Moxa Industrial Linux 2 (Debian 10) Manual for V2406C Series WL Models

Version 1.0, January 2023

www.moxa.com/products

Moxa Industrial Linux 2 (Debian 10) Manual
for V2406C Series WL Models

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1. Introduction

Moxa Industrial Linux 2 (MIL 2)

Moxa Industrial Linux 2 (MIL 2) is an optimized Linux distribution for industrial applications and users that is released and maintained by Moxa.

MIL 2 is based on Debian 10 with kernel 4.19 and is integrated with several feature sets designed to strengthen and accelerate user application development as well as ensure system reliability and security. MIL 2's key features include Secure Boot, secure update, backup & recovery, computer interface management, and network connection management.

V2406C Secure and Standard Models

The V2406C models with Whisky Lake processor are of two types: Standard model and Secure model. The secure models have additional security features including Secure Boot, Disk Encryption, Secure restoration, and Secure Update.

To identify the model that you have, run the **`mx-interface-mgmt deviceinfo`** command. Only a secure model will have **SECUREBOOT** enabled.

```
moxa@moxa-tbzkb1090923: ~# mx-interface-mgmt deviceinfo
SERIALNUMBER=TBBBB1182827
MODELNAME=V2406C-WL7-CT-T
SECUREBOOT=Enabled
```

The following table lists the differences between the V2406C standard and secure models.

	Standard Model	Secured Model
Secure Boot	n/a	✓
Disk Encryption	n/a	✓
Secure recovery	n/a	✓
Secure Update	✓	✓
TPM 2.0	✓	✓

Eligible Computing Platforms

This user manual is applicable to V2406C Series WL models with Intel® 8th Gen Whisky Lake processor. You can order these models with preinstalled MIL 2 via the Moxa Configure-to-Order (CTO) system using the V2406C-CT-T (CTO) or V2406C-T (CTO) model names.

Migrating From Debian 9 to MIL 2 (Debian 10)

Before migrating an application previously developed on Debian 9 provided by Moxa to MIL2 (Debian 10), refer to the following table that highlights the major differences between the V2406C Debian 9 and MIL 2.

NOTE

The table should not be used as a comparison of standard Debian 9 to 10 usages and package changes. V2406C with Debian 9 does not support direct upgrade to MIL2 (Debian 10). If you have such request, contact a Moxa sales representative for your region.

Category	Description	V2406C With Debian 9	V2406C With MIL 2 (Debian 10)
User Account	Default account	Default Account: **moxa** Default password: **moxa**	Default Account: **moxa** Default password: **moxa**
	Enforce password change upon first log-in	Not supported	✓
	Password complexity enforcement	Not supported	• At least 8 characters in length • Checking against a dictionary of commonly used term that should not be set as the password
Backup & Store	Reinstall a system image	Via the Moxa utility on a bootable USB storage drive	Via Moxa system restore utility using bootable USB
	Create a backup & restore	Via the Moxa image utility on a bootable USB storage drive	Via Moxa System Management (MSM) utility under Linux
	Create a snapshot & restore	Not supported	Via Moxa System Management (MSM) utility under Linux
	Automatic system failback recovery	Not supported	Via Moxa System Management (MSM) utility under Linux
Network connection	Default LAN (Ethernet) port configuration	LAN1(static IP):192.168.3.127 LAN2(static IP):192.168.4.127	• LAN1: Assigned by DHCP server. Link-local IP addresses will be assigned when DHCP server is not available • LAN2(static IP):192.168.4.127
	Cellular connection utility	Use **cell_mgmt**	Via Moxa Connection Manager (MCM) with the following **additional** features: • GUI to configure and manage a network • Connection keep-alive • Connection failover/failback • Cellular, Wi-Fi, and Ethernet interface management • DHCP server • Data usage monitoring • IPv6 support • Cellular connection diagnosis • Cellular modem firmware upgrade • C API for network and connection status inquiry
	Wi-Fi connection utility	Use **wifi_mgmt**	
Computer Interface Management	Serial port mode change (RS-232, RS-422, and RS-485 2-wire)	Use **mx-uart-ctl**	Refer to serial port in Moxa Computer Interface Manager (MCIM) section
	Module control including power control, module detection, initialize setting, and SIM slot switching	Use **mx-module-ctl or cell_mgmt** for cellular module control	Refer to cellular,wifi, socket interface in Moxa Computer Interface Manager (MCIM) section
	Digital I/O Control	Use **moxa-dio-control**	Refer to Digital IN/OUT (DIO) interface in Moxa Computer Interface Manager (MCIM) section
	Manually mount a USB storage device	Use **mount**	Refer to storage and partitions in Moxa Computer Interface Manager (MCIM) section
	Automatically mount a USB storage device	Add USB under **/etc/fstab**	
Other Configuration	Check product serial number	Use **dmidecode -t 1**	Use **mx-interface-mgmt deviceinfo**
	Check system/OS image version	Use **kversion**	Use **mx-ver**

2. Getting Started

Connecting From a VGA Console

Connect the display monitor to the connector on your computer, and then power it up by connecting it to the power adapter. It takes approximately 30 to 60 seconds for the system to boot up. Once the system is ready, a login screen will appear on your monitor.

To log in, type the login name and password as requested. The default values are both **moxa**. For more details on default login username and password, please reference the Default Credentials and Password Strength.

Root account login is disabled until you manually create a password for the account. The user **moxa** is in the **sudo** group so you can operate system level commands with this user using the **sudo** command. For additional details, see the Switching to the Root Privilege section in Chapter 7.

ATTENTION

For security reasons, we highly recommend that you disable the default user account and create your own user accounts.

Connecting From an SSH Console

The V2406C computer supports SSH connections remotely or over an Ethernet network. If you are connecting the computer using an Ethernet cable, refer to the following IP address information.

Ethernet Port	Configuration	IP Address
LAN 1*	DHCP (DHCP client)	Assigned by DHCP server. Link-local IP addresses will be assigned when DHCP server is not available
LAN 2	Static IP	192.168.4.127

*LAN 1 is by default for DHCP/link-local IP configuration and is managed by Moxa Connection Manger (MCM).

NOTE

Be sure to configure the IP address of your notebook/PC's Ethernet interface on the same subnet as the LAN port of V2406C you plan to connect to. For example, 192.168.4.**126** for LAN2.

After a connection has been established, type the login name and password as requested. The default values are both **moxa**. For more details on default login username and password, see Default Credentials and Password Strength.

The **root** account login is disabled until you manually create a password for the account. The user **moxa** is in the **sudo** group; so, you can operate system-level commands with this user using the **sudo** command. For additional details, see the Switching to the Root Privilege section in Chapter 7.

ATTENTION

For security reasons, we highly recommend that you disable the default user account and create your own user accounts.

Linux Users

NOTE

These steps apply to the Linux PC you are using to connect to the V2406C computer. Do NOT apply these steps to the V2406C computer itself.

Use the **ssh** command from a Linux computer to access the computer's LAN2 port.

```
user@PC1:~ ssh moxa@192.168.4.127
```

Type **yes** to complete the connection.

```
The authenticity of host '192.168.3.127' can't be established.
RSA key fingerprint is 8b:ee:ff:84:41:25:fc:cd:2a:f2:92:8f:cb:1f:6b:2f.
Are you sure you want to continue connection (yes/no)? yes_
```

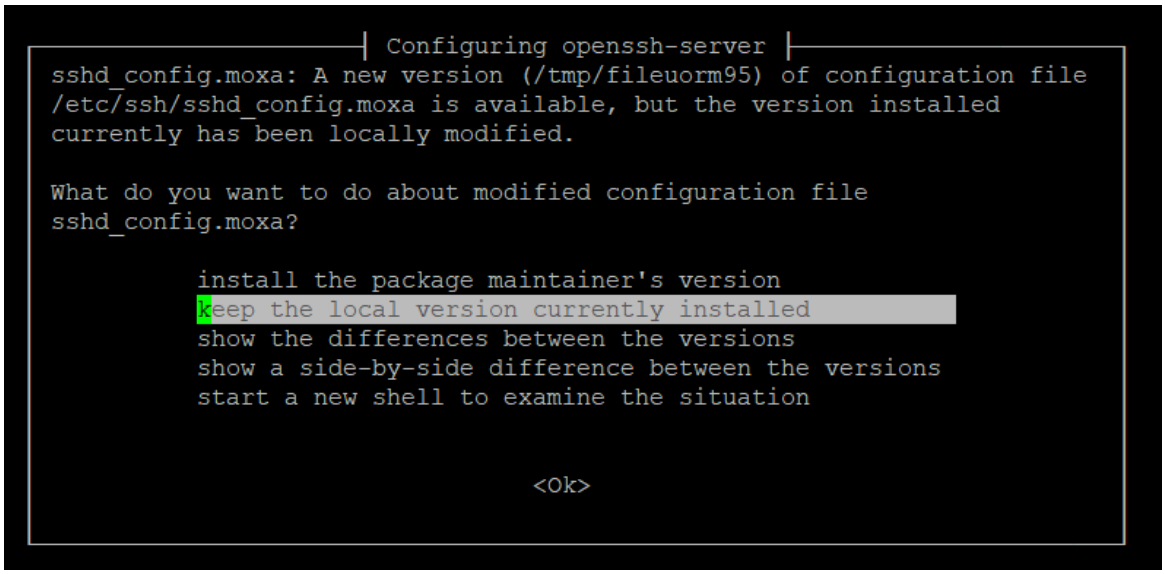
To connect using LAN1, you need to know its IP address.

ATTENTION

In order to secure your system, we suggest doing a regular SSH-rekey, as shown in the following steps:

```
moxa@moxa-tbzkb1090923:~$ cd /etc/ssh
moxa@moxa-tbzkb1090923:~$ sudo rm /etc/ssh/ssh_host_*
moxa@moxa-tbzkb1090923:~$ sudo dpkg-reconfigure openssh-server
moxa@moxa-tbzkb1090923:~$ sudo /etc/init.d/ssh restart
```

Select "**keep the local version currently installed**" following is prompt during rekey process:



For more information about SSH, refer to the following link:
https://wiki.debian.org/SSH

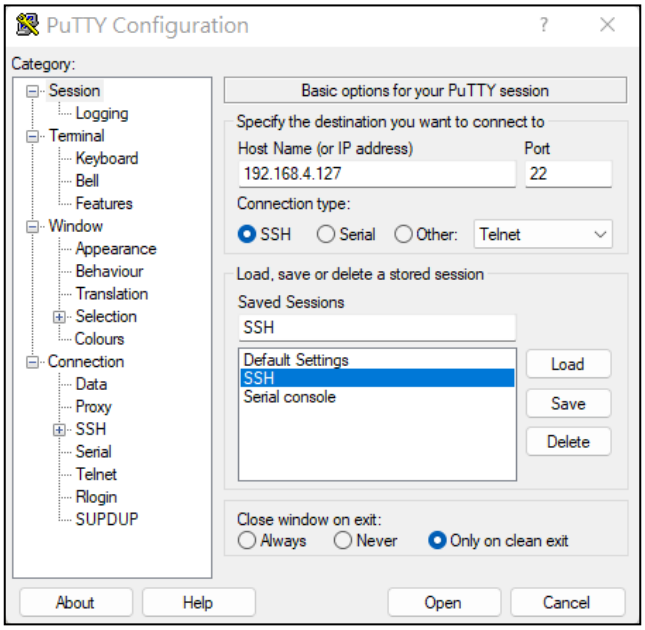
Windows Users

NOTE

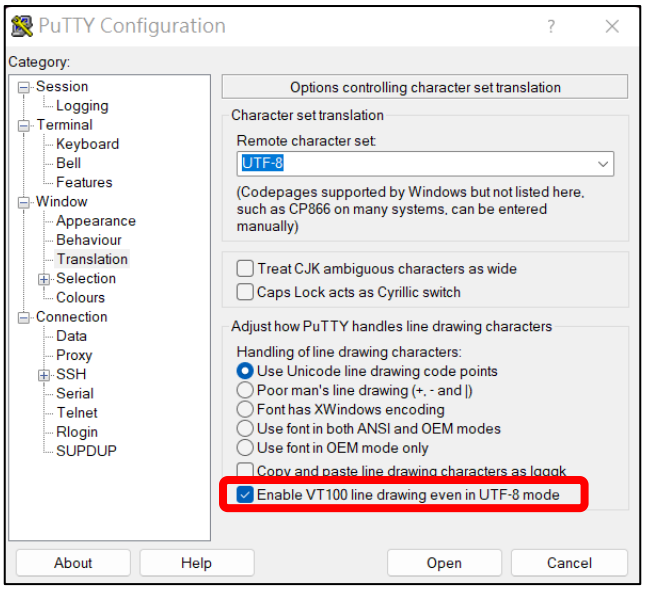
These steps apply to the Windows PC you are using to connect to the V2406C computer. Do NOT apply these steps to the V2406C computer itself.

Take the following steps from your Windows PC.

Click on the link http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html to download PuTTY (free software) to set up an SSH console for the V2406C computer in a Windows environment. The following figure shows a simple example of the configuration that is required.



Enable **VT100 line drawing** option for the MCM GUI configurator to show correctly.



User Account Management

Default User Account and Password Policy

The default login username and password are both **moxa** for the first-time login. You will be prompted to set a new password before you can continue to login.

Default Username: moxa
Default Password: moxa

New password strength Requirement:

- At least 8 characters in length
- Dictionary checking is enabled to prevent the use of common passwords

To modify the password strength policy, edit the **/etc/security/pwquality.conf.d/00-moxa-standard-pwquality.conf** file to configure the policy.

NOTE

Click the following link for more information on the password strength configuration.
https://manpages.debian.org/bullseye/libpwquality-common/pwquality.conf.5.en.html

Creating and Deleting User Accounts

You can use the **useradd** and **userdel** commands to create and delete user accounts. Be sure to reference the main page of these commands to set relevant access privileges for the account. Following example shows how to create a **test1** user in the **sudo** group whose default login shell is **bash** and has home directory at **/home/test1**:

```
moxa@ moxa-tbzkb1090923:~# sudo useradd -m -G sudo -s /bin/bash test1
```

To change the password for test1, use the **passwd** option along with the new password. Retype the password to confirm the change.

```
moxa@moxa-tbzkb1090923:~# sudo passwd test1
New password:
Retype new password:
passwd: password updated successfully
```

To delete the user **test1**, use the **userdel** command.

```
moxa@ moxa-tbzkb1090923:# sudo userdel test1
```

Modifying User Accounts

You can use the **usermod** commands to create and modify the user account settings. Some examples of commonly used settings are listed here, including adding a user to a group, locking an account, activating an account and setting the password expiration date for the account.

Adding a user **test1** to the user group **Moxa**.

```
moxa@ moxa-tbzkb1090923:# sudo usermod -a -G Moxa test1
```

Disabling or locking the user account **test1**.

```
moxa@ moxa-tbzkb1090923:# sudo usermod -L test1
```

Activating the user account **test1**.

```
moxa@ moxa-tbzkb1090923:# sudo usermod -U test1
```

Set a password expire date of 2023-11-01 for the user account **test1**.

```
moxa@ moxa-tbzkb1090923:# sudo usermod -e 2023-11-01 test1
```

NOTE

For the complete usage guidelines of the **usermod** commands, see https://linux.die.net/man/8/usermod.

Changing the Password

You can use the **passwd** command to change the password of a user account. Changing the password will not have any impact on other functionalities.

An example of refreshing the password for user account **test1**.

```
moxa@ moxa-tbzkb1090923:# sudo passwd test1
New password:
Retype new password:
passwd: password updated successfully
```

Installing a USB Storage Device

This system doesn't support automounting of USB storage drives for security reasons. If you want to manually mount an USB storage drive or configure automounting, refer to Storage and Partition.

Shutting Down the Device

To shut down the computer, first disconnect the power source. When the computer is powered off, main components such as the CPU, RAM, and storage devices are powered off, although an internal clock may retain battery power.

You can use the Linux command **shutdown** to close all software running on the device and halt the system. However, main components such as the CPU, RAM, and storage devices will continue to be powered after you run this command.

```
moxa@moxa-tbzkb1090923: ~# sudo shutdown -h now
```

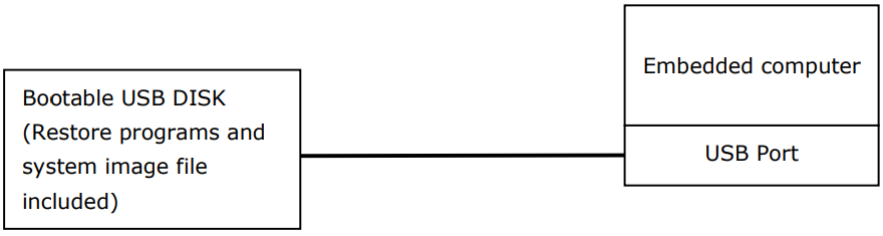
Restoring Moxa Industrial Linux on the System

Restoring Environment

The restoring environment includes the V2406C embedded computer and a bootable USB storage drive that contains the restoration programs and a system image file.

Hardware

The hardware used includes a PC, a V2406C computer, and a USB storage drive with the restore programs



Restoring the System From a USB Storage Drive

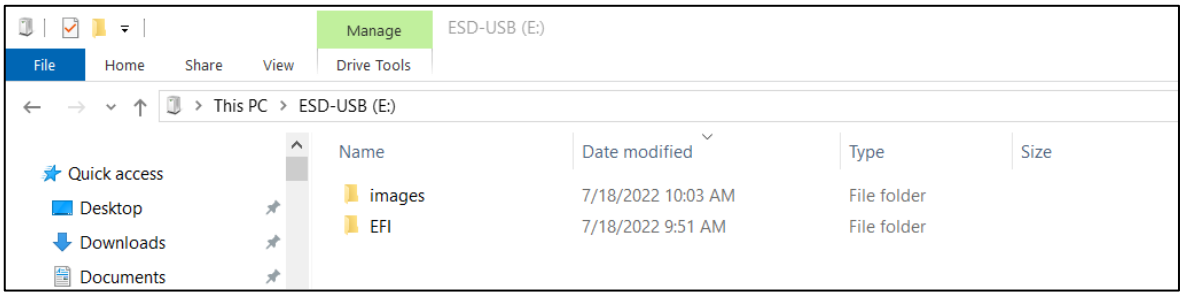
Step 1: Prepare your USB restoration drive

1. Prepare a single-partition USB storage drive with FAT32 filesystem and at least 2 GB free space.
2. Download the V2406C OS image zip file from V2406C product page.
3. Extract the **EFI.zip** file in **MIL_SecureImageRestoreTool.zip** to the USB storage drive.
4. Create a folder called "images".
5. Store the OS image file and its SHA512 checksum under the "images" folder.

Here are some examples of the image file and checksum file names:

- FWR_V2406C-WL_V1.0_Build_21052718_ImageBuild_210603_045322.img
- FWR_V2406C-WL_V1.0_Build_21052718_ImageBuild_210603_045322.img.sha512sum.bin.signed

The structure of the main folder in the restoration USB storage drive should be as follows:



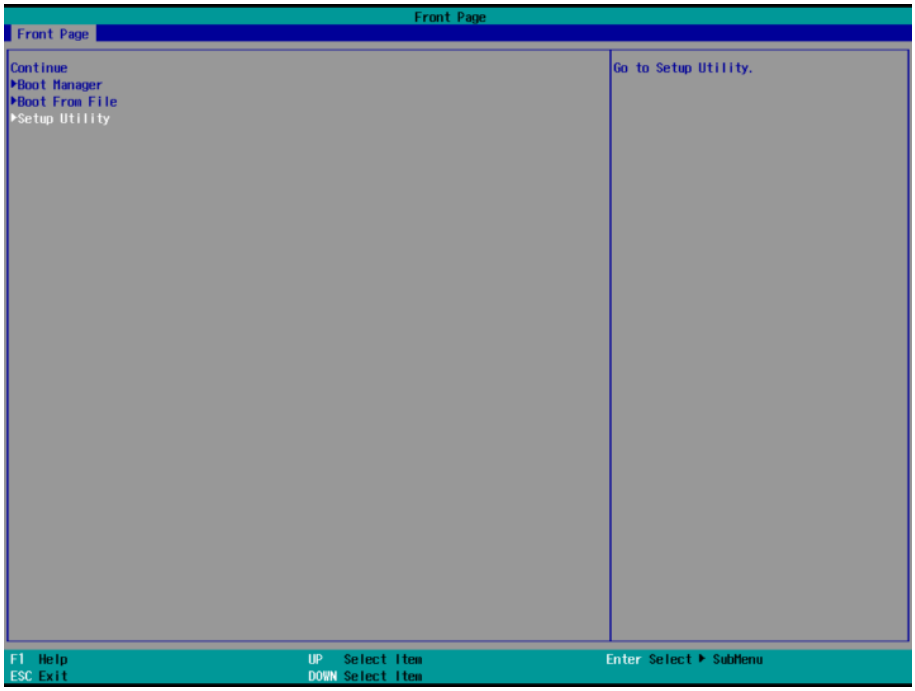
Here is an example for the contents of the "images" folder.

Your restoration USB storage drive is now ready.

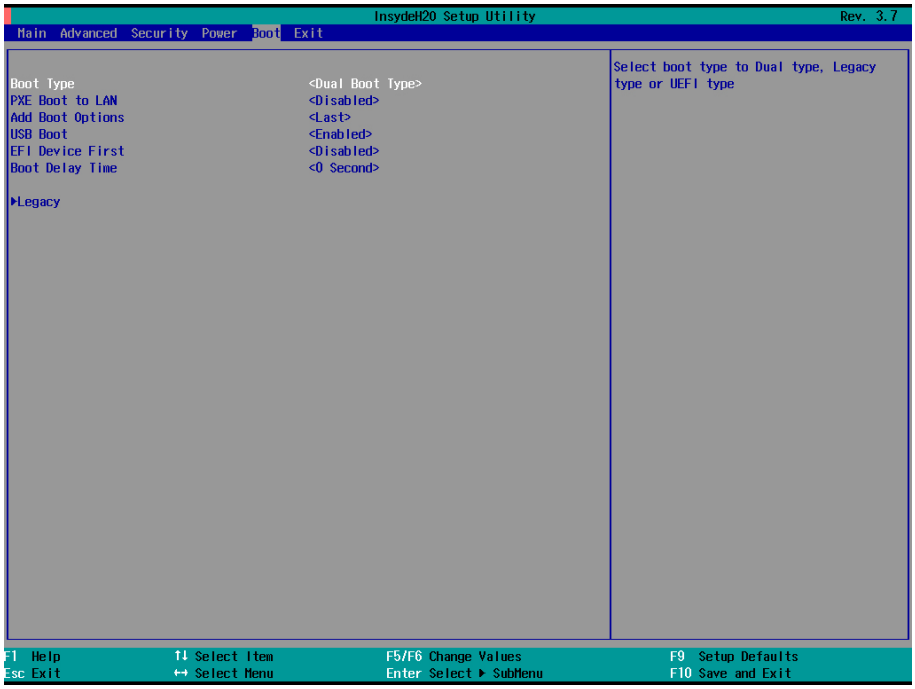
Step 2: Change the BIOS settings

You will need to change the BIOS settings to boot from the USB storage drive.

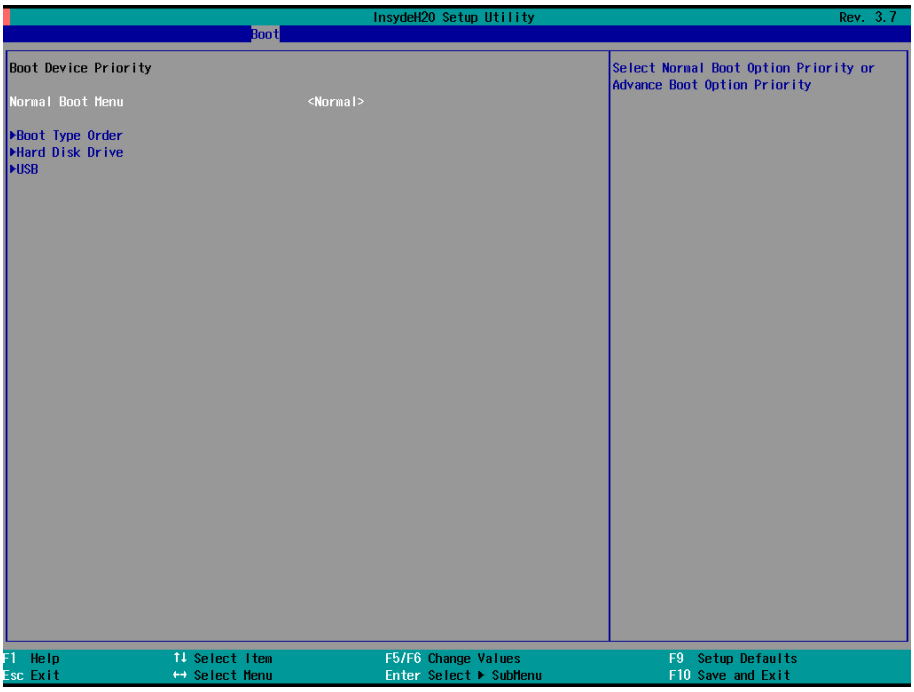
1. Turn on the computer and press **F2.** Select **Setup Utility** in the following screen.



2. Select **Boot** and then select UEFI **Boot Type**. Press **Enter** to continue.

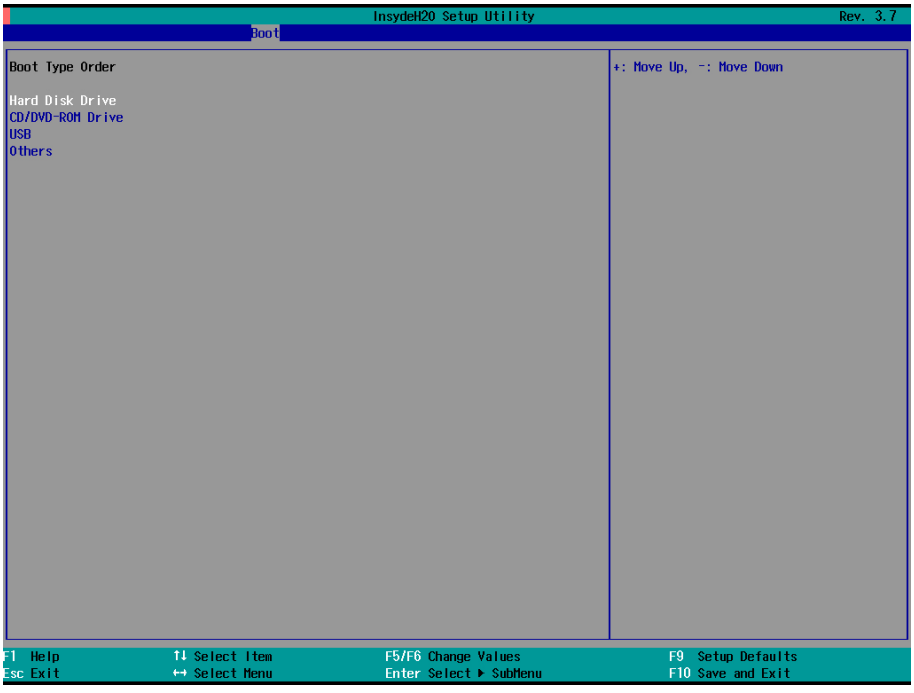


3. Select **Boot Type Order**.



4. Select the USB storage drive and then press "+" to move it to the first boot device position.

> **WARNING**
>
> Setting an incorrect boot priority will lead to restore or boot failure.



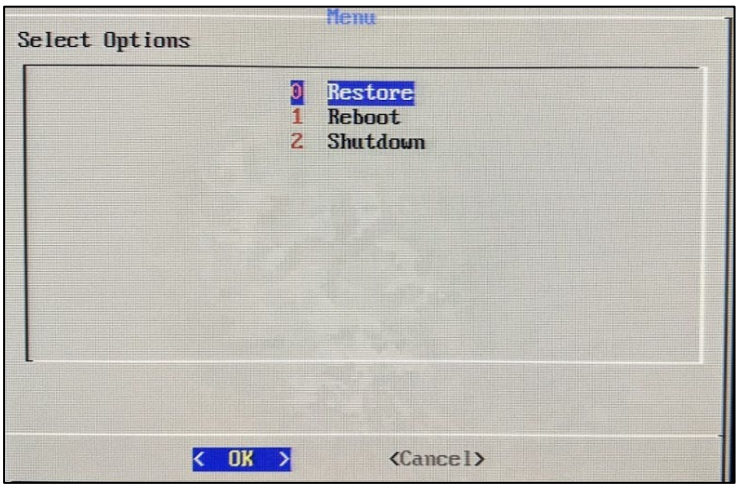
5. Press **F10** and then press **Enter** to save and exit the BIOS setup.
6. Insert the USB storage drive and then reboot the computer.
7. Press F2 to enter the BIOS setting.
8. Select the **Boot Manager**.
9. Select EFI **USB device.**

The system will boot using the restore utility on the USB storage drive.

Step 3: Restore the system from the USB storage drive

Connect the USB storage drive to any of the V2406C computer's USB ports and then reboot the computer. The system will boot from the USB storage drive containing the restoration utility.

1. Select the **Restore** option.



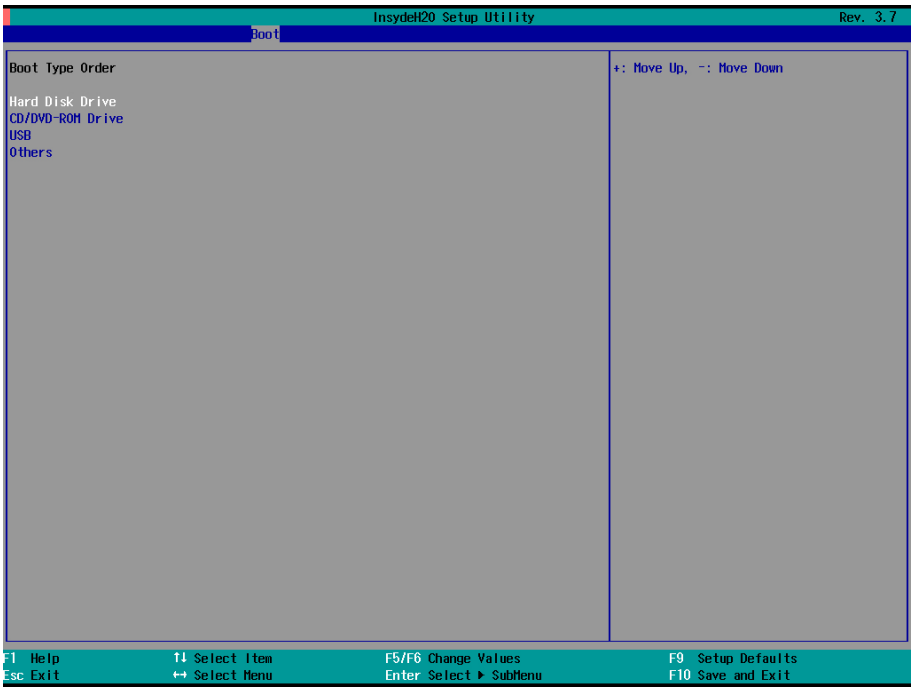
2. Select **OK** and wait for the image restoration process to finish.

   After the process has finished, you can select to **Reboot** and remove the USB storage drive after the computer has been powered off.

Step 4: Change the BIOS Settings to boot from the original disk

Now, you will need to change the boot priority so that the system can boot from the original disk. As the system reboots, press **F2** to enter the BIOS setup menu.

1. Select **Hard Disk Drive,** press + to move the selection to the first boot device position, and press **Enter.**
   Ensure that the hard disk drive has the first boot priority.



2. Press **F10** and then press **Enter** to save and exit BIOS settings.

Step 5: Reboot the Computer

You need to wait about 10 to 15 minutes for the system to restart, since the system configuration files will be initiated while booting up for the first time. **Do not turn off the computer or shut down the computer** while the system is restarting; otherwise, the IIS service will be terminated. When the operating system has successfully launched, you will need to restart your computer so that the new settings can be activated.

Updating Moxa Industrial Linux

Querying the System Image Version

Use the **mx-ver** command to check the system **image version** on your V2406C computer.

```
moxa@moxa-tbzkb1090923:# mx-ver
V2406C-WL7-CT-T MIL2 version 1.1 Build 22062013
```

Updating Moxa Industrial Linux Using SecureApt

The V2406C Series WL computers support **SecureApt**, which uses a GPG public key system to ensure the integrity and authenticity of patches are validated before download, and x.509 certification authentication for secure transmission via HTTPS. The private key pair of the GPG key for the Moxa APT repository is stored in an on-premises Sign Server, accessible only by authorized Moxa personnel.

For instructions on updating your V2406C computer using APT (Advanced Packaging Tools), see How to Keep Moxa IIoT Gateway Software Up-to-date.

NOTE

For information on how SecureApt works, see https://wiki.debian.org/SecureApt.

Failback for Updates

We strongly recommend enabling the failback function before performing an update. Refer to failback feature on the Moxa System Manager (MSM) for details.

3. Device Configuration

In this chapter, we describe how to configure the basic settings of the V2406C, including localizing the computer, audio re-tasking, and HDD/SSD disk hot-swap.

Localizing Your V2406C Computer

Adjusting the System Time

The V2406C computer has two time settings. One is the system time, and the other is the RTC (Real Time Clock) time kept by the V2406C's hardware.

Adjusting the Time Manually

Use the **date** command to query the current system time or set a new system time. Use the **hwclock** command to query the current RTC time or set a new RTC time.

Use the **date MMDDhhmmYYYY** command to set the system time:

MM = Month
DD = Date
hhmm = Hour and minute
YYYY = Year

```
moxa@moxa-tbzkb1090923:# sudo date 102900282021
Fri 29 Oct 2021 12:28:00 AM GMT
```

Use the following command to set the RTC time to system time:

```
moxa@moxa-tbzkb1090923:# sudo date
Wed Mar 6 19:33:51 CST 2019
moxa@moxa-tbzkb1090923:# sudo hwclock
2019-03-06 19:33:57.482903+0800
moxa@moxa-tbzkb1090923:# sudo date 030619352019.30
Wed Mar 6 19:35:30 CST 2019
moxa@moxa-tbzkb1090923:# sudo hwclock -w
moxa@moxa-tbzkb1090923:# sudo date; hwclock
Wed Mar 6 19:35:34 CST 2019
2019-03-06 19:35:34.061120+0800
```

NOTE

Click the following links for more information on date and time:
https://www.debian.org/doc/manuals/system-administrator/ch-sysadmin-time.html
https://wiki.debian.org/DateTime

NTP Client or system-timesyncd Service

The V2406C can use a NTP (Network Time Protocol) client to initialize a time request to a remote NTP server. Use the **ntpdate** command to update the system time. Make sure that the device is connected to an Ethernet network before you run the **ntpdate** command.

```
# ntpdate time.stdtime.gov.tw
# hwclock –w
```

For more information about NTP and NTP server addresses, visit http://www.ntp.org

```
moxa@moxa-tbzkb1090923:# sudo ntpdate time.stdtime.gov.tw
6 Mar 19:36:21 ntpdate[1172]: adjust time server 118.163.81.61 offset -0.000877
sec
moxa@moxa-tbzkb1090923:# sudo hwclock -w
moxa@moxa-tbzkb1090923:# sudo date; hwclock
Wed Mar 6 19:36:50 CST 2019
2019-03-06 19:36:50.154796+0800
```

The V2406C has a built-in system-timesyncd service that is used for Network Time Synchronization. This service is enabled by default.

```
root@Moxa:/home/moxa# systemctl status systemd-timesyncd
systemd-timesyncd.service - Network Time Synchronization
 Loaded: loaded (/lib/systemd/system/systemd-timesyncd.service; enabled; vendor
preset: enabled)
 Drop-In: /lib/systemd/system/systemd-timesyncd.service.d
  └─disable-with-time-daemon.conf
 Active: active (running) since Wed 2019-03-06 19:30:32 CST; 7min ago
 Docs: man:systemd-timesyncd.service(8)
Main PID: 274 (systemd-timesyn)
 Status: "Synchronized to time server 103.18.128.60:123
(2.debian.pool.ntp.org)."
 Tasks: 2 (limit: 4915)
 CGroup: /system.slice/systemd-timesyncd.service
  └─274 /lib/systemd/systemd-timesyncd

Mar 06 19:30:31 Moxa systemd[1]: Starting Network Time Synchronization...
Mar 06 19:30:32 Moxa systemd[1]: Started Network Time Synchronization.
Mar 06 19:31:02 Moxa systemd-timesyncd[274]: Synchronized to time server
103.18.128.60:123 (2.debian.pool.ntp.org).
```

ATTENTION

Before using the NTP client utility, check your IP address and network settings (gateway and DNS) to ensure that an Internet connection is available.

Setting the Time Zone

There are two ways to configure the V2406C's time zone. One is using the **TZ** variable. The other is using the **/etc/localtime** file.

Using the TZ Variable

The format of the TZ environment variable looks like this:

TZ=*<Value>HH[:MM[:SS]][daylight[HH[:MM[:SS]]][,start date[/starttime], enddate[/endtime]]]*

Here are some possible settings for the North American Eastern time zone:

1. **TZ=EST5EDT**
2. **TZ=EST0EDT**
3. **TZ=EST0**

In the first case, the reference time is GMT and the stored time values are correct worldwide. A simple change of the TZ variable can print the local time correctly in any time zone.

In the second case, the reference time is Eastern Standard Time and the only conversion performed is for Daylight Saving Time. Therefore, there is no need to adjust the hardware clock for Daylight Saving Time twice per year.

In the third case, the reference time is always the time reported. You can use this option if the hardware clock on your machine automatically adjusts for Daylight Saving Time or you would like to manually adjust the hardware time twice a year.

```
moxa@Moxa-tbzkb1090923:~$ TZ=EST5EDT
moxa@Moxa-tbzkb1090923:~$ export TZ
```

You must include the TZ setting in the **/etc/rc.local** file. The time zone setting will be activated when you restart the computer.

The following table lists other possible values for the TZ environment variable:

Hours From Greenwich Mean Time (GMT)	Value	Description
0	GMT	Greenwich Mean Time
+1	ECT	European Central Time
+2	EET	European Eastern Time
+2	ART	
+3	EAT	Saudi Arabia
+3.5	MET	Iran
+4	NET	
+5	PLT	West Asia
+5.5	IST	India
+6	BST	Central Asia
+7	VST	Bangkok
+8	CTT	China
+9	JST	Japan
+9.5	ACT	Central Australia
+10	AET	Eastern Australia
+11	SST	Central Pacific
+12	NST	New Zealand
-11	MIT	Samoa
-10	HST	Hawaii
-9	AST	Alaska
-8	PST	Pacific Standard Time
-7	PNT	Arizona
-7	MST	Mountain Standard Time
-6	CST	Central Standard Time
-5	EST	Eastern Standard Time
-5	IET	Indiana East
-4	PRT	Atlantic Standard Time
-3.5	CNT	Newfoundland
-3	AGT	Eastern South America
-3	BET	Eastern South America
-1	CAT	Azores

Using the localtime File

The local time zone is stored in the **/etc/localtime** and is used by GNU Library for C (glibc) if no value has been set for the TZ environment variable. This file is either a copy of the **/usr/share/zoneinfo/** file or a symbolic link to it. The V2406C does not provide **/usr/share/zoneinfo/** files. You should find a suitable time zone information file and write over the original local time file in the V2406C.

Device Suspend

The V2406C supports ACPI S3 (suspend to RAM) function. To use this function, you should enable option S3 in the BIOS and then use the **systemctl suspend** command as follows:

```
root@Moxa:/home/moxa# systemctl suspend
```

When the device suspend function is in effect, press the power button to wake up the computer.

If you login in as administrator (root) in X windows, you can use **System** (**Shutdown** (**Suspend** to suspend your device. Note that this option is not available to non-root users.

Some components on Moxa's embedded computers may need to be reset after resuming. You can write a simple script and save it in the **/usr/lib/pm-utils/sleep.d/** directory to complete this procedure. For example, you can create the following script for your application.

```
#!/bin/sh

case "$1" in
        hibernate|suspend)
                    echo "close AP and tty ports which are opened"
                echo "operations before serial ports suspend"
                ;;
        thaw|resume)
                    echo "restart AP"
                echo "operations after serial ports resume"
                ;;
        *) exit $NA
                ;;
esac
```

NOTE

For more information, refer to the systemd suspend service man page at:
https://www.freedesktop.org/software/systemd/man/systemd-suspend.service.html

Wake on LAN

The V2406C supports wake on LAN (WoL), a feature used to wake up a device from suspend (S3) and shutdown (S5). To check the WOL support on an Ethernet port x, run the **ethtool enp***x* command, where **enp***x* is the network interface name.

```
root@Moxa:/home/moxa# apt update && apt install ethtool
root@Moxa:/home/moxa# ethtool enp0s31f6
Settings for enp0s31f6:
        Supported ports: [ TP ]
        Supported link modes:   10baseT/Half 10baseT/Full
                                100baseT/Half 100baseT/Full
                                1000baseT/Full
        Supported pause frame use: No
        Supports auto-negotiation: Yes
        Advertised link modes:  10baseT/Half 10baseT/Full
                                100baseT/Half 100baseT/Full
                                1000baseT/Full
        Advertised pause frame use: No
        Advertised auto-negotiation: Yes
        Speed: 1000Mb/s
        Duplex: Full
        Port: Twisted Pair
        PHYAD: 1
        Transceiver: internal
        Auto-negotiation: on
        MDI-X: on (auto)
        Supports Wake-on: pumbg
        Wake-on: g
        Current message level: 0x00000007 (7)
                               drv probe link
        Link detected: yes
```

The default WoL option is **g** (wake on magic packet). If the WoL setting is not g, we suggest that you modify the setting with the **ethtool -s enpx wol g** command.

The following example illustrates how to wake up a computer from suspend (S3):

1. On Moxa's embedded computer:
   - Enable the S3 option in the BIOS.
   - Get the MAC address by issuing the **ifconfig eth*x*** command (***x*** is the port number).
   - Suspend to RAM using the **pm-suspend --quirk-s3-bios** command.
2. A remote computer:

   Issue the **etherwake -b <mac-address-of-the-embedded-computer>** command to wake up the computer as per the following example:

```
etherwake -b 00:90:e8:00:d7:38
```

The following example illustrates how to wake up a computer from shutdown (S5):

1. Moxa's embedded computer:

   Shut down the computer using the **shutdown -h now** command.
2. A remote computer:

   Issue the **etherwake -b <mac-address-of-the-embedded-computer>** command to wake up the computer as per the following example:

```
etherwake -b 00:90:e8:00:d7:38
```

Renaming the Network Interfaces

You can use the udev rules to rename the network interfaces. For example, if you would like to rename them to the classic "ethX" naming, you can create a rules file named **/etc/udev/rules.d/70-persistent-net.rules**, and edit the content of the file as given below:

Renaming the interfaces using the MAC address (example)

```
SUBSYSTEM=="net", ACTION=="add", ATTR{address}=="00:90:e8:00:d7:38",
NAME="eth0"
SUBSYSTEM=="net", ACTION=="add", ATTR{address}=="00:90:e8:00:d7:58",
NAME="eth1"
```

Audio Re-tasking Utility

```
Usage:
        mx-audio-retask [Options]

Operations:
        -v,--version
                Show utility version
        -p,--port <port_index>
                Select Jack Index (e.g. 1, 2, ...)
        -m,--mode <mode_name>
                Switch Jack Mode

Mode List:
        LINE_OUT
        SPEAKER
        HEADPHONE
        LINE_IN
        MICROPHONE

Example:
        Get audio jack 1 mode
        # mx-audio-retask -p 1
        Switch audio jack 2 to HEADPHONE mode
        # mx-audio-retask -p 2 -m HEADPHONE
```

The following is an example for **mx-audio-retask:**

```
$ mx-audio-retask -p 1 -m HEADPHONE
Set 'Port 1' as Mode 'HEADPHONE' is succeeded.
Write audio fw file is succeeded.
Please reboot to finish audio retask setup

# after reboot
$ mx-audio-retask -p 1
Pin 0x14 (Black Headphone, Front side): present = No

$ mx-audio-retask -p 2 -m LINE_IN
Set 'Port 2' as Mode 'LINE_IN' is succeeded.
Write audio fw file is succeeded.
Please reboot to finish audio retask setup

# after reboot
$ mx-audio-retask -p 2
Pin 0x18 (Black Line In, Front side): present = No

# if port is not specific, default port is 1
$ mx-audio-retask -m LINE_OUT
Set 'Port 1' as Mode 'LINE_OUT' is succeeded.
Write audio fw file is succeeded.
Please reboot to finish audio retask setup
```

hda-jack-retask Utility

The hda-jack-retask utility is a user-friendly GUI program to manipulate the HD-audio pin control for jack re-tasking. If you have a problem about the jack assignment, try this program and check whether you can get useful results.

```
# install KDE
apt install aptitude tasksel
aptitude install ~t^desktop$ ~t^kde-desktop$

# install alsa-tools-gui package
root@Moxa:/home/moxa# apt install alsa-tools-gui

# execute hdajackretask GUI interface
root@Moxa:/home/moxa# hdajackretask
```

HDD/SSD Disk Hotswap Daemon

Hot-swappable SSD/HDD slot for expansion storage. V2406C has two hot-swappable 2.5” SSD/HDD slot, and two hot-swap buttons to control hot swap and show SATA status (control by mx_hotswapd.service).

```
# when SSD/HDDs were inserted to two slots (for example: Disk 1)
# the terminals will show message to info user.

mxhtspd: Disk slot 1 was detected.

root@Moxa:/home/moxa# mount | grep "/media"
/dev/sdb1 on /media/disk1p1 type ext4 (rw,relatime,data=ordered)
/dev/sdc1 on /media/disk2p1 type ext4 (rw,relatime,data=ordered)

# press Disk 1/2 button over 3 seconds
# the terminals will show message to info user to remove disk.

mxhtspd: Remove disk 1 is done.

root@Moxa:/home/moxa# mount | grep "/media"
```

```
(show nothing)

# the udev rules auto-mounts SSD/HDD as /media/disk1p* and /media/disk1p*
root@Moxa:/home/moxa# mount | grep "/media"
/dev/sdb1 on /media/disk1p1 type ext4 (rw,relatime,data=ordered)
/dev/sdc1 on /media/disk2p1 type ext4 (rw,relatime,data=ordered)
```

4. Using and Managing Computer Interfaces

In this chapter, we include more information on the V2406C computer's interfaces, such as the serial interface, storage and the wireless module.

Moxa Computer Interface Manager (MCIM)

On many occasions, there isn't one standard method to access and configure specific interfaces on Moxa x86 computers because the hardware varies. Hence, programing across different Moxa x86 computer models can be difficult and time consuming. The goal of MCIM is to provide a unified software interface to access and configure non-standard computer interfaces. For example, MCIM can change the serial port interface mode (e.g., RS-232,RS-485-2W,RS-422). However, configuring the serial port baud rate is not possible in MCIM because Linux provides a standard method to set the baud rate

MCIM is a command-line interface (CLI) Moxa utility designed to access and manage Moxa x86 computers' interfaces. Use the **`# mx-interface-mgmt`** command to display the menu page.

Configuring the Log Level

To set the log level of MCIM, edit the configuration file **`/etc/moxa/MoxaComputerInterfaceManager/MoxaComputerInterfaceManager.conf`**

Key	Value	Description
LOG_LEVEL	debug/info/warn/error	The log-level settings for the logs generated by MCIM for debugging and troubleshooting. The default level is "info".

Device Information

Use **`# mx-interface-mgmt deviceinfo`** to get the information of your V2406C Computer.

Command and Usage	Description
deviceinfo	Show the following information: • Serial number (S/N) • Model name • SECUREBOOT (Enabled / Disabled)

LED Indicators

Use **`# mx-interface-mgmt led`** command to get the list of controllable on the computer.

The MCIM commands for LED indicator control are listed in the following table:

Command and Usage	Description
led	Shows the following information for all controllable LEDs: • Name (as labeled on the device) • Model series of the device • Color of the LED • Description of the LED • LED state (on/off/heartbeat)
led <led_name>	Show the above information of a **specified** LED.
led <name> get_state	Get the current state (on/off/heartbeat) of a **specified** LED.
led <name> set_state <led_state>	Set the state of a **specified** LED. Value of <state> can be **on**, **off**, or **heartbeat.**

ATTENTION

V2406C does not have any controllable LED, so it is expected that **`mx-interface-mgmt led`** returns no result.

Storage and Partitions

Use **`# mx-interface-mgmt disk`** and **`# mx-interface-mgmt partition`** commands for managing the storage device and partitions.

Command and Usage	Description
disk	Show the following information of **all** embedded and external storage: • Name (e.g., mSATA, USB) • Device node (e.g., /dev/sda) • System disk (Y/N), if 'Y', it is the disk with MIL 2 installed • Number of partitions • Automount enabled/disabled (Y/N)
disk <disk_name>	Show the following information of a **specified** storage device: • Name (e.g., mSATA, USB) • Device node (e.g., /dev/sda) • System disk (Y/N), if 'Y', it is the disk with MIL installed • Partition name and device node • Automount enabled/disabled (Y/N)
disk <disk_name> set_automount <value>	Set a **specified** external storage device (e.g., USB) to automount when attach to device; <value> is true/false.
partition	Show the following information of partitions on **all** internal and external storage: • Name (e.g., mSATA_p1, mSATA_p2, USB_p1) • Device node (e.g., /dev/sda1) • Partition mounted (Y/N) • Partition mount point (e.g., /boot_device/p1) • Filesystem(e.g., ext4, FAT32)
partition <partition_name>	Show the above information of a **specified** partition.
partition <partition_name> mount	Mount a **specified** partition.
partition <partition_name> unmount	Unmount a **specified** partition.

For example, to query the available storage device and set USB storage drive to automount, use the following command:

```
moxa@moxa-tbzkb1090923:~$ mx-interface-mgmt disk

NAME    DEVICE       SYSTEM_DISK  NUMBER_OF_PARTITIONS  AUTOMOUNT_SETTING
USB     /dev/sdb     N            1                     false
mSATA   /dev/sda     Y            4                     false

moxa@moxa-tbzkb1090923:~$ sudo mx-interface-mgmt disk USB set_automount true
```

To query the available partitions and mount the partition 1 of the USB storage drive, use the following command:

```
moxa@moxa-tbzkb1090923:~# mx-interface-mgmt partition
NAME       DEVICE          IS_MOUNTED    FS_TYPE  MOUNTPOINT
mSATA_p1   /dev/sda1       Y             vfat     /boot_device/p1
mSATA_p2   /dev/sda2       Y             ext4     /boot_device/p2
mSATA_p3   /dev/sda3       Y             ext4     /boot_device/p3
mSATA_p4   /dev/sda4       Y             ext4     /boot_device/p4
USB_p1     /dev/sdb1       N             N/A       N/A

moxa@moxa-tbzkb1090923:~# sudo mx-interface-mgmt partition USB_p1 mount
moxa@moxa-tbzkb1090923:~$ mx-interface-mgmt partition USB_p1
NAME=USB_p1
DEVICE=/dev/sdb1
IS_MOUNTED=Y
```

```
FS_TYPE=vfat
MOUNTPOINT=/media/USB_p1
```

WARNING

Setting external storage device to automount may expose your device to cybersecurity risks. It is highly recommended that you do not automount storage device unless your device is placed is in a highly secure environment.

Serial Port

The serial ports support RS-232, RS-422, and RS-485 2-wire operation modes with flexible baud rate settings. The default operation mode is RS-232.

Use the **`# mx-interface-mgmt serialport`** command to query and configure the operation mode for a serial port.

Command and Usage	Description
serialport	Shows the following information for **all** serial ports on the device: • Name (as labeled on device) • Device node (e.g., /dev/ttyM0)
serialport <serialport_name>	Shows the following information for a **specified** serial port: • Name (as labeled on device) • Device node (e.g., /dev/ttyM0) • Supported operation modes (e.g., RS-232, RS-485-2W, RS-422) • Supported baudrates • Current operation mode configured
serialport < serialport_name> get_interface	Gets the current operation mode for a **specified** serial port.
serialport <serialport_name> set_interface <serial_interface>	Sets the operation mode for a **specified** serial port.

Changing the Serial Port Operation Mode

For example, to change the mode of COM1 serial port from default RS-232 mode to the RS-422 mode, use the following command:

```
moxa@moxa-tbzkb1090923:~# mx-interface-mgmt serialport
NAME   DEVICE
P1     /dev/ttyM0
P2     /dev/ttyM1
P3     /dev/ttyM2
P4     /dev/ttyM3

moxa@moxa-tbzkb1090923:~# mx-interface-mgmt serialport P1

NAME=P1
DEVICE=/dev/ttyM0
SUPPORTED_INTERFACES=RS-232,RS-485-2W,RS-422
SUPPORTED_BAUDRATES=50,75,110,134,150,300,600,1200,1800,2000,2400,3600,4800,720
0,9600,19200,38400,57600,115200
INTERFACE=RS-232

moxa@moxa-tbzkb1090923:~# sudo mx-interface-mgmt serialport P1 set_interface
RS-422
moxa@moxa-tbzkb1090923:~# mx-interface-mgmt serialport P1 get_interface
RS-422
root@moxa-tbzkb1090923:~#
```

Changing Other Serial Interface Settings With STTY

The **stty** command is used to view and modify the serial terminal settings.

Displaying All Settings

Use the following example to display all serial terminal settings of COM1 serial port.

```
moxa@moxa-tbzkb1090923:/# mx-interface-mgmt serialport
NAME  DEVICE
P1    /dev/ttyM0
P2    /dev/ttyM1
P3    /dev/ttyM2
P4    /dev/ttyM3


moxa@moxa-tbzkb1090923:/#  sudo stty -a -F /dev/ttyM0

speed 9600 baud; rows 0; columns 0; line = 0;
intr = ^C; quit = ^\; erase = ^?; kill = ^U; eof = ^D; eol = <undef>; eol2 =
<undef>; swtch = <undef>; start = ^Q; stop = ^S; susp = ^Z; rprnt = ^R; werase
= ^W; lnext = ^V; discard = ^O; min = 1; time = 0;
-parenb -parodd -cmspar cs8 hupcl -cstopb cread clocal -crtscts
-ignbrk -brkint -ignpar -parmrk -inpck -istrip -inlcr -igncr icrnl ixon -ixoff
-iuclc -ixany -imaxbel -iutf8
opost -olcuc -ocrnl onlcr -onocr -onlret -ofill -ofdel nl0 cr0 tab0 bs0 vt0 ff0
isig icanon iexten echo echoe echok -echonl -noflsh -xcase -tostop -echoprt
echoctl echoke -flusho -extproc
```

Configuring Serial Settings

The following example changes the baud rate to 115200.

```
moxa@moxa-tbzkb1090923:~$ sudo stty 115200 -F /dev/ttyM0
```

Check the settings to confirm that the baud rate has changed to 115200.

```
moxa@moxa-tbzkb1090923:~$ sudo stty -a -F /dev/ttyM0

speed 115200 baud; rows 0; columns 0; line = 0;
intr = ^C; quit = ^\; erase = ^?; kill = ^U; eof = ^D; eol = <undef>; eol2 =
<undef>; swtch = <undef>; start = ^Q; stop = ^S; susp = ^Z; rprnt = ^R; werase
= ^W; lnext = ^V; discard = ^O; min = 1; time = 0;
-parenb -parodd -cmspar cs8 hupcl -cstopb cread clocal -crtscts
-ignbrk -brkint -ignpar -parmrk -inpck -istrip -inlcr -igncr icrnl ixon -ixoff
-iuclc -ixany -imaxbel -iutf8
opost -olcuc -ocrnl onlcr -onocr -onlret -ofill -ofdel nl0 cr0 tab0 bs0 vt0 ff0
isig icanon iexten echo echoe echok -echonl -noflsh -xcase -tostop -echoprt
echoctl echoke -flusho -extproc
```

NOTE

Detailed information on the stty utility is available at the following link:
http://www.gnu.org/software/coreutils/manual/coreutils.html

Ethernet Interface

Use **# mx-interface-mgmt ethernet** command to display information on the Ethernet ports.

Command and Usage	Description
ethernet	Show the following information of **all** ethernet ports on the device: • Name (as labeled on device) • Network interface name (eth0, eth1, etc.)
ethernet <ethernet_name>	Show the above information of a **specified** ethernet port.

```
moxa@moxa-tbzkb1090923:~$ mx-interface-mgmt ethernet
NAME   DEVICE_NAME
LAN1   enp0s31f6
LAN2   enp2s0
moxa@moxa-tbzkb1090923:~$ mx-interface-mgmt ethernet LAN1
NAME=LAN1
DEVICE_NAME=enp0s31f6
moxa@moxa-tbzkb1090923:~$
```

Digital IN/OUT (DIO) Interface

Use **# mx-interface-mgmt dio** to query and configure the state of each Digital in/out (DIO) interface, and also configure hook script.

Command and Usage	Description
dio	Show the following information of **all** DIO interfaces: • Name (as labeled on device) • State (high/low) • Event • Path of falling edge script • Path of rising edge script
dio <dio_name>	Show the above information of a **specified** DI or DO interface.
dio <dio_name> get_state	Get the current state (high/low) of a **specified** DI or DO interface.
dio <dio_name> set_state <dio_state>	Set the state (high/low) of a **specified** DO interface.
dio <dio_name> add_hook <edge> <path>	Add an edge script (rising/falling) from a **specified** path to an interface.
dio <dio_name> remove_hook <edge>	Remove the edge script (rising/falling) of an interface.

Buzzer

Use **# mx-interface-mgmt buzzer** to query and set the state of buzzer alarm of the V2406C computer

Command and Usage	Description
buzzer	Show the following information of **all** buzzers: • Name • State (on/off)
buzzer <buzzer_name>	Show the following information of a **specified** buzzer: • Name • State (on/off)
buzzer <buzzer_name> get_state	Get the current state (on/off) of a **specified** buzzer.
buzzer <buzzer_name> set_state	Set the state (on/off) of a **specified** buzzer.

```
root@moxa-tbzkb1090923:~# mx-interface-mgmt buzzer
NAME     STATE
Buzzer1  off
root@moxa-tbzkb1090923:~#
```

Cellular Module Interface

Use **# mx-interface-mgmt cellular** command to query and manage cellular module(s)

Command and Usage	Description
cellular	Show the following information for **all** cellular modules: • Name (e.g., Cellular1) • Network interface name (wwan0, wwan1, etc.) • Cellular module detected (true/false)
cellular <name>	Show the detail information of a **specified** cellular module: • Name (e.g., Cellular1) • Network interface name (wwan0, wwan1) • Cellular module detected (true/false) • QMI Port (e.g., /dev/cdc-wdm0) • AT Port (e.g., /dev/ttyUSB4) • GPS Port (e.g., /dev/ttyUSB3) if GPS is supported • Cellular module power status (on/off) • Number of available SIM slots on the device • The SIM slot # that is currently used by the cellular module *Note: SIM slot # correspond to the labeled slot # on the device.*
cellular <name> get_power	Get the cellular module power status (on/off).
cellular <name> set_power <power_state>	Set the cellular module power status (on/off). *Note: Module will power-on when device reboot.*
cellular <name> get_sim_slot	Get the SIM slot # that is currently used by the cellular module.
cellular <name> set_ sim_slot <sim_slot>	Set the SIM slot # used by cellular module. *Note: SIM slot # will be set to default (slot 1) when the device reboot.*

NOTE

Some cellular modules may not support power on/off or SIM slot control.

An example of using MCIM to query the cellular module information and changing the SIM slot # use by the module from slot 1 to 2 is given below:

```
moxa@moxa-tbzkb1090923:~$ mx-interface-mgmt cellular
NAME         DEVICE_NAME     DEVICE_DETECTED
Cellular1    wwp0s20f0u6i2   true
moxa@moxa-tbzkb1090923:~$ mx-interface-mgmt cellular Cellular1

NAME=Cellular1
DEVICE_NAME=wwp0s20f0u6i2
QMI_PORT=/dev/cdc-wdm0
AT_PORT=/dev/ttyUSB2
GPS_PORT=/dev/ttyUSB1
DEVICE_DETECTED=true
POWER=on
SIM_SLOT_NUMBER=2
SIM_SLOT=1

moxa@moxa-tbzkb1090923:~$ mx-interface-mgmt cellular Cellular1 set_sim_slot 2
moxa@moxa-tbzkb1090923:~$ mx-interface-mgmt cellular Cellular1 get_sim_slot
2
```

NOTE

SIM_Slot=1 for Cellular1 means the SIM slot labeled as “A1” on V2406C is the active slot, where SIM_Slot=2 refers to “A2”

Wi-Fi Module Interface

Use the **# mx-interface-mgmt wifi** command to query and manage Wi-Fi modules.

Command and Usage	Description
wifi	Shows the following information of **all** Wi-Fi modules: • Name (e.g., WiFi1) • Network interface name (wlan0, wlan1) • Wi-Fi module detected (true/false)
wifi <name>	Shows the above information for a **specified** Wi-Fi module.
wifi <name> get_power	Gets the Wi-Fi module power status (on/off).
wifi <name> set_power <power_state>	Set the Wi-Fi module power status (on/off). *Note: The module will power-on when the device reboots.*

NOTE

Some Wi-Fi modules may not support power on/off control.

Socket Interface

Use the **# mx-interface-mgmt socket** command manage the Mini PCI-E sockets on the V2406C Computer

Command and Usage	Description
socket	List all the available sockets' name (e.g., Socket1, Socket2).
socket <socket_name>	Shows the following information for a **specified** Mini PCI-E socket: • Name (e.g., Socket1, Socket2) • Power status (on/off) • Number of available SIM slots if a cellular module is insert to this Mini PCI-E socket • Get the SIM slot # that is currently used by the cellular module on this Mini PCI-E socket *Note: SIM slot # correspond to the labeled slot # on the device.*
socket < socket_name> get_power	Gets the power status (on/off) for a **specified** Mini PCI-E socket.
socket <name> set_power <power_state>	Set the power status (on/off) for a **specified** Mini PCI-E socket. *Note: The socket will power-on when the device reboots.*

Configuring the Real COM Mode

You can use Moxa's NPort series serial device drivers to extend the number of serial interfaces (ports) on your V2406C computer. The NPort comes equipped with COM drivers that work with Windows systems and TTY drivers for Linux systems. The driver establishes a transparent connection between the host and serial device by mapping the IP Port of the NPort's serial port to a local COM/TTY port on the host computer.

Real COM Mode also supports up to 4 simultaneous connections, so that multiple hosts can collect data from the same serial device at the same time.

One of the major conveniences of using Real COM Mode is that Real COM Mode allows users to continue using RS-232/422/485 serial communications software that was written for pure serial communications applications. The driver intercepts data sent to the host's COM port, packs it into a TCP/IP packet, and then redirects it through the host's Ethernet card. At the other end of the connection, the NPort accepts the Ethernet frame, unpacks the TCP/IP packet, and then sends it transparently to the appropriate serial device attached to one of the NPort's serial ports.

The Real COM driver is installed on the V2406C computer by default. You will be able to view the driver related files in the **/usr/lib/npreal2/driver** folder.

> mxaddsvr (Add Server, mapping tty port) > mxdelsvr (Delete Server, unmapping tty port)

> mxloadsvr (Reload Server) > mxmknod (Create device node/tty port)

> mxrmnod (Remove device node/tty port)

> mxuninst (Remove tty port and driver files)

At this point, you will be ready to map the NPort serial port to the system **tty** port. For a list of supported NPort devices and their revision history, click https://www.moxa.com/en/support/search?psid=50278.

Mapping TTY Ports

Make sure that you set the operation mode of the desired NPort serial port to Real COM mode. After logging in as a super user, enter the directory /usr/lib/npreal2/driver and then execute mxaddsvr to map the target NPort serial port to the host tty ports. The syntax of **mxaddsvr** command is as follows:

mxaddsvr [NPort IP Address] [Total Ports] ([Data port] [Cmd port])

The **mxaddsvr** command performs the following actions:

1. Modifies the npreal2d.cf.
2. Creates tty ports in the /dev directory with major & minor number configured in npreal2d.cf.
3. Restarts the driver.

Mapping TTY Ports (automatic)

To map tty ports automatically, execute the **mxaddsvr** command with just the IP address and the number of ports, as shown in the following example:

```
# cd /usr/lib/npreal2/driver
# ./mxaddsvr 192.168.3.4 16
```

In this example, 16 tty ports will be added, all with IP 192.168.3.4 consisting of data ports from 950 to 965 and command ports from 966 to 981.

ATTENTION

You must reboot the system after mapping tty ports with **mxaddsvr**.

Mapping TTY Ports (manual)

To map tty ports manually, execute the **mxaddsvr** command and specify the data and command ports as shown in the following example:

```
# cd /usr/lib/npreal2/driver
# ./mxaddsvr 192.168.3.4 16 4001 966
```

In this example, 16 tty ports will be added, all with IP 192.168.3.4, with data ports from 4001 to 4016 and command ports from 966 to 981.

ATTENTION

You must reboot the system after mapping tty ports with **mxaddsvr**.

Removing Mapped TTY Ports

After logging in as root, enter the directory /usr/lib/npreal2/driver and then execute the **mxdelsvr** command to delete a server. The syntax of **mxdelsvr** is:

mxdelsvr [IP Address]

Example:

```
# cd /usr/lib/npreal2/driver
# ./mxdelsvr 192.168.3.4
```

The following actions are performed when the **mxdelsvr** command is executed:

1. Modify npreal2d.cf.
2. Remove the relevant tty ports from the /dev directory.
3. Restart the driver.

If the IP address is not provided in the command line, the program will list the installed servers and total ports on the screen. You will need to choose a server from the list for deletion.

5. Configuring and Managing a Network

Moxa Connection Manager (MCM)

MCM is a network management utility developed by Moxa to manage the LAN and WAN network on your V2406C computer, including Wi-Fi, cellular, and ethernet interfaces. With MCM, you can easily fill in the connection profile and priority in the configuration file; then MCM will automatically connect and keep the connection alive. Following are the major features of MCM:

- Cellular, Ethernet and Wi-fi connection
- Connection auto keep-alive, failover, and failback
- DHCP server
- Data usage monitoring
- Cellular connection diagnosis tool
- Cellular modem and network information
- Cellular modem firmware upgrade with failback

Interface	Default Managed by MCM	Network Configuration
LAN1	Yes	• Set as DHCP WAN by default. • After boot up, if LAN1 cannot obtain an IP from DHCP server for 20 seconds, then link-local IP addresses is automatically assigned.
LAN2	No	Static IPv4, 192.168.4.127
Cellular/ Wi-Fi	No	Not configured

To run **MCM**, you must use root permission to run **# mx-connect-mgmt.**

```
MOXA Connection Management Command-line Utility

USAGE:
    mx-connect-mgmt [SUBCOMMAND]

FLAGS:
    -h, --help      Prints help information
    -V, --version   Prints version information

SUBCOMMANDS:
    configure       Configure MOXA Connection Management via GUI dialog
    datausage       Show interface data usage information and related functions
    debug           Debug and diagnose cellular connection
    help            Show the help menu
    ls              List available network interfaces
    modem           Upgrade cellular modem firmware
    nwk_status      Show network and modem's information and connection status
    reload          Reload configuration files and restart interfaces
    start           Start to control interfaces
    stop            Stop to control interfaces
    unlock_pin      Unlock SIM PIN for the specified interface
    unlock_puk      Unlock PUK and and reset SIM PIN for the specified
interface
    wifi            Search Wi-Fi AP
```

NOTE

By default, only LAN1 port is managed by MCM.

There are 2 types of configuration files for MCM. One is main configuration file to manage the interrelationship between each interface, and one configuration files per each network interfaces available the V2406C computer

Config Type	Description	File Location
Main Config.	Main configuration file which is to configure which network interface you would like MCM to manage and set the priority during failover/failback	/etc/moxa/MoxaConnectionManager/ **MoxaConnectionManager.conf**
Interface Config.	Per interface configuration file which is to configure properties of individual interfaces. Such as APN, PIN code of cellular connection or SSID and password of Wi-Fi.	/etc/moxa/MoxaConnectionManager /interfaces/ **[interface name].conf**

NOTE

When modification is made to configuration file, you must use **# mx-connect-mgmt** reload to make the change effective.

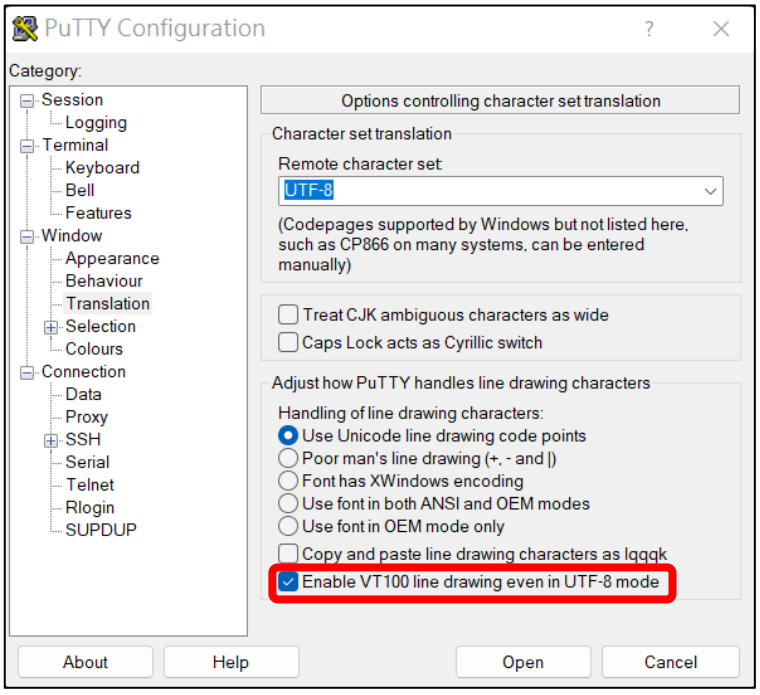
Instead of modifying the configuration file directly, we highly recommend you use the **GUI Configurator** described in next section to configure MCM.

Setting Up MCM With GUI Configurator

GUI Configurator Overview

To configure the WAN network through ethernet, Wi-Fi or cellular interface on the V2406C computer, you can use the simple GUI dialog provided by using **# mx-connect-mgmt configure** command.

If you are using PuTTY, enable **VT100 line drawing** option under **Windows** > **Translation** for the GUI to show correctly



1. Main page

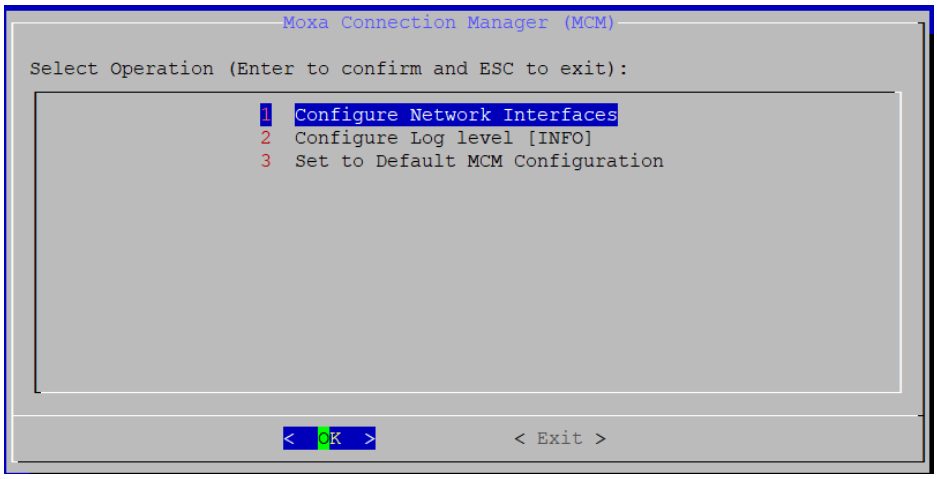


Figure 5.1 – Main page

Option Name	Description
Configure Network Interface	Configure network setting for
Configure Log Level	• Available syslog levels are ERR, WARN, INFO, DEBUG, TRACE • MCM log is save in /var/log/syslog
Set to Default MCM Configuration	Set all configuration to default

2. Configure network type for each interface and set the WAN connection priority for failover/failback

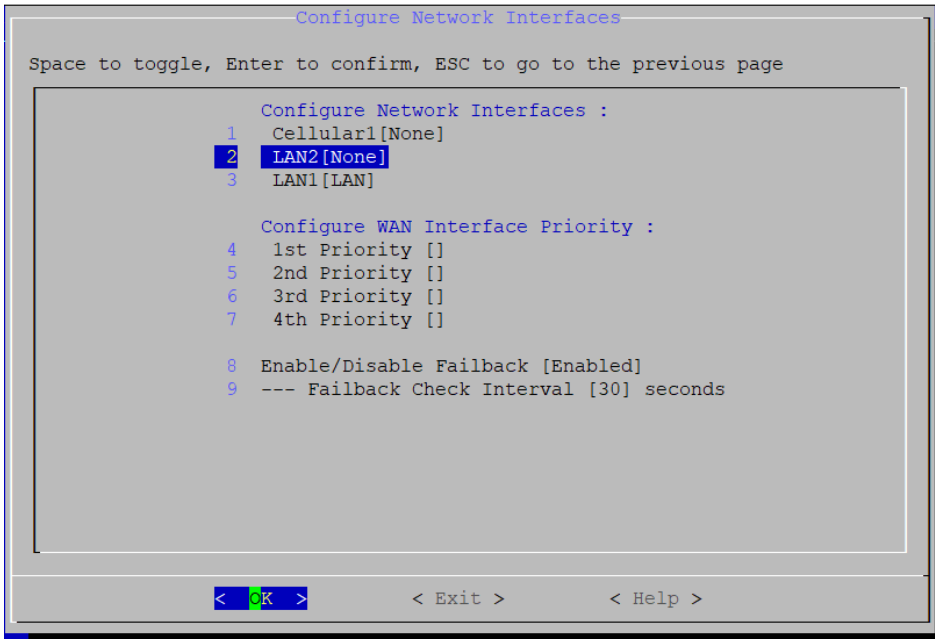


Figure 5.2 –Configure network interface

Option Name	Description
Configure Network Interfaces	A list of available network interfaces will show, where you can set the network type for each interface. The options are: • **WAN** - When set to WAN, this interface will be added to the default gateway list and allow MCM to apply automatic keep-alive and failover/failback control over it • **LAN** - When set to LAN, MCM will connect this interface using the network attributes defined in Profile-1 and DHCP server can be enabled for this interface • **LAN Bridge**- Bridge two or more LAN interfaces to construct a larger LAN • **Manual** - When set to Manual, it allows the user to have total control over this interface. MCM will connect this interface one-time only network attributes defined in Profile-1. MCM will not set these interfaces as default gateway nor apply connection keep-alive and failover/failback control over it. • **None** - MCM will not manage this interface

Option Name	Description
Configure WAN Interface Priority	MCM will use the WAN interface set as 1st Priority as the default gateway. When the 1st priority interface becomes unavailable, MCM will automatically failover to the next priority interface.
Enable/Disable Failback	When enabled, the backup connection will automatically failback to the higher priority connection when it became available again
Failback Check Interval	This value determines how long (in seconds) the higher priority connection should maintain stability before MCM trigger the failback. The purpose is to avoid unstable connections causing frequent failover and failback

3. Configure individual network interface

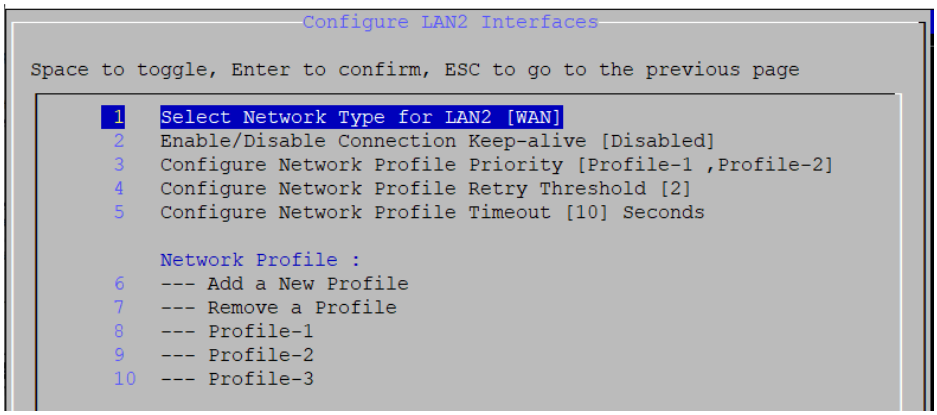


Figure 5.3 –Configurable options for WAN interface

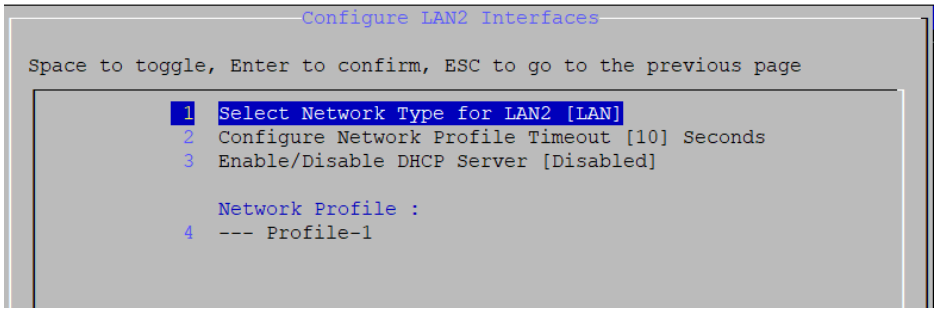


Figure 5.4 –Configurable options for LAN interface

Option Name	Network Type	Description
Select Network Type	All	Available options are WAN/LAN/LAN Bridge/Manual/None
Enable/Disable Connection Keep-alive	WAN	You can enable this setting if a seamless failover experience is required, meaning if a backup interface is set to always keep-alive, then MCM can failover to a ready-to-use backup connection without the initialization downtime.
Configure Network Profile Priority	WAN	When the 1st priority WAN network's profile cannot connect or becomes unavailable, MCM will automatically failover to the next profile in this priority list Note: network profile failback is currently not supported
Configure Network Profile Retry Threshold	WAN	This value determines the maximum attempts MCM will try to connect using the current WAN network profile before failover to the next profile in the priority list.
Configure Network Profile Timeout	All	This value (in seconds) determines the maximum time MCM will try to connect using the current network profile before determining the connection is unavailable
Bridge IPv4 Address	LAN-bridge	Assign a static IPv4 address for the bridged LAN interfaces
Bridge IPv4 Subnet Mask	LAN-bridge	Assign a static IPv4 subnet mask for the bridged LAN interfaces
Enable/Disable DHCP Server	LAN, LAN-bridge	Configure a specific LAN or bridged LAN interfaces as DHCP server

Option Name	Network Type	Description
Network Profile	WAN, LAN, Manual	• This section displays all network profile in a list with option to add, modify or remove a profile. • If network type is set to LAN or Manual, only profile-1 will be used because network profile failover is only available for WAN

4. Configure network profile of an interface

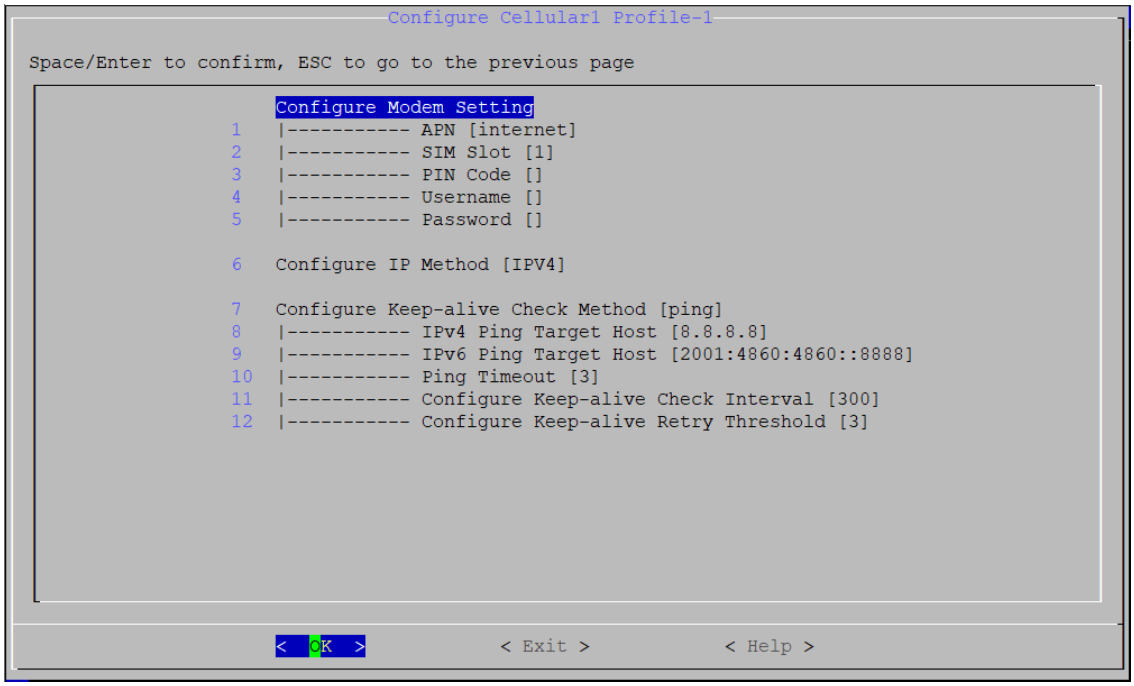


Figure 5.5 –Network profile setting (cellular interface as an example)

Option Name	Interface	Description
Configure Modem Setting	Cellular (WAN)	Configure cellular connection parameters including **APN**, **SIM slot** (which SIM slot number to use), **PIN Code**, **Username**, **Password**
	Wi-Fi (WAN)	Configure Wi-Fi connection parameters including **Mode** (only Wi-Fi client mode is supported), **SSID**, and **Password** *Note: make sure to leave the password field empty if you are connecting to a public Wi-Fi without password*
Configure IP Method	All interfaces	Configure IP related parameters including protocol version (IPv4, IPv6 or IPv4v6) and IP assignment method (DHCP, auto*, static IP or Link-local)
Configure Keep-alive Check Method	All interfaces	Select the method to check connection is alive • **Ping:** Connection is only considered alive if pinging the target server specified is successful • **Check-ip-exist:** As long as an IP is assigned to the interface (e.g., the base station assigns IP to the cellular modem or DHCP server assigns IP to LAN port), are considered connection is alive

* IP assignment method “auto” is for IPv6 only, which support Stateless Address Auto-Configuration (SLACC) and Stateless for DHCPv6.

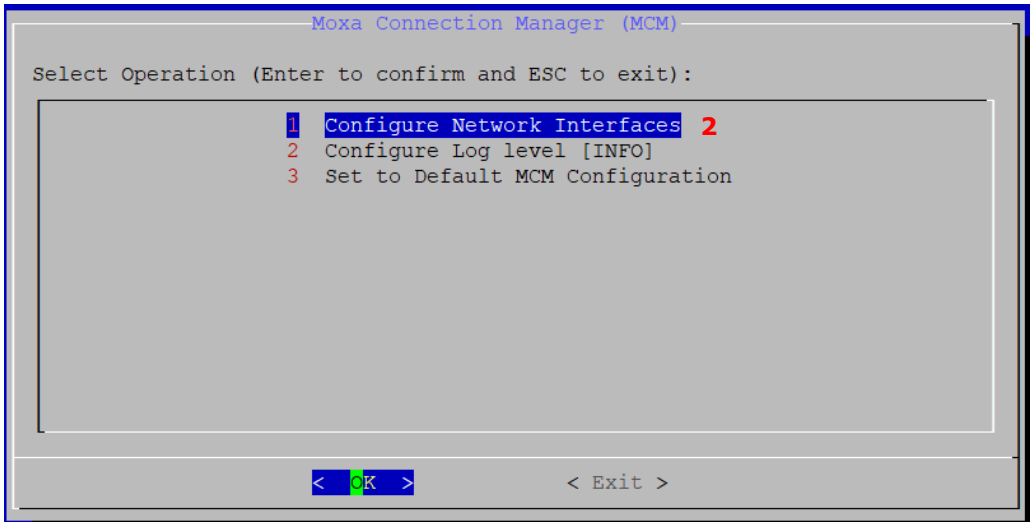
Cellular and Wi-Fi Failover/Failback

One of the key features in MCM is WAN connection auto-failover, where you can configure multiple backup WAN networks. When the primary connection becomes unavailable, MCM will automatically fail over to the backup network depending on the priority you set. You can even configure the connection to fall back to the primary one when it is back online.

In below example, we will set Wi-Fi interface as the primary WAN network and Cellular(4G/LTE) as the backup. MCM will automatically switch to using Cellular(4G/LTE) when Wi-Fi is down and back to Wi-Fi when it is back online.

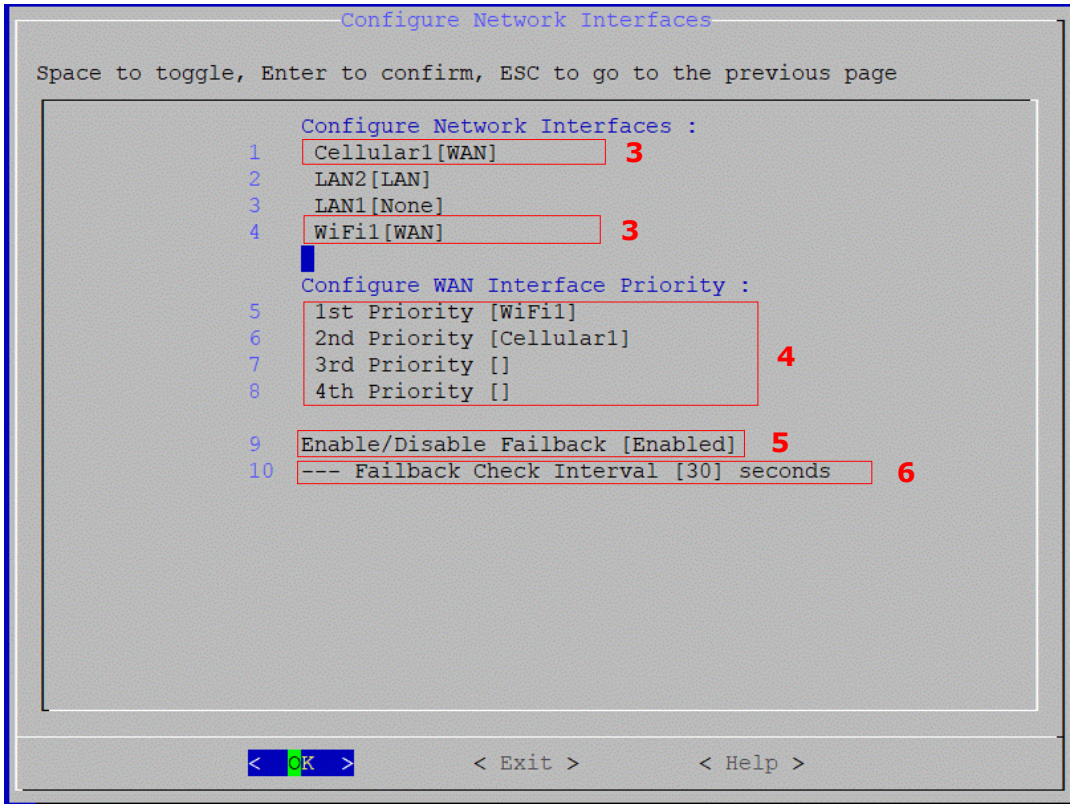
1. Run **# mx-connect-mgmt configure** to launch a simple GUI dialog configurator.

```
root@moxa-tbbbb1182827:/# mx-connect-mgmt configure
```



2. Select "Configure Network Interfaces"
3. Set interface Cellular1 and WiFi1 both to WAN, and
4. Set WiFi1 as the 1st priority and Cellular1 as 2nd priority
5. Make sure Failback is enabled if you would like MCM to automatically switch back to Wi-Fi from cellular when it is back online.

6. Failback Check Interval [30] seconds mean MCM will make sure Wi-Fi connection is alive and stable for 30 seconds before failback to use Wi-Fi as the primary connection (default gateway). The purpose is to avoid unstable connections causing frequent failover and failback.



7. Go to the interface configuration page of WiFi1 and Cellular1 (Figure 5.5 is an example of Cellular)
8. The option "**Enable/Disable Connection Keep-alive**" is **disabled** by default. It means there will be a short period without network during Wi-Fi to cellular failover process since MCM will only initiate the cellular connection when failover is triggered.

   You can enable this setting if a seamless failover experience is desired. When enabled, it allows MCM to failover to a ready-to-use backup connection without the initialization downtime.
9. MCM also supports network profile failover. For example, on a V2406C computer with multiple SIM slots, you can set up two profiles for cellular interface; each uses a different SIM slot and SIM card.
   - **Network Profile Priority**: in this example, MCM will use profile-1 by default and failover to use profile-2 when it cannot establish a connection with profile-1.
   - **Network Profile Timeout and Retry Threshold**: in this example, MCM will try to connect with profile-1 two times, each with a maximum of 90 seconds timeout before switching to profile-2.

10. You can modify the default profile-1 and profile-2 or add/remove a profile.

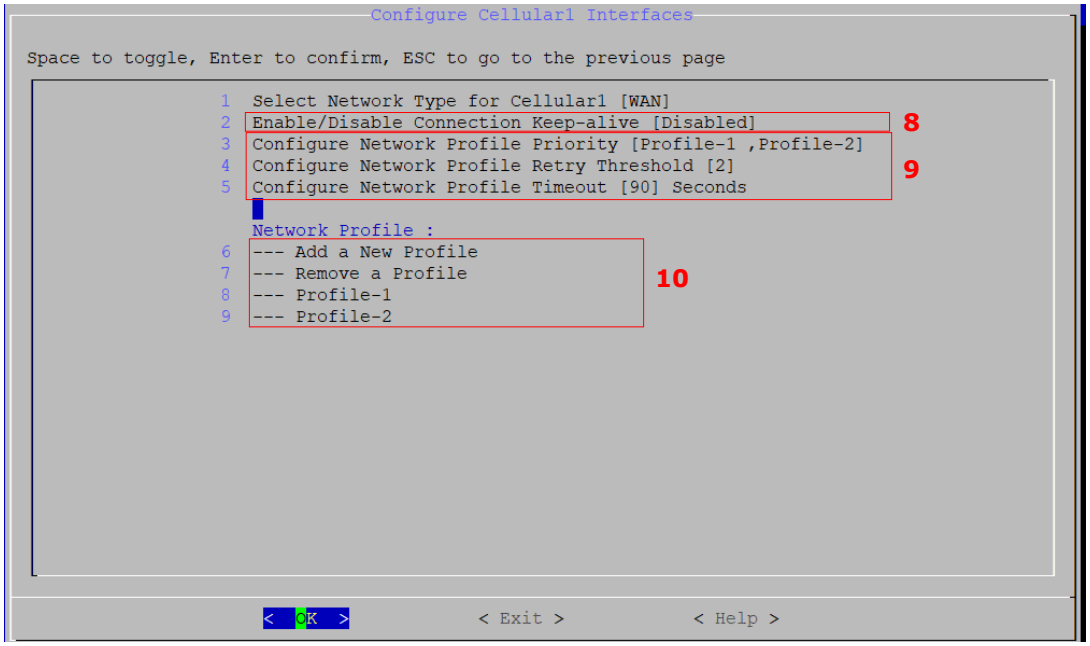


Figure 5.6 –Interface configuration page of Cellular1

11. Go to profile configuration page.
12. Configure the cellular modem related attribute. In this example, a SIM card in SIM slot 1 with PIN code "9917" and APN "internet" is used for Profile-1
13. Select the IP protocol generation. IPv4, IPv6, and IPv4v6 are the available options.
14. Select how MCM determine the connection is alive. Currently, only "ping' method is supported for WAN network. In this example, following configuration are set for Profile-1 of Cellular1 interface
    - MCM will ping the IP of Google public DNS every 700 seconds
    - MCM will try to ping the target host maximum 3 times (Retry Threshold) before concluding profile-1 cannot connect. For each ping attempt, MCM will consider ping fails if server doesn't response in 3 seconds (Ping timeout)
15. Once completed the configuration, exit MCM and select save and reload configuration file for the configuration to take effect

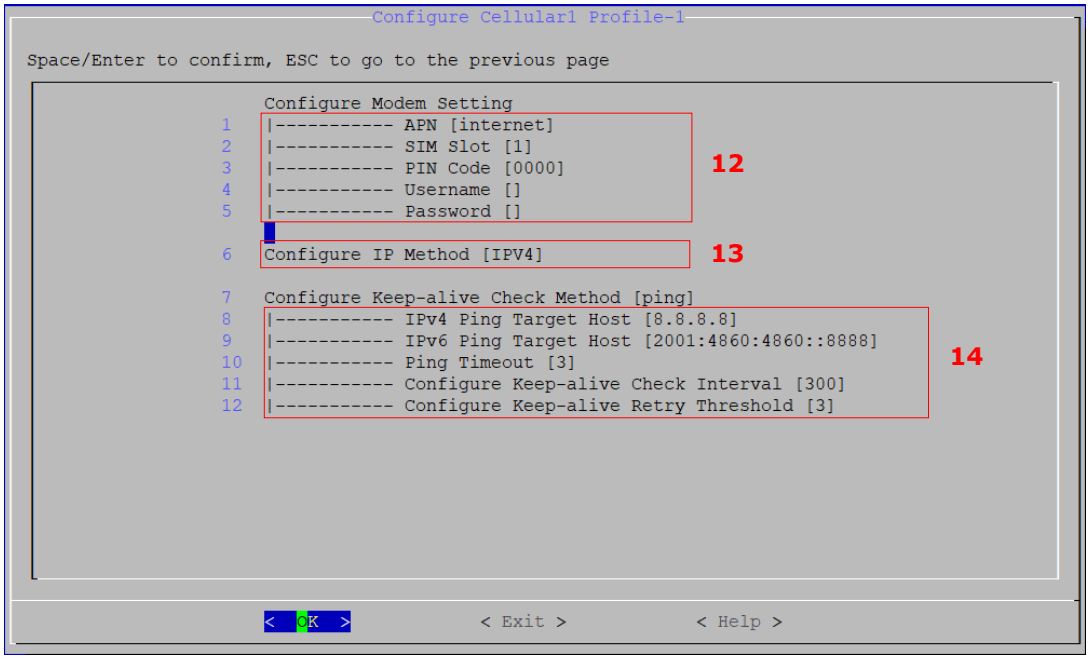


Figure 5.7–network profile configuration page of Cellular1 interface

Checking the Network Status

Checking the Interface and Connection Status

- Use **# mx-connect-mgmt nwk_info [Interface name]** to check the interface and connection status
- Use **# mx-connect-mgmt nwk_info [Interface name]**

```
moxa@moxa-tbbbb1182827: # sudo mx-connect-mgmt nwk_info Cellular1
------------------------------------------------
Interface Name          : Cellular1
Enabled                 : true
WAN Priority            : 2
Device Name             : wwan0
Device Type             : Modem
Network Type            : WAN
Mac Address             :
IPv4 Method             : dhcp
IPv6 Method             :
------------------------------------------------
Modem State             : Connected
------------------------------------------------
Radio Access Tech       : UMTS
Signal Strength         : Poor
Operator Name           : Chunghwa
Unlock Retries          : SIM PIN(3)
SIM Slot                : 1
IMSI                    : 466924253357038
------------------------------------------------
Connection Status       : Connected
Default Route           : false
------------------------------------------------
IPv4 | Address           : 10.224.91.86
     | Netmask           : 255.255.255.252
     | Gateway           : 10.224.91.85
     | Primary DNS       : 168.95.1.1
     | Secondary DNS     : 168.95.192.1
------------------------------------------------
IPv6 | Address           :
     | Netmask           :
     | Gateway           :
     | Primary DNS       :
     | Secondary DNS     :
```

Figure 5.8 –an example of nwk_info result of interface Cellular1

Most of the data fields and values are self-explanatory. Below are additional details to some of the data fields:

Fields	Description	Available Interface
Enabled	• **True:** This interface is managed by MCM • **False:** This interface is not managed by MCM	Wi-Fi, Ethernet, Cellular
WAN priority	The WAN priority set in Figure 5.2	Wi-Fi, Ethernet, Cellular
Network Type	WAN/LAN/Manual/None according to the set value in Figure 5.2	Wi-Fi, Ethernet, Cellular
Modem State	• **Not Ready:** The cellular modem can't be detected, or some configuration is not set correctly in MCM configuration files. • **Initializing:** The cellular is initializing • **SIM PIN Locked:** SIM PIN is locked; you can unlock with **unlock_pin** command	Cellular only

Fields	Description	Available Interface
	• **SIM PUK Locked:** SIM PUK is locked; you can unlock with `unlock_puk` command • **Radio Power Off:** The cellular modem is entering flight mode • **Radio Power On:** The cellular modem is exiting flight mode • **Searching Base Station:** The cellular modem has exited flight mode and searching for base-station • **Attached to Base Station:** The cellular modem is registered with a network provider but without data connections. • **Connecting:** The cellular modem is connecting • **Connected:** The cellular modem is connected • **No SIM:** SIM card is missing or malfunctioning	
Radio Access Tech	GSM/GSM COMPACT/UMTS/LTE, etc.	Cellular only
Signal Strength	• None/Very Poor • Poor • Fair • Good • Excellent *Note: see cellular signal strength for defined criteria*	Cellular only
SIM Slot	The SIM slot number being used	Cellular only
Connection Status	• **Initializing:** Initializing network connection • **Device Ready:** Detected the network interface is ready • **Connecting:** Connecting according to setting in profile • **Configuration Error:** Profile configuration error • **Disabling:** Stopping the connection • **Disabled:** When an interface is not managed by MCM, or MCM service is stopped • **Connected:** Connection is "working". The criteria for "working" are determine by the Keep-alive Check Method in Figure 5.5. For example, if method is set to ping, the connection is consider working if ping is successful • **Unable to connect:** The network profile is set correctly but the connection is not working determined by the Keep-alive Check Method in Figure 5.5 • **Reconnecting:** Connection is being reconnecting	Wi-Fi, Ethernet, Cellular
Default Route	• **True:** This interface is currently being used as default route • **False:** This interface is not the default route	Wi-Fi, Ethernet, Cellular

Cellular Signal Strength

Below are the criteria that MCM uses to determine the signal strength for 3G(UMTS) and 4G(LTE):

Using 4G(LTE) signal level as an example:

1. For the signal level "Excellent", both RSSI and EC/IO need to meet the defined criteria in below table
2. If the RSSI value meets the "Excellent" criteria but EC/IO meets only the "Good" criteria, then the MCM will show "Good" signal level

3G(UMTS) Signal Level	RSSI (dBm)	EC/IO(db)
Excellent	>=-77	>=-6
Good	>=-87	>=-10
Fair	>=-97	>=-14
Poor	>=-107	>=-20
None/Very Poor	<-107	<-20

4G(LTE) Signal Level	RSRP (dBm)	RSSNR(db)
Excellent	>=-85	>=13
Good	>=-95	>=5
Fair	>=-105	>=1
Poor	>=-115	>=-3
None/Very Poor	<-115	<-3

Monitoring the Data Usage

Use **# mx-connect-mgmt datausage** to check the data usage of a specified interface between a specified start and end date.

```
moxa@moxa-tbbbb1182827:# sudo mx-connect-mgmt datausage -h

mx-connect-mgmt-datausage
Show interface data usage information and related functions

USAGE:
    mx-connect-mgmt datausage [FLAGS] [OPTIONS] [interface]
FLAGS:
    -h, --help     Prints help information
    -r, --reset    Reset data usage database
OPTIONS:
    -s, --since <date>    Sets the begin date of data usage cumulative period,
                          expected date format YYYY-MM-DD HH:MM or YYYY-MM-DD

    -t, --to <date>       Sets the end date of data usage cumulative period,
                          expected date format YYYY-MM-DD HH:MM or YYYY-MM-DD
ARGS:
    <interface>
```

Below is an example of how to check the data usage of Wi-Fi interface between 2022/7/3 and 2022/7/4.

```
moxa@moxa-tbbbb1182827:# sudo mx-connect-mgmt datausage --since 2022-07-03 --to
2022-07-04 WiFi1
moxa@moxa-tbbbb1182827:
rx: 21884544 bytes
tx: 116086 bytes
```

Upgrading the Cellular Modem Firmware

Use **# mx-connect-mgmt modem upgrade [Interface name]** will check and install the latest cellular modem firmware tested by Moxa from Moxa APT server.

- Your cellular network will be down temporary during the upgrade and the connection will be reconnected by MCM after the upgrade is complete
- You can also upgrade the firmware locally by specifying a file path following **-F** or **--filepath** option
- By default, firmware downgrade is not allowed and not recommended. If you insist to downgrade the firmware, you can add -f flag to force the downgrade.
- You can use **mx-connect-mgmt nwk_info [interface name] -a** command to check the current cellular modem firmware version
- MCM will perform auto-reinstallation if upgrade fails.

```
moxa@moxa-tbbbb1182827:/# mx-connect-mgmt modem upgrade -h
mx-connect-mgmt-modem-upgrade
Upgrade modem FWR

USAGE:
    mx-connect-mgmt modem upgrade [FLAGS] [OPTIONS] [interface]
FLAGS:
    -f              force upgrade FWR
    -h, --help    Prints help information
OPTIONS:
    -F, --filepath <filename>    Sets the FWR file path
ARGS:
    <interface>
```

Cellular Network Diagnosis

Use **# mx-connect-mgmt debug** to perform diagnosis on the cellular network if you have trouble getting it to connect. The diagnosis tool can identify common issues such has missing antenna, weak signal strength, SIM card pin code error, SIM locked, etc.

```
moxa@moxa-tbbbb1182827:# sudo mx-connect-mgmt debug -h
mx-connect-mgmt-debug
Debug and diagnose cellular connection

USAGE:
    mx-connect-mgmt debug [SUBCOMMAND]

FLAGS:
    -h, --help    Prints help information

SUBCOMMANDS:
    diag      Perform diagnosis on the cellular interface
    help      Prints this message or the help of the given subcommand(s)
    listen    Listen to properties changed
```

Using API to Retrieve the MCM Status

MCM provides C application programming interfaces (APIs) for developer to retrieve various network and interface status from MCM

Please refers to following link for the C API document
https://moxa.gitlab.io/open-source/linux/gitbook/moxa-connection-manager-api-document/

To integrating your applications securely with the MC C API, you should follow the below guideline:

1. Confirm that the return value of the API is 0 and the returned struct pointer is not NULL to avoid using the wrong memory address.
2. Always free the structure pointer returned by the API to avoid memory leak.

6. Backup and Recovery

In this chapter, we will introduce how to use Moxa System Management (MSM) utility to perform snapshot, backup, decommission and recovery. MSM provides an automatic failback mechanism to ensure that the device can recover to the last known working and secure state when device fail to operate actions after a critical event such as a system update.

Function	Description
Snapshot	• The snapshot has a smaller footprint as it saves just the differences (partition 3 in Figure 6.1) compared to the out-of-factory rootfs (partition 2 in Figure 6.1). • The snapshot is saved in the V2406C computer and cannot be exported. Hence, a snapshot can only be used to restore the computer that the snapshot was taken from.
Backup	• The backup has a larger footprint as it saves the entire system including the out-of-factory rootfs. • The backup can be exported to an external storage. • The backup can be used to restore the V2406C computer that the backup is taken from or another computer of the same model.
Automatic Failback Recovery	• When failback recovery is enabled, a replica of the system including the snapshot is created. • If a boot failure event occurs after failback recovery is enabled, the system will automatically use the replica to recover the system • Failback recovery should be enabled before performing any critical actions that may potentially result in a device failure (e.g., power loss during critical software component update could brick a computer).

Below diagram illustrate an overview of MIL 2 system layout:

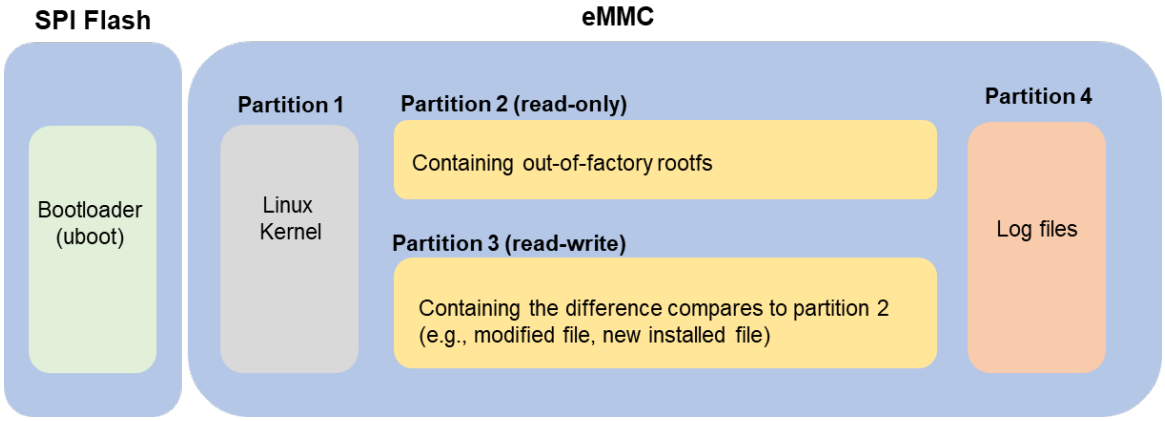


Figure 6.1 - Layout Overview of the V2406C computer with MIL 2

System Snapshot

Snapshot preserves the state and data of the V2406C computer as a restoration point at a specific point in time so that you can restore it to that point if something goes wrong. Snapshots only save the Linux kernel and new and modified files to the out-of-factory rootfs (partition 2). Therefore, the size of a snapshot is much smaller than a backup.

Use the **`# mx-system-mgmt -snapshot <sub-command> <option>`** to create restore a system. You must use **`sudo`** or run the command with root permission.

Sub-commands	Description
create	Creates a snapshot of system • A snapshot includes **kernel (partition 1)** and **rootfs (partition 3)** • Only one snapshot is saved. A new snapshot will overwrite the previous snapshot • Snapshot is stored in **rootfs (partition 3)**
restore	Restores the system with the snapshot. System failback will be disabled after a system is restored from the snapshot.
delete	Deletes the existing snapshot
Info	Displays the create time and size of the existing snapshot

Option	Description
-y or --yes	Automatically consent to the prompts during create, restore, and delete processes

System Backup

Compares to snapshot, a backup saves Linux kernel and the rootfs on your V2406C Computer. Therefore, if you create a backup on V2406C **Secure** model with MIL 2, you can use the same backup to restore another UC- V2406C **Secure** model with MIL 2.

Use **`# mx-system-mgmt --backup <sub-command> <option>`** command to create, delete, and restore a backup. You must use **`sudo`** or run the command with the root permission.

Sub-commands	Description
create	Creates a backup of the system • The backup includes **kernel (partition 1), rootfs (partition 2),** and **rootfs (partition 3)** • By default, the backup is created in the **/boot_device/p3/backup/** directory with the name **backup.tar**, together with an **info** file that contains the backup information and cryptographic hash of the backup. • The backup includes system snapshot. If you would like to reduce the size of backup, you can delete the snapshot in the system before performing the backup if the snapshot is not needed.
delete	Deletes the backup from default directory
restore	Restores the system using the backup from default directory. • System failback will be disabled after restoration. • Existing snapshot on system will be deleted after restoring the system from a backup. • The cryptographic hash in the **info** file will be used to validate the integrity of the backup file before the restore process begin. • A system reboot is required after restoration
info	Displays the create time and size of the backup in the default directory
-D or --directory	Specifies the directory for **`create`**, **`delete`**, **`restore`**, and **`info`** commands

Option	Description
-y or --yes	Automatically consent to the prompt during create, delete and restore

The following example shows how to back up a system to a USB storage drive with the mounting point **/media/USB_p1**:

```
moxa@moxa-tbzkb1090923:# sudo mx-system-mgmt --backup create -D /media/USB_p1
Set /media/USB_p1 as backup directory.
Check the backup information...
There is no backup information
Start evaluating space, please wait...
Estimation of Required Space: 628MB
```

```
Available Space: 32756MB
Would you like to continue? (y/N)y
Synchronize boot files...
              0   0%    0.00kB/s    0:00:00 (xfr#0, to-chk=0/2)
Start creating backup file...
 628MiB 0:00:57 [11.0MiB/s] [ <=> ]
Type: backup
Create Time: 2021.11.06-17:32:29
Size: 628MB
The backup has been created successfully under: /media/USB_p1
```

The following example shows how to restore a backup from the USB storage drive with the mounting point **/media/USB_p1**:

```
moxa@moxa-tbzkb1090923:# sudo mx-system-mgmt --backup restore -D /media/USB_p1
Set /media/USB_p1 as backup directory.
Check the backup information...
Type: backup
Create Time: 2021.11.06-17:44:43
Size: 628MB
Start verifying backup file, please wait...
Verified OK!
Start evaluating space, please wait...
Estimation of Required Space: 628MB
Available Space: 5125MB
Would you like to continue? (y/N)y
Check the snapshot information...
Type: snapshot
Create Time: 2021.11.06-15:42:47
Size: 235MB
This will delete the existing snapshot.
Do you want to continue? (y/N)y
Check the snapshot information...
Type: snapshot
Create Time: 2021.11.06-15:42:47
Size: 235MB
The snapshot has been deleted successfully.
To restore the backup file will overwrite current system and factory default
system.
Do you want to continue? (y/N)y
Start using the backup file to restore the system...
 628MiB 0:01:00 [10.4MiB/s] [==========================================>]
100%
Synchronize boot files...
              0   0%    0.00kB/s    0:00:00 (xfr#0, to-chk=0/2)
System has been restored successfully. Reboot is required to take effect.
moxa@moxa-tbzkb1090923:# sudo reboot
```

Setting to Default

You can also use the **mx-system-mgmt -d restore** command to restore the computer to factory default. You must use **sudo** or run the command with the root permission.

```
moxa@moxa-tbzkb1090923:/# sudo mx-system-mgmt -d restore
```

ATTENTION

Reset-to-default will erase all the data stored on the boot storage

Please back up your files before resetting the system to factory defaults. All the data stored in the V2406C computer's boot storage will be destroyed after resetting to factory defaults.

System Failback Recovery

A system bootup failure may occur when critical files are lost or corrupted. A typical and common cause of boot up failure is power lost during system update. Moxa System Management (MSM) provides system failback capability which can automatically recovers your system to the last known working state if boot up failure is detected after critical change(s) are made to the primary system. The boot failure criteria are customizable by user.

Before applying critical update or changes to the device, it is recommended to enable system failback first.

Use **# mx-system-mgmt --system-failback <sub-command> <option>** to enable or disable system failback. You must use **sudo** or run the command with the root permission.

Sub-commands	Description
enable	Enables system failback and create a replica of the system • The replica includes **kernel (partition 1)** and **rootfs (partition 3)** • The replica is stored in **rootfs (partition 3)** • When the V2406C computer fails to boot up, the device will automatically reboot and replace the broken system with the working replica. • The replica includes a system snapshot. If you would like to reduce the size of the replica, you can delete the snapshot if you no longer need it.
disable	Disables the system failback and delete the existing system replica
info	Displays the create time and size of replica
state	Displays the status of system failback (enabled/disabled)

Option	Description
-y or --yes	Automatically consent to the prompts during the enable and disable processes

Below is an example of how to enable system failback and display the information of the system replica:

```
moxa@moxa-tbzkb1090923:/# sudo mx-system-mgmt --system-failback enable
Start evaluating space, please wait...
Estimation of Required Space: 233MB
Available Space: 5333MB
Would you like to continue? (y/N) y
Start processing...
Synchronize boot files...
              0   0%    0.00kB/s    0:00:00 (xfr#0, to-chk=0/2)
              0   0%    0.00kB/s    0:00:00 (xfr#0, to-chk=0/2)
Start creating replica...
   244,670,045  99%   11.94MB/s    0:00:19 (xfr#170, to-chk=0/294)
Type: replica
Create Time: 2021.11.06-14:35:14
Size: 235MB
The system failback has been enabled and the replica has been created
successfully.
moxa@moxa-tbzkb1090923:/# sudo mx-system-mgmt --system-failback info
Check the replica information...
Type: replica
Create Time: 2021.11.06-14:35:14
Size: 235MB
```

Customize the Boot Up Failure Criteria

If you would like to customize the boot failure criteria, you can edit below script to add criteria you like Moxa System Manager to check.

/etc/moxa-system-manager/check-hooks.d/99-example.sh

In the following example 99-example.sh, the Moxa System Manager will consider the boot up is successful if the **moxa-connection-manager.service** starts successfully by returning a zero value. If the program returns a non-zero value, the service will not mark the startup as successful and it will enter the system-failback process to restore the system.

```
#systemctl is-active moxa-connection-manager.service && exit 0 || exit 1
```

7. Security Capability

In this chapter, we will introduce the V2406C computer's key security function offering for customers to deploy and operate Moxa computer in a secure manner

User Account Permissions and Privileges

Switching to the Root Privilege

In Moxa Industrial Linux, the root account is disabled in favor of better security. The default user account **moxa** belongs to the sudo group. Sudo is a program designed to let system administrators allow permitted users to execute some commands as the root user or another user. The basic philosophy is to give as few privileges as possible but still allow people to get their work done. Using sudo is better (safer) than opening a session as root for a number of reasons, including:

- Nobody needs to know the root password (sudo prompts for the current user's password). Extra privileges can be granted to individual users temporarily, and then taken away without the need for a password change.
- It is easy to run only the commands that require special privileges via sudo; the rest of the time, you work as an unprivileged user, which reduces the damage caused by mistakes.
- Some system-level commands are not available to the user moxa directly, as shown in the sample output below:

```
moxa@Moxa-tbzkb1090923:~$ sudo ifconfig
eth0      Link encap:Ethernet  HWaddr 00:90:e8:00:00:07
          inet addr:192.168.3.127  Bcast:192.168.3.255  Mask:255.255.255.0
          UP BROADCAST ALLMULTI MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

eth1      Link encap:Ethernet  HWaddr 00:90:e8:00:00:08
          inet addr:192.168.4.127  Bcast:192.168.4.255  Mask:255.255.255.0
          UP BROADCAST ALLMULTI MULTICAST  MTU:1500  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

lo        Link encap:Local Loopback
          inet addr:127.0.0.1  Mask:255.0.0.0
          inet6 addr: ::1/128 Scope:Host
          UP LOOPBACK RUNNING  MTU:16436  Metric:1
          RX packets:32 errors:0 dropped:0 overruns:0 frame:0
          TX packets:32 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:0
          RX bytes:2592 (2.5 KiB)  TX bytes:2592 (2.5 KiB)
```

You can switch to root account using the **`sudo -i`** (or **`sudo su`**) command. For security reasons, do not operate the **all** commands from the **`root`** account.

NOTE

Click the following link for more information on the **sudo** command.
https://wiki.debian.org/sudo

ATTENTION

You might get the permission denied message when using pipe or redirect behavior with a non-root account.

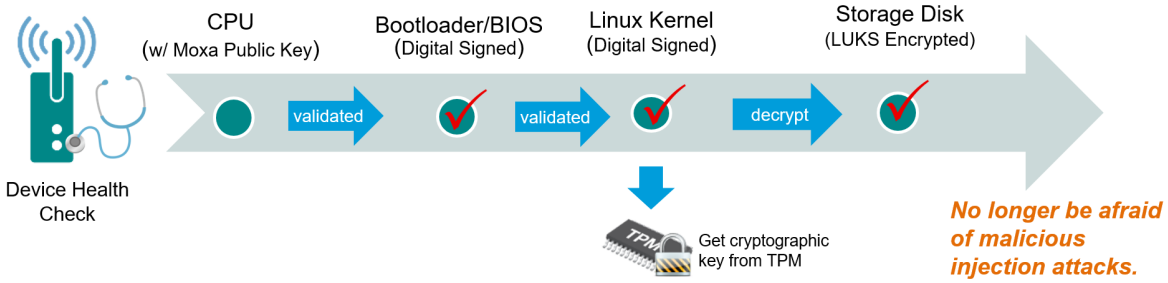
You must use the **'sudo su -c'** command to run the command instead of using >, <, >>, <<, etc.

Note: The single quotes enclosing the full command are required.

Secure Boot and Disk Encryption

Secure boot and disk encryption are available in **Secure model**, designed to make platform integration more secure. Moxa's secure boot process begins from CPU as hardware root-of-trust to ensure BIOS and Linux kernels are validated with Moxa digital signature before execution, preventing malicious or un-authenticated BIOS and kernels to run on the V2406C computer.

Next, only after BIOS and kernel have been validated, the LUKS (Linux Unified Key Setup) encrypted root file system (rtfs) will be decrypted by a key provisioned in TPM during factory production. The disk encryption prevent confidential data could be read without authorization when the device is stolen or lost.



Public key infrastructure (PKI)

Moxa secure boot use X.509 public key infrastructure (PKI) to validate authenticity and integrity of BIOS and Linux kernel.

How are private key protected?

Private keys used to digital sign Moxa software are stored in on-premises tamper and intrusion-resistant hardware security module (HSM), where strict access authorization and 24-hour video surveillance are applied.

Key lifecycle and revocation

In an unlikely scenario where the private key stored in HSM is compromised, Moxa will announce the news on Moxa Security Advisory, including instructions to revoke the compromised public key burned in the CPU via a utility downloadable from Moxa APT repository. Then update the BIOS and system image signed by a new private key.

ATTENTION

Do NOT arbitrarily replace the kernel or BIOS on Secure model, or the computer will not be able to boot up.

Trusted Platform Module (TPM 2.0)

The V2406C **Secure model** computer includes a TPM 2.0 hardware module. TPM provides a hardware-based approach to manage user authentication, network access, data protection and more that takes security to higher level than software-based security. It is strongly recommended to manage keys with TPM and store digital credentials such as passwords

The TPM can be managed via the tpm2_tools pre-installed in Moxa Industrial Linux (https://github.com/tpm2-software/tpm2-tools).

TPM software stack & tool is maintained by tpm2-software community
https://tpm2-software.github.io/

A good reference of TPM 2.0 introduction
https://link.springer.com/chapter/10.1007/978-1-4302-6584-9_3