# CSA-7210

## 2U Rackmount Network Appliance with Dual Intel® Xeon® Processor

# User's Manual



| | |
|---|---|
| Manual Rev.: | Rev. 1.0 |
| Revision Date: | July 3, 2020 |
| Part No.: | 50-1Z307-1000 |

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Leading EDGE COMPUTING

# Preface

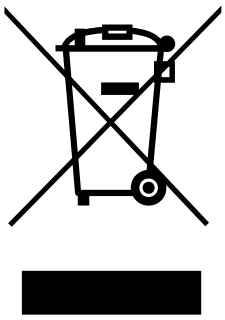
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### Revision History

| Revision | Release Date | Description of Change(s) |
|---|---|---|
| 1.0 | 2020-07-03 | Initial release |



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## Conventions




Information to prevent minor physical injury, component damage, data loss, and/or program corruption when trying to complete a task.

*Informations destinées à prévenir les blessures corporelles mineures, les dommages aux composants, la perte de données et/ou la corruption de programme lors de l'exécution d'une tâche.*




Information to prevent serious physical injury, component damage, data loss, and/or program corruption when trying to complete a specific task.

Informations destinées à prévenir les blessures corporelles graves, les dommages aux composants, la perte de données et/ou la corruption de programme lors de l'exécution d'une tâche spécifique.



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# 1 Overview

## 1.1 Introduction

The ADLINK CSA-7210 is a 2U 19" rackmount Network Appliance with Intel® Xeon® Scalable processor and Intel® C620 series Chipset. The CSA-7210 features an IO intensive architecture with up to 64x SFP+ ports, high scalability with four Network Interface Module (NIM) slots, 3.5’’ SATA drive bays,  and is an ideal platform for communications infrastructure deployment.

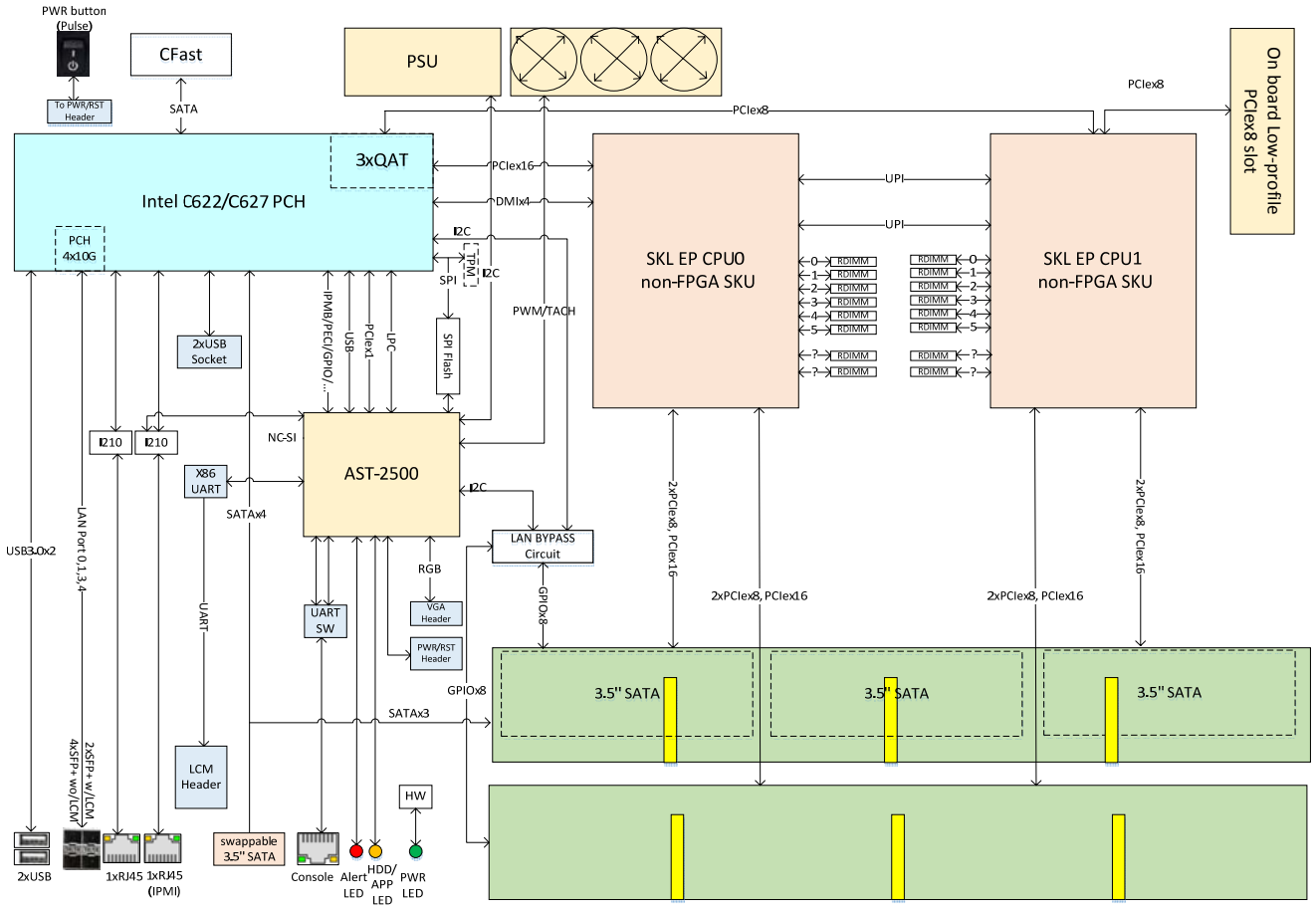
The main features of the CSA-7210 are summarized as follows:

- Support 2x FHFL PCIE extension and four network interface modules (NIMs) or Flexible IO interfaces through eight network interface modules (NIMs) adaptable to a variety of complex connectivity scenarios
- Advanced LAN bypass features; bypass modes of each NIM can be set independently through BIOS or IPMI interface
- 16x DDR4 memory slots for up to 512GB memory to meet the requirement of network packet processing
- Up to 4x 3.5" SATA drives, supports additional storage expansion via PCIe or CFast
- Intelligent system management compatible with IPMI 2.0, supports SOL and adaptive fan speeds
- Support for PacketManager software to provide data plane software stacks for dynamic layer 3 forwarding and flow-based forwarding, accelerating development of customer applications
- Integrates Wind River® Titanium Server, and open source software including Intel® DPDK, Open vSwitch and nDPI, facilitating the building of packet parsing applications



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## 1.2 Block Diagram

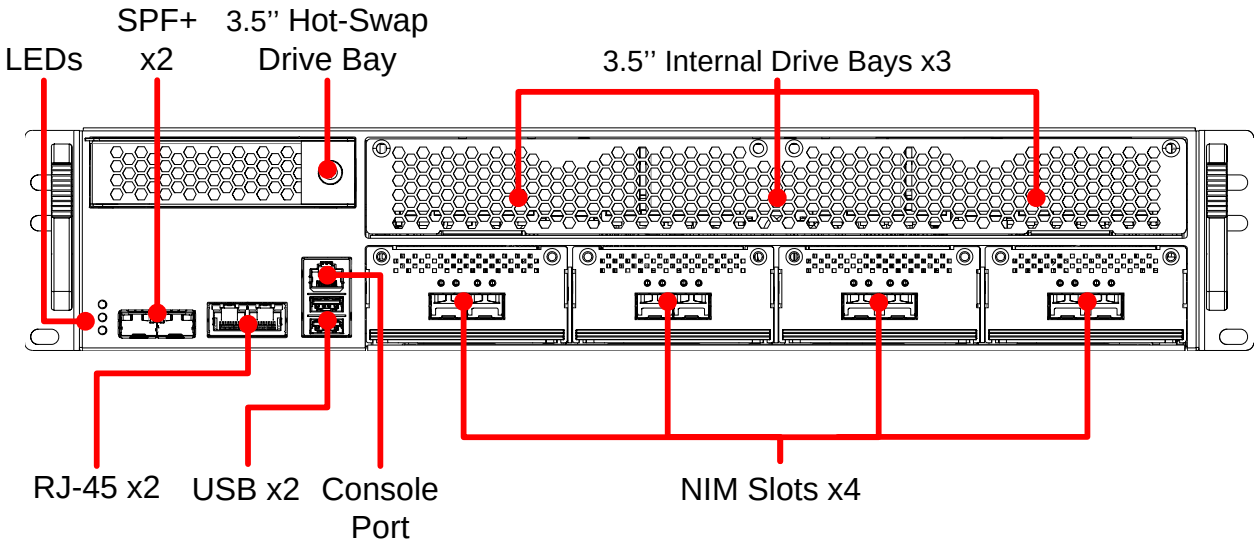




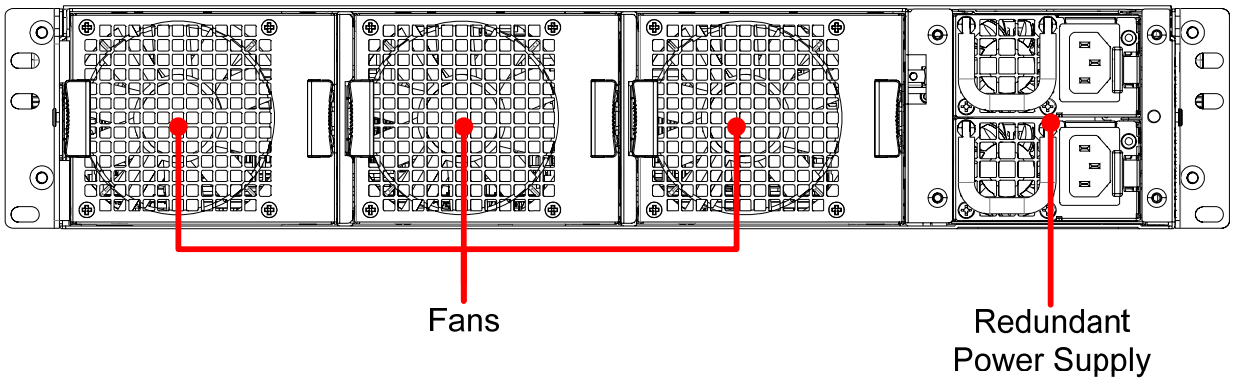

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# 1.3 Mechanical Overview

## 1.3.1 Front Panel



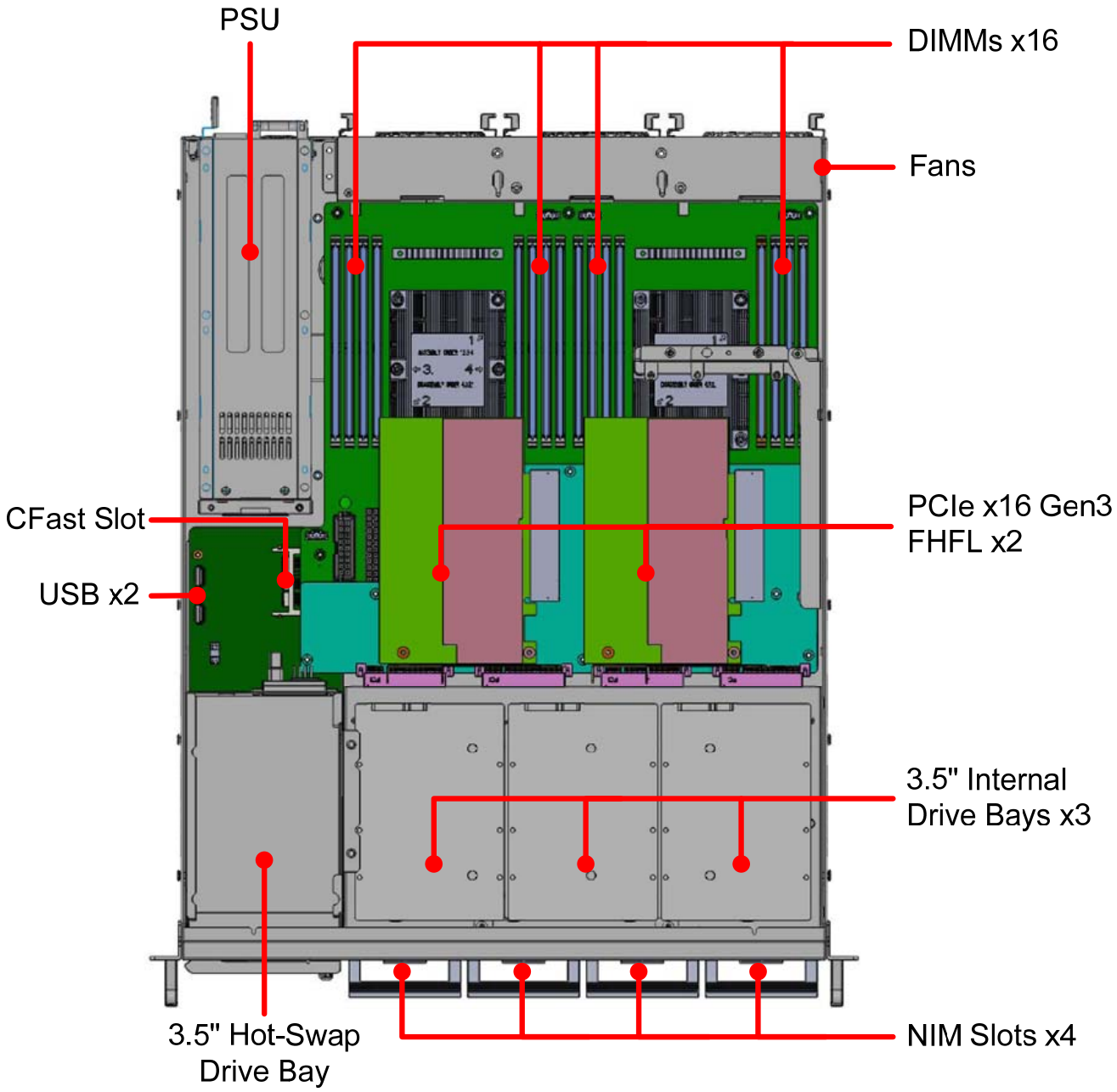

## 1.3.2 Rear Panel






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### 1.3.3 Chassis Layout

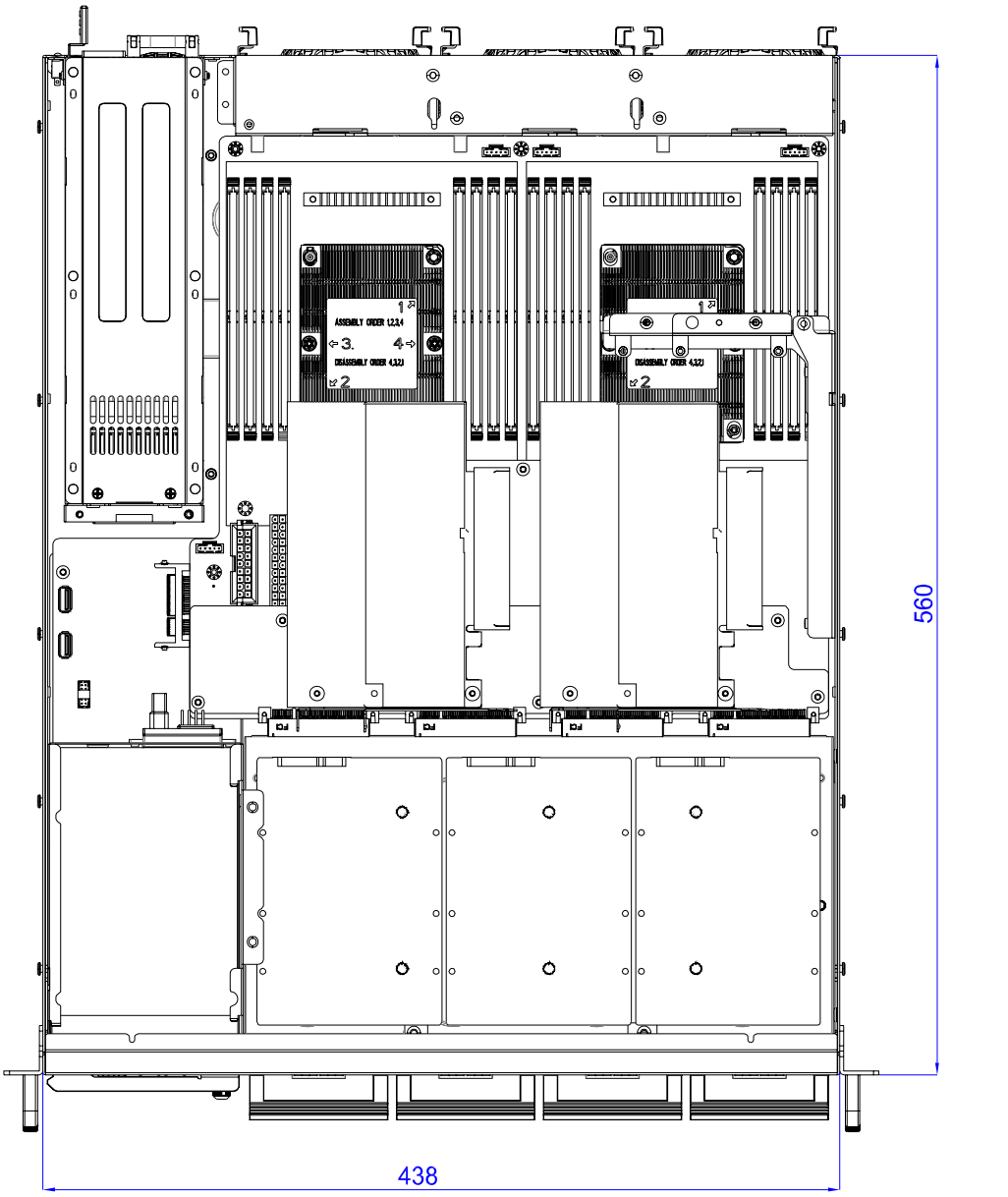


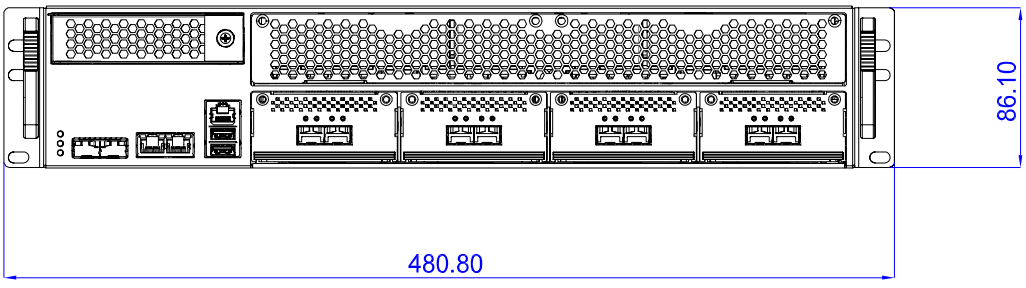



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## 1.3.4 Dimensions

Dimensions: mm






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# 2 Specifications

## 2.1 CSA-7210 Specifications

### Main System

| | |
|---|---|
| **CPU** | Intel® Xeon® Silver 4110 Processor 2.10Hz (8C/16T, 85W)<br>Intel® Xeon® Silver 4114 Processor 2.20 GHz (10C/20T, 85W)<br>Intel® Xeon® Gold 5120T Processor 2.20 GHz (14C/28T, 105W)<br>Intel® Xeon® Gold 6130 Processor 2.10 GHz (16C/32T, 125W)<br>Intel® Xeon® Gold 6140 Processor 2.30 GHz (18C/36T, 140W)<br>Intel® Xeon® Gold 6150 Processor 2.70 GHz (18C/36T, 165W) |
| **L3 Cache** | 11MB to 24.75MB, dependent on processor |
| **Chipset** | Intel® C622/C627 Chipset |
| **Memory** | 16x DDR4-2133/2400/2666 DIMM sockets, ECC, registered, up to 512GB |
| **BIOS** | AMI BIOS on SPI flash memory |
| **Operating System** | Windows 7 64-bit, Windows 10 64-bit, Windows Server 2016, Linux Kernel 2.6 and above |
| **Intel® QuickAssist Technology** | 100Gb/s Intel® QAT support (optional) |
| **Trusted Platform Module** | TPM 1.2 (TPM 2.0 optional) |
| **Chassis Management** | IPMI v2.0 compliant with iKVM and SOL support |
| **Software Support** | Validated with DPDK, provides a high throughput for data plane packet processing |

### Interfaces

| | |
|---|---|
| **Expansion** (SKU dependent) | • 8x Network Interface Module (NIM) slots*<br>or<br>• 4x NIM slots*<br>• 2x PCIe x16 Gen 3 slot (FHHL)<br>*ADLINK Network Interface Module (NIM) proprietary form factor |
| **Ethernet** | 2x RJ-45 10/100/1000BASE-T Ethernet ports<br>2x 10G SFP+ Ethernet ports |
| **Remote Console** | 1x RJ-45 serial port |
| **USB** | 2x USB 3.0 (front panel)<br>2x USB 3.0 (internal) |
| **Graphics** | 1x VGA port (internal, optional) |
| **LEDs** | Power, Alert, Drive Activity (user programmable) |



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## Storage

| | |
|---|---|
| **Drive Bays** | 1x 3.5'' hot-swappable SATA 6 Gb/s drive bay |
| **Internal** | 1x onboard CFast socket<br>3x 3.5'' internal SATA 6 Gb/s drive bays with hardware RAID support (SKU dependent) |

## Mechanical & Environmental

| | |
|---|---|
| **Form Factor** | 2U 19'' rackmount 438mm x 88mm x 560mm (W x H x D) |
| **Fans** | 3 fans, adaptive speed |
| **Power** | 800W or 1200W, AC/DC/HVDC |
| **Temperature** | Operating temp.: 0°C -40°C<br>Storage temp.: -40°C to 70°C |
| **Humidity** | Operating: 10% to 85% @40°C, non-condensing<br>Storage: 5% to 90%, non-condensing |
| **Shock** | Operating: half-sine 2G, 11ms pulse, 100 pulses on each of three axes |
| | Non-operating: trapezoidal, 25G, 170 inches/sec delta V, three drops on each of three axes |
| **Vibration** | Non-operating: 2.2Grms, 10 minutes per axis on all three axes |
| **Acoustic Level** | Sound pressure < 75 dBA @1m with all fans at maximum speed |
| **Certifications** | FCC Class A, CE emissions, UL, CB, CCC and RoHS compliant |
| **MTBF** | 90,000 hours |



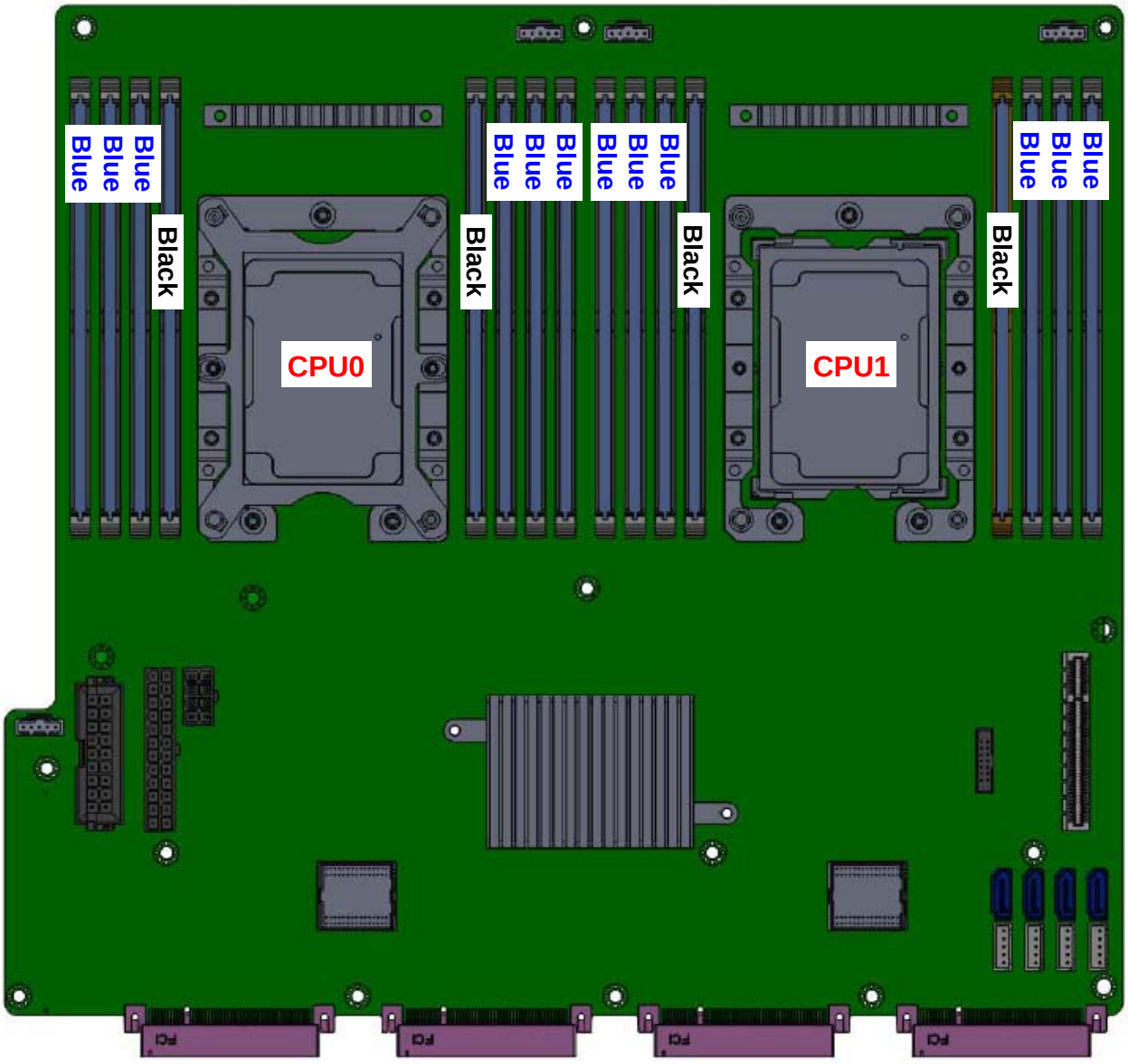
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# 3 Getting Started

## 3.1 Installing Memory Modules

When installing memory modules in the CSA-7210, the blue DIMM slots of each channel can be freely populated (it is suggested to fill the slots from “outside to inside” for each CPU). However, the black DIMM slots must be populated after the blue DIMM slots are completely filled, otherwise the device will not boot up. Please refer to the figure below.

**Note:** The device will not boot up if the black DIMM slots are populated before the blue DIMM slots are completely filled.






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## 3.2 BIOS Update

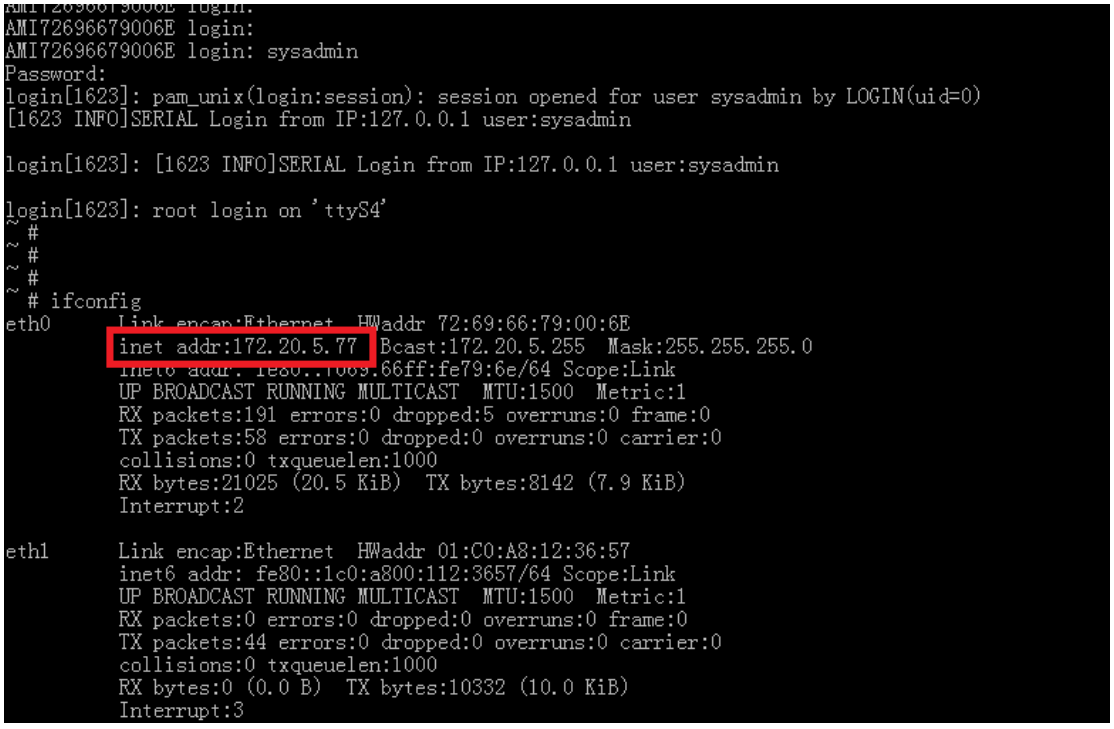
Users can update the CSA-7210 system BIOS over various interfaces (GbE LAN, KCS, console port).

### 3.2.1 Updating the BIOS via Network with BMC Tool

1. Install a Linux distribution, such as Ubuntu 14, to the debug PC.
2. Install “expect” to your debug PC (ex: sudo apt-get install expect).
3. Copy the BMC FW package “BMC_CSA-7210_Release_V1.05” to the debug PC;

**Upgrade Procedure:**

1. Check the IP of the BMC of CSA-7210. Power on the CSA-7210, boot the BMC to Linux (username: sysadmin; Passwd: superuser), and type “ifconfig” check its IP address.




2. On the debug PC, execute the following commands to perform the upgrade.

   cd BMC_CSA-7210_Release_V1.05

   cd BIOS

   ./adlinktool.sh bios1 BIOS_xxxx.bin 172.20.5.77



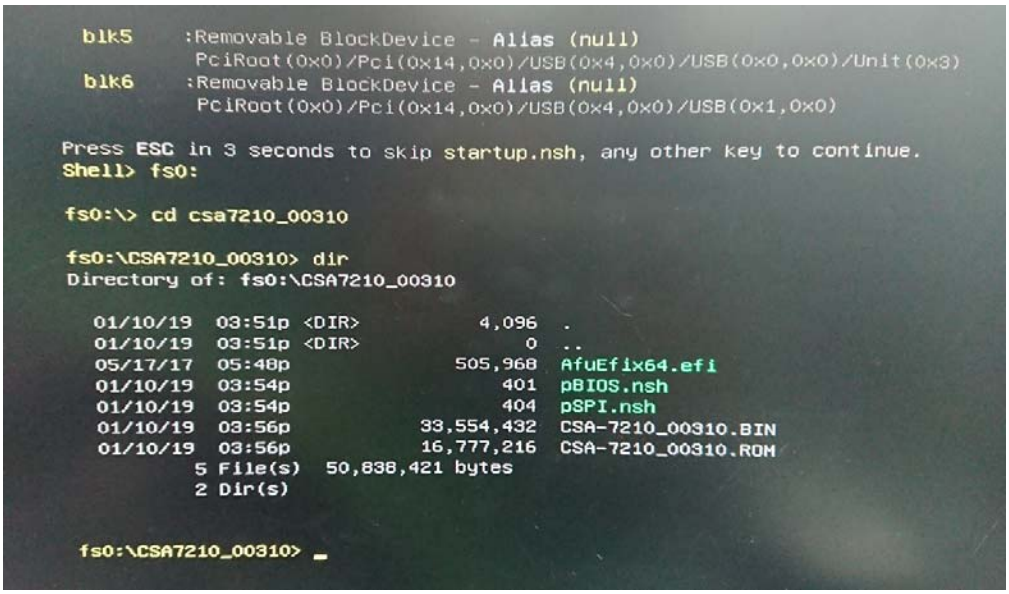
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### 3.2.2 Updating BIOS via Host with BIOS Tool

1. Boot/Login to Shell
2. Update the BIOS over host with the following commands.

Example:

AfuEfix64 BIOS.ROM /p /b /n /k (to update BIOS without ME)
AfuExfi64 BIOS.BIN /p /b /n /k /me (to update the entire BIOS)





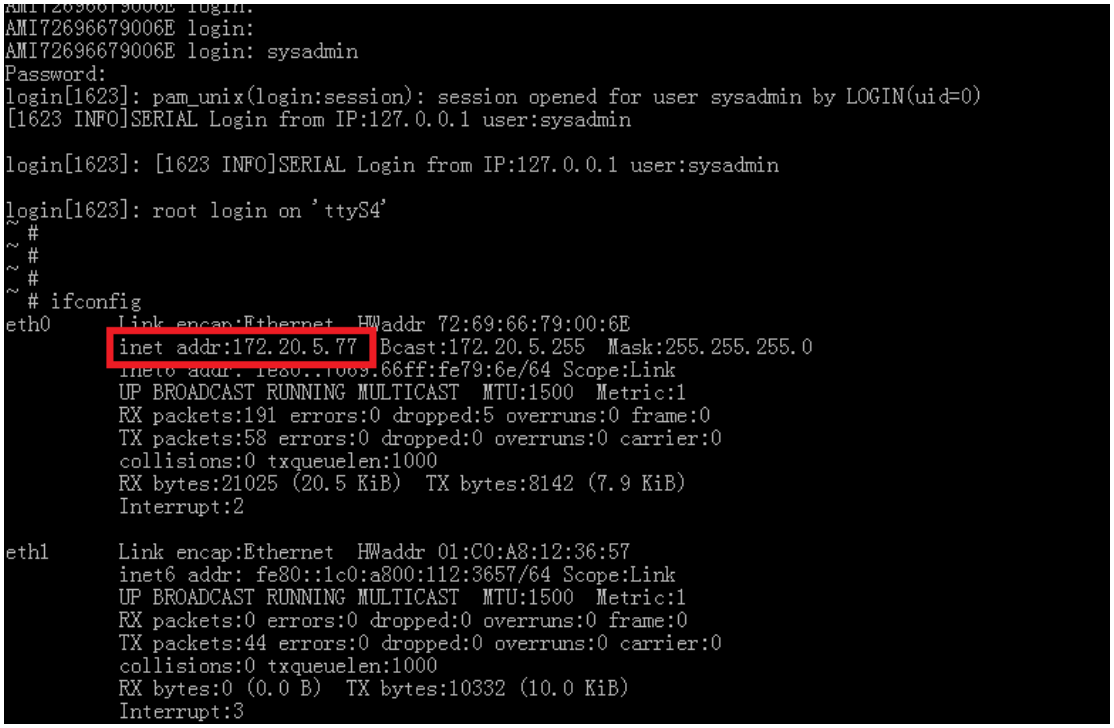

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## 3.3 BMC Firmware Update

1. Install a Linux distribution, such as Ubuntu 14, to the debug PC.
2. Install “expect” to your debug PC (ex: sudo apt-get install expect).
3. Copy the BMC FW package “BMC_CSA-7210_Release_V1.05” to the debug PC;

**Upgrade Procedure:**

1. Check the IP of the BMC of CSA-7210. Power on the CSA-7210, boot the BMC to Linux (username: sysadmin; Passwd: superuser), and type “ifconfig” check its IP address.




2. On the debug PC, execute the following commands to perform the upgrade.

   cd BMC_CSA-7210_Release_V1.05

   cd FW

   ./adlinktool.sh bmc1 rom.ima 172.20.5.77



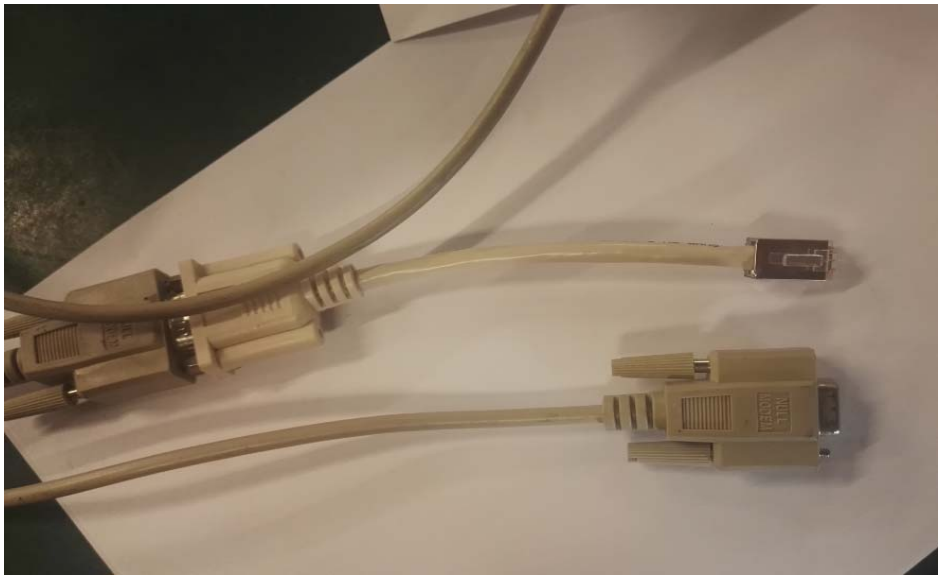
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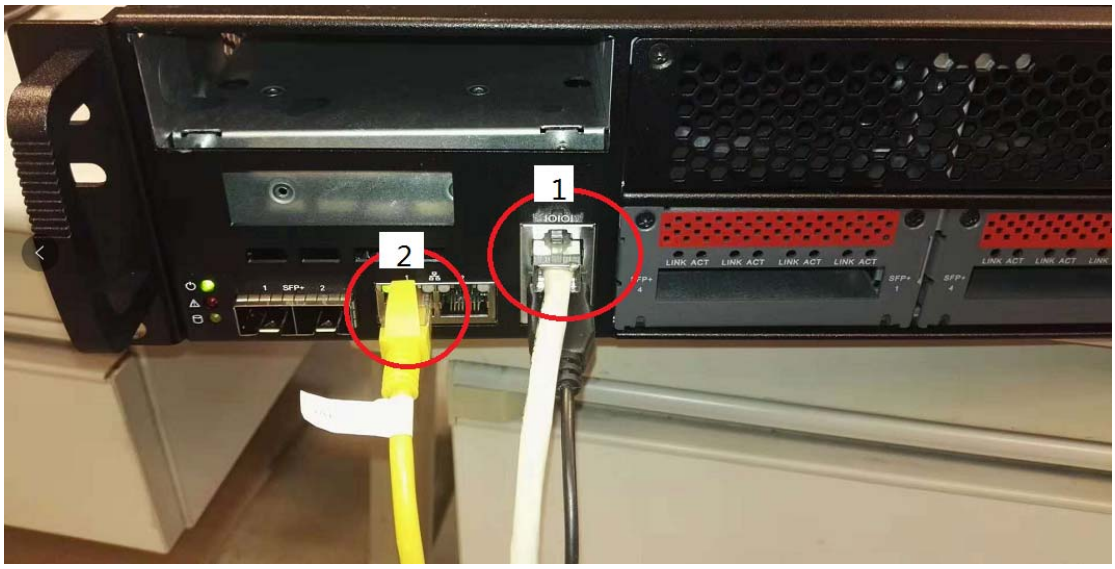
## 3.4 Login to the BMC via Serial Console

**Step 1**
Set the UART to BMC mode using SW1 on the I/O board.

| SW1 | Default | BMC Debug |
|---|---|---|
| TX | Pins 2-7: ON | Pins 1-8: ON |
| RX | Pins 4-5: ON | Pins 3-6: ON |

**Step 2**
Connect the serial cable between CSA-7210 board and PC;

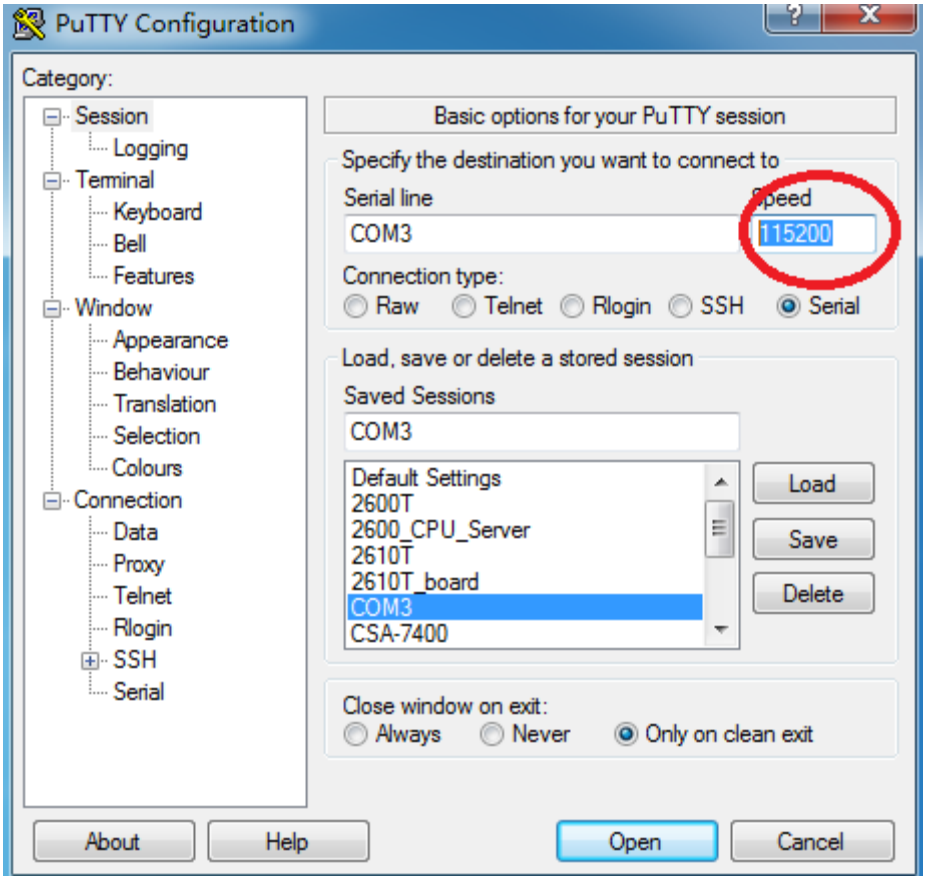




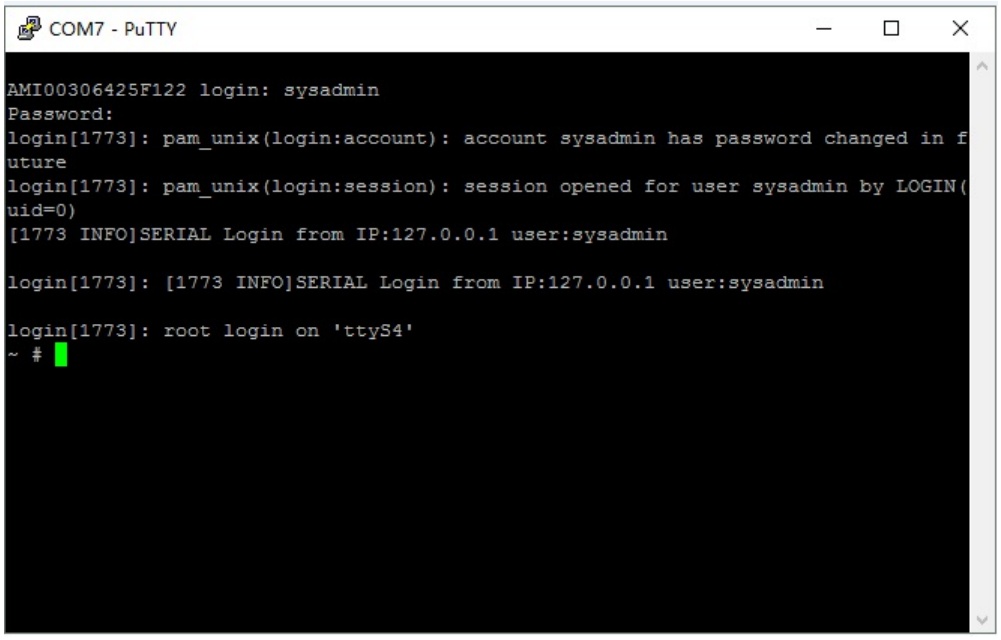



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**Step 3**
Open a serial port console tool (such as PuTTY), choose the higher numbered COM port (it may be different on different computers, please try both), then set the baud rate to 115200.




**Step 3**
Input the user name “sysadmin” and password “superuser” to login to the system.






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## 3.5 BMC eth0 Default and Static IP Settings

The default IP setting is DHCP. Users can login to the BMC to modify.

### Static IP Settings

Ipmitool -I lan -H 127.0.0.1 -U admin -P admin raw 0x0c 0x01 0x01 0x0 0x1
# start config

Ipmitool -I lan -H 127.0.0.1 -U admin -P admin raw 0x0c 0x01 0x01 0x4 0x1
# set IP to static mode

Ipmitool -I lan -H 127.0.0.1 -U admin -P admin raw 0x0c 0x01 0x01 0x3 0xac 0x14 0x5 0xe8
# set IP, the last four bytes is IP in hex, here is 172.20.5.232

Ipmitool -I lan -H 127.0.0.1 -U admin -P admin raw 0xc 0x1 0x1 0x6 0xff 0xff 0xff 0x0
#Change Mask to 255.255.255.0

Ipmitool -I lan -H 127.0.0.1 -U admin -P admin raw 0x0c 0x01 0x01 0xC 0xac 0x14 0x5 0xfe
# set Gateway, the last four bytes, here is 172.20.5.254

Ipmitool -I lan -H 127.0.0.1 -U admin -P admin raw 0x0c 0x01 0x01 0x0 0x0
# set complete
DHCP setting:

Ipmitool -I lan -H 127.0.0.1 -U admin -P admin raw 0x0c 0x01 0x01 0x0 0x1
# start config

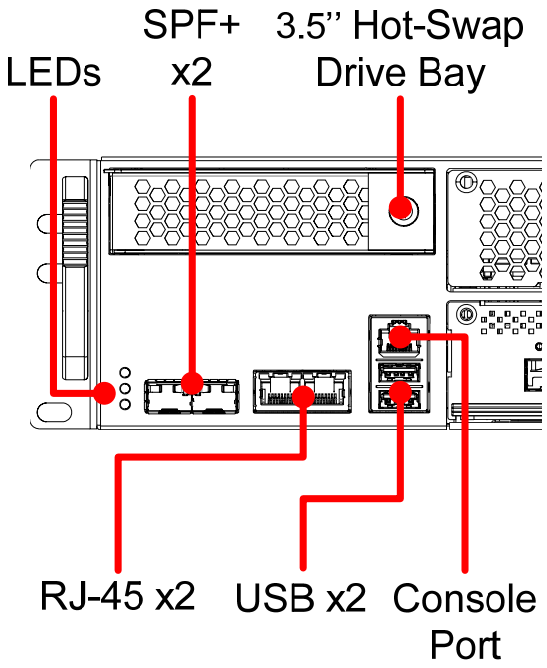
Ipmitool -I lan -H 127.0.0.1 -U admin -P admin raw 0x0c 0x01 0x01 0x4 0x2
# set IP to DHCP mode

Ipmitool -I lan -H 127.0.0.1 -U admin -P admin raw 0x0c 0x01 0x01 0x0 0x0
# set complete



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# 4 System Interfaces




## 4.1 Status LEDs

### 4.1.1 HDD LED (yellow)

The HDD LED is controlled by SATALED# from the chipset. When SATA storage is active (read/write), the LED will blink.

### 4.1.2 Power LED (green)

The Power LED will light up in boot up state.

### 4.1.3 Alert LED (red)

The LED will light when a BIOS failure is detected or a sensor reading exceeds its upper/lower un-recoverable threshold.



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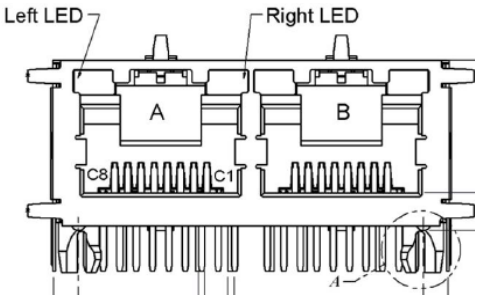
## 4.2 LAN LEDs

The LAN LEDs are integrated into the RJ-45 connector. Their behavior is as follows.

| LED1 - Left (Speed) | |
|---|---|
| 10 Mbps | Off |
| 100 Mbps | Green |
| 1000 Mbps | Orange |

The LED2 (Link/Activity) indicates that a link has been established by lighting orange. When data is transmitted the LED blinks orange.

| LED2 - Right (Link/Activity) | |
|---|---|
| Link with no activity | Orange (steady) |
| Link with activity | Orange (blinking) |




## 4.3 NIM LED Definitions

NIM Service Port Status LED behaviour is as follows.

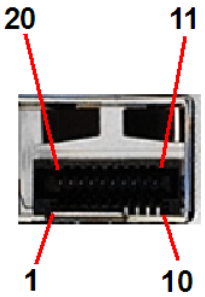
| LAN | LED | Status | LED Color |
|---|---|---|---|
| SFP/SFP+ | Left | Link up | Yellow |
| | | Link down | Off |
| | Right | Link with no activity | Off |
| | | Link with activity | Green Blinking |
| | | Link down | Off |
| GbE RJ45 | Left | 10 Mbps | Off |
| | | 100 Mbps | Green |
| | | 1000 Mbps | Yellow |
| | Right | Link with no activity | Green |
| | | Link with activity | Green blinking |
| | | Link down | Off |



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## 4.4 SFP+ Ports

| Pin | Signal Name |
|---|---|
| 1 | GND |
| 2 | TX_FAULT |
| 3 | TX_DSBL |
| 4 | SDA |
| 5 | SCL |
| 6 | MOD_ABS |
| 7 | RS0 |
| 8 | RX_,OS |
| 9 | RS1 |
| 10 | GND |
| 11 | GND |
| 12 | RD- |
| 13 | RD+ |
| 14 | GND |
| 15 | VCCR |
| 16 | VCCT |
| 17 | GND |
| 18 | TD+ |
| 19 | TD- |
| 20 | GND |

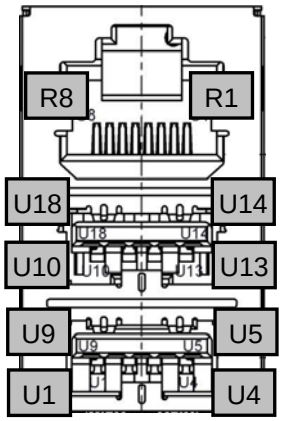




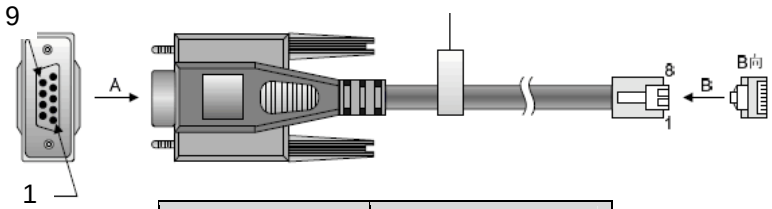

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## 4.5 Dual USB 3.0 and RJ-45 Console Port

| Pin | Signal Name |
|---|---|
| R1 | N/C |
| R2 | N/C |
| R3 | COM_TXD |
| R4 | GND |
| R5 | GND |
| R6 | COM_RXD |
| R7 | N/C |
| R8 | N/C |
| U1 | 5V |
| U2 | USB2_N |
| U3 | USB2_P |
| U4 | GND |
| U5 | SSRX_N |
| U6 | SSRX_P |
| U7 | GND |
| U8 | SSTX_N |
| U9 | SSTX_P |
| U10 | 5V |
| U11 | USB2_N |
| U12 | USB2_P |
| U13 | GND |
| U14 | SSRX_N |
| U15 | SSRX_P |
| U16 | GND |
| U17 | SSTX_N |
| U18 | SSTX_P |




The CSA-7210 comes with an RJ-45 to DB-9 console port adapter cable.

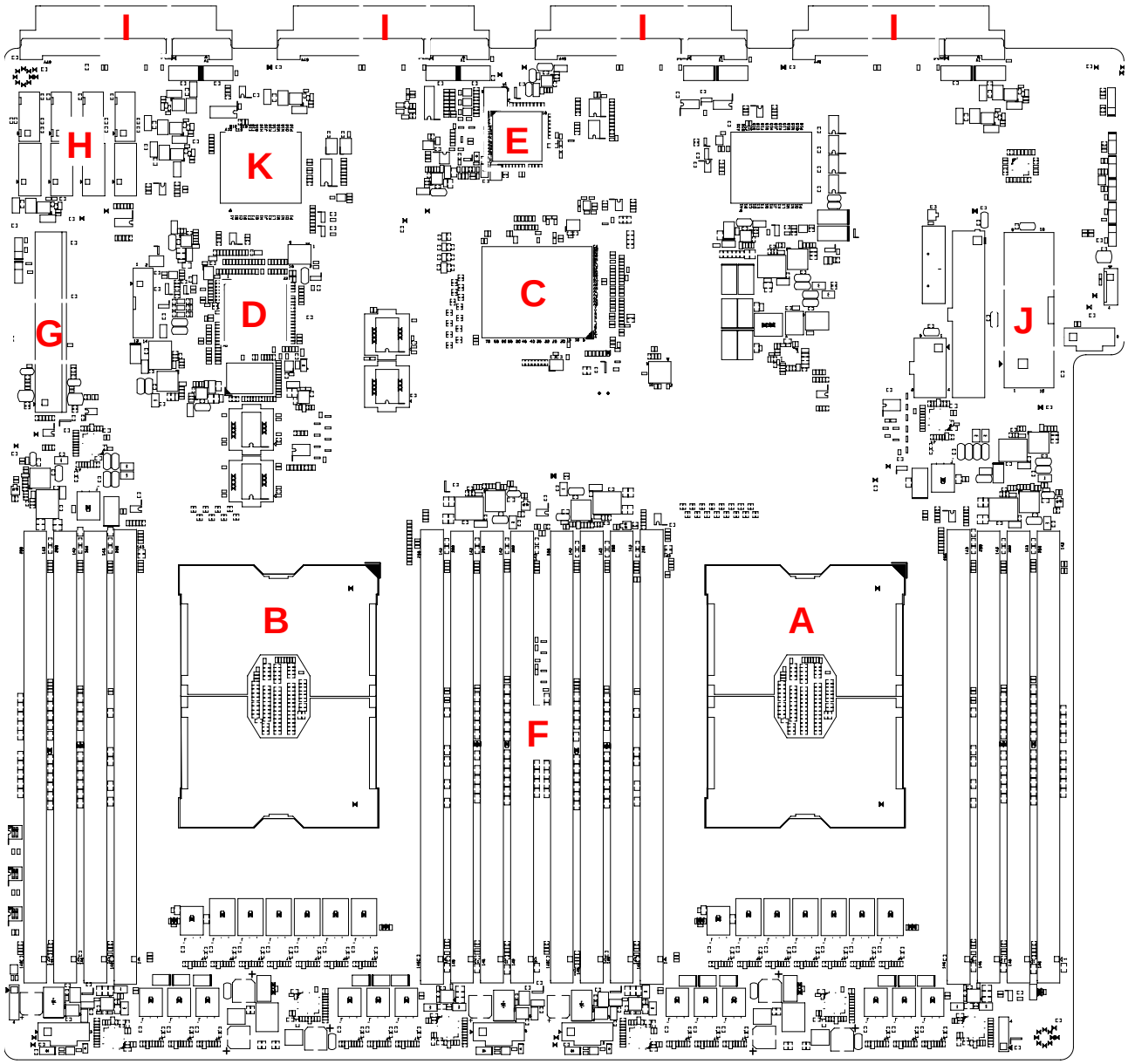



| DB-9 Pin | Signal |
|---|---|
| 1 | — |
| 2 | RXD |
| 3 | TXD |
| 4 | DTR |
| 5 | SG |
| 6 | DSR |
| 7 | RTS |
| 8 | CTS |
| 9 | — |



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## 4.6 Board Layout




| | | | |
|---|---|---|---|
| **A** | CPU0 | **G** | PCIe x8 slot |
| **B** | CPU1 | **H** | SATA Port |
| **C** | PCH | **I** | NIM slot |
| **D** | BMC Chip | **J** | PWR CONN |
| **E** | CPLD Chip | **K** | B2B for Daughter Board |
| **F** | DDR4 DIMM | | |



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# 5 LAN Bypass Function

The CSA-7210 is equipped with a LAN Bypass function to allow uninterrupted network traffic in the case of power disruption, system failure, or if a single in-line appliance is shut down or hangs. The default behavior of the LAN Bypass function is determined by BIOS setting.

## 5.1 LAN Bypass Support

The following table outlines the behaviour of the LAN Bypass function when when set On/Off in the BIOS under different power conditions.

| Bypass Setting \ Power Status | | Power On Mode | Power Off Mode (S5, Standby Power only) | No AC/DC power with 1st Gen NIM | No AC/DC power with 2nd Gen NIM |
|---|---|---|---|---|---|
| **All Bypass Off** | | Bypass **Off** | Bypass **Off** | Bypass **On** | Bypass **Off** |
| **All Bypass On** | | On boot Bypass is **On** for all segments. Control is handed to the BMC as soon as it is ready. | Bypass **On** | Bypass **On** | Bypass **On** |
| **By Segment** | **Bypass On** | On boot Bypass is **On.** Control is handed to the BMC as soon as it is ready. | Bypass **On** | Bypass **On** | Bypass **On** |
| | **Bypass Off** | On boot Bypass is **Off.** Control is handed to the BMC as soon as it is ready. | Bypass **Off** | Bypass **On** | Bypass **Off** |

**Table 1. LAN Bypass Support for 1st and 2nd generation of NIMs**

**Note:** Check the generation of the installed NIMs and make sure the **Error! Reference source not found.** on page **Error! Bookmark not defined.** are correct.



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## 5.2 NIM Hardware Description

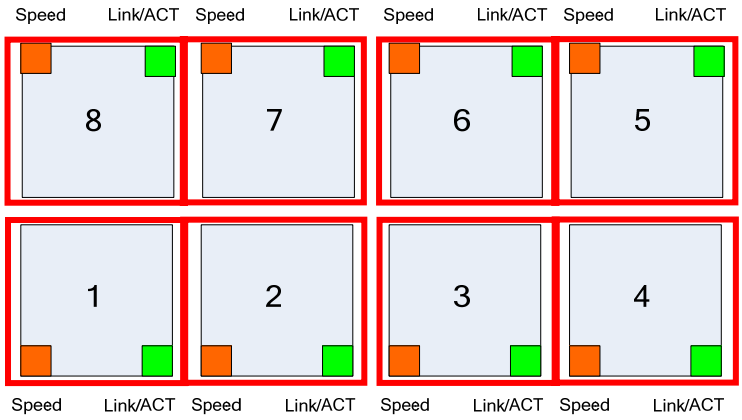
The CSA-7210 can bypass the LAN port on designated NIMs (CSA-Z4X01, CSA-Z8X10).

**(1) Bypass LED** (Front Panel)
Yellow: When one or more LAN segment has LAN Bypass is enabled
Off: When all LAN segments LAN Bypass are disabled

**(2) CSA-Z4X01 LAN Bypass Port Pairing**

**LAN Bypass Pair 1:** Port 1 & Port 2
**LAN Bypass Pair 2:** Port 3 & Port 4

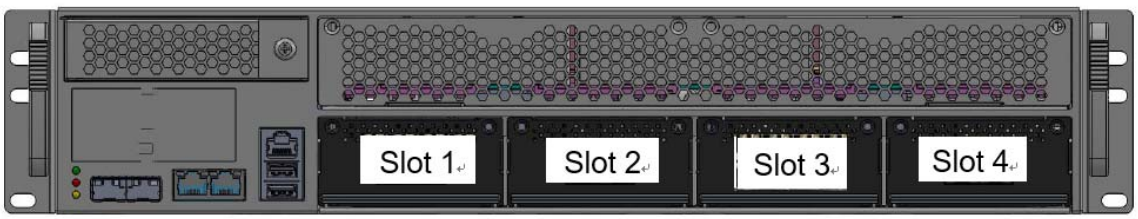
**(3) CSA-Z8X10 LAN Bypass Port Pairing**




**LAN Bypass Pair 1:** Port 1 & Port 2
**LAN Bypass Pair 2:** Port 3 & Port 4
**LAN Bypass Pair 3:** Port 5 & Port 6
**LAN Bypass Pair 4:** Port 7 & Port 8

## 5.3 NIM Slot LAN Segmentation

The NIM slot numbers correspond to the LAN segment numbers.






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## 5.4 NIM Slot PCIe Mapping Table

| CPU | NIM Slot | PCIe Root Port Number |
|---|---|---|
| CPU0 | Slot 1 | 2C |
| CPU0 | Slot 2 | 2A |
| CPU1 | Slot 3 | 2C |
| CPU1 | Slot 4 | 2A |



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# Important Safety Instructions

For user safety, please read and follow all **instructions**, **WARNINGS**, **CAUTIONS,** and **NOTES** marked in this manual and on the associated equipment before handling/operating the equipment.

1. Read these safety instructions carefully.
2. Keep this user's manual for future reference.
3. Read the specifications section of this manual for detailed information on the operating environment of this equipment.
4. The equipment can be operated at an ambient temperature of 40°C.
5. When installing/mounting or uninstalling/removing equipment; or when removal of the chassis lid required for user servicing (Section 3.1-3.5):
   - Turn off power and unplug any power cords/cables, and
   - Reinstall the chassis lid before restoring power.




Hazardous moving parts. Keep body parts out of the motion path.

6. To avoid electrical shock and/or damage to equipment:
   - Keep equipment away from water or liquid sources;
   - Keep equipment away from high heat or high humidity;
   - Keep equipment properly ventilated (do not block or cover ventilation openings);
   - Make sure to use recommended voltage and power source settings;
   - Always install and operate equipment near an easily accessible electrical socket-outlet;
   - Secure the power cord (do not place any object on/over the power cord);
   - Only install/attach and operate equipment on stable surfaces and/or recommended mountings;
   - If the equipment will not be used for long periods of time, turn off and unplug the equipment from its power source.
   - The power cord must be connected to a socket or outlet with a ground connection.
7. Never attempt to fix the equipment. Equipment should only be serviced by qualified personnel.
8. A Lithium-type battery may be provided for uninterrupted, backup or emergency power.




Risk of explosion if battery is replaced with one of an incorrect type. Please dispose of used batteries appropriately.



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9. This equipment is not suitable for use in locations where children are likely to be present.
10. Equipment must be serviced by authorized technicians when:
    - The power cord or plug is damaged;
    - Liquid has penetrated the equipment;
    - It has been exposed to high humidity/moisture;
    - It is not functioning or does not function according to the user's manual;
    - It has been dropped and/or damaged; and/or,
    - It has an obvious sign of breakage.
11. Please pay strict attention to all warnings and advisories appearing on the device, to avoid injury or damage.
12. The equipment may have more than one power supply input. To reduce the risk of electrical shock, trained personnel should disconnect all power supply inputs before servicing.




**Shock hazard!** Disconnect all power supply inputs before servicing.



Shock hazard!
Risque d'électrocution!



Multiple power sources
Sources d'alimentation multiples

13. It is recommended that equipment be installed only in a server room or computer room where access is:
    - Restricted to qualified service personnel or users familiar with restrictions applied to the location, reasons therefor, and any precautions required;
    - Only afforded by the use of a tool or lock and key, or other means of security, and is controlled by the authority responsible for the location.
14. Suitable for installation in Information Technology Rooms in accordance with Article 645 of the National Electrical Code and NFPA 75.



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# Consignes de Sécurité Importantes

Pour assurer la sécurité de l'utilisateur, veuillez lire et suivre toutes les **directives**, ainsi que les **AVERTISSEMENTS**, **MISES EN GARDE** et **REMARQUES** de ce manuel et indiqués sur l'équipement associé avant de manipuler ou utiliser l'équipement.

1. Veuillez lire attentivement ces instructions de sécurité avec soin.
2. Veuillez conserver ce manuel pour référence future.
3. Veuillez lire la section des spécifications de ce manuel pour avoir des informations détaillées sur l'environnement d'exploitation de cet équipement.
4. L'équipement peut être utilisé à une température ambiante de 40 °C.
5. Lors de l'installation ou du montage et de la désinstallation ou de la dépose de l'équipement; ou lors de la dépose du couvercle du châssis pour procéder à l'entretien par l'utilisateur (Sections 3.1-3.5):
   - Coupez l'alimentation et débranchez les cordons et les câbles d'alimentation, et
   - Reposez le couvercle du châssis avant de remettre l'alimentation.




Pièces mobiles dangereuses. Gardez les parties du corps hors de la trajectoire.

6. Pour éviter un risque d'électrocution et pour éviter d'endommager l'équipement :
   - Éloignez l'équipement de l'eau et de toute source liquide;
   - Éloignez l'équipement de toute source de chaleur ou d'humidité élevée;
   - Gardez l'équipement correctement ventilé (ne pas bloquer ou couvrir les ouvertures de ventilation);
   - Veillez à utiliser la tension recommandée et les réglages adéquats pour la source d'alimentation;
   - Veuillez toujours installer et exploiter l'équipement à proximité d'une prise de courant facilement accessible;
   - Assurez-vous que le cordon d'alimentation est acheminé de manière sécuritaire (ne déposez aucun objet dessus);
   - Installez, fixez et utilisez l'équipement sur des surfaces stables ou sur les fixations recommandées uniquement;
   - Si l'équipement n'est pas utilisé pendant une longue période, éteignez-le et débranchez-le de sa source d'alimentation.
   - Le cordon d'alimentation doit être connecté à une prise ou à une prise de courant avec mise à la terre.
7. N'essayez jamais de réparer l'équipement. L'équipement ne doit être réparé que par du personnel qualifié.
8. Une pile au lithium peut être installée pour assurer l'alimentation de secours ou d'urgence en continu.




Risque d'explosion si la batterie est remplacée par une batterie d'un type incorrect. Veuillez éliminer les piles usagées de manière appropriée.



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9. Cet équipement ne convient pas à une utilisation dans des lieux pouvant accueillir des enfants.
10. L'équipement doit être entretenu par des techniciens agréés lorsque :
    - le cordon d'alimentation est endommagé ou lorsque la fiche électrique est endommagée;
    - du liquide a pénétré à l'intérieur de l'équipement;
    - l'équipement a été exposé à un taux d'humidité élevé;
    - l'équipement ne fonctionne pas ou ne fonctionne pas conformément au manuel de l'utilisateur;
    - l'équipement est tombé ou lorsqu'il a été endommagé;
    - l'équipement présente un signe évident de défaillance.
11. Veuillez porter une attention rigoureuse à tous les avertissements et à tous les avis figurant sur l'appareil, pour éviter des blessures ou des dommages.
12. L'équipement peut avoir plus d'une entrée d'alimentation. Pour réduire le risque d'électrocution, le personnel qualifié devrait déconnecter toutes les entrées d'alimentation avant de procéder à l'entretien.




**Risque d'électrocution!** Débranchez toutes les entrées d'alimentation avant de procéder à l'entretien.



Shock hazard!
Risque d'électrocution!



Multiple power sources
Sources d'alimentation multiples

13. Il est recommandé que l'équipement soit installé que dans une salle de serveur ou de la salle informatique où:
    - L'accès est limité au personnel de maintenance qualifié ou utilisateurs familiers avec les restrictions appliquées à l'emplacement, motifs, et tout les précautions nécessaires, et;
    - L'accès est uniquement assurée par l'utilisation d'un outil ou clé, ou d'autres moyens de sécurité, et est contrôlé par l'autorité responsable de l'emplacement.
14. Peut être installé dans des salles de matériel de traitement de l'information conformément à l'article 645 du National Electrical Code et à la NFPA 75.



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# Getting Service

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