DFI

ECX700-AL

Ruggedized Fanless Embedded System

User's Manual

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Changes after the publication's first release will be based on the product's revision. The website will always provide the most updated information.

Trademarks

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FCC and DOC Statement on Class B

This equipment has been tested and found to comply with the limits for a Class B 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 residential installation. 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. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio TV technician for help.

Notice:

1. The changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
2. Shielded interface cables must be used in order to comply with the emission limits.
3. Do not open the system's back cover.If opening the cover for maintenance is a must, only a trained technician is allowed to do so.
4. Waterproof capability may be affected if a system is dissembled; under such circumstances DFI shall not be liable for any quality deterioration.

Table of Contents

About this Manual

This manual can be retrieved from the website.

The manual is subject to change and update without notice, and may be based on editions that do not resemble your actual products. Please visit our website or contact our sales representatives for the latest editions.

Warranty

1. Warranty does not cover damages or failures that arises from misuse of the product, inability to use the product, unauthorized replacement or alteration of components and product specifications.

2. The warranty is void if the product has been subjected to physical abuse, improper installation, modification, accidents or unauthorized repair of the product.

3. Unless otherwise instructed in this user's manual, the user may not, under any circumstances, attempt to perform service, adjustments or repairs on the product, whether in or out of warranty. It must be returned to the purchase point, factory or authorized service agency for all such work.

4. We will not be liable for any indirect, special, incidental or consequential damages to the product that has been modified or altered.

Static Electricity Precautions

It is quite easy to inadvertently damage your PC, system board, components or devices even before installing them in your system unit. Static electrical discharge can damage computer components without causing any signs of physical damage. You must take extra care in handling them to ensure against electrostatic build-up.

1. To prevent electrostatic build-up, leave the system board in its anti-static bag until you are ready to install it.
2. Wear an antistatic wrist strap.
3. Do all preparation work on a static-free surface.
4. Hold the device only by its edges. Be careful not to touch any of the components, contacts or connections.
5. Avoid touching the pins or contacts on all modules and connectors. Hold modules or connectors by their ends.

Important:
Electrostatic discharge (ESD) can damage your processor, disk drive and other components. Perform the upgrade instruction procedures described at an ESD workstation only. If such a station is not available, you can provide some ESD protection by wearing an antistatic wrist strap and attaching it to a metal part of the system chassis. If a wrist strap is unavailable, establish and maintain contact with the system chassis throughout any procedures requiring ESD protection.

Safety Precautions

- Use the correct DC / AC input voltage range.
- Unplug the power cord before removing the system chassis cover for installation or servicing. After installation or servicing, cover the system chassis before plugging in the power cord.
- There is danger of explosion if battery incorrectly replaced.
- Replace only with the same or equivalent specifications of batteries recommend by the manufacturer.
- Dispose of used batteries according to local ordinance.
- Keep this system away from humid environments.
- Make sure the system is placed or mounted correctly and stably to prevent the chance of dropping or falling may cause damage.
- The openings on the system shall not be blocked and shall be kept in distance from other objects to make sure of proper air ventilation to protect the system from overheating.
- Dress the cables, especially the power cord, so they will not be stepped on, in contact with high temperature surfaces, or cause any tripping hazards.
- Do not place anything on top of the power cord. Use a power cord that has been approved for use with the system and is compliant with the voltage and current ranges required by the system's electrical specifications.
- If the system is to be unused or stored for a long time, disconnect it from the power source to avoid damage by transient overvoltage.
- If one of the following occurs, consult a service personnel:
  - The power cord or plug is damaged.
  - Liquid has penetrated the system.
  - The system has been exposed to moisture.
  - The system is not working properly.
  - The system is physically damaged.
- The unit uses a three-wire ground cable which is equipped with a third pin to ground the unit and prevent electric shock. Do not defeat the purpose of this pin. If your outlet does not support this kind of plug, contact your electrician to replace the outlet.
- Disconnect the system from the electricity outlet before cleaning. Use a damp cloth for cleaning the surface. Do not use liquid or spray detergents for cleaning.
- Before connecting, make sure that the power supply voltage is correct. The device is connected to a power outlet which should be grounded connection.

The system may burn fingers while running.

Wait for 30 minutes to handle electronic parts after power off.

Chapter 1 - Introduction

▶ Specifications

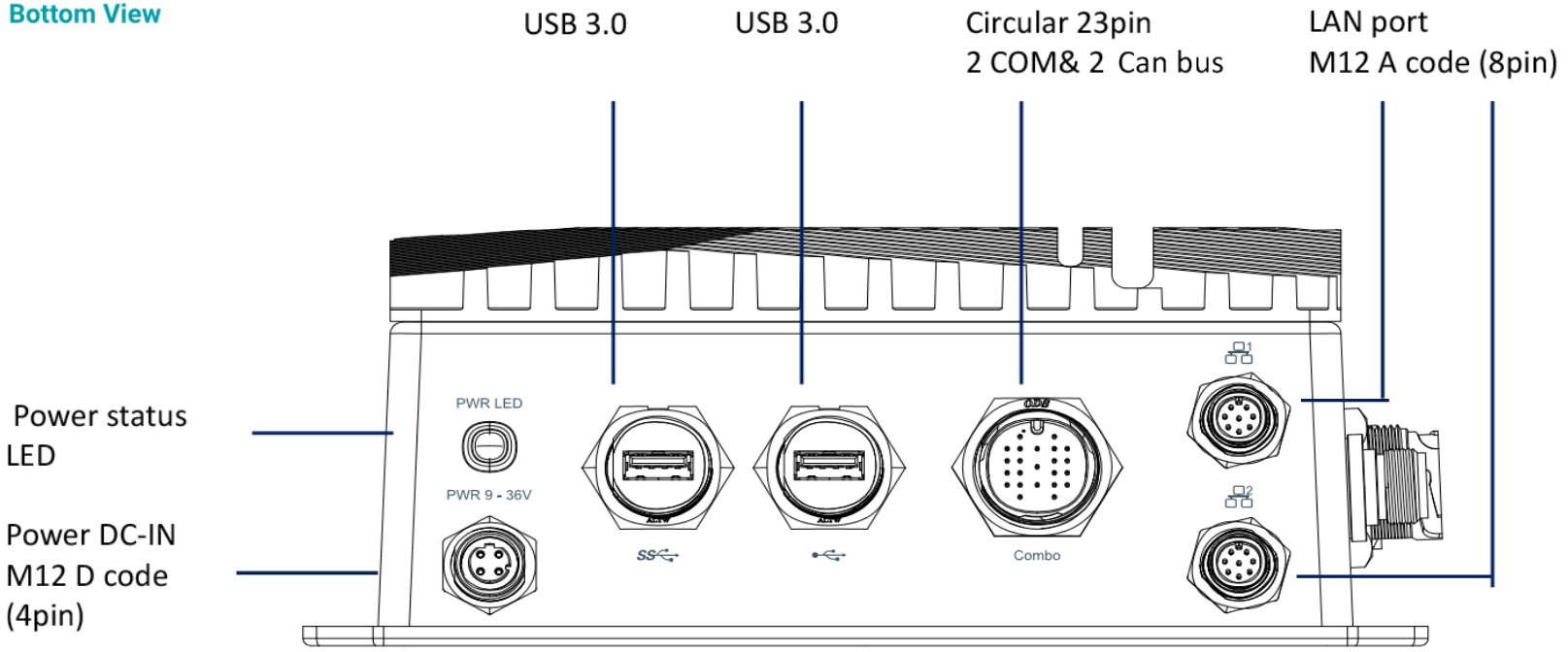
SYSTEM	Processor	Intel Atom® Processor E3900 Series, BGA 1296 Intel Atom® x7-E3950 Processor, Quad Core, 2M Cache, 1.6GHz (2.0GHz), 12W Intel Atom® x5-E3940 Processor, Quad Core, 2M Cache, 1.6GHz (1.8GHz), 9.5W Intel Atom® x5-E3930 Processor, Dual Core, 2M Cache, 1.3GHz (1.8GHz), 6W
	Memory	2GB/4GB/8GB memory onboard
	BIOS	AMI SPI 128Mbit (supports UEFI/Legacy mode and Security Boot (optional)
GRAPHICS	Controller	Intel® HD Graphics
	Feature	OpenGL 4.2, Direct X 11.1, OpenCL 1.2, OGL ES 3.0 HW Decode: H.264, MPEG2, VC1, VP8, H.265, MPEG4, MVC, VP9, WMV9, JPEG/MJPEG HW Encode: H.264, MPEG4, VP8, H.265, MVC
	Display	1 x HDMI or VGA VGA: resolution up to 1920 x 1200@60Hz HDMI: resolution up to 3840x2160@30Hz
STORAGE	eMMC	Support EMMC up to 8G/16GB/32GB/64GB (optional)
EXPANSION	Interface	1 x Full-size Mini PCIe for 4G LTE module 1 x Full-size Mini PCIe for Canbus 1 x M.2 2230 (USB2.0/PCIe) for WiFi module
ETHERNET	Controller	2 x Intel® I210AT PCIe (10/100/1000Mbps)
LED	Indicators	1 x Power Status LED
BOTTOM I/O	USB	2 x USB 3.0
	LAN	2 x GbE
	Combo	2 x RS232 and 2 x Can bus protocol
	Power	1 x 9~36V DC-IN
TOP I/O	Antenna Hole	2 x Antenna (LTE)
	Vent	1 x Vent
FRONT I/O	Display	1 x HDMI or 1 x VGA (optional)
	SIM slot	1 x SIM card slot
	Antenna Hole	2 x Antenna (WiFi)
WATCHDOG TIMER	WATCHDOG TIMER	System Reset, Programmable via Software from 1 to 255 Seconds
POWER	Type	DC-in 9~36V
	Connector	M12 D-code

OS SUPPORT	Microsoft	Windows 10 IoT Enterprise 64-bit
	Linux	Linux
MECHANISM	Mounting	Wall Mount
	Dimensions (W x H x D)	217 x 188 x 87 mm (with wall-mount bracket)
	Weight	2.1 kg
ENVIRONMENT	Operating Temperature	-40 to 70°C (E3950,E3940, E3930 only)
	Storage Temperature	-40 to 85°C
	Relative Humidity	5 to 95% RH (non-condensing)
STANDARDS AND CERTIFICATIONS	Construction	IP66 enclosure
	Shock	Operation shock test: Half Sine Wave 15G, 11ms, 3 Shock Per Axis / MIL-STD-810G
	Vibration	Operation Vibration test: IEC 60068-2-64/ MIL-STD-810G
	Certifications	CE, FCC class A

Chapter 2 - Hardware Installation

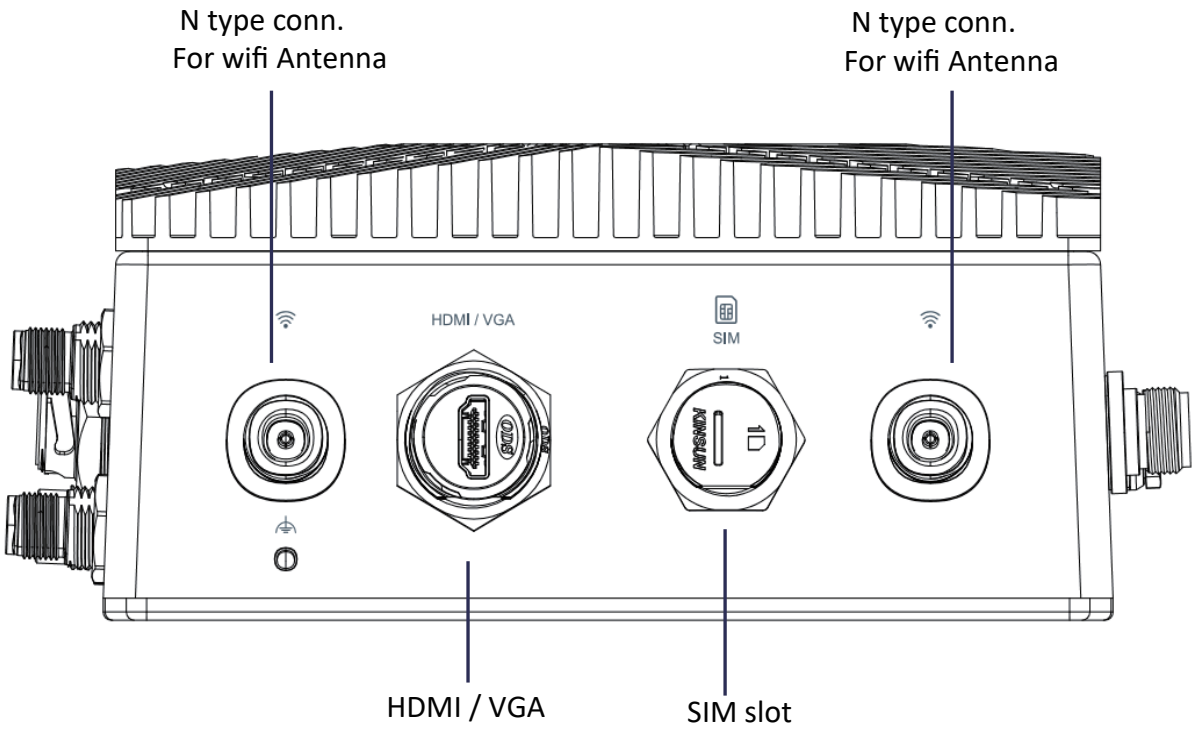
▶ Outlook

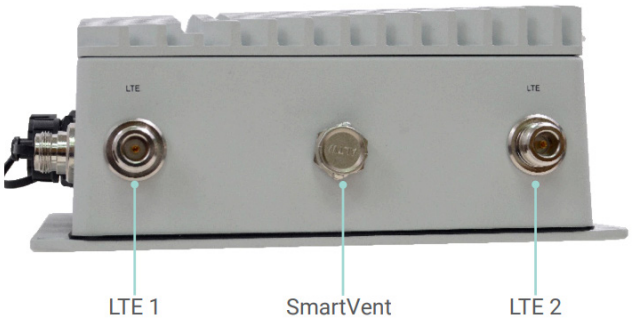
Bottom View




HDMI / VGA
SIM

Right View


N type conn.
For wifi Antenna
N type conn.
For wifi Antenna
HDMI / VGA
SIM
HDMI / VGA
SIM slot

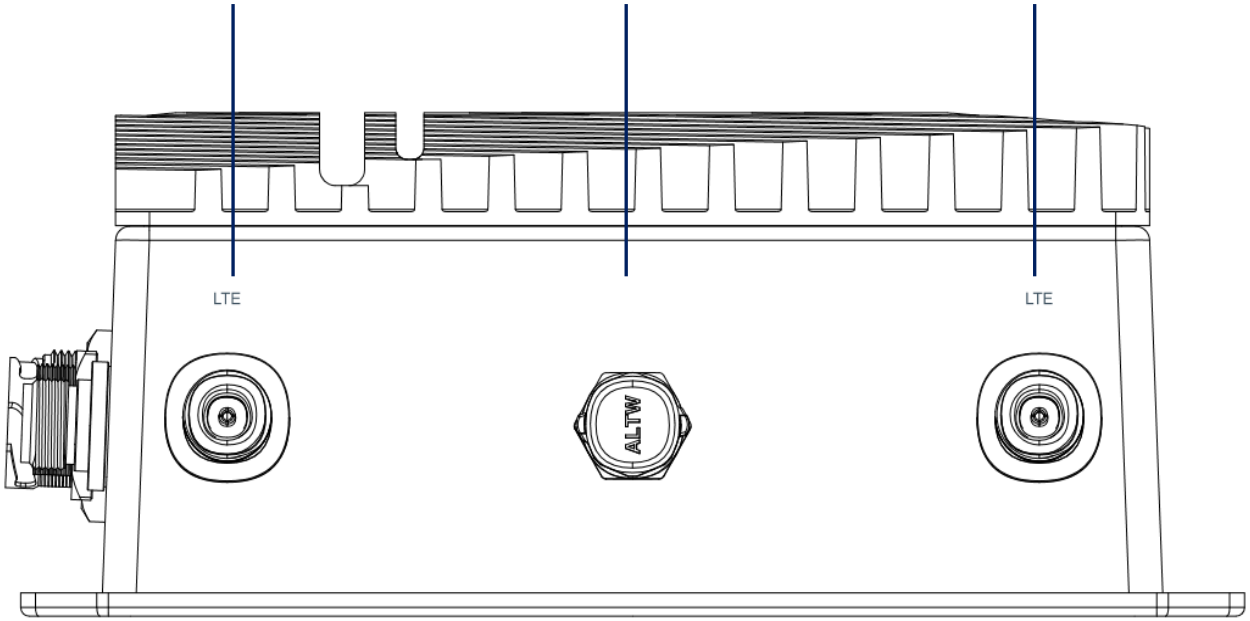


Top View

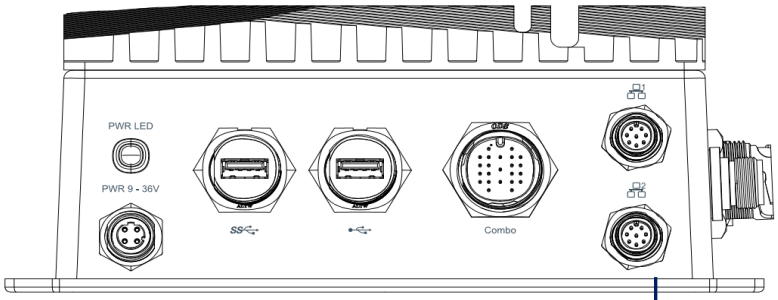
N type conn for LTE antenna

Vent

N type conn for LTE antenna



▶ Cable Assembly –LAN cable

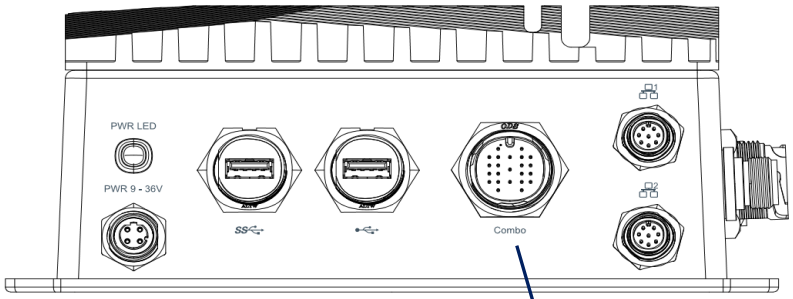


LAN port
M12 A code (8pin)

LAN converter cable to connect ECX700 and device cable

This is a standard LAN converter cable after assembly; customer can either use our converter cable or a customized cable to directly connect ECX700 with their devices

▶ Cable Assembly –23pin 1to4 cable

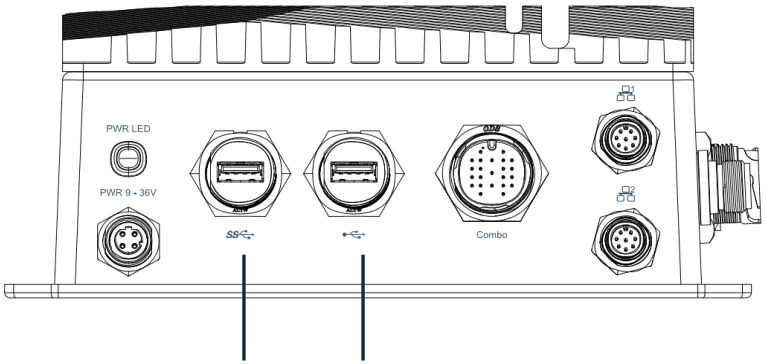


Circular 23pin
2 COM& 2Can
bus

23pin 1to4 converter cable to connect ECX700 and cables of RS232 or CAN devices

This is a standard 23pin 1to4 converter cable after assembly; customer can either use our converter cable or a customized cable to directly connect ECX700 with their devices

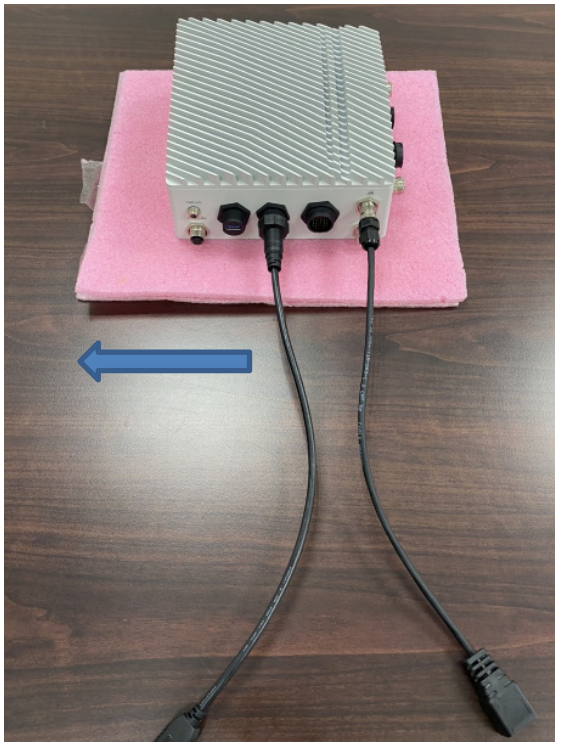
▶ Cable Assembly –USB cable



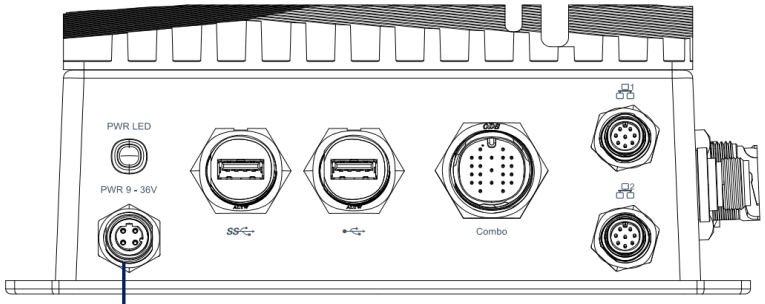
USB 3.0

USB3.0 converter cable to connect ECX700 and cables of customer's USB devices

This is a standard USB converter cable after assembly; customer can either use our USB converter cable or a customized cable to directly connect ECX700 with their USB devices



▶ Cable Assembly –USB cable

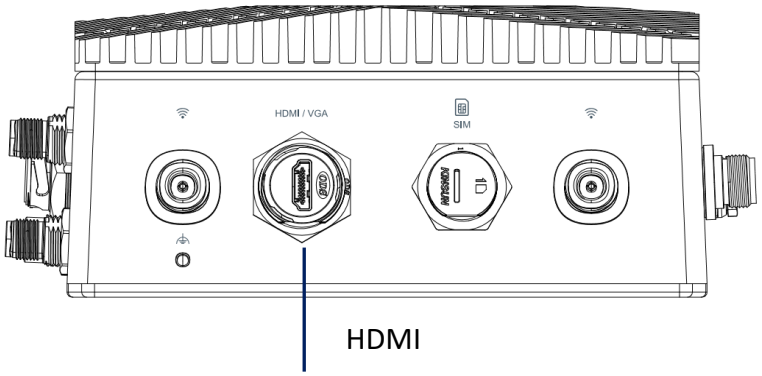


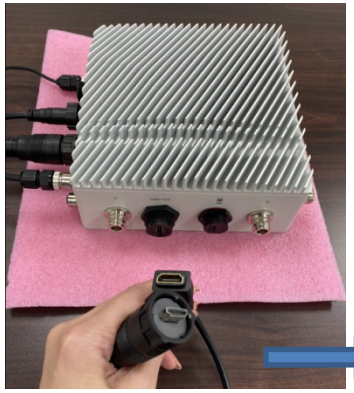
Power DC-IN
M12 D code
(4pin)

Power adaptor converter cable to connect ECX700 and cables of customer's power adaptor

This is a standard power converter cable after assembly; customer can either use our power converter cable or a customized cable to directly connect ECX700 with their power adaptor

▶ **Cable Assembly –HDMI cable**

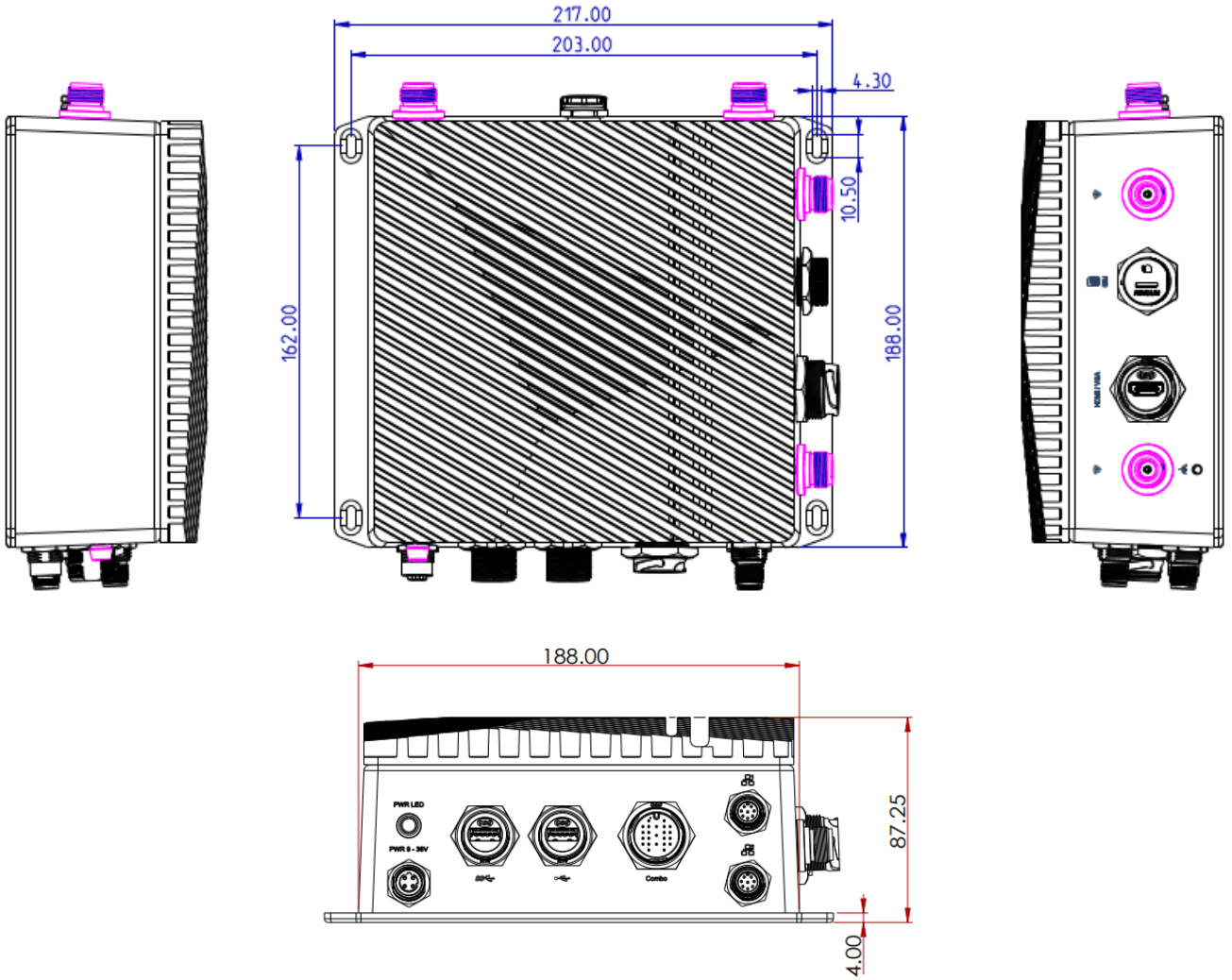




HDMI converter cable to connect ECX700 and cables of customer's HDMI Display

This is a standard HDMI converter cable after assembly; customer can either use our HDMI converter cable or a customized cable to directly connect ECX700 with their Display

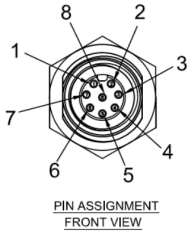
▶ Dimensions


217.00
203.00
4.30
10.50
162.00
188.00
188.00
87.25
4.00
PWR LED
PWR 9 - 36V
Combo

▶ Pin-out - COM +CAN 23 PIN

1	DCD-
2	RD
3	TD
4	DTR-
5	GND
6	DSR-
7	RTS-
8	CTS-
9	RI-
10	DCD-
11	RD
12	TD
13	DTR-
14	GND
15	DSR-
16	RTS-
17	CTS-
18	RI-
19	CAN1-L
20	CAN1-H
21	CAN2-L
22	CAN2-H
23	GND

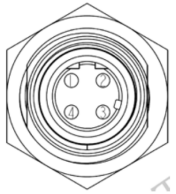
▶ Pin-out - M12 LAN



PIN ASSIGNMENT
FRONT VIEW

1	ORANGE/WHITE
2	ORANGE
3	GREEN/WHITE
4	GREEN
5	BLUE
6	BLUE/WHITE
7	BROWN/WHITE
8	BROWN

▶ Pin-out - 4PIN POWER



FRONT VIEW

1	V-
2	V-
3	V+
4	V+

Chapter 3 - BIOS Settings

▶ Overview

The BIOS is a program that takes care of the basic level of communication between the CPU and peripherals. It contains codes for various advanced features found in this system board. The BIOS allows you to configure the system and save the configuration in a battery-backed CMOS so that the data retains even when the power is off. In general, the information stored in the CMOS RAM of the EEPROM will stay unchanged unless a configuration change has been made such as a hard drive replaced or a device added.
It is possible that the CMOS battery will fail causing CMOS data loss. If this happens, you need to install a new CMOS battery and reconfigure the BIOS settings.

Note:
The BIOS is constantly updated to improve the performance of the system board; therefore the BIOS screens in this chapter may not appear the same as the actual one. These screens are for reference purpose only.

Default Configuration
Most of the configuration settings are either predefined according to the Load Optimal Defaults settings which are stored in the BIOS or are automatically detected and configured without requiring any actions. There are a few settings that you may need to change depending on your system configuration.

Entering the BIOS Setup Utility
The BIOS Setup Utility can only be operated from the keyboard and all commands are keyboard commands. The commands are available at the right side of each setup screen.
The BIOS Setup Utility does not require an operating system to run. After you power up the system, the BIOS message appears on the screen and the memory count begins. After the memory test, the message “Press DEL to run setup” will appear on the screen. If the message disappears before you respond, restart the system or press the “Reset” button. You may also restart the system by pressing the <Ctrl> <Alt> and <Del> keys simultaneously.

Legends

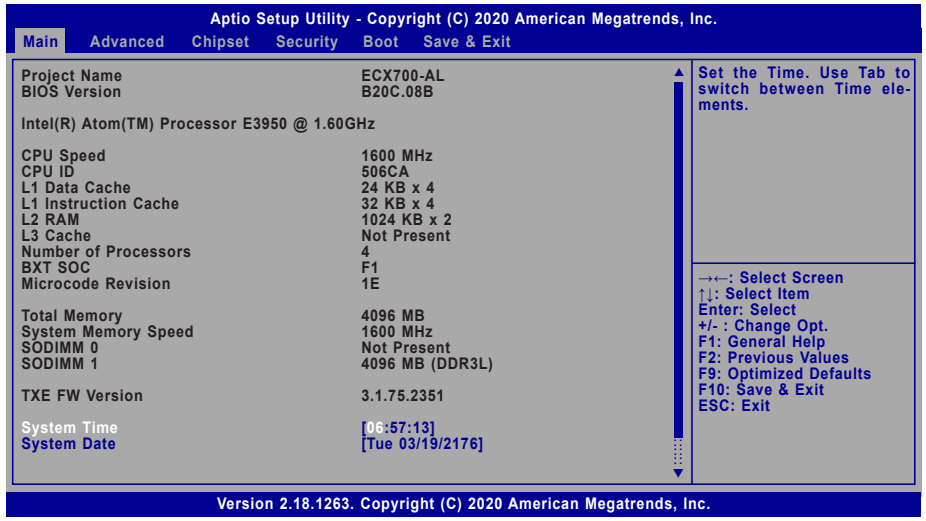
Keys	Function
Right / Left arrow	Move the highlight left or right to select a menu
Up / Down arrow	Move the highlight up or down between submenus or fields
<Enter>	Enter the highlighted submenu
+ (plus key)/F6	Scroll forward through the values or options of the highlighted field
- (minus key)/F5	Scroll backward through the values or options of the highlighted field
<F1>	Display general help
<F2>	Display previous values
<F7>	Popup Boot Device List
<F9>	Optimized defaults
<F10>	Save and Exit
<Esc>	Return to previous menu

Scroll Bar
When a scroll bar appears to the right of the setup screen, it indicates that there are more available fields not shown on the screen. Use the up and down arrow keys to scroll through all the available fields.

Submenu
When “▶” appears on the left of a particular field, it indicates that a submenu which contains additional options are available for that field. To display the submenu, move the highlight to that field and press <Enter>.

▶ Main

The Main menu is the first screen that you will see when you enter the BIOS Setup Utility.



System Time

The time format is <hour>, <minute>, <second>. The time is based on the 24-hour military-time clock. For example, 1 p.m. is 13:00:00. Hour displays hours from 00 to 23. Minute displays minutes from 00 to 59. Second displays seconds from 00 to 59.

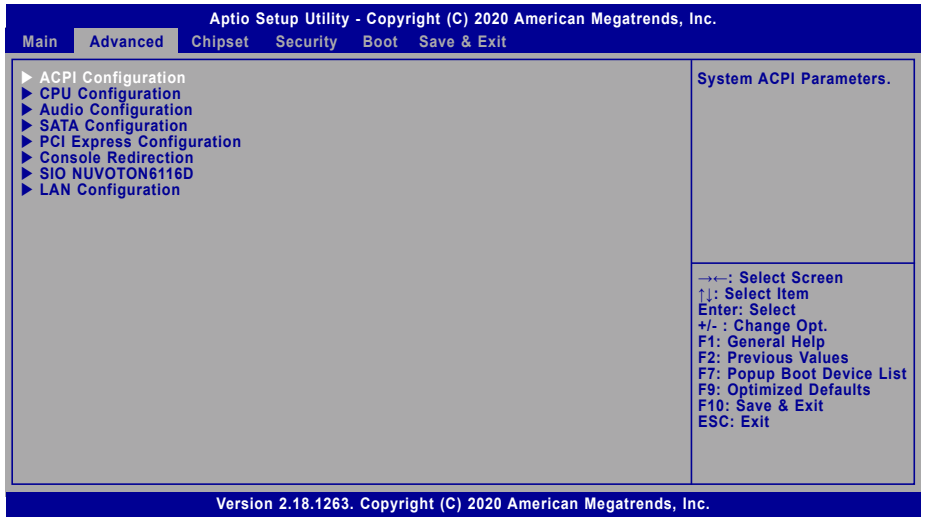
System Date

The date format is <month>, <date>, <year>. Press "Tab" to switch to the next field and press "-" or "+" to modify the value.

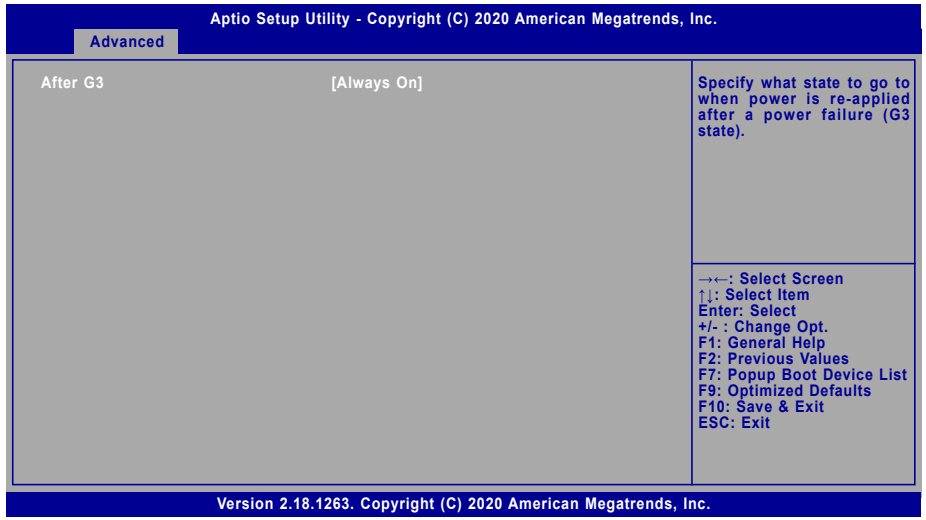
▶ Advanced

The Advanced menu allows you to configure your system for basic operation. Some entries are defaults required by the system board, while others, if enabled, will improve the performance of your system or let you set some features according to your preference.

Important:
Setting incorrect field values may cause the system to malfunction.



ACPI Configuration

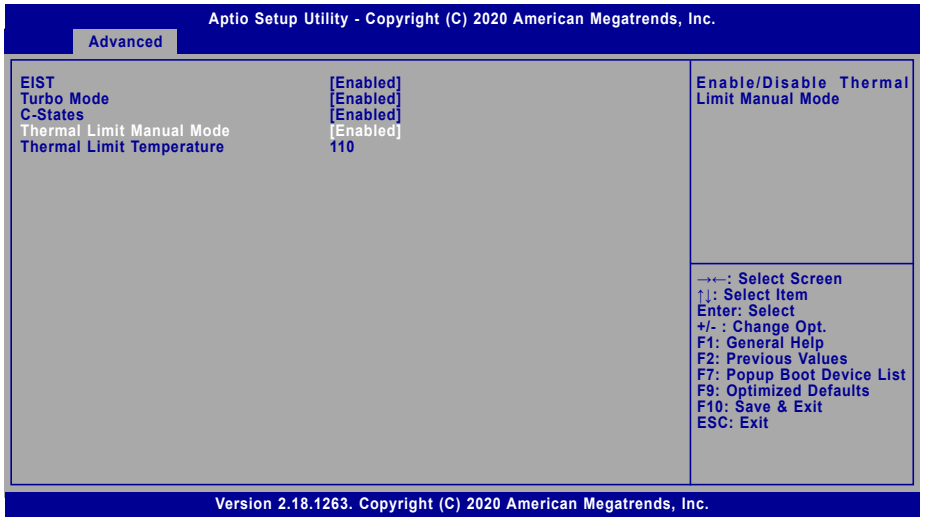


After G3

This field is to specify what state the system should be in when power is re-applied after a power failure.

Always On The system automatically powers on after power failure.

Always Off The system enter soft-off state after power failure. Power-on signal input is required to power up the system.



EIST

This field is used to enable or disable the Intel SpeedStep® Technology, which helps optimize the balance between system's power consumption and performance. After it is enabled in the BIOS, EIST features can then be enabled via the operating system's power management.

Turbo Mode

Enable or disable turbo mode of the processor. This field will only be displayed when EIST is enabled.

C-States

Enable or disable CPU Power Management. It allows CPU to enter "C states" when it's idle and nothing is executing.

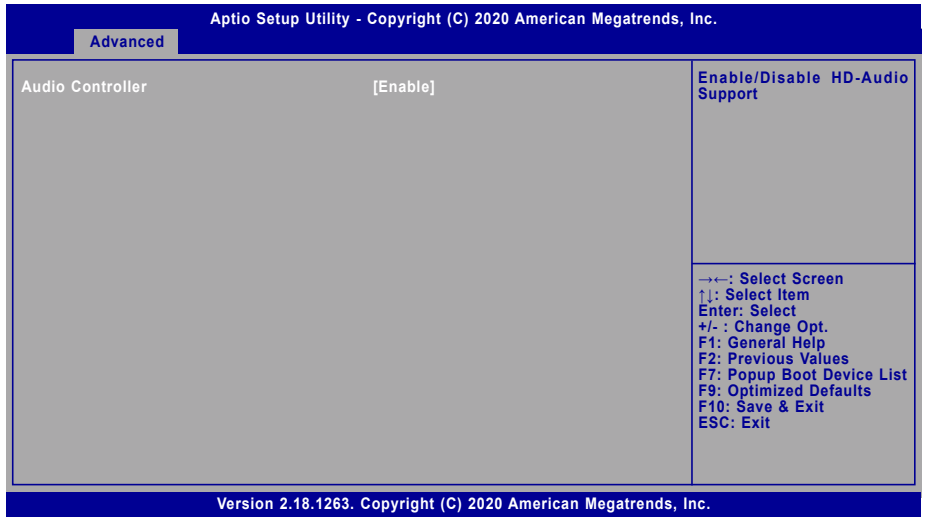
Thermal Limit Manual Mode

Enable this field and manually set a temperature to which the CPU TDP adheres — increments from 80°C to 110°C.

Note:
Some of the fields may not be available when the features are not supported by the equipped CPU.

▶ Advanced

Audio Configuration



Audio Controller

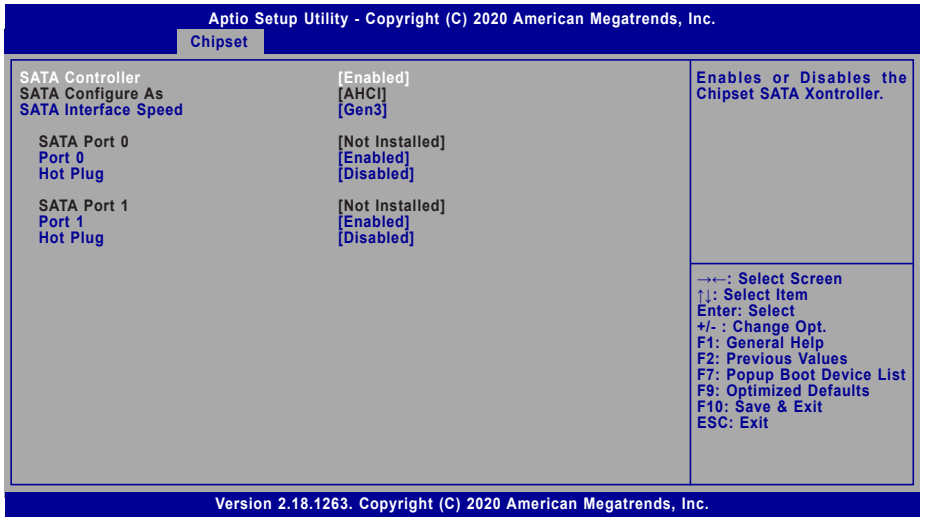
Control the detection of the HD Audio device.

Disable HDA will be unconditionally disabled.

Enable HDA will be unconditionally enabled.

▶ Advanced

SATA Configuration



SATA Controller(s)

This field is used to enable or disable the Serial ATA controller.

SATA Speed

This field is used to select SATA speed generation limit: Gen1, Gen2 or Gen3.

SATA Port 0

Information about the mSATA (Mini PCIe 1) device.

SATA Port 1

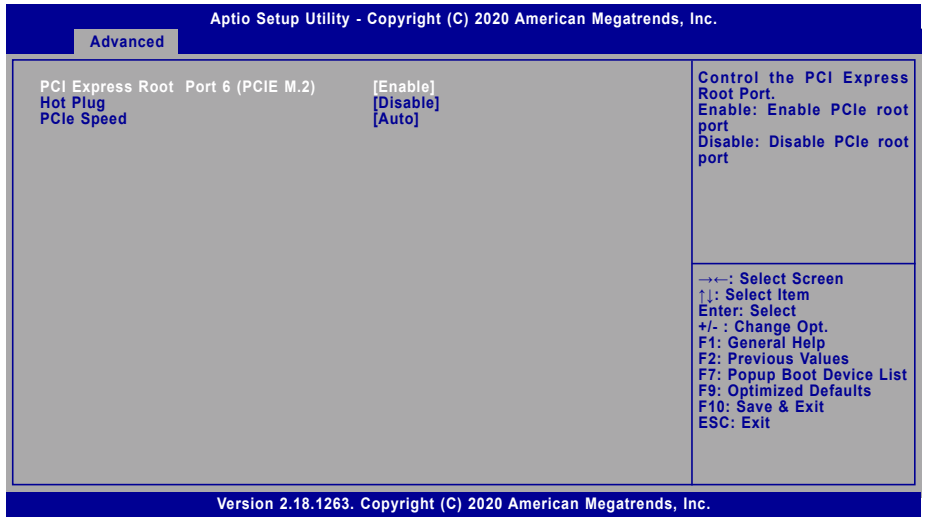
Information about the SATA SSD Drive device.

Port 0/1 and Hot Plug

Enable or disable the Serial ATA port and its hot plug function.

▶ Advanced

PCI Express Configuration



PCI Express Root Port 6 (PCIE M.2)

Enable or disable the PCI Express Root Port (M.2 E Key).

PCIe Speed

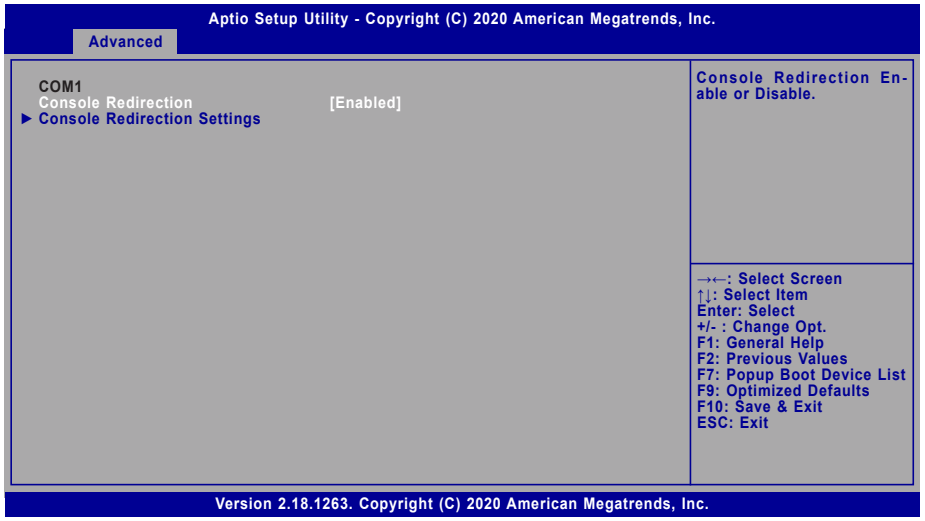
Select PCIe Speed of the current port — AUTO, Gen1, or Gen 2.

Hot Plug

Enable or disable hot plug function of the port.

▶ Advanced

Console Redirection

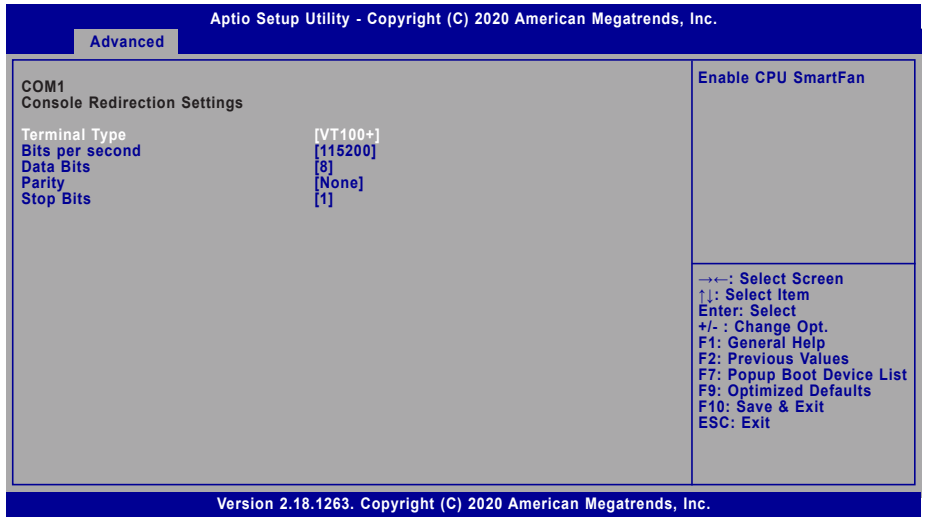


Console Redirection

By enabling Console Redirection of a COM port, the sub-menu of console redirection settings will become available for configuration as detailed in the following.

▶ Advanced

▶ Console Redirection Settings



Configure the serial settings of the current COM port.

Terminal Type

Select terminal type: VT100, VT100+, VT-UTF8 or ANSI.

Bits per second

Select serial port transmission speed: 9600, 19200, 38400, 57600 or 115200.

Data Bits

Select data bits: 7 bits or 8 bits.

Parity

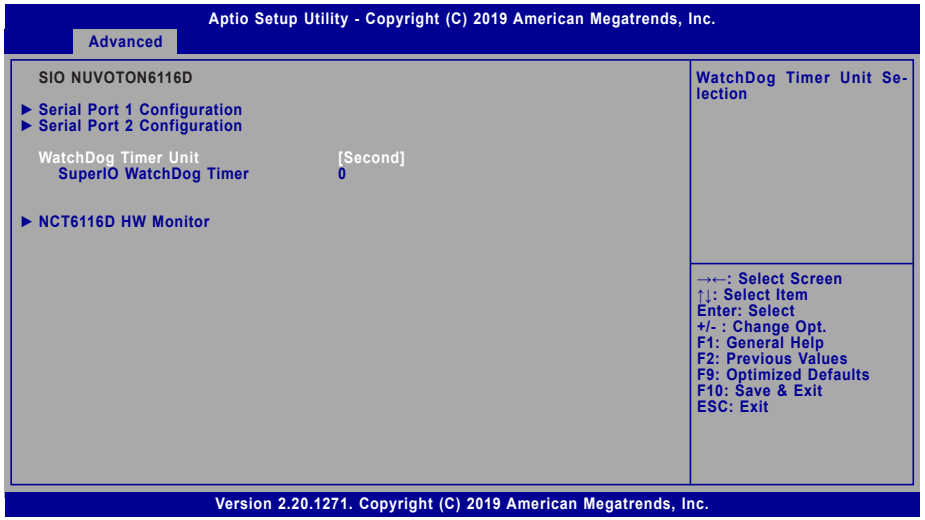
Select parity bits: None, Even, Odd, Mark or Space.

Stop Bits

Select stop bits: 1 bit or 2 bits.

▶ Advanced

SIO NUVOTON6116D



WatchDog Timer Unit

Select WatchDog Timer Unit — Second or Minute.

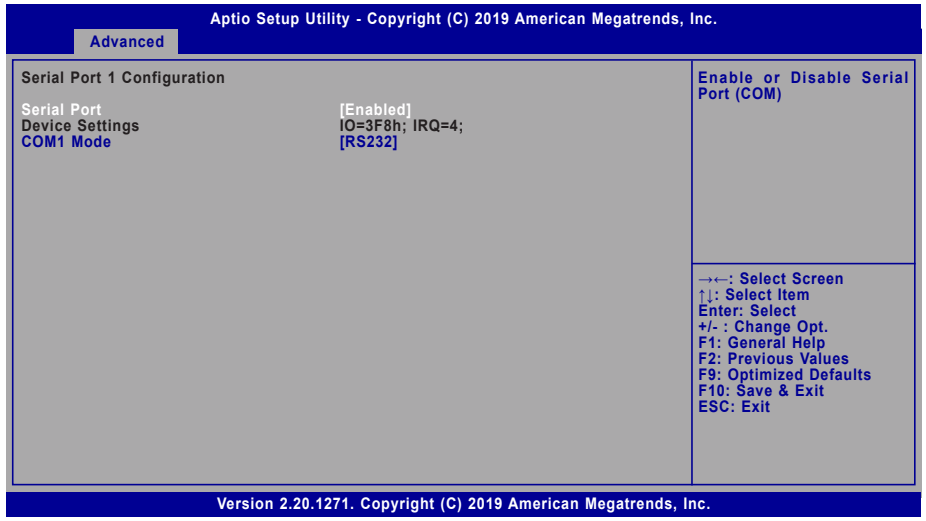
SuperIO WatchDog Timer

Set SuperIO WatchDog Timer Timeout value. The range is from 0 (disabled) to 255.

Note:
The sub-menus are detailed in following sections.

▶ Advanced ▶ NCT6116D Super IO Configuration

▶ Serial Port 1/2 Configuration



Serial Port

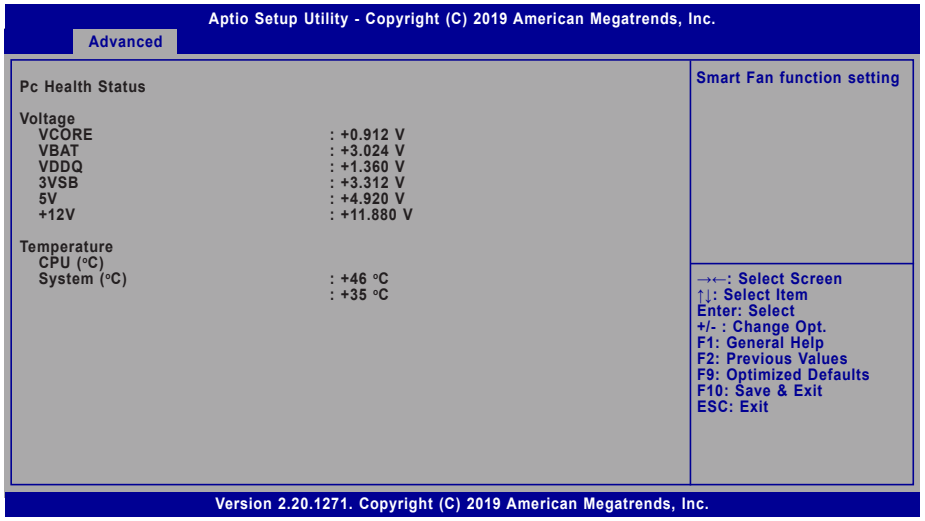
Enable or disable the current serial COM port.

COM1/2 Mode

Select the serial mode for the COM ports — RS232, RS422, or RS485.

▶ Advanced

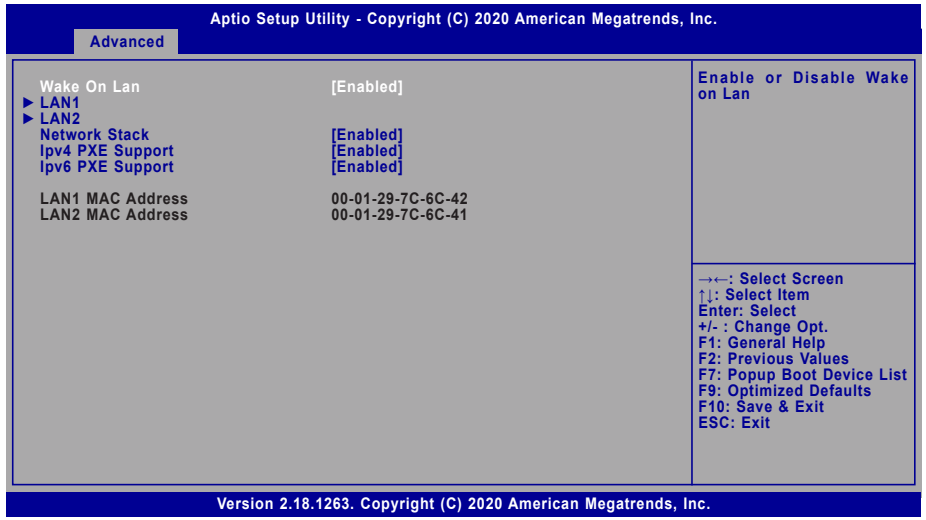
NCT6116D HW Monitor



This section displays the system's health information, i.e. voltage readings, CPU and system temperature readings.

▶ Advanced

LAN Configuration



Wake On LAN

Enable or disable the function to wake the system via LAN.

► LAN1/2

Enable or disable a LAN port.

Network Stack

Enable or disable UEFI network stack. The following fields will appear when this field is enabled.

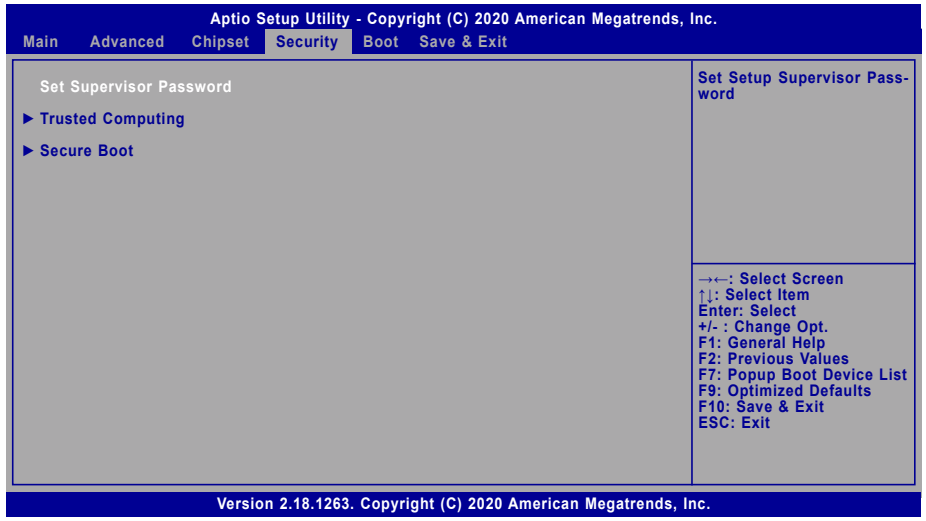
Ipv4 PXE Support

Enable or disable IPv4 PXE boot support.

Ipv6 PXE Support

Enable or disable IPv6 PXE boot support.

▶ Security



Set Supervisor Password

Set the supervisor password. To clear the password, input nothing and press enter when a new password is asked.

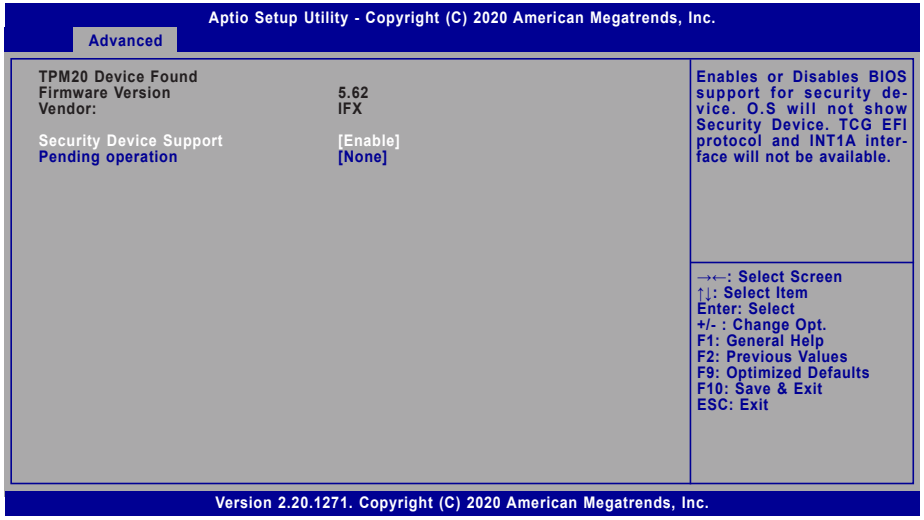
Trusted Computing

Enables or Disables BIOS support for security device.

Secure Boot

Enables or Disables Secure Boot.

Trusted Computing



Security Device Support

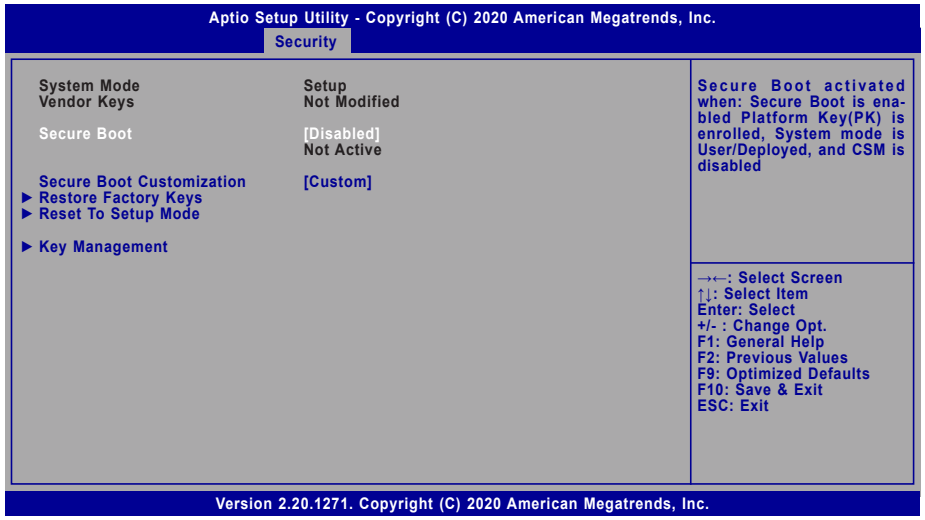
This field is used to enable or disable BIOS support for the security device such as an TPM 2.0 to achieve hardware-level security via cryptographic keys.

Pending operation

To clear the existing TPM encryption, select "TPM Clear" and restart the system. This field is not available when "Security Device Support" is disabled.

▶ Security

Secure Boot



Secure Boot

The Secure Boot store a database of certificates in the firmware and only allows the OSes with authorized signatures to boot on the system. To activate Secure Boot, please make sure that “Secure Boot” is “[Enabled]”, Platform Key (PK) is enrolled, “System Mode” is “User”, and CSM is disabled. After enabling/disabling Secure Boot, please save the configuration and restart the system. When configured and activated correctly, the Secure Boot status will be “Active”.

Secure Boot Customization

Select the secure boot mode — Standard or Custom. When set to Custom, the following fields will be configurable for the user to manually modify the key database.

Restore Factory Keys

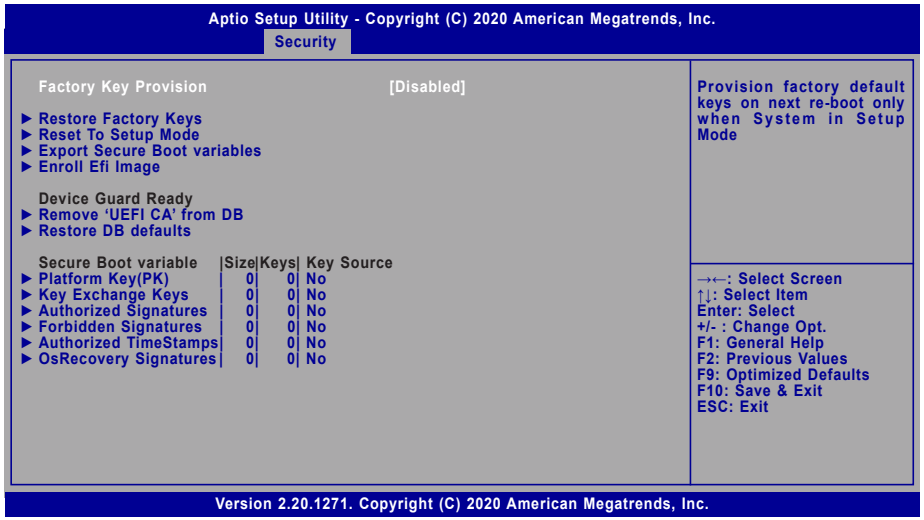
Force system to User Mode. Load OEM-defined factory defaults of keys and databases onto the Secure Boot. Press Enter and a prompt will show up for you to confirm.

Reset To Setup Mode

Clear the database from the NVRAM, including all the keys and signatures installed in the Key Management menu. Press Enter and a prompt will show up for you to confirm.

▶ Security ▶ Secure Boot

▶ Key Management



Factory Key Provision

Enable or disable the provision factory default keys on next re-start. This will only take place when the “System Mode” in the previous menu is in “Setup”, which can be achieved by moveing the cursor to the “Reset To Setup Mode” and press Enter.

Restore Factory Keys

Force system to User Mode. Configure NVRAM to contain OEM-defined factory default Secure Boot keys.

Reset To Setup Mode

Clear the database from the NVRAM, including all the keys and signatures installed in the Key Management menu. Press Enter and a prompt will show up for you to confirm.

Export Secure Boot variables

Export the Secure Boot settings (i.e. all keys and signatures) as files to the root directory of a file system device. Press Enter and select a storage device listed in the pop-up menu. The saved files will be named automatically according to the type of key/signature as listed below.

Factory Key Provision

Enable or disable the provision factory default keys on next re-start. This will only take place when the "System Mode" in the previous menu is in "Setup", which can be achieved by moveing the cursor to the "Reset To Setup Mode" and press Enter.

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Export Secure Boot variables

Export the Secure Boot settings (i.e. all keys and signatures) as files to the root directory of a file system device. Press Enter and select a storage device listed in the pop-up menu. The saved files will be named automatically according to the type of key/signature as listed below.

- "PK" for Platform Keys
- "KEK" for Key Exchange Keys
- "db" for Authorized Signatures
- "dbx" for Forbidden Signatures

Enroll Efi Image

Allow the image to run in Secure Boot mode. Enroll SHA256 Hash certificate of a PE image into Authorized Signature Database (db). Press Enter and select a storage device listed in the pop-up menu, select a directory, and then select the EFI Image document.

Remove 'UEFI CA' from DB

Remove Microsoft UEFI CA from the Authorized Signature database. For systems that support Device Guard, Microsoft UEFI CA must NOT be included in the Authorized Signature database.

Restore DB defaults

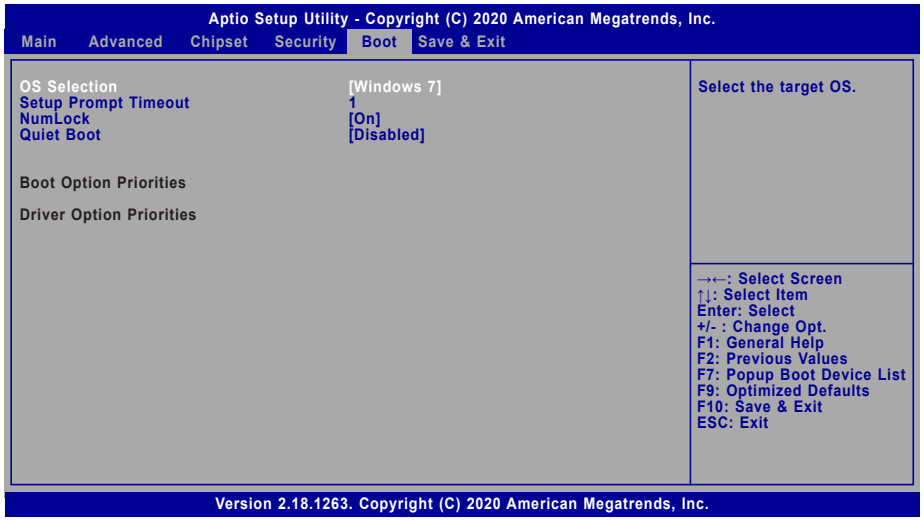
Press Enter to restore the database variable to factory defaults.

Manually configure the following keys and signatures. Move the cursor to the field and press Enter, and then a pop-up menu will show up.

Platform Key(PK), Key Exchange Keys, Authorized Signatures, Forbidden Signatures, Authorized TimeStamps, OsRecovery Signatures

Details	List the information of enrolled keys and signatures
Export	Save the key or signature as a file to the root directory of a file system. The saved files will be named automatically according to the type of key/signature as previously listed in the "Export Secure Boot Variables".
Update	Load factory default database
Append	Enroll keys and signatures from a file system
Delete	Delet keys and signatures

▶ Boot



OS Selection

Select the target OS the system is to boot into — Windows 10, Windows 7, Linux.

Setup Prompt Timeout

Set the number of seconds to wait for the setup activation key — 1 to 65535, 65535 (0xFFFF) meaning indefinite waiting.

NumLock

Select the keyboard NumLock state — On or Off.

Quiet Boot

This section is used to enable or disable quiet boot option.

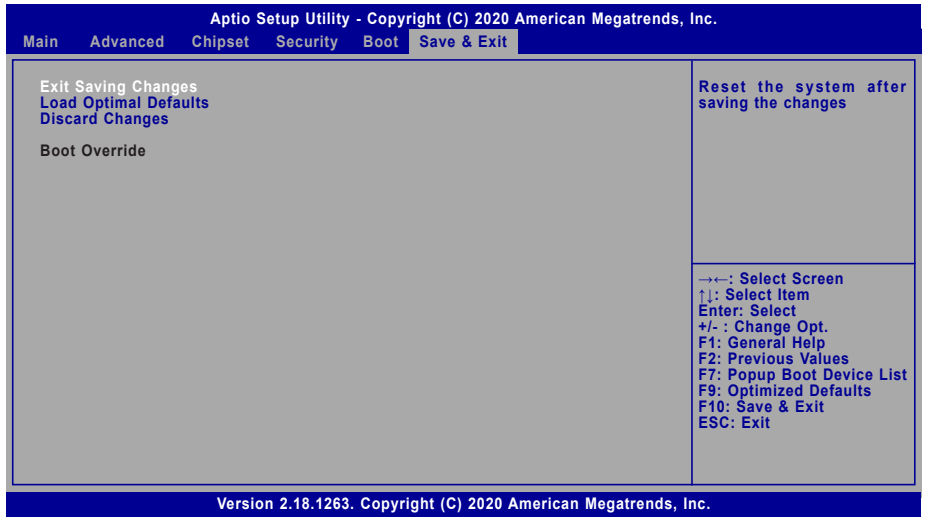
Boot Option Priorities

Rearrange the system boot order of available boot devices.

Driver Option Priorities

Select the driver boot order.

▶ Save & Exit



Exit Saving Changes

To save the changes, select this field and then press <Enter>. A dialog box will appear. Select Yes to reset the system after saving all changes made.

Load Optimal Defaults

To restore and load the optimized default values, select this field and then press <Enter>. A dialog box will appear. Select Yes to restore the default values of all the setup options.

Discard Changes

To discard the changes, select this field and then press <Enter>. A dialog box will appear. Select Yes to reset the system setup without saving any changes.

Boot Override

Move the cursor to an available boot device and press Enter, and then the system will immediately boot from the selected boot device. The Boot Override function will only be effective for the current boot. The “Boot Option Priorities” configured in the Boot menu will not be changed.

▶ Updating the BIOS

To update the BIOS, you will need the new BIOS file and a flash utility. Please contact technical support or your sales representative for the files and specific instructions about how to update BIOS with the flash utility. For updating AMI BIOS in UEFI mode, you may refer to the how-to video at https://www.dfi.com/Knowledge/Video/5.

▶ Notice: BIOS SPI ROM

1. The Intel® Management Engine has already been integrated into this system board. Due to the safety concerns, the BIOS (SPI ROM) chip cannot be removed from this system board and used on another system board of the same model.
2. The BIOS (SPI ROM) on this system board must be the original equipment from the factory and cannot be used to replace one which has been utilized on other system boards.
3. If you do not follow the methods above, the Intel® Management Engine will not be updated and will cease to be effective.

Note:
a. You can take advantage of flash tools to update the default configuration of the BIOS (SPI ROM) to the latest version anytime.
b. When the BIOS IC needs to be replaced, you have to populate it properly onto the system board after the EEPROM programmer has been burned and follow the technical person's instructions to confirm that the MAC address should be burned or not.