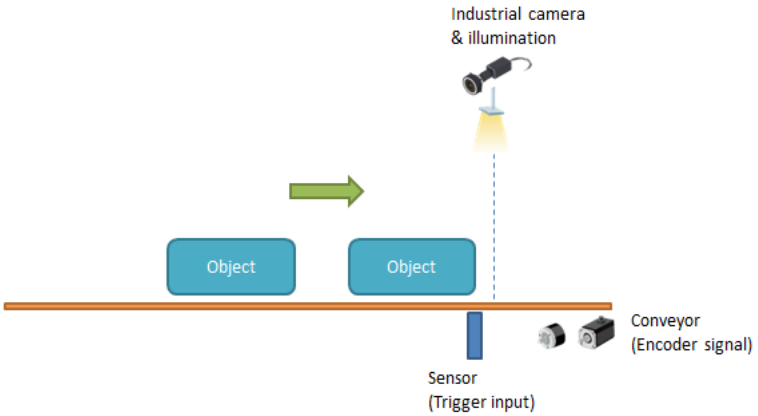
The user can select two conditions for the MVS900 to generate an interrupt signal.

4.2 Application

This section shows the real cases in the machine vision field.

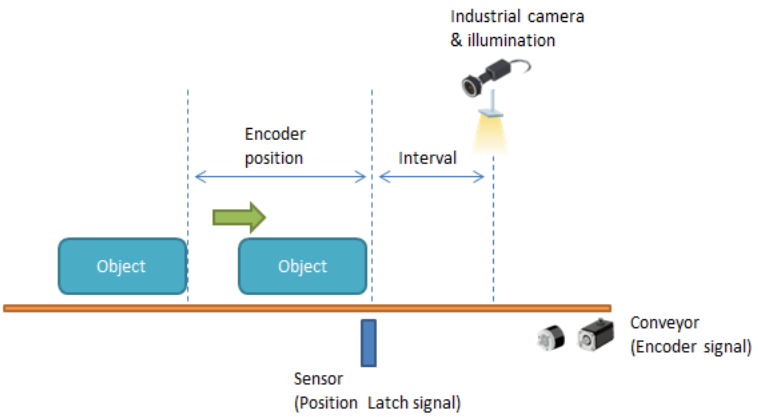
4.2.1 Scenario 1

In this scenario, when an optical sensor or encoder detects objects passing down the production line, it will send trigger signals to notify the system. These signals trigger a camera to capture images. Data from the camera is then used by a vision platform to identify features. Finally, should an object with defects be detected, it is rejected by a pneumatic actuator or robotic arm. These functions will provide real-time I/O with microsecond-scale control and lighting control to meet timing sequence requirements and ensure high quality image output.



4.2.2 Scenario 2

In this application, the system needs to record the encoder positions for camera trigger. The AX92352's hardware is specifically designed to store encoder positions. When the sensor produces an external latch input signal, the encoder position value will be recorded to the latch register. Users can get these position data by calling API and set value to the FIFO buffer. Further, trigger-out will output the FIFO data, which adds up both latch and interval values.



Section 5
AMI BIOS Utility

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

5.1 Setting

To enter the setup screens, follow the steps below:

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

Note: ***If your computer cannot boot after making and saving system changes with Setup, you can restore BIOS optimal defaults by setting JP1 (see section 1.7.1).***

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

5.2 Navigation Keys

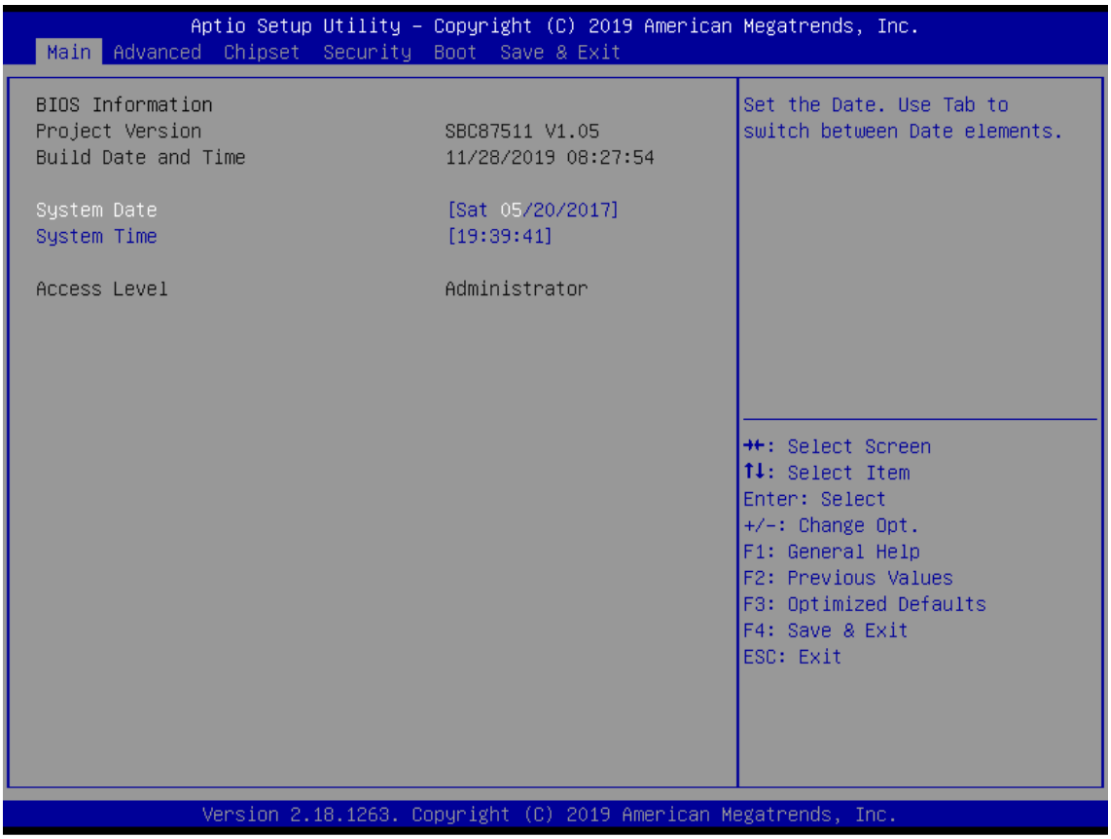
The BIOS setup/utility uses a key-based navigation system called hot keys. Most of the BIOS setup utility hot keys can be used at any time during the setup navigation process. These keys include <F1>, <F2>, <Enter>, <ESC>, <Arrow> keys, and so on.

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

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

5.3 Main Menu

The first time you enter the setup utility, you will be in the Main setup screen. You can always return to the Main setup screen by selecting the Main tab. System Time/Date can be set up as described below. The Main BIOS setup screen is shown below.



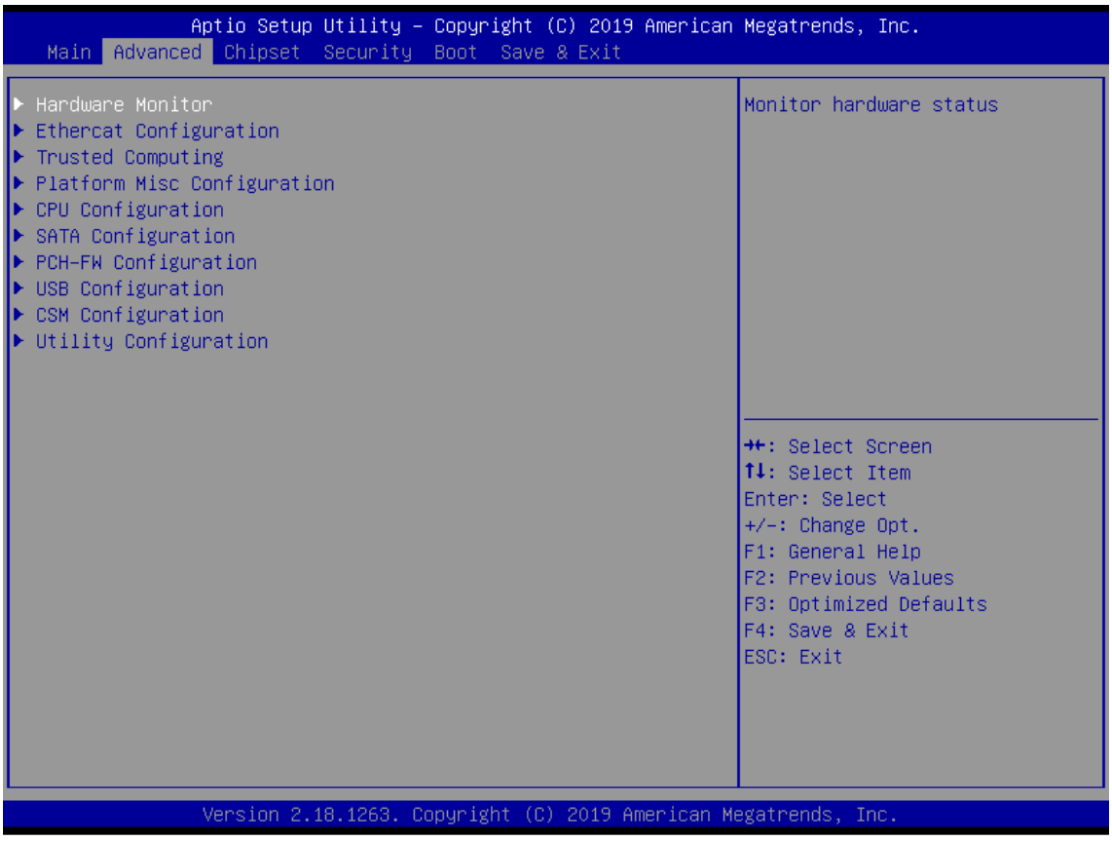
- **System Date/Time**
  Use this option to change the system time and date. Highlight System Time or System Date using the <Arrow> keys. Enter new values through the keyboard. Press the <Tab> key or the <Arrow> keys to move between fields. The date must be entered in MM/DD/YY format. The time is entered in HH:MM:SS format.

5.4 Advanced Menu

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

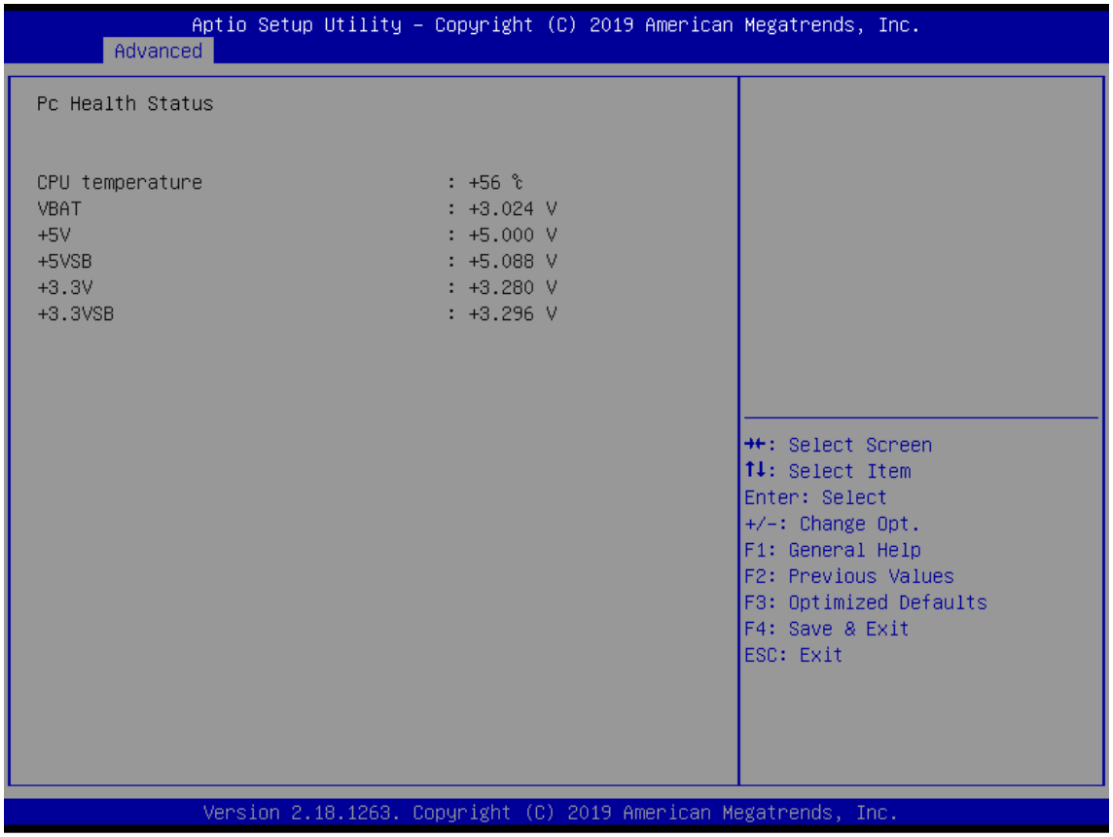
- ► Hardware Monitor
- ► EtherCAT Configuration
- ► Trusted Computing
- ► Platform Misc Configuration
- ► CPU Configuration
- ► SATA Configuration
- ► PCH-FW Configuration
- ► USB Configuration
- ► CSM Configuration
- ► Utility Configuration

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



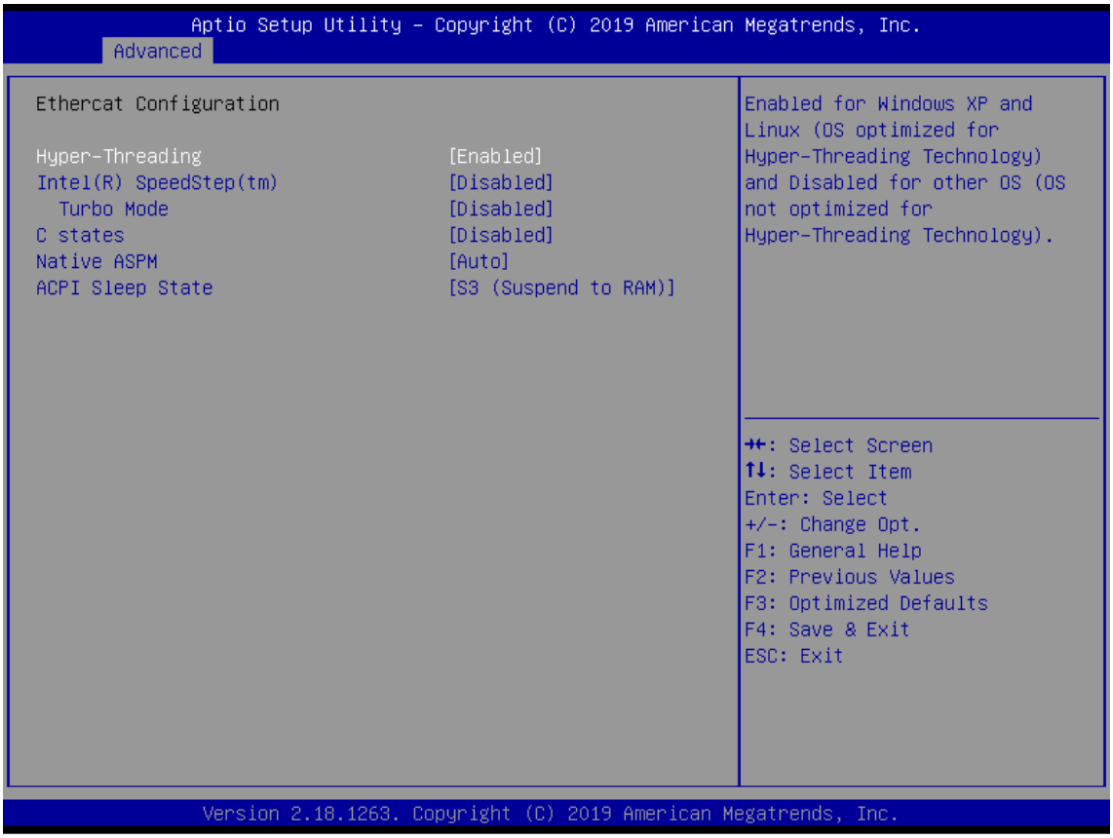
- **Hardware Monitor**

This screen monitors hardware health.



- **EtherCAT Configuration**

Set “Disable” mode in the following 5 times to support the Ethercat.

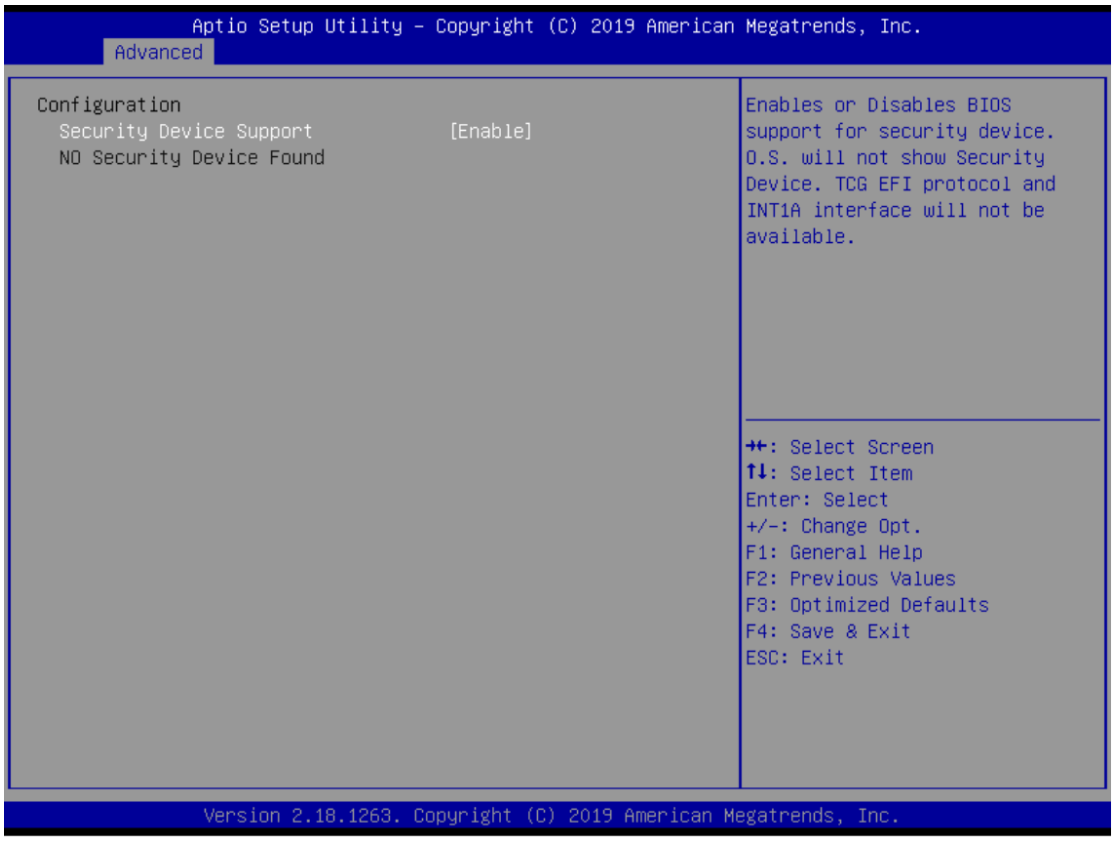


➢ **ACPI Sleep State**

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

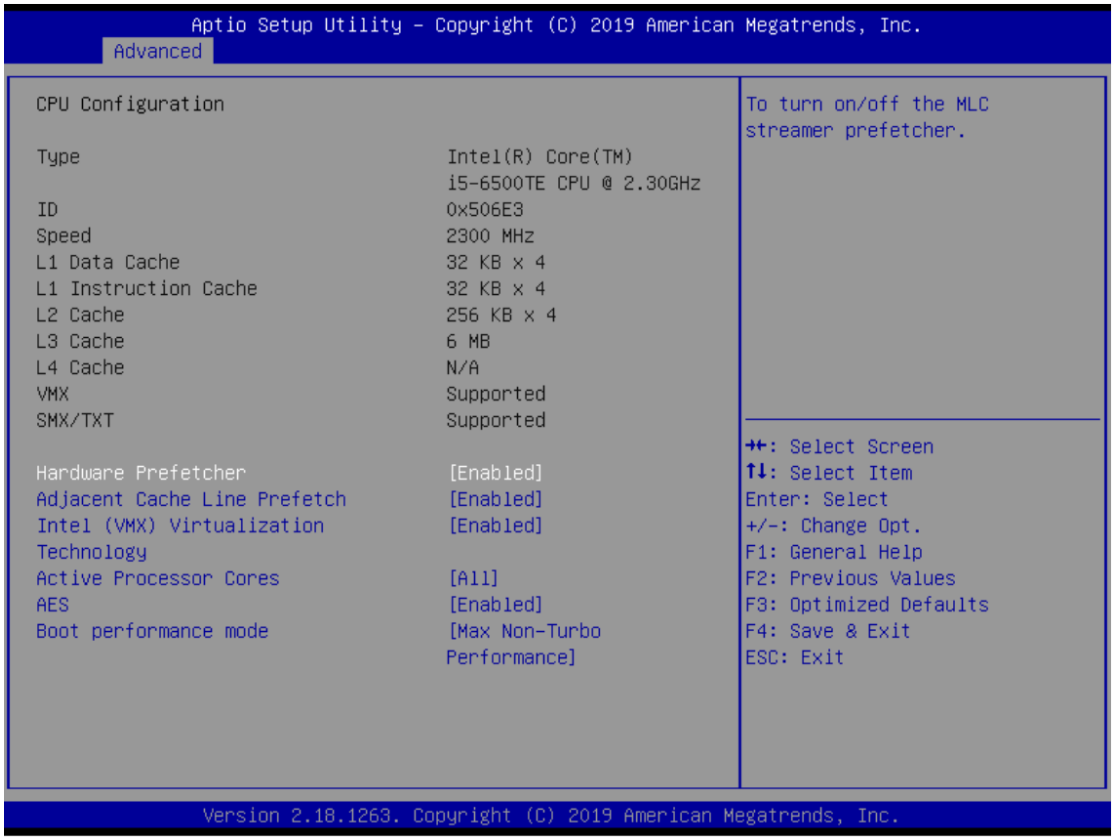
- **Trusted Computing**

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



- **CPU Configuration**

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



- **Hardware Prefetcher**

  Turn on/off the MLC streamer prefetcher.

- **Adjacent Cache Line Prefetch**

  Turn on/off prefetching of adjacent cache lines.

- **Intel Virtualization Technology**

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

- **Active Processor Cores**

  Number of cores to enable in each processor package.

- **AES**

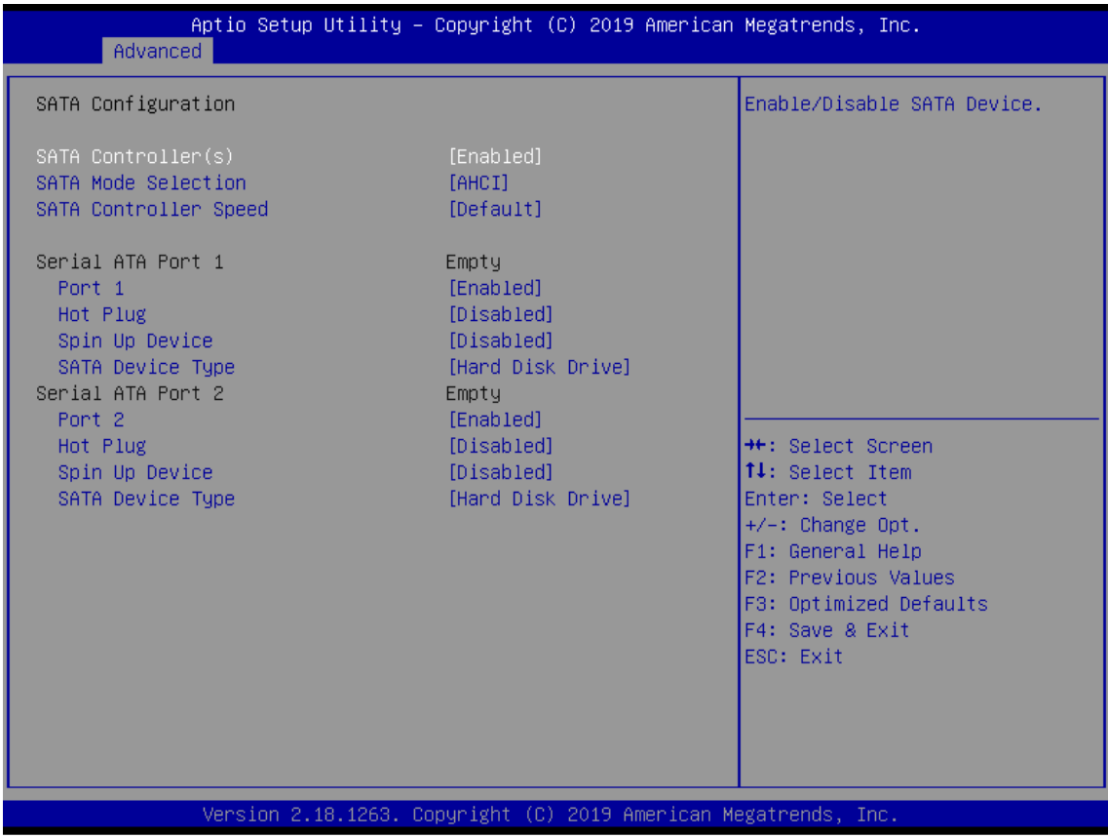
  Enable / Disable AES (Advanced Encryption Standard)

- **Boot performance mode**

  Select the performance state that the BIOS will set starting from reset vector

- **SATA Configuration**

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



- **SATA Controller(s)**
  Enable or disable the SATA Controller feature. The default is Enabled.

- **SATA Mode Selection**
  Determine how SATA controller(s) operate. Operation mode options are RAID and AHCI (Advanced Host Controller Interface). The default is the AHCI mode.

- **SATA Controller Speed**
  Indicates the maximum speed the SATA controller can support.

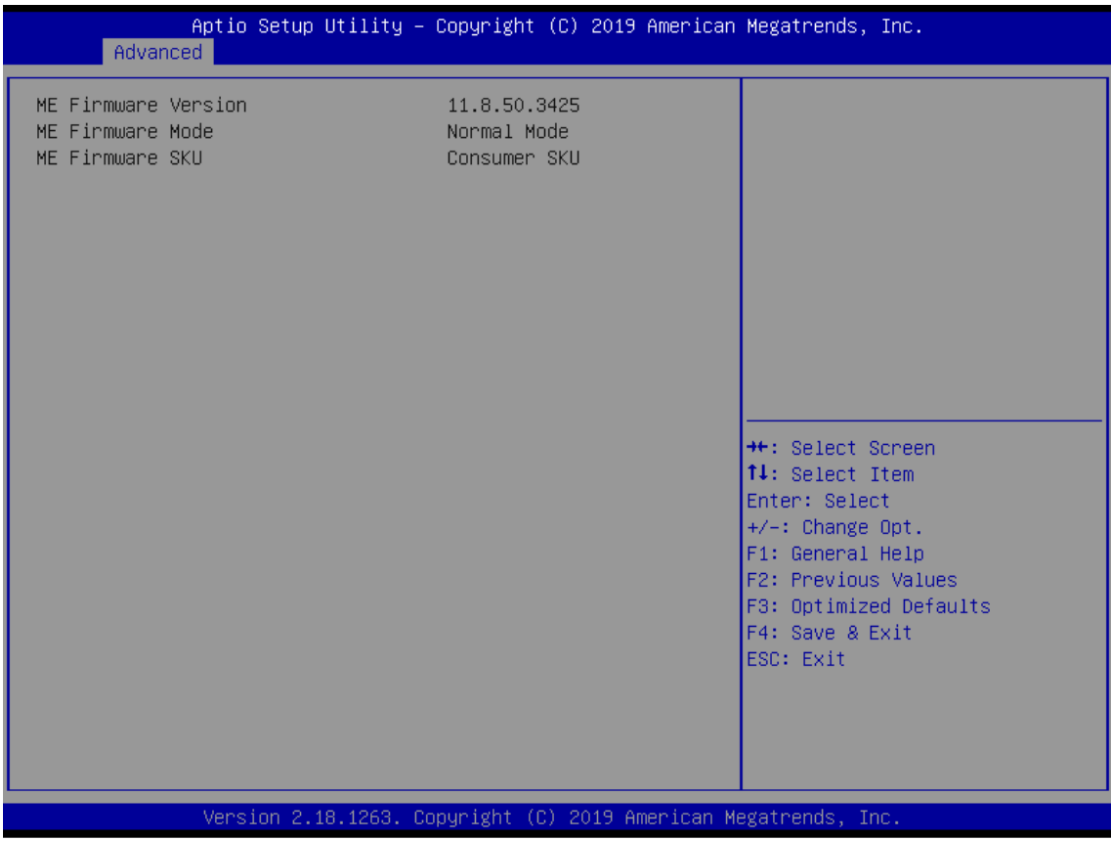
- **Hot Plug**
  Designates this port as Hot Pluggable.

- **Spin Up Device**
  If enabled for any of ports, Staggerred Spin Up will be performed and only the drives that have this option enabled will spin up at boot. Otherwise all drives spin up at boot.

- **SATA Device Type**
  Identify the SATA port is connected to a solid-state drive (SSD) or hard disk drive (HDD).

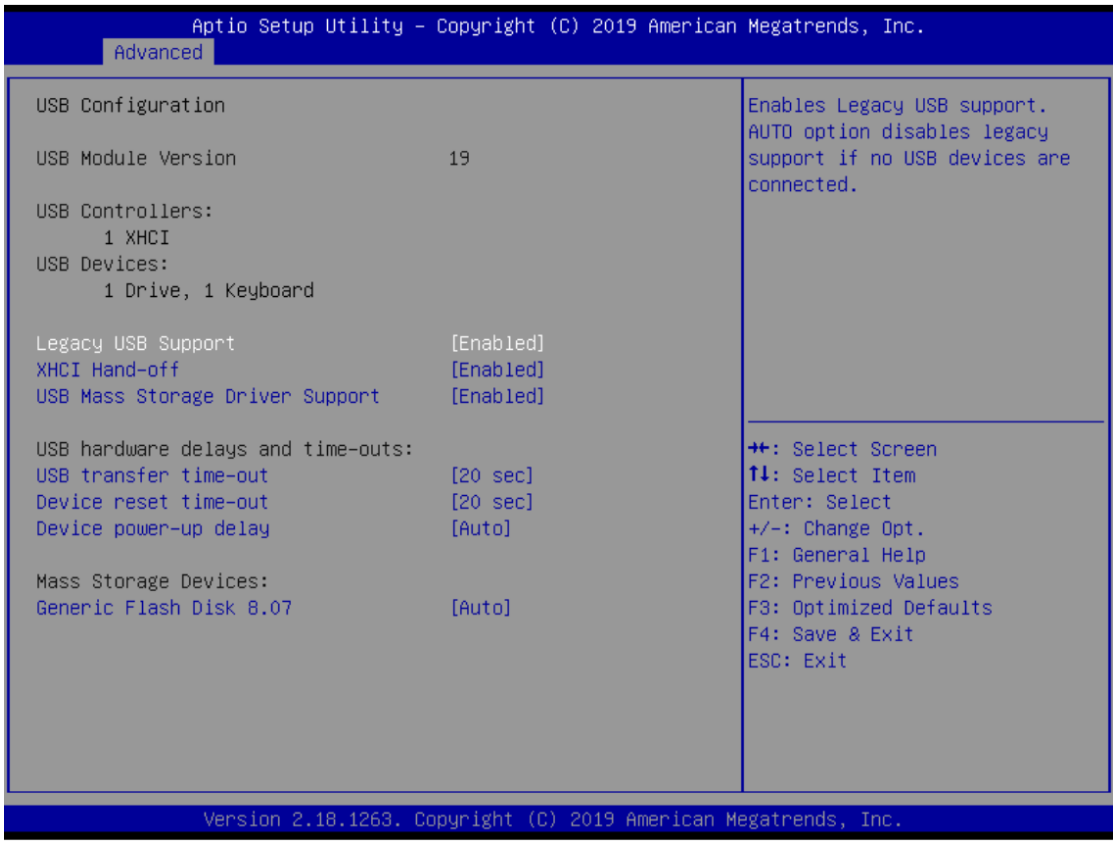
- **PCH-FW Configuration**

Display ME firmware information



- **USB Configuration**

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



- **USB Devices**
  Displays all detected USB devices.

- **Legacy USB Support**
  Enables Legacy USB support. The AUTO option disables legacy support if no USB devices are connected.

- **XHCI Hand-off**
  This is a workaround for OSes without XHCI hand-off support. The XHCI ownership change should be claimed by XHCI driver.

- **USB Mass Storage Driver Support**
  Enable/Disable USB Mass Storage Driver Support.

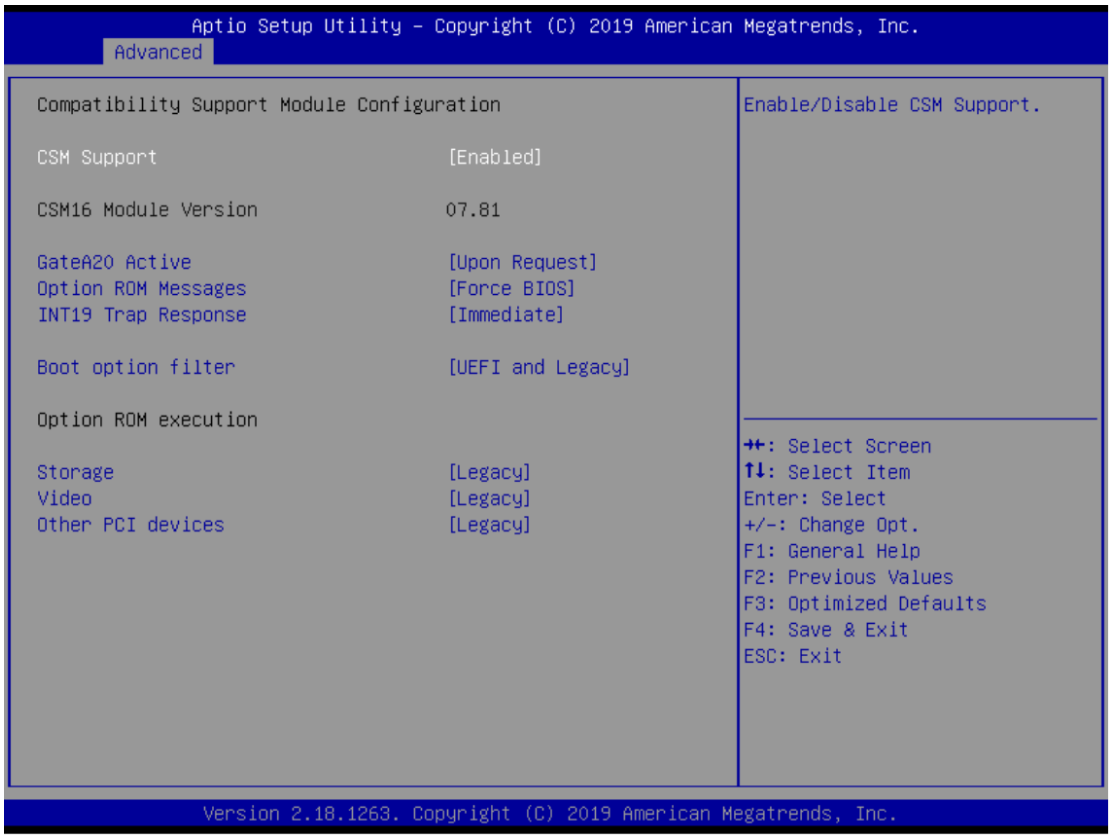
- **USB transfer time-out**
  The time-out value for Control, Bulk, and Interrupt transfers.

- **Device reset time-out**
  USB mass storage device Start Unit command time-out.

- **Device power-up delay**
  Maximum time the device will take before it properly reports itself to the Host Controller. 'Auto' uses default value: for a Root port it is 100 ms, for a Hub port the delay is taken from Hub descriptor.

- **CSM Configuration**

The screen displays CSM information.



- **CSM Support**
  Enabled / Disable CSM Support.

- **GateA20 Active**
  UPON REQUEST - GA20 can be disabled using BIOS services. ALWAYS - do not allow disabling GA20. This option is useful when any RT code is executed above 1MB.

- **Option ROM Messages**
  Set display mode for Option ROM.

- **INT19 Trap Response**
  BIOS reaction on INT19 trapping by Option ROM: IMMEDIATE - execute the trap right away; POSTPONED - execute the trap during legacy boot.

- **Boot option filter**
  This option controls Legacy/UEFI ROMs priority.

- **Storage**
  Controls the execution of UEFI and Legacy Storage OpROM.

- **Video**
  Controls the execution of UEFI and Legacy Video OpROM.

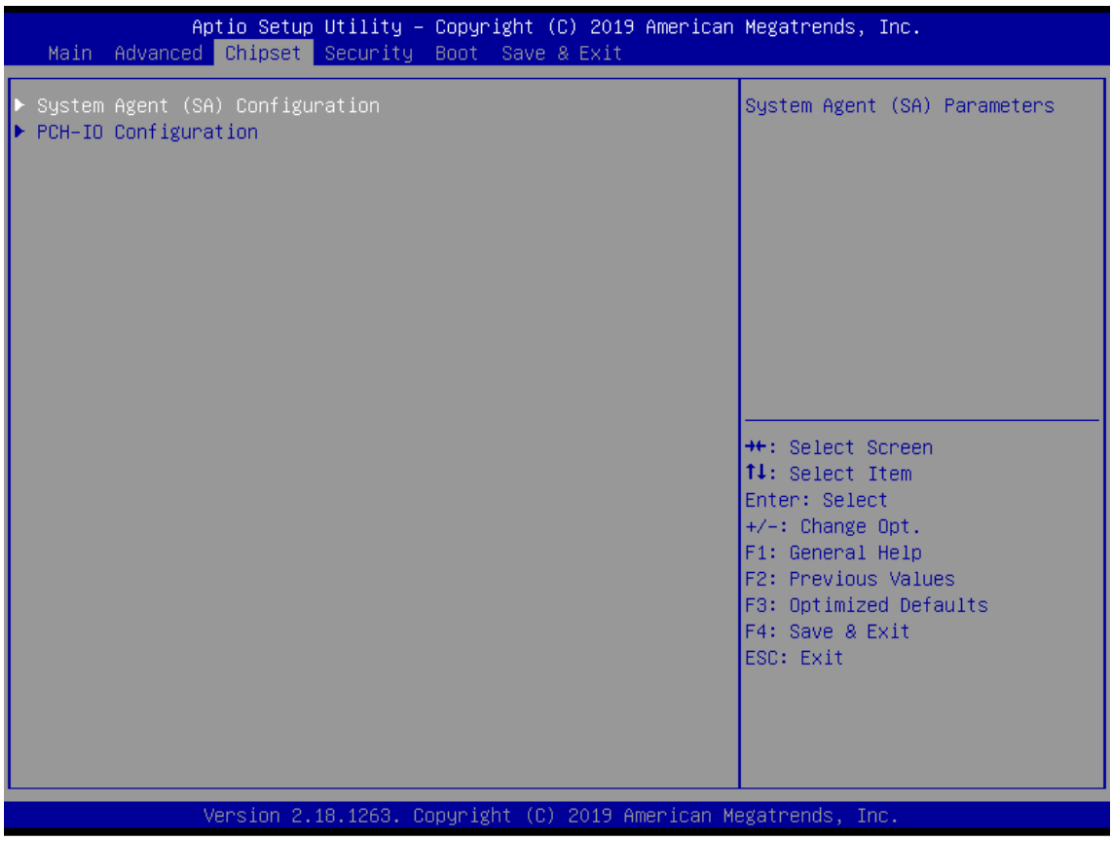
- **Other PCI devices**
  Determines OpROM execution policy for devices other than Network, Storage, or Video.

6.5 Chipset Menu

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

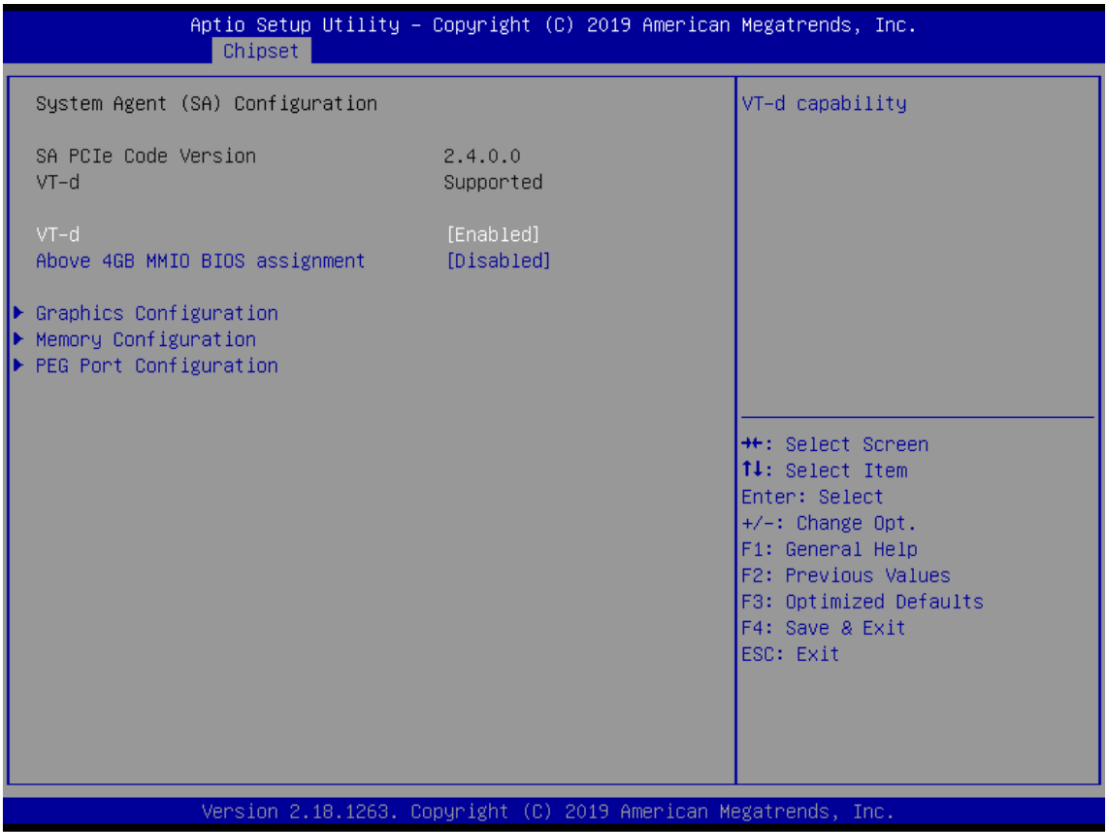
► **System Agent (SA) Configuration**

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



- **System Agent (SA) Configuration**

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



➢ **Graphics Configuration**

Use this item for graphics configuration settings.

➢ **Memory Configuration**

Use this item for memory configuration settings.

➢ **PEG Port Configuration**

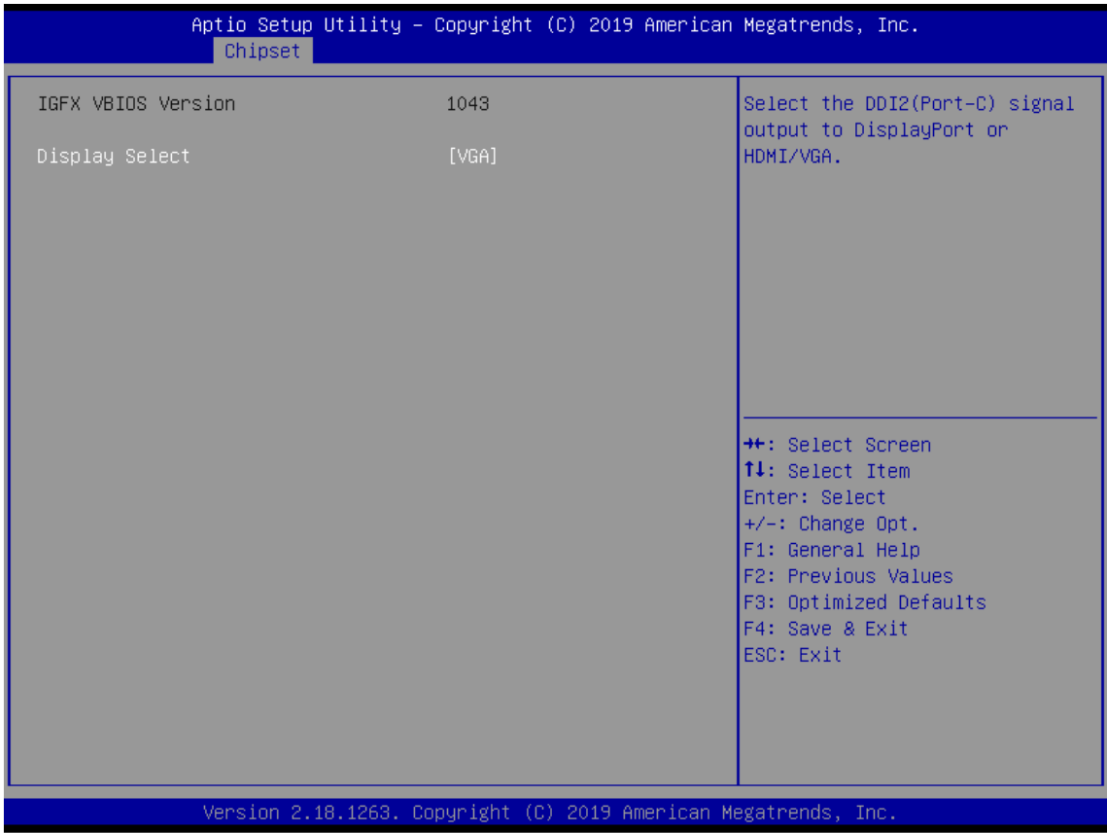
Use this item for PEG Port Configuration settings.

➢ **VT-d**

VT-d capability

➢ **Above 4GB MMIO BIOS assignment**

Enable/Disable above 4GB Memory Mapped IO BIOS assignment. This is enabled automatically when Aperture Size is set to 2048MB.

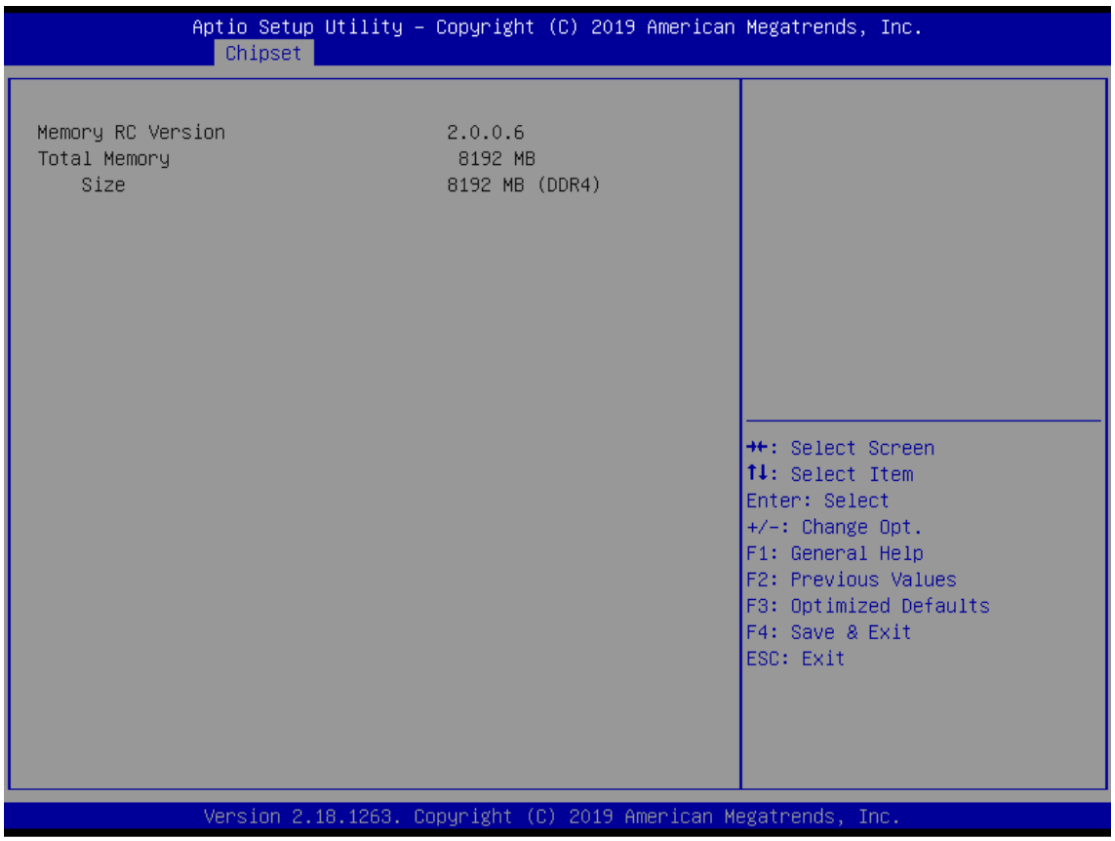


- **Display Select**

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

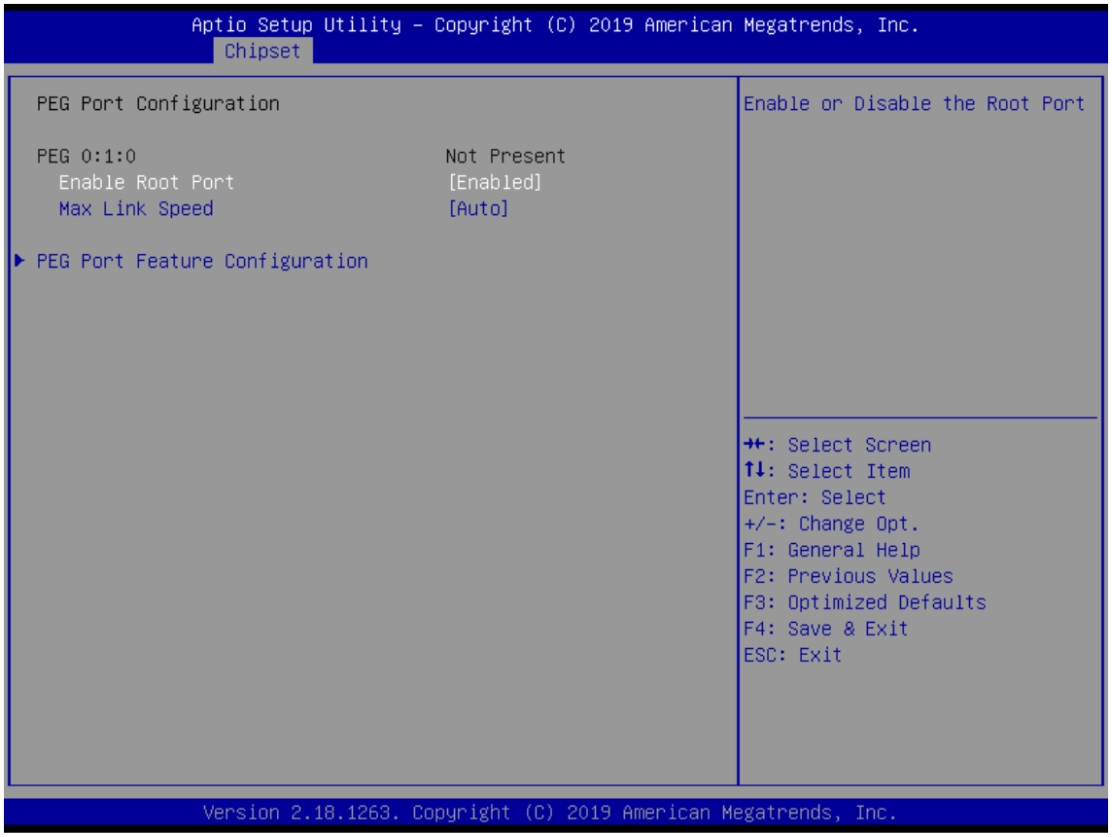
- **Memory Configuration**

This screen shows Memory information.



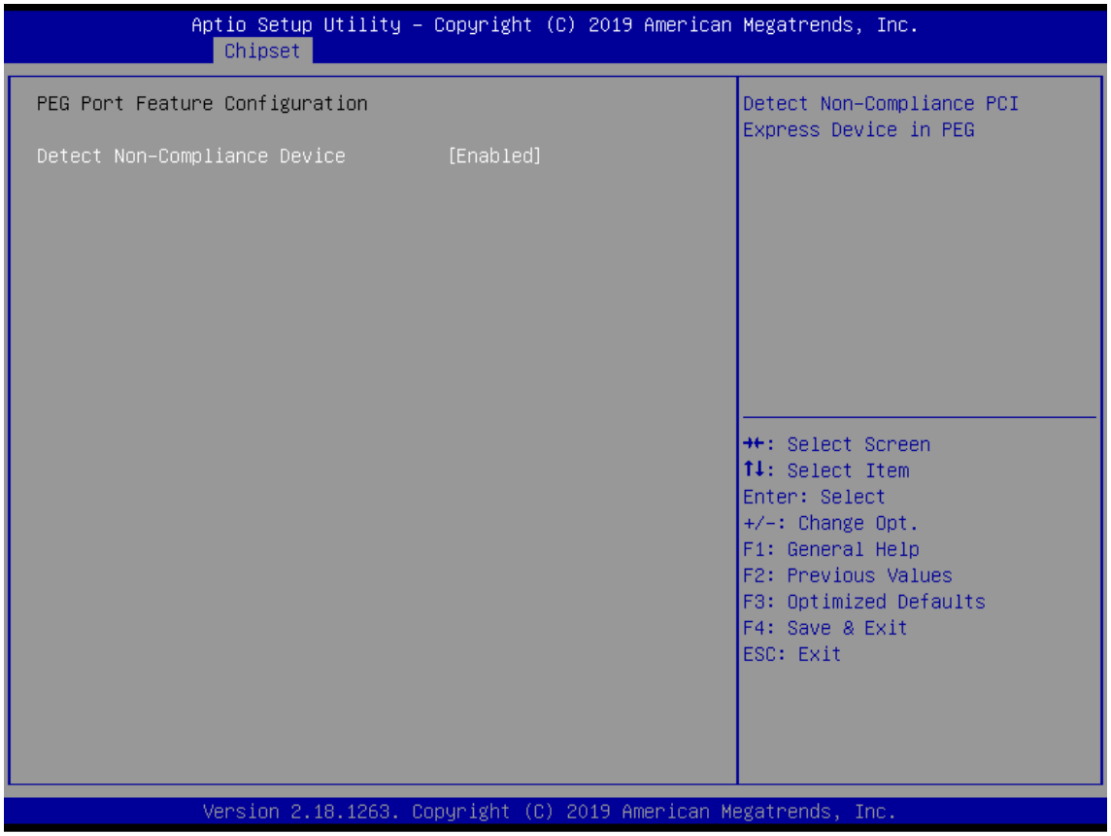
- **PEG Port Configuration**

This screen shows Enable Root Port and Max Link function settings. Further, the next item provides functions for PEG Port Feature Configuration. For items marked with "▶", please press <Enter> for more options.

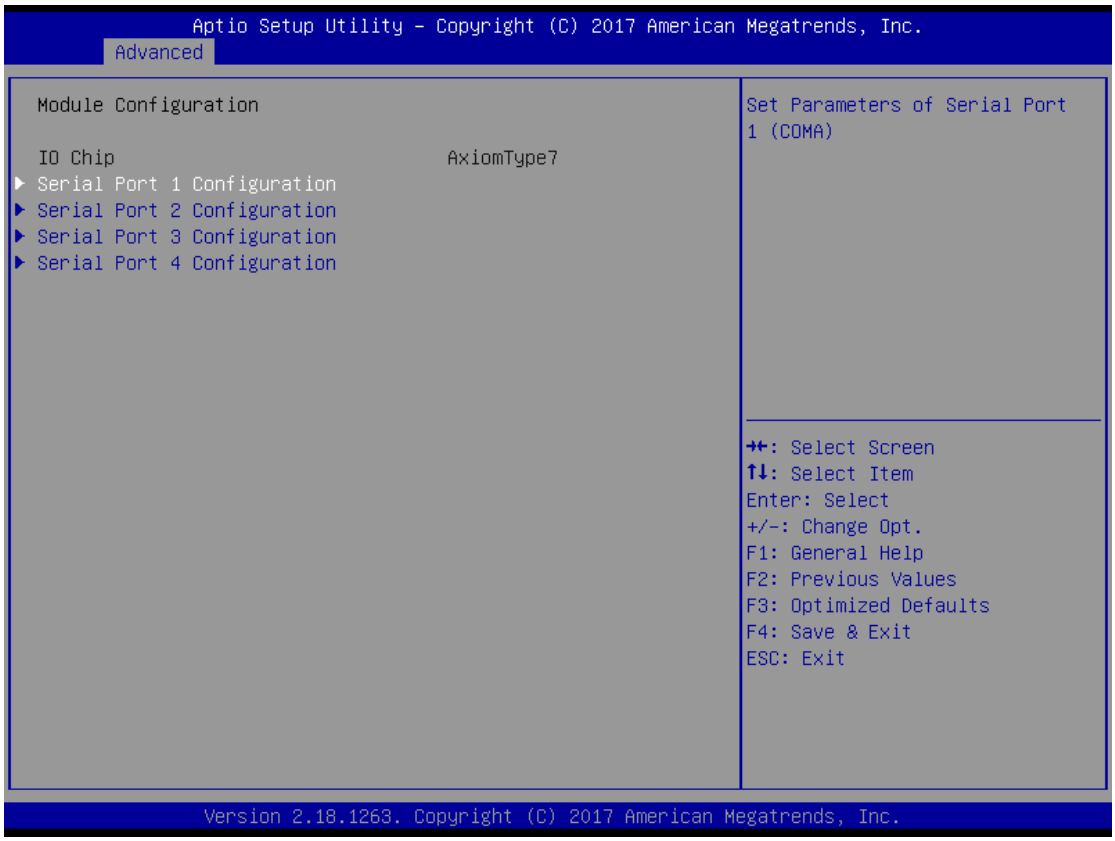


- **PEG Port Feature Configuration**

This screen shows Detect Non-Compliance Device settings.



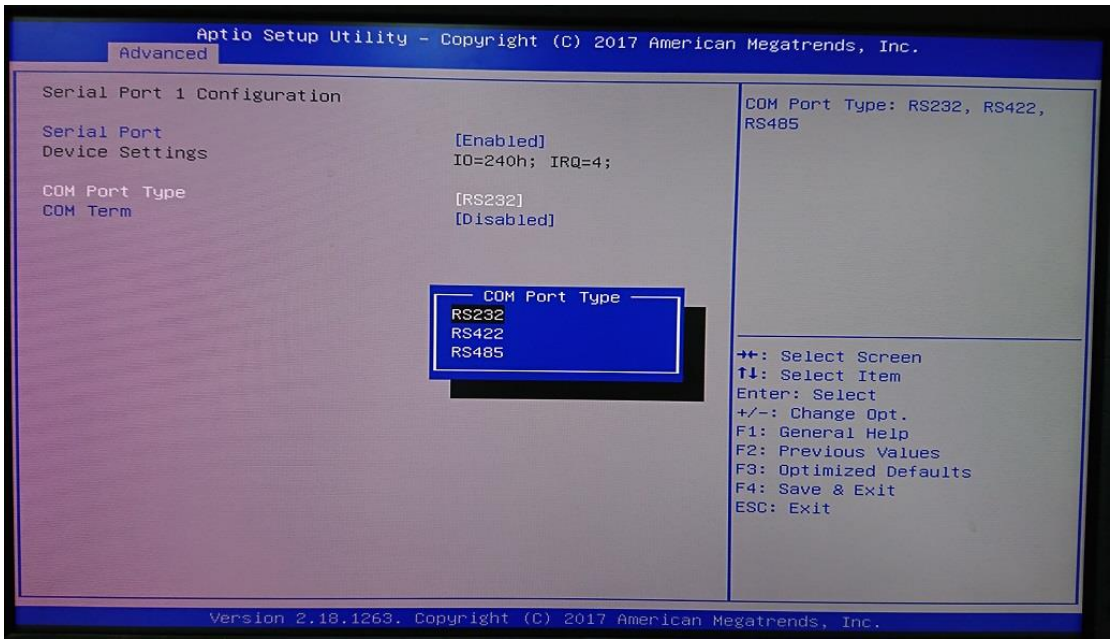
- **Module Configuration**



➢ **Serial Port 1~4 Configuration**

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

- **Serial Port (1~2) Configuration**

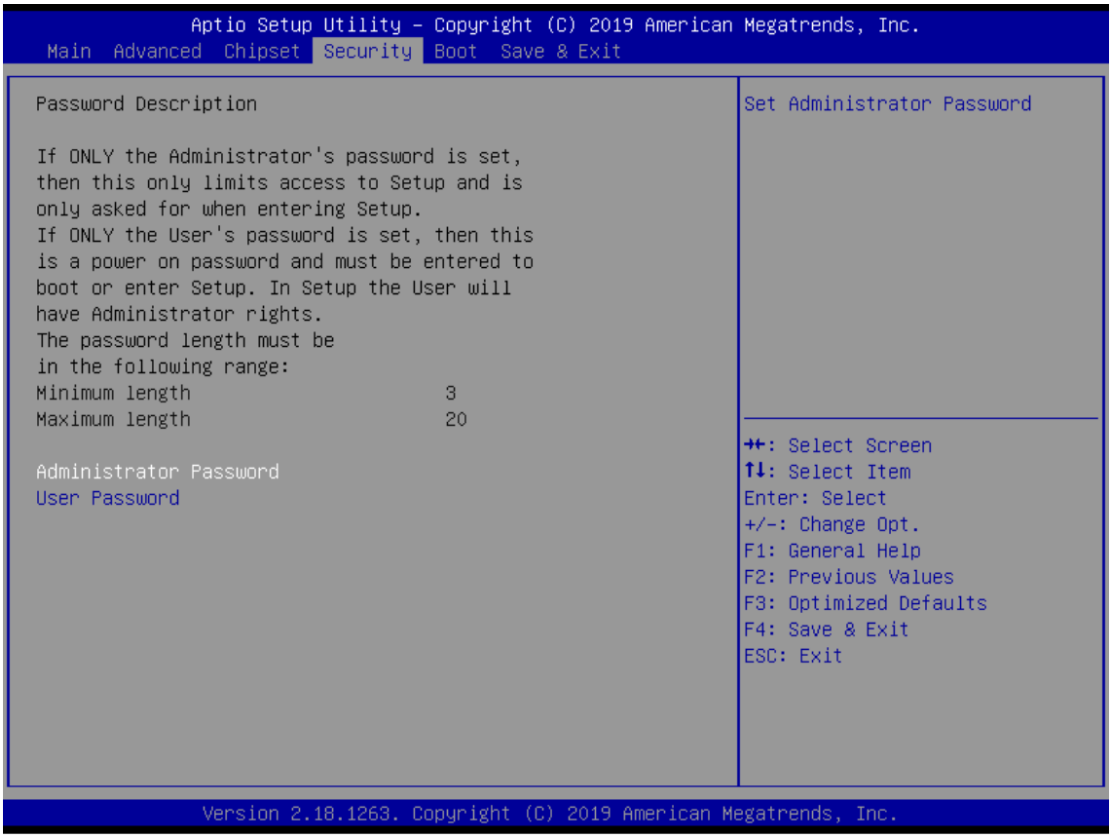


➢ **COM Port Type**

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

5.6 Security Menu

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



- **Administrator Password**

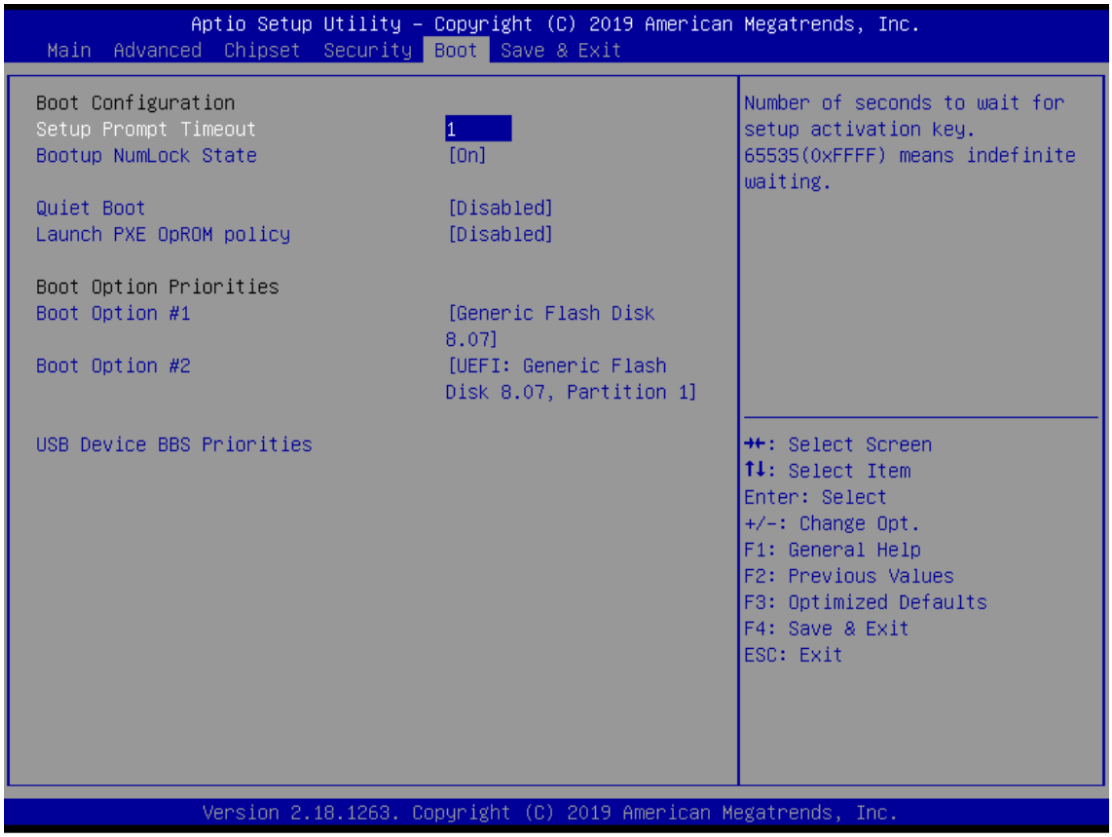
  This item indicates whether an administrator password has been set (installed or uninstalled).

- **User Password**

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

5.7 Boot Menu

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



- **Setup Prompt Timeout**

  Number of seconds to wait for setup activation key. 65535(0xFFFF) means indefinite waiting.

- **Bootup NumLock State**

  Use this item to select the power-on state for the keyboard NumLock.

- **Quiet Boot**

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

- **Launch PXE OpROM policy**

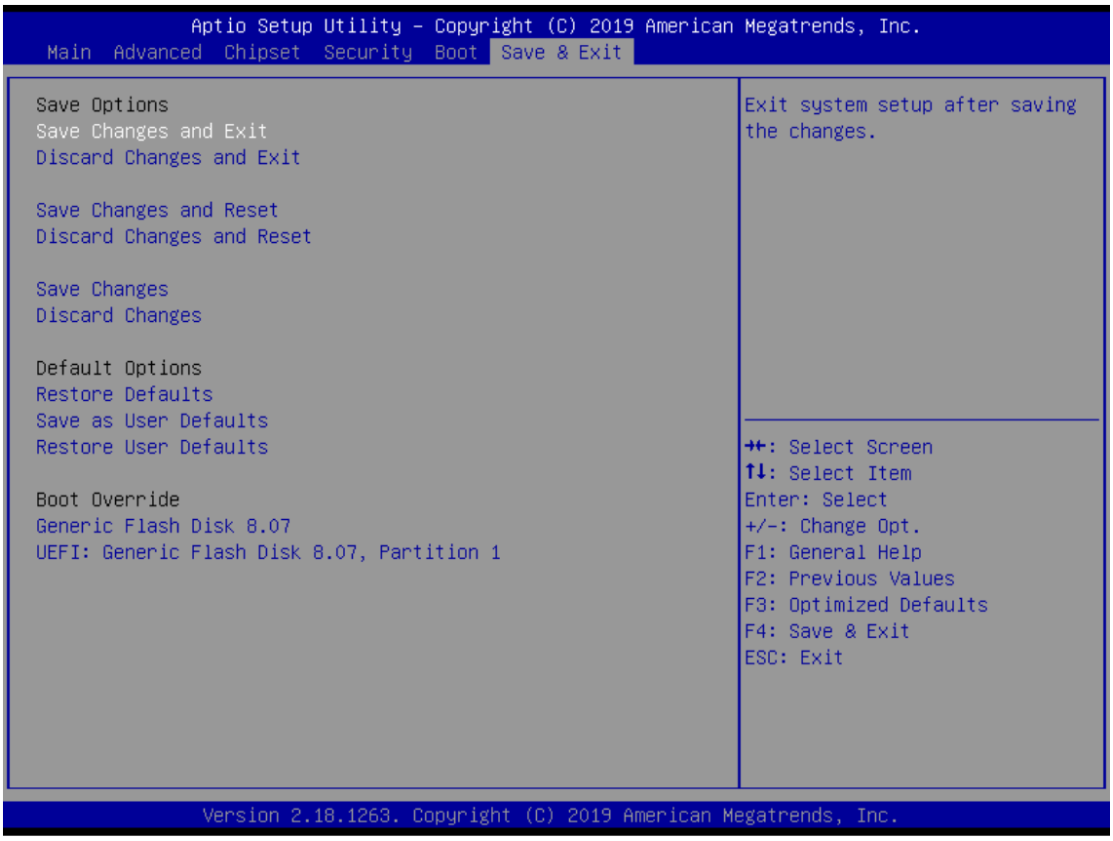
  Use this item to enable or disable the boot ROM function of the onboard LAN chip when the system boots up.

- **Boot Option Priorities**

  There are settings for boot priority. Specify the boot device priority sequence from the available devices.

5.8 Save & Exit Menu

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



- **Save Changes and Exit**

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

- **Discard Changes and Exit**

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

- **Save Changes and Reset**

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

- **Discard Changes and Reset**

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

- **Save Changes**

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

- **Discard Changes**

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

- **Restore Defaults**

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

- **Save as User Defaults**

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

- **Restore User Defaults**

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

Appendix A
Watchdog Timer

A.1 About Watchdog Timer

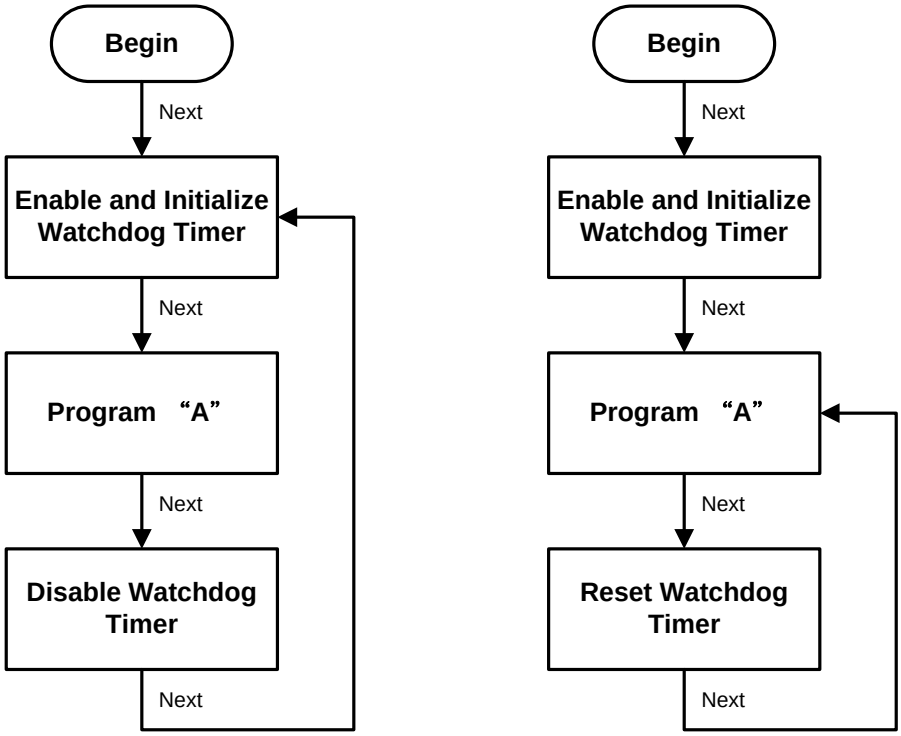
Software stability is major issue in most applications. Some embedded systems are not watched by an operator for 24 hours. It is usually too slow to wait for someone to reboot when computer hangs. The systems need to be able to reset automatically when things go wrong. The watchdog timer gives us solutions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

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

A.2 How to Use Watchdog Timer

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

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



A.3 Sample Program

Assembly sample code:

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

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

;Enable WDT base address:
mov     dx,2Eh
mov     al,30h
```

```
out     dx,al
mov     dx,2Fh
mov     al,01h
out     dx,al

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

;Set base timer :
mov     dx,2Eh
mov     al,0F6h
out     dx,al
mov     dx,2Fh
mov     al,Mh           ;M=00h,01h,...FFh (hex),Value=0 to 255
out     dx,al           ;(see Note below)

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

Note:

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

***M** = time value*

00: Time-out disable

01: Time-out occurs after 1 second

02: Time-out occurs after 2 seconds

03: Time-out occurs after 3 seconds

.

.

FFh: Time-out occurs after 255 seconds

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

***M** = time value*

00: Time-out disable

01: Time-out occurs after 1 minute

02: Time-out occurs after 2 minutes

03: Time-out occurs after 3 minutes

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FFh: Time-out occurs after 255 minutes