V2201 Series Linux Software User's Manual

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V2201 Series Linux Software User's Manual

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1

Introduction

Thank you for purchasing a Moxa V2201 x86 ready-to-run Linux-based embedded computer (V2201-LX). This manual introduces the software configuration and management of the computer, which runs on the Linux operating system.

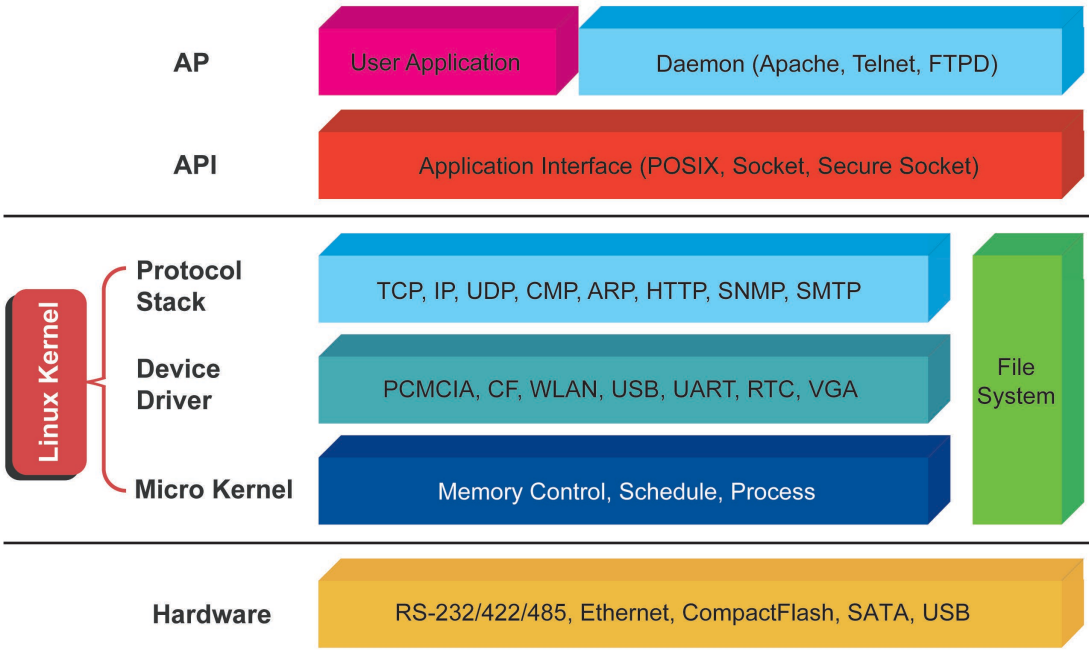
Linux is an open, scalable operating system that allows you to build a wide range of innovative, small-footprint devices. Software written for desktop PCs can be easily ported to the embedded computer with a GNU cross compiler and minimum source code modifications. A typical Linux-based device is designed for a specific use, and is often not connected to other computers, or a number of such devices connect to a centralized, front-end host.

The following topics are covered in this chapter:

- **Software Specifications**

Software Specifications

The Linux operating system preinstalled on the V2201-LX is the **Debian Stretch 9.12** distribution. The Debian project is a worldwide group of volunteers who endeavor to produce an operating system distribution that is composed entirely of free software. The Debian GNU/Linux follows the standard Linux architecture, making it easy to use programs that meet the POSIX standard. Program porting can be done with the GNU toolchain provided by Moxa. In addition to Standard POSIX APIs, device drivers for Moxa UART and other special peripherals are also included. An example software architecture is shown below:



NOTE For information and documentation on Debian GNU/Linux and the free software concept, refer to the following links:
http://www.debian.org/
http://www.gnu.org/

ATTENTION

The software architecture presented above is only an example. Different product models or different build revisions of the Linux operating system may include components not shown here.

2

Software Configuration

In this chapter, we explain how to operate the V2201-LX directly from your desktop. You can connect to your embedded computer: using a HDMI display or via SSH over a network console from a Windows or Linux machine. This chapter describes basic Linux operating system configurations. Advanced network management and configuration instructions are described in the "*3 Managing Communications*" chapter.

The following topics are covered in this chapter:

- **Account Management**
- **Starting From an HDMI Console**
- **Connecting From an SSH Console**
  - Windows Users
  - Linux Users
- **Adjusting the System Time**
  - Setting the Time Manually
  - Using the NTP Client and the systemd-timesyncd Service
  - Managing the Service Using the systemd Script
- **Cron Daemon for Executing Scheduled Commands**
- **Mounting an USB Storage Device**
- **Checking the Linux Version**
- **APT—Installing and Removing Packages**

Account Management

Connect the embedded computer to a display and turn on the computer. Enter the following information to log in into the computer.

Login: moxa
Password: moxa

For enhanced security, we have disabled the root account. We strongly recommend that you change the password after the first login. After successfully logging in, provide a new password.

```
Using username "moxa".
Linux Moxa 4.9.0-6-amd64 #1 SMP Debian 4.9.88-1 (2018-04-29) x86_64

    ####       ####    ######    ####### ######     ##
     ###      ####   ###    ###    ####   ####     ###
      ###     ###   ###     ###    ###    ##      ###
      ###    ####   ##       ##    ###   #       ####
      ####    # ##  ###       ###    ### ##       ## ##
     ## ##    # ##  ###       ##     ####        #  ##
     ## ###  ## ##  ##        ##     ####        #  ###
     ##  ##  #  ##  ##        ##      ###       #######
     ##  ##  #  ##  ###       ###     #####      #    ##
     ##   ###   ##  ###       ###    ##  ###     #    ###
     ##   ###   ##   ##       ##    ##    ###    ##    ##
     ##   ###   ##    ##     ##     #     ###    #     ##
   ######  #  ######   ########   ####### ##########  ######

For further information check:
http://www.moxa.com/

You have mail.
Last login: Wed Mar  6 00:10:56 2019 from 10.144.54.91
You are using Moxa embedded computer.
Please change the default password in consideration of higher security level or disable
the default user, moxa.
moxa@Moxa:~$
```

After you change the default password, remember to type **sudo** each time you want to run commands with the privilege of a root account. For example, typing **sudo ifconfig enp1s0 192.168.100.100** will allow you to configure the IP address of the LAN 1 port.

```
moxa@Moxa:~$ sudo ifconfig enp1s0 192.168.100.100
moxa@Moxa:~$ sudo  ifconfig enp1s0
enp1s0: flags=4099<UP,BROADCAST,MULTICAST>  mtu 1500
       inet 192.168.100.100  netmask 255.255.255.0  broadcast 192.168.100.255
       ether 00:90:e8:00:d7:38  txqueuelen 1000  (Ethernet)
       RX packets 0  bytes 0 (0.0 B)
       RX errors 0  dropped 0  overruns 0  frame 0
       TX packets 0  bytes 0 (0.0 B)
       TX errors 0  dropped 0 overruns 0  carrier 0  collisions 0
       device memory 0xb1300000-b137ffff
```

Use **sudo –i** to login as the root user to have more privileges.

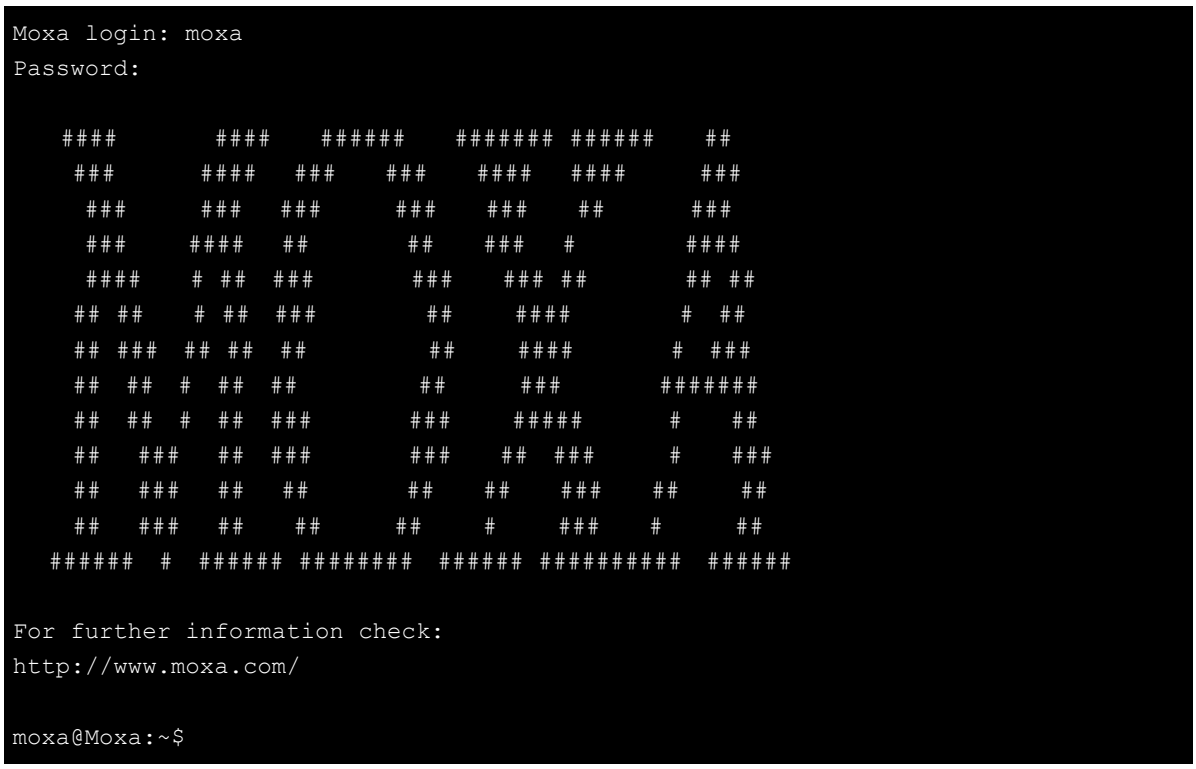
```
moxa@Moxa:~# sudo -i
[sudo] password for moxa:
root@Moxa:~$
```

Starting From an HDMI Console

Connect a display to the HDMI connector of the V2201-LX and power it up by connecting the power adapter. The system will take 30 to 60 seconds to boot up. Once the system is ready, a login screen is displayed.

Enter the login name and password. The default values are both **moxa**.

Login: moxa
Password: moxa



Connecting From an SSH Console

The V2201-LX supports the SSH console to offer better network security compared to Telnet. The default IP addresses and netmasks of the network interfaces are as follows:

	Default IP Address	Netmask
LAN 1	192.168.3.127	255.255.255.0
LAN 2	192.168.4.127	255.255.255.0

Before using an SSH client on your development PC, you should change the IP address of the PC so that the network ports are in the same subnet as the IP address of the LAN ports that you will connect to. For example, if you will connect to LAN1, you could set your PC's IP address to 192.168.3.126, and the netmask to 255.255.255.0. If you will connect to LAN2, set your PC's IP address to 192.168.4.126, and the netmask to 255.255.255.0.

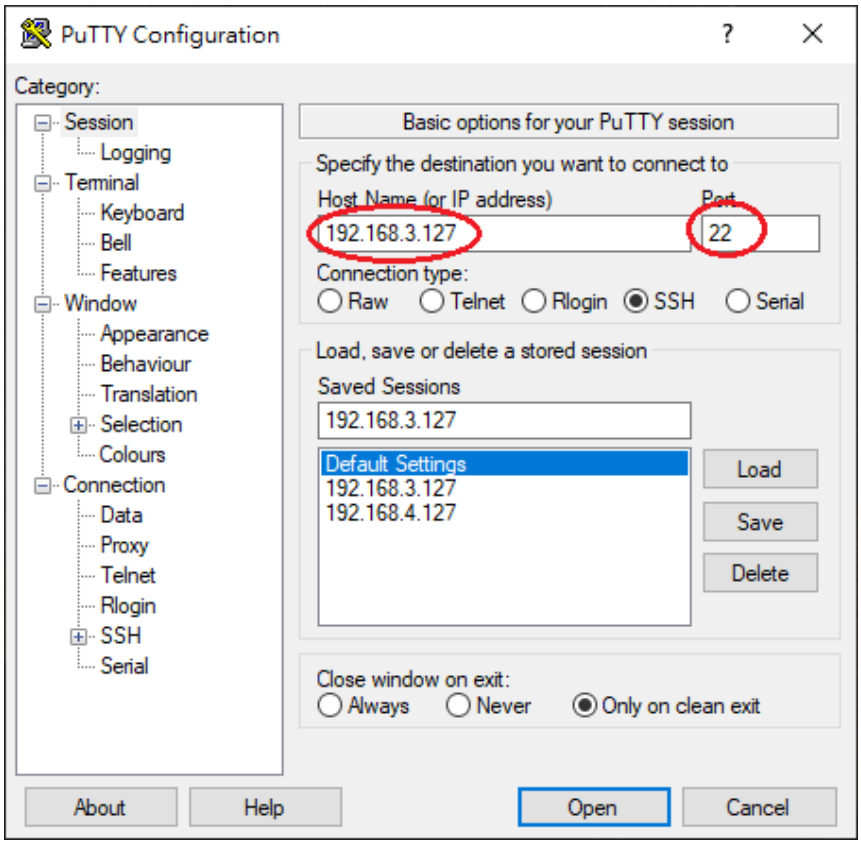
Use a cross-over Ethernet cable to connect your development PC directly to the target embedded computer, or use a straight-through Ethernet cable to connect the computer to a LAN hub or switch. Next, use a SSH client on your development PC to connect to the target computer. After a connection has been established, type the login name and password as requested to log in into the computer. The default values are both moxa.

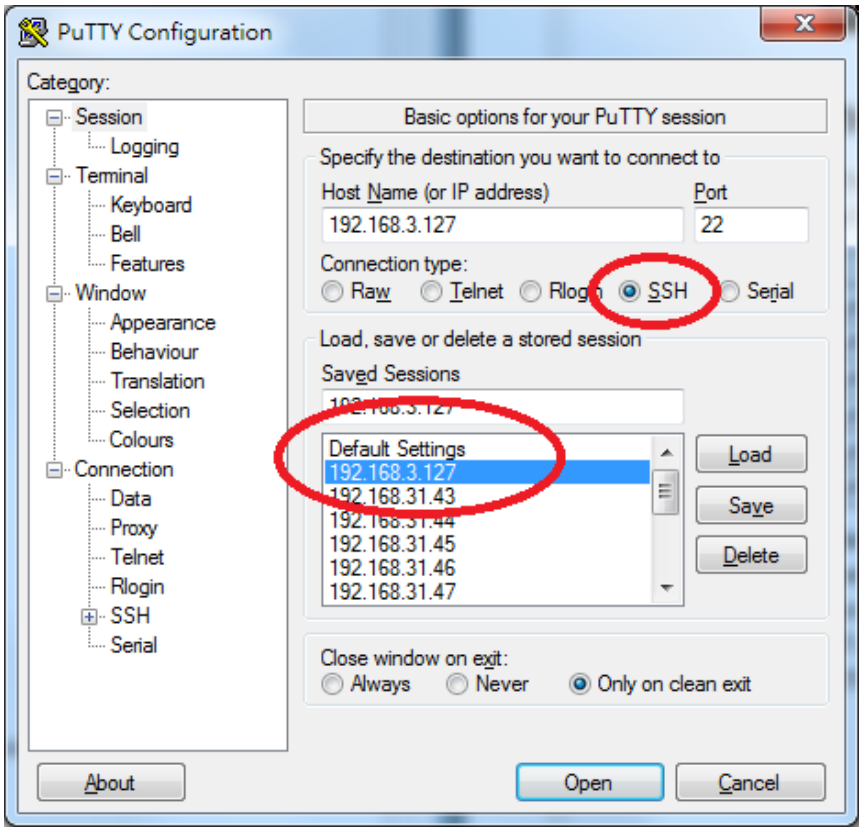
Login: moxa
Password: moxa

Windows Users

Download the PuTTY tool to set up an SSH console on your development PC. The tool can be downloaded free of cost at: http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html

The following screens show an example of the configuration settings required to set up an SSH connection.





Linux Users

From a Linux PC, use the **ssh** command to access the embedded computer's console utility via the SSH.

```
# ssh moxa@192.168.3.127
```

Type **yes** to open the connection.

```
[moxa@Moxa:~$]# ssh moxa@192.168.3.127
The authenticity of host '192.168.3.127 (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_
```

Adjusting the System Time

The V2201-LX has two time settings; the system time and the real-time clock (RTC) built into the hardware.

Setting 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 following command to set the system time.

moxa@Moxa:~# date *MMDDhhmmYYYY*

MM: Month
DD: Date
hhmm: Hour and Minute
YYYY: Year

Use the following command to write the current system time to the RTC.

 # hwclock

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

Using the NTP Client and the systemd-timesyncd Service

The computer 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.

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

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

The computer has a built-in **system-timesyncd** service that is used for network time synchronization. The 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 make sure an Internet connection is available.

Managing the Service Using the systemd Script

Linux services can be started or stopped using **systemd** scripts. The **systemctl** command is used to enable or disable a service.

Follow the example below to add or remove a service.

Creating a System Service Unit

This example creates a systemd service unit in **/etc/systemd/system/networking-check.service**.

Run the following command using the vi editor to create the **networking-check.service** file.

```
root@Moxa:~#  vi /etc/systemd/system/networking-check.service
```

Enter the following entries into the file.

```
[Unit]
After=snmpd.service

[Service]
ExecStart=/usr/local/bin/networking-check.sh

[Install]
WantedBy=default.target
```

- **After**: Instructs systemd on when the script should be run. In our case the script will run after the **snmpd.service** has started.
- **ExecStart**: Provides a full path to the script
- **WantedBy**: Specifies the boot target to which the systemd unit should be installed

This is a basic example of a system script. For more information, check the **systemd.service** script.

1. Create the **/usr/local/bin/networking-check.sh** script to check the network status.
   This example will ping a global DNS server to check if a network is available and write the results into the **/var/log/networking-check.log**.

```
moxa@Moxa:~# sudo vi /usr/local/bin/networking-check.sh
#!/bin/sh

while [ 1 ]; do
    date >> /var/log/networking-check.log
    ping -q -w 1 8.8.8.8
    if [ $? -eq  0 ]; then
        echo "Network is available" >> /var/log/networking-check.log
    else
        echo "Network is not available" >> /var/log/networking-check.log
    fi
    sleep 1
done
```

2. Before we launch the service, we need to make the script executable using the following command:

```
root@Moxa:~# chmod a+x /usr/local/bin/networking-check.sh
```

3. Start the **networking-check** service.

```
root@Moxa:~# systemctl start networking-check
```

   The **networking-check.sh** will be launched in the background.

```
root@Moxa:~# ps aux|grep networking-check
root     2260  0.0  0.0   4288  1500 ?       Ss   14:49   0:00 /bin/sh
/usr/local/bin/networking-check.sh
root     2276  0.0  0.0  12784   980 pts/0    S+   14:49   0:00 grep networking-check
```

   A **/var/log/networking-check.log** file is also created.

```
root@Moxa:~# cat /var/log/networking-check.log
Wed Mar 14 14:49:09 EDT 2018
Network is available
...
```

4. You can enable the service at boot time using the following command and by rebooting the system.

```
root@Moxa:~# systemctl enable networking-check
root@Moxa:~# reboot
```

To disable the service, use the **systemctl disable** command as follows:

```
root@Moxa:~# systemctl disable networking-check
```

Remember to stop the service to prevent the log file from occupying too much disk space.

Cron Daemon for Executing Scheduled Commands

The Cron daemon will search **/etc/crontab** for crontab files. It wakes up every minute and checks each command to see if it should be run within that minute. When executing commands, output is mailed to the owner of the **crontab** (or to the user named in the MAILTO environment variable in the **crontab** files, if such a user exists).

Modify the file **/etc/crontab** to set up your scheduled applications. **Crontab** files have the following format:

minute (mm)	hour (h)	date (dom)	Month (mon)	Week (dow)	User (user)	Command (command)
0-59	0-23	1-31	1-12	0-6 (0 is Sunday)		

For example, issue the following command if you want to launch a program at 8:00 hrs every day.

```
#minute hour  date  month  week  user   command
*        8    *     *      *     root   /path/to/your/program
```

The following example demonstrates how to use **Cron** to update the system time and RTC time every day at 8:00 hrs.

1. Write a shell script named fixtime.sh with the following content and save it to **/home/**.

   ```
   #!/bin/sh
   ntpdate time.stdtime.gov.tw
   hwclock –w
   exit 0
   ```

2. Change the mode of **fixtime.sh**

   ```
   # chmod 755 fixtime.sh
   ```

3. Modify the **/etc/crontab** file to run fixtime.sh at 8:00 every day.
   Add the following line at the end of crontab file.

   ```
   * 8 * * *   root    /home/fixtime.sh
   ```

Mounting an USB Storage Device

The computer doesn't support auto mounting of USB storage devices automatically; you need to manually mount the devices. Before mounting the USB storage, check the USB storage name using the **dmesg** command.

```
root@Moxa:~# dmesg
...
[  564.751226] sd 6:0:0:0: Attached scsi generic sg1 type 0
[  564.752400] sd 6:0:0:0: [sdb] 3973118 512-byte logical blocks: (2.03 GB/1.89 GiB)
[  564.753008] sd 6:0:0:0: [sdb] Write Protect is off
[  564.753013] sd 6:0:0:0: [sdb] Mode Sense: 03 00 00 00
[  564.753674] sd 6:0:0:0: [sdb] No Caching mode page found
[  564.753797] sd 6:0:0:0: [sdb] Assuming drive cache: write through
```

```
[  564.759333]  sdb: sdb1
[  564.762273] sd 6:0:0:0: [sdb] Attached SCSI removable disk
```

Or check **/proc/partitions**.

```
root@Moxa:~# cat /proc/partitions
major minor  #blocks  name
   8       0    7824600 sda
   8       1    7823576 sda1
   8      16    1986559 sdb
   8      17    1985535 sdb1
```

Mount the USB storage partition 1 **/dev/sdb1** at **/mnt**.

```
root@Moxa:~# mount
...
/dev/sdb1 on /mnt type vfat
(rw,relatime,fmask=0022,dmask=0022,codepage=437,iocharset=ascii,shortname=mixed,u
tf8,errors=remount-ro)
```

```
root@Moxa:~# mount -t vfat /dev/sdb1 /mnt
```

If you want to automatically mount the USB storage at boot up, you can add the following in **/etc/fstab**.

```
...
LABEL=root   /            ext4    noatime,errors=remount-ro 0      1
#usbfs          /proc/bus/usb   usbfs   defaults 0      0
/dev/sdb1       /mnt    vfat    defaults        0       0
```

ATTENTION

Remember to run the **# sync** command before you disconnect the USB storage device. If you do not issue the command, you may lose data.

ATTENTION

Remember to exit the **/media/usb0** or **/media/usb1** directory when you disconnect the USB storage device. If you stay in the **/media/usb0** or **/media/usb1** directory, the automatic unmount process will fail. If that happens, type **# umount /media/usb0** to unmount the USB device manually.

Checking the Linux Version

The program **uname**, which stands for "UNIX Name" and is part of the UNIX operating system, prints the name, version, and other details of the operating system running on the computer. Use the -**a** option to generate a response similar to the one shown below:

```
moxa@Moxa:~$ uname -a
Linux Moxa 4.9.0-6-amd64 #1 SMP Debian 4.9.88-1 (2018-04-29) x86_64 GNU/Linux
```

APT—Installing and Removing Packages

APT is the Debian tool used to install and remove packages. Before installing a package, you need to configure the apt source file **/etc/apt/sources.list**.

1. Use the vi editor to configure **/etc/apt/sources.list**.

```
deb mirror://debian.moxa.com/debian/mirrors stretch main contrib non-free
deb http://deb.debian.org/debian stretch main contrib non-free
#deb-src http://deb.debian.org/debian stretch main contrib non-free
deb http://deb.debian.org/debian stretch-updates main contrib non-free
#deb-src http://deb.debian.org/debian stretch-updates main contrib non-free
deb http://deb.debian.org/debian stretch-backports main contrib non-free
#deb-src http://deb.debian.org/debian stretch-backports main contrib non-free
deb http://security.debian.org/ stretch/updates main contrib non-free
#deb-src http://security.debian.org/ stretch/updates main contrib non-free
```

2. Update the source list after you configure it.

```
root@Moxa:~# apt-get update
root@Moxa:~#
```

3. After identifying the package(s) that you want to install (for example, **vim**), type:

```
root@Moxa:~# apt-get install vim
root@Moxa:~#
```

Use one of the following commands to remove a package.

(a) For a simple package removal:

```
root@Moxa:~# apt-get remove vim
root@Moxa:~#
```

(b) For a complete package removal:

```
root@Moxa:~# apt-get remove vim --purge
root@Moxa:~#
```

ATTENTION

You can free up the cache space with the **`# apt-get clean`** command.

```
root@Moxa:~# apt-get clean
root@Moxa:~#
```

3

Managing Communications

The V2201-LX ready-to-run embedded computer is a network-centric platform designed to serve as a front-end for data acquisition and industrial control applications. This chapter describes how to configure the various communication functions supported by the Linux operating system.

The following topics are covered in this chapter:

- **Detecting Network Interfaces**
- **Changing the Network Settings**
  - Changing the interfaces Configuration File
  - Adjusting the IP Addresses Using ifconfig
- **DNS Client**
  - /etc/resolv.conf
  - /etc/nsswitch.conf
- **Configuring the Cellular Connection**
  - Using cell_mgmt
  - Dial-up Process
  - Dial-up Commands
  - Cellular Module
  - GPS
- **Configuring the Wi-Fi Connection**
  - Configuring WPA2

Detecting Network Interfaces

Debian Linux systems use **udevd** to detect new network interfaces including Ethernet interfaces and wireless interfaces. Some of the rules used for creating a persistent network interface naming order are **/lib/udev/rules.d/75-persistent-net-generator.rules** and **etc/udev/rules.d/70-persistent-net.rules.** The content of the later is similar to the following:

```
# PCI device 0x10ec:0x8168 (r8168)
SUBSYSTEM=="net", ACTION=="add", DRIVERS=="?*", ATTR{address}=="00:90:e8:00:00:20",
ATTR{dev_id}=="0x0", ATTR{type}=="1", KERNEL=="eth*", NAME="eth0"

# PCI device 0x10ec:0x8168 (r8168)
SUBSYSTEM=="net", ACTION=="add", DRIVERS=="?*", ATTR{address}=="00:90:e8:00:00:21",
ATTR{dev_id}=="0x0", ATTR{type}=="1", KERNEL=="eth*", NAME="eth1"
```

The above example indicates that the system has detected two Ethernet interfaces.

ATTENTION

When replacing or connecting a network interface, the system may keep the old record in **/etc/udev/rules.d/70-persistent-net.rules**, which could cause network interfaces to be detected abnormally. To avoid this problem, delete the contents of the file **/etc/udev/rules.d/70-persistent-net.rules** and reboot the system.

Changing the Network Settings

The V2201-LX has two 10/100 or 10/100/1000 Ethernet ports named LAN1 and LAN2. The default IP addresses and netmasks of these network interfaces are:

	Default IP Address	Netmask
LAN1	192.168.3.127	255.255.255.0
LAN2	192.168.4.127	255.255.255.0

These network settings can be modified by changing the **interfaces** configuration file, or they can be adjusted temporarily with the **`ifconfig`** command.

Changing the interfaces Configuration File

1. Type **cd /etc/network** to change directories.

```
moxa@Moxa:~# cd /etc/network
```

2. Type **vi interfaces** to edit the network configuration file using the **vi** editor. You can configure the V2201's Ethernet ports for static or dynamic (DHCP) IP addresses.

```
moxa@Moxa:/etc/network# vi interfaces
```

Static IP Address

You can modify the default static IP addresses as follows:

```
# The loopback network interface
auto lo
iface lo inet loopback

# The primary network interface
auto eth0
iface eth0 inet static
       address 192.168.3.127
       netmask 255.255.255.0
       broadcast 192.168.3.255

auto eth1
iface eth1 inet static
       address 192.168.4.127
       netmask 255.255.255.0
       broadcast 192.168.4.255
```

Dynamic IP Address Using DHCP

To configure one or both LAN ports to request an IP address dynamically, replace **`static`** with **`dhcp`** in the previous command.

```
# The primary network interface
auto eth0
iface eth0 inet dhcp
```

After modifying the boot settings of the LAN interface, issue the following command to immediately activate the LAN settings.

```
moxa@Moxa:~# /etc/init.d/networking restart
```

Adjusting the IP Addresses Using ifconfig

IP settings can be adjusted at runtime, but the new settings will only be saved to the flash ROM if the **/etc/network/interfaces** is modified. For example, type the command **`# ifconfig enp1s0 192.168.1.1`** to change the IP address of LAN1 to 192.168.1.1.

```
moxa@Moxa:~# ifconfig enp1s0 192.168.1.1
moxa@Moxa:~#
```

DNS Client

The V2201-LX supports DNS client (but not the DNS server). To set up a DNS client, you need to edit the following two configuration files: **/etc/resolv.conf** and **/etc/nsswitch.conf**.

/etc/resolv.conf

This is the most important file that you need to edit when using DNS. For example, before using **# ntpdate time.stdtime.gov.tw** to update the system time, you will need to add the DNS server address to the file. Ask your network administrator which DNS server address you should use. The DNS server's IP address is specified using the **nameserver** command. For example, if the DNS server's IP address is 168.95.1.1, add the following to the **/etc/resolv.conf** file**.**

nameserver 168.95.1.1

```
root@Moxa:/etc# cat resolv.conf
#
# resolv.conf  This file is the resolver configuration file
# See resolver(5).
#
#nameserver 192.168.1.16
nameserver 168.95.1.1
nameserver 140.115.1.31
nameserver 140.115.236.10
Moxa:/etc#
```

/etc/nsswitch.conf

This file defines the sequence of files, **/etc/hosts** or **/etc/resolv.conf**, to be read to resolve the IP address. The **hosts** line in **/etc/nsswitch.conf** means use **/etc/host** first and the DNS service to resolve the address.

```
# /etc/nsswitch.conf
#
# Example configuration of GNU Name Service Switch functionality.
# If you have the `glibc-doc-reference' and `info' packages installed, try:
# `info libc "Name Service Switch"' for information about this file.

passwd:         compat
group:          compat
shadow:         compat

hosts:          files dns
networks:       files

protocols:      db files
services:       db files
ethers:         db files
rpc:            db files

netgroup:       nis
```

Configuring the Cellular Connection

Using cell_mgmt

The **cell_mgmt** utility is used to manage the cellular module in the computer. You must use **sudo** to run the **cell_mgmt** command or use root permission. The **cell_mgmt** utility does not support SMS and MMS communication.

Manual Page

```
NAME
    cell_mgmt

USAGE
    cell_mgmt [-i <module id>] [options]

OPTIONS
      -i <module id>
             Module identifier, start from 0 and default to 0.
      -s <slot id>
             Slot identifier, start from 1 and default value depends
             on module interface.
             example: module 0 may in slot 2
      modules
             Shows module numbers supported.
      slot
             Shows module slot id
      interface [interface id]
             Switching and checking module interface(s)
      start [OPTIONS]
             Start network.

             OPTIONS:
             PIN - PIN code
             Phone - Phone number (especially for AT based modules)
             Auth - Authentication type(CHAP|PAP|BOTH), default=NONE.
             Username
             Password

             example:
                cell_mgmt start
                cell_mgmt start PIN=0000
                cell_mgmt start PIN=0000 Phone=*99#
                cell_mgmt start PIN=0000 Phone=*99# \
                       Auth=BOTH Username=moxa Password=moxamoxa
      stop
             network.
      power_on
             Power ON.
      power_off
             Power OFF.
      power_cycle
             Power cycle the module slot.
```

```
switch_sim <1|2>
        Switch SIM slot.
gps_on
        GPS ON.
gps_off
        GPS OFF.
attach_status
        Query network registration status.
status
        Query network connection status.
signal
        Get signal strength.
at <'AT_COMMAND'>
        Input AT Command.
        Must use SINGLE QUOTATION to enclose AT Command.
sim_status
        Query sim card status.
unlock_pin <PIN>
        Unlock PIN code and save to configuration file.
pin_retries
        Get PIN code retry remain times.
pin_protection <enable|disable> <current PIN>
        Set PIN protection in the UIM.
set_flight_mode <0|1>
        Set module into flight mode (1) or online mode (0).
set_apn <APN>
        Set APN to configuration file.
check_carrier
        Check current carrier.
switch_carrier <Verizon|ATT|Sprint|Generic>
        Switching between US carrier frequency bands.
m_info
        Module/SIM information.
module_info
        Module information.
module_ids
        Get device IDs (ex: IMEI and/or ESN).
iccid
        Get SIM card ID
imsi
        Get IMSI (International Mobile Subscriber Identity).
location_info
        Get cell location information.
operator
        Telecommunication operator.
vzwauto
        Verizon Private Network auto dialup.
version
        Cellular management version.
```

Dial-up Process

Before dialing, ensure that the APN (access point name) is set correctly and the cellular module is attached to a base station.

1. Unlock the PIN code if the SIM is locked.
   Use the **cell_mgmt sim_status** command to check the SIM card status and the **cell_mgmt unlock_pin** <*PIN*> command to unlock the SIM card if a SIM PIN is set.

```
moxa@Moxa:/home/moxa$ sudo cell_mgmt sim_status
+CPIN: READY
```

2. Use the **cell_mgmt set_apn** <*APN*> command to set the name of the access point that will be used to connect to the carrier.

```
moxa@Moxa:/home/moxa$ sudo cell_mgmt set_apn internet
old APN=test, new APN=internet
```

3. Check if the service attaches with the correct APN.

```
moxa@Moxa:/home/moxa$ sudo cell_mgmt attach_status
CS: attached
PS: attached
```

   PS (packet-switched) should be **attached** for a network connection.

4. Dial up using the **cell_mgmt start** command.

```
moxa@Moxa:/home/moxa$ sudo cell_mgmt start
PIN code: Disabled or verified
Starting network with '_qmicli --wds-start-network=apn=internet,ip-type=4
--client-no-release-cid --device-open-net=net-802-3|net-no-qos-header'...
Saving state... (CID: 8)
Saving state... (PDH: 1205935456)
Network started successfully
```

   The dial-up function in the **cell_mgmt** utility will automatically set the DNS and default gateway of the computer, if they have not been set.

Dial-up Commands

cell_mgmt start

To start a network connection, use the default cellular module of the computer (If the computer supports multiple modules, use the **cell_mgmt interface** command to verify the default module that is selected).

If you run the **cell_mgmt start** command with the **Username**, **Password**, and **PIN**, the configuration will be written to the configuration file **/etc/moxa-cellular-utils/moxa-cellular-utils.conf**.

This information is then used when you run the command without specifying the options.

Usage: **cell_mgmt start Username=[user] Password=[pass] PIN=[pin_code]**

cell_mgmt stop

Stops/disables the network connection on the cellular module of the computer

```
moxa@Moxa:/home/moxa$ sudo cell_mgmt stop
Killed old client process
Stopping network with '_qmicli --wds-stop-network=1205933264 --client-cid=8'...
Network stopped successfully
Clearing state...
```

cell_mgmt status

Provides information on the status of the network connection.

```
moxa@Moxa:/home/moxa$ sudo cell_mgmt status
Status: connected
```

cell_mgmt signal

Provides the cellular signal strength. For moxa-cellular-utils version 2.0.0 and later, cellular signal strength is indicated using levels.

```
root@Moxa:/home/moxa$ sudo cell_mgmt signal
4G Level 4 (Good)
```

Level	Description
5	Excellent
4	Good
3	Fair
2	Poor
1	Very Poor
0	No Signal

For moxa-cellular-utils versions prior to version 2.0.0, the cellular signal strength is measured using Reference Signal Received Power (RSRP). The following table lists the signal strength for various RSRP ranges.

```
moxa@Moxa:/home/moxa$ sudo cell_mgmt signal
umts -77 dbm
```

RSRP	Signal Strength
<-115 dBm	No signal
-105 to -115 dBm	Poor
-95 to -105 dBm	Fair
-85 to -95 dBm	Good
>-85 dBm	Excellent

cell_mgmt operator

Provides information on the cellular service provider.

```
moxa@Moxa:/home/moxa$ sudo cell_mgmt operator
Chunghwa
```

Cellular Module

cell_mgmt module_info

Provides information on the cellular module including AT port, GPS port, QMI port, and module name.

```
moxa@Moxa:/home/moxa$ sudo cell_mgmt module_info
SLOT: 1
Module: MC7354
WWAN_node: wwan0
AT_port: /dev/ttyUSB2
GPS_port: /dev/ttyUSB1
QMI_port: /dev/cdc-wdm0
Modem_port: NotSupport
```

cell_mgmt interface

Used to view the supported modules and default module on the computer with their IDs. Change the default module by specifying the ID.

```
moxa@Moxa:/home/moxa$ sudo cell_mgmt interface
[0] wwan0    <Current>
```

cell_mgmt power_cycle

Use the **cell_mgmt power_cycle** command to power cycle the cellular module in the computer. You may see a kernel message indicating that the module has been reloaded.

```
moxa@Moxa:/home/moxa$ sudo cell_mgmt power_cycle
Network already stopped
Clearing state...
[232733.202208] usb 1-1: USB disconnect, device number 2
[232733.217132] qcserial ttyUSB0: Qualcomm USB modem converter now disconnected from
ttyUSB0
[232733.225616] qcserial 1-1:1.0: device disconnected
[232733.256738] qcserial ttyUSB1: Qualcomm USB modem converter now disconnected from
ttyUSB1
[232733.265214] qcserial 1-1:1.2: device disconnected
[232733.281566] qcserial ttyUSB2: Qualcomm USB modem converter now disconnected from
ttyUSB2
[232733.290006] qcserial 1-1:1.3: device disconnected
[232733.313572] qmi_wwan 1-1:1.8 wwan0: unregister 'qmi_wwan'
usb-musb-hdrc.0.auto-1, WWAN/QMI device
[232746.879873] usb 1-1: new high-speed USB device number 3 using musb-hdrc
[232747.020358] usb 1-1: config 1 has an invalid interface number: 8 but max is 3
[232747.027639] usb 1-1: config 1 has no interface number 1
[232747.036212] usb 1-1: New USB device found, idVendor=1199, idProduct=68c0
[232747.043185] usb 1-1: New USB device strings: Mfr=1, Product=2, SerialNumber=3
[232747.050473] usb 1-1: Product: MC7354
[232747.054151] usb 1-1: Manufacturer: Sierra Wireless, Incorporated
[232747.068022] qcserial 1-1:1.0: Qualcomm USB modem converter detected
[232747.079525] usb 1-1: Qualcomm USB modem converter now attached to ttyUSB0
[232747.089754] qcserial 1-1:1.2: Qualcomm USB modem converter detected
[232747.099156] usb 1-1: Qualcomm USB modem converter now attached to ttyUSB1
```

```
[232747.109317] qcserial 1-1:1.3: Qualcomm USB modem converter detected
[232747.118581] usb 1-1: Qualcomm USB modem converter now attached to ttyUSB2
[232747.130890] qmi_wwan 1-1:1.8: cdc-wdm0: USB WDM device
[232747.137174] qmi_wwan 1-1:1.8 wwan0: register 'qmi_wwan' at
usb-musb-hdrc.0.auto-1, WWAN/QMI device, 0a:ba:e1:d6:ed:4a
```

cell_mgmt check_carrier

The **`cell_mgmt check_carrier`** command helps to check if the current carrier matches with the service (SIM card) provider.

```
moxa@Moxa:/home/moxa$ sudo cell_mgmt check_carrier
----------Carrier Info----------
preferred firmware=05.05.58.01
preferred carrier name=ATT
preferred carrier config=ATT_005.026_000
firmware=05.05.58.01
carrier name=ATT
carrier config=ATT_005.026_000
--------------------------------
```

cell_mgmt switch_carrier

Some modules provide multiple carrier support. Use the **`cell_mgmt switch_carrier`** command to switch between carriers. It may take some time (depending on the module's mechanism) to switch between carriers.

```
moxa@Moxa:/home/moxa$ sudo cell_mgmt switch_carrier
----------------------
Usage:
      switch_carrier <Verizon|ATT|Sprint|Generic>
moxa@Moxa:/home/moxa$ sudo cell_mgmt switch_carrier Verizon
----------switch_carrier------------
cmd=AT!GOBIIMPREF="05.05.58.01","VZW","VZW_005.029_001"

OK

OK


wait for power cycle...
Network already stopped
Clearing state...
[236362.468977] usb 1-1: USB disconnect, device number 3
[236362.482562] qcserial ttyUSB0: Qualcomm USB modem converter now disconnected from
ttyUSB0
[236362.491019] qcserial 1-1:1.0: device disconnected
[236362.521065] qcserial ttyUSB1: Qualcomm USB modem converter now disconnected from
ttyUSB1
[236362.529430] qcserial 1-1:1.2: device disconnected
[236362.544653] qcserial ttyUSB2: Qualcomm USB modem converter now disconnected from
ttyUSB2
[236362.553133] qcserial 1-1:1.3: device disconnected
[236362.558283] qmi_wwan 1-1:1.8 wwan0: unregister 'qmi_wwan'
usb-musb-hdrc.0.auto-1, WWAN/QMI device
[236376.209868] usb 1-1: new high-speed USB device number 4 using musb-hdrc
```

```
[236376.350358] usb 1-1: config 1 has an invalid interface number: 8 but max is 3
[236376.357639] usb 1-1: config 1 has no interface number 1
[236376.364991] usb 1-1: New USB device found, idVendor=1199, idProduct=68c0
[236376.371925] usb 1-1: New USB device strings: Mfr=1, Product=2, SerialNumber=3
[236376.379217] usb 1-1: Product: MC7354
[236376.382924] usb 1-1: Manufacturer: Sierra Wireless, Incorporated
[236376.400588] qcserial 1-1:1.0: Qualcomm USB modem converter detected
[236376.412010] usb 1-1: Qualcomm USB modem converter now attached to ttyUSB0
[236376.422273] qcserial 1-1:1.2: Qualcomm USB modem converter detected
[236376.429958] usb 1-1: Qualcomm USB modem converter now attached to ttyUSB1
[236376.441031] qcserial 1-1:1.3: Qualcomm USB modem converter detected
[236376.448337] usb 1-1: Qualcomm USB modem converter now attached to ttyUSB2
[236376.461514] qmi_wwan 1-1:1.8: cdc-wdm0: USB WDM device
[236376.467762] qmi_wwan 1-1:1.8 wwan0: register 'qmi_wwan' at
usb-musb-hdrc.0.auto-1, WWAN/QMI device, 0a:ba:e1:d6:ed:4a
[236411.387228] usb 1-1: USB disconnect, device number 4
[236411.393963] qcserial ttyUSB0: Qualcomm USB modem converter now disconnected from
ttyUSB0
[236411.402361] qcserial 1-1:1.0: device disconnected
[236411.422719] qcserial ttyUSB1: Qualcomm USB modem converter now disconnected
[236411.431186] qcserial 1-1:1.2: device disconnected
[236411.446102] qcserial ttyUSB2: Qualcomm USB modem converter now disconnected from
ttyUSB2
[236411.454583] qcserial 1-1:1.3: device disconnected
[236411.459687] qmi_wwan 1-1:1.8 wwan0: unregister 'qmi_wwan'
usb-musb-hdrc.0.auto-1, WWAN/QMI device
[236423.109879] usb 1-1: new high-speed USB device number 5 using musb-hdrc
[236423.250364] usb 1-1: config 1 has an invalid interface number: 8 but max is 3
[236423.257649] usb 1-1: config 1 has no interface number 1
[236423.266064] usb 1-1: New USB device found, idVendor=1199, idProduct=68c0
[236423.273024] usb 1-1: New USB device strings: Mfr=1, Product=2, SerialNumber=3
[236423.280331] usb 1-1: Product: MC7354
[236423.284011] usb 1-1: Manufacturer: Sierra Wireless, Incorporated
[236423.298320] qcserial 1-1:1.0: Qualcomm USB modem converter detected
[236423.310356] usb 1-1: Qualcomm USB modem converter now attached to ttyUSB0
[236423.318614] qcserial 1-1:1.2: Qualcomm USB modem converter detected
[236423.328841] usb 1-1: Qualcomm USB modem converter now attached to ttyUSB1
[236423.338942] qcserial 1-1:1.3: Qualcomm USB modem converter detected
[236423.348418] usb 1-1: Qualcomm USB modem converter now attached to ttyUSB2
[236423.360733] qmi_wwan 1-1:1.8: cdc-wdm0: USB WDM device
[236423.366960] qmi_wwan 1-1:1.8 wwan0: register 'qmi_wwan' at
usb-musb-hdrc.0.auto-1, WWAN/QMI device, 0a:ba:e1:d6:ed:4a
moxa@Moxa:/home/moxa$ sudo cell_mgmt check_carrier
----------Carrier Info----------
preferred firmware=05.05.58.01
preferred carrier name=VZW
preferred carrier config=VZW_005.029_001
firmware=05.05.58.01
carrier name=VZW
carrier config=VZW_005.029_001
--------------------------------
```

cell_mgmt at *AT_command*

Used to input an **AT** command. For example, use the **AT** command AT+CSQ as follows:

```
moxa@Moxa:/home/moxa$ sudo cell_mgmt at 'AT+CSQ'

+CSQ: 18,99

OK
```

GPS

To view the GPS information, do the following:

1. Power on the GPS module.

```
root@Moxa:/home/moxa# cell_mgmt gps_on
```

2. Check the GPS port using the **cell_mgmt** command.
   In the following example, the GPS port is at **/dev/ttyUSB1**.

```
root@Moxa:/home/moxa# cell_mgmt module_info
SLOT: 1
Module: MC7354
WWAN_node: wwan1
AT_port: /dev/ttyUSB2
GPS_port: /dev/ttyUSB1
QMI_port: /dev/cdc-wdm1
Modem_port: NotSupport
AT_port (reserved): NotSupport
```

3. Type the following command to get the GPS location information from the GPS port.

```
root@Moxa:/home/moxa# cat /dev/ttyUSB1
```

Configuring the Wi-Fi Connection

You can configure the Wi-Fi connection for your x86 computer using a configuration file and the **wpa_supplicant** command.

Configuring WPA2

Moxa's x86 computers support WPA2 security using the **/sbin/wpa_supplicant** program. Refer to the following table for the configuration options. The following table specifies whether an encryption and/or authentication key must be configured before associating with a network.

Infrastructure mode	Authentication mode	Encryption status	Manual Key required?	IEEE 802.1X enabled?	Key required before joining network?
ESS	Open	None	No	No	No
ESS	Open	WEP	Optional	Optional	Yes
ESS	Shared	None	Yes	No	Yes
ESS	Shared	WEP	Optional	Optional	Yes
ESS	WPA	WEP	No	Yes	No
ESS	WPA	TKIP	No	Yes	No
ESS	WPA2	AES	No	Yes	No
ESS	WPA-PSK	WEP	Yes	Yes	No
ESS	WPA-PSK	TKIP	Yes	Yes	No
ESS	WPA2-PSK	AES	Yes	Yes	No

Configuring Wireless LAN Using the Configuration File

You can create a **/etc/wpa_supplicant/wpa_supplicant.conf** file to configure a Wi-Fi connection. An example of a configuration file for an OPEN/WEP/WPA/WPA2 access point is given below:

```
ctrl_interface=/var/run/wpa_supplicant
update_config=1
### Open system ###
#network={
# ssid="Open"
# key_mgmt=NONE
#}
####################
##### WEP #####
#network={
# ssid="WEP-ssid"
# bssid=XX:XX:XX:XX:XX:XX
# key_mgmt=NONE
# wep_key0=KEY
#}
###############
##### WPA/WPA2 PSK #####
#network={
# ssid="WPA-ssid"
# proto=WPA WPA2 RSN
# key_mgmt=WPA-PSK
# pairwise=TKIP CCMP
# group=TKIP CCMP
# psk="KEY"
#}
#######################
```

The basic command to connect to a WPA-supplicant is as follows:

```
root@Moxa:~# wpa_supplicant -i <interface> -c <configuration file> -B
```

The **-B** option should be included because it forces the supplicant to run in the background.

1. Connect with the following command after editing the **wpa_supplicant.conf** file:

```
root@Moxa:~# wpa_supplicant -i wlp3s0 -c
/etc/wpa_supplicant/wpa_supplicant.conf -B
```

2. Use the **#sudo apt-get install wireless-tools** command to install the Wi-Fi utility.

   You can use the **iwconfig** command to check the connection status. The response you receive should be similar to the following:

```
wlp3s0 IEEE 802.11abgn ESSID:"MOXA_AP"
Mode:Managed Frequency:2.462 GHz Access Point: 00:1F:1F:8C:0F:64
Bit Rate=36 Mb/s Tx-Power=27 dBm
Retry min limit:7 RTS thr:off Fragment thr:off
Encryption key:1234-5678-90 Security mode:open
Power Management:off
Link Quality=37/70 Signal level=-73 dBm
Rx invalid nwid:0 Rx invalid crypt:0 Rx invalid frag:0
Tx excessive retries:0 Invalid misc:0 Missed beacon:0
```

For additional information, refer to https://hostap.epitest.fi/wpa_supplicant/.

WARNING

Moxa strongly advises against using the WEP and WPA encryption standards. Both are now officially deprecated by the Wi-Fi Alliance, and are considered insecure. To guarantee good Wi-Fi encryption and security, use WPA2 with AES encryption algorithms.

4

System Recovery

The V2201-LX comes preinstalled with the Embedded Linux operating system, which is stored in the mSATA shipped with the computer. Although it rarely happens, you may find on occasion that operating system files and/or the disk file system are damaged. This chapter describes how to recover the Linux operating system.

The following topics are covered in this chapter:

- **Recovery Environment**
- **Recovery Procedure**
- **Saving the System to the USB Drive**

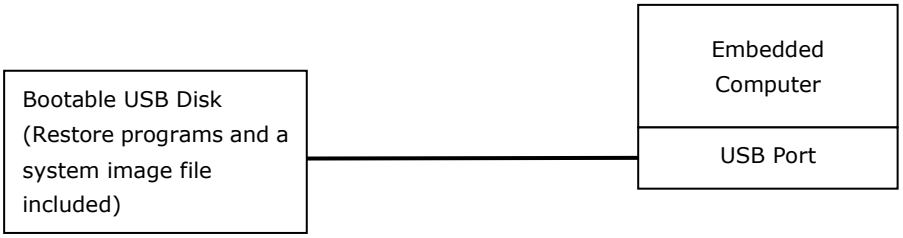
Recovery Environment

The restore environment includes the embedded computer and a bootable USB disk that contains the restore programs and a system image file.

Hardware

The hardware used includes a PC, the embedded computer, and a USB disk with the restore programs.

NOTE The USB disk should have a storage capacity of at least 2 GB.



Restoring the System From the USB Drive

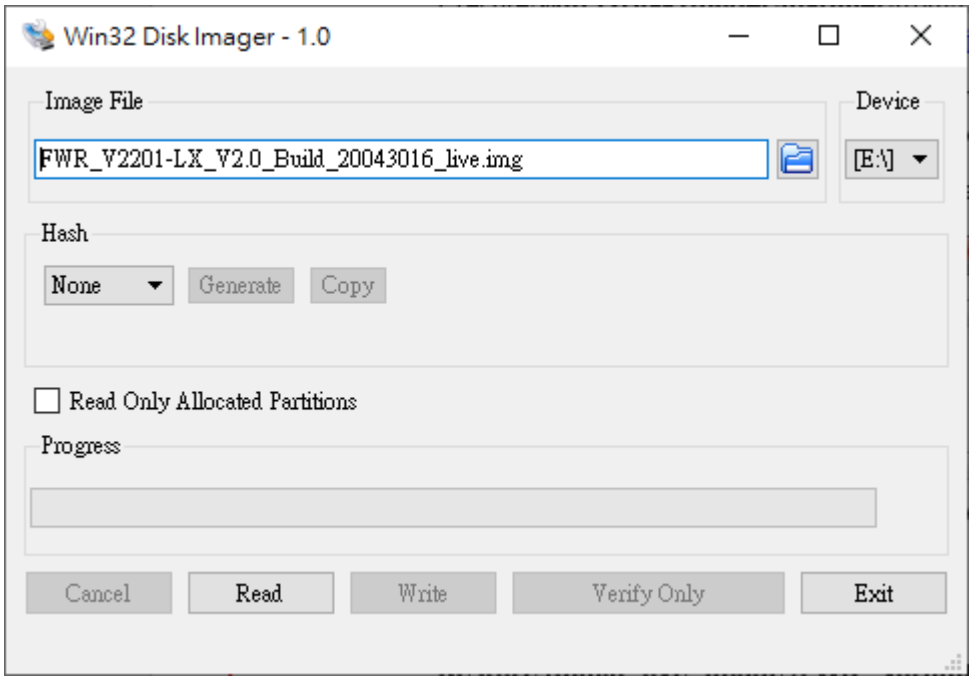
Step 1: Prepare your USB drive

For Windows Users

Download and run the **Win32DiskImager installer** from:
https://sourceforge.net/projects/win32diskimager/.

After the installation process is complete, run **Win32DiskImager,** select the Moxa Live USB image file **Restore\moxa_live_image\FWR_*<product>*_*<version>*_Build_*<date>*_live.img**, and click **Write**.

The Moxa Live USB image file contains the corresponding firmware image.



For Debian Linux Users

Copy the image file to the USB storage device node.

Image file:
Restore\moxa_live_image\FWR_<*product*>_<*version*>_ReBuild_<*date*>_live_image.img

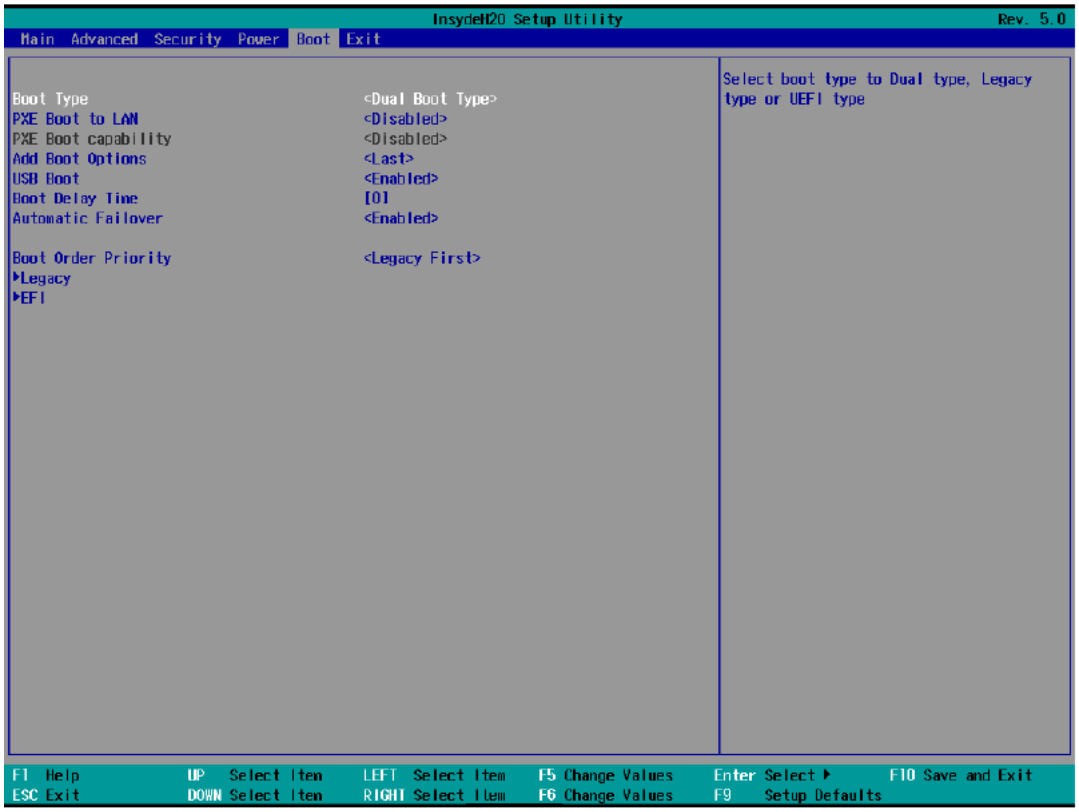
For example, **/dev/sde** is the USB storage device node on V2201.

```
root@Moxa:/home/moxa# dd if= FWR_<product>_<version>_Build_<date>_live.img
of=/dev/sde conv=noerror,sync status=progress bs=4096
```

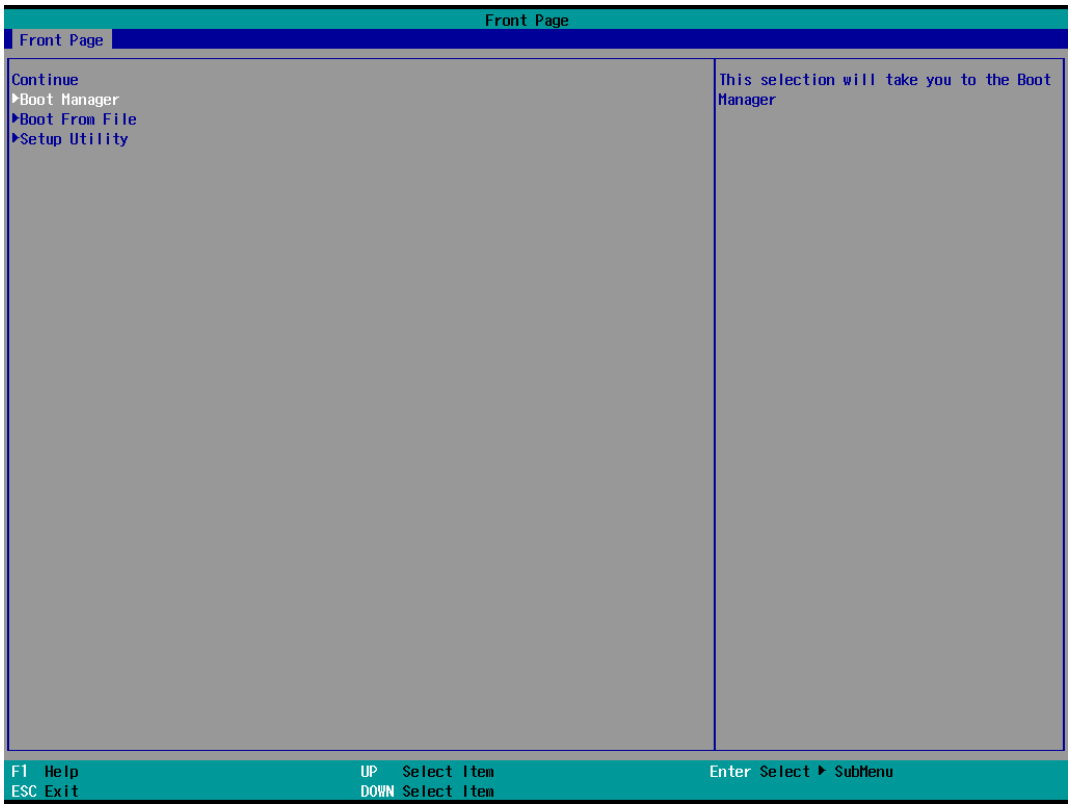
Step 2: Change the BIOS settings

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

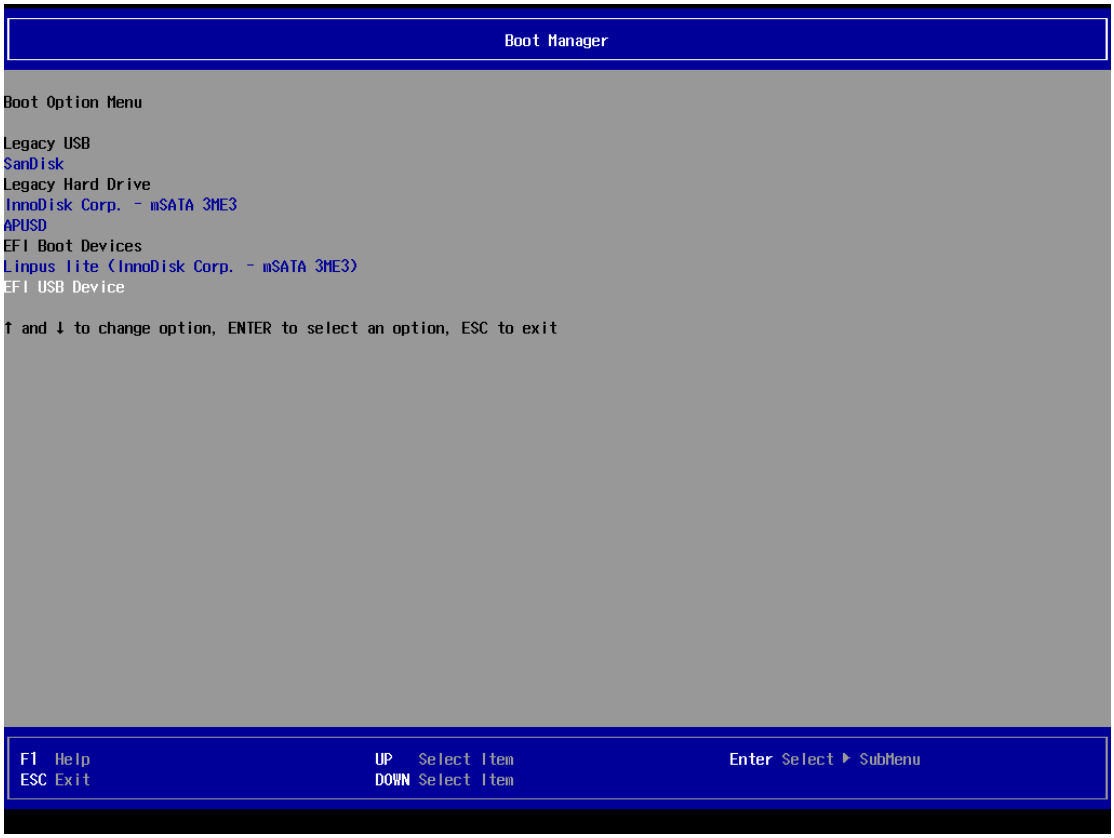
1. Turn on the computer and press **F2**.
2. Click on the **Boot** tab and make sure the **Dual Boot Type** or **EFI** is selected.
   Here, we have selected **Dual Boot Type** as an example.



3. Press **F10** and then press **Enter** to save the changes and exit the BIOS setup.
4. Insert the USB disk and then reboot the computer.
5. Press F2 to enter the BIOS setting.
6. Select the **Boot Manager**.



7. Select **EFI USB device.**
   The system will boot from the restore utility.

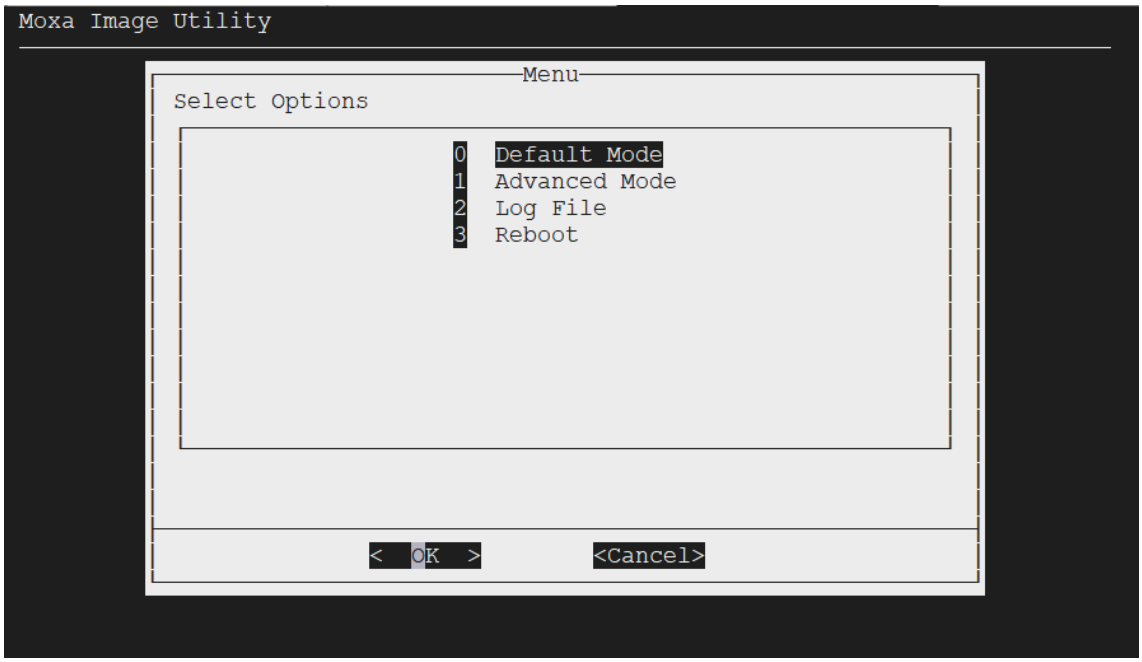


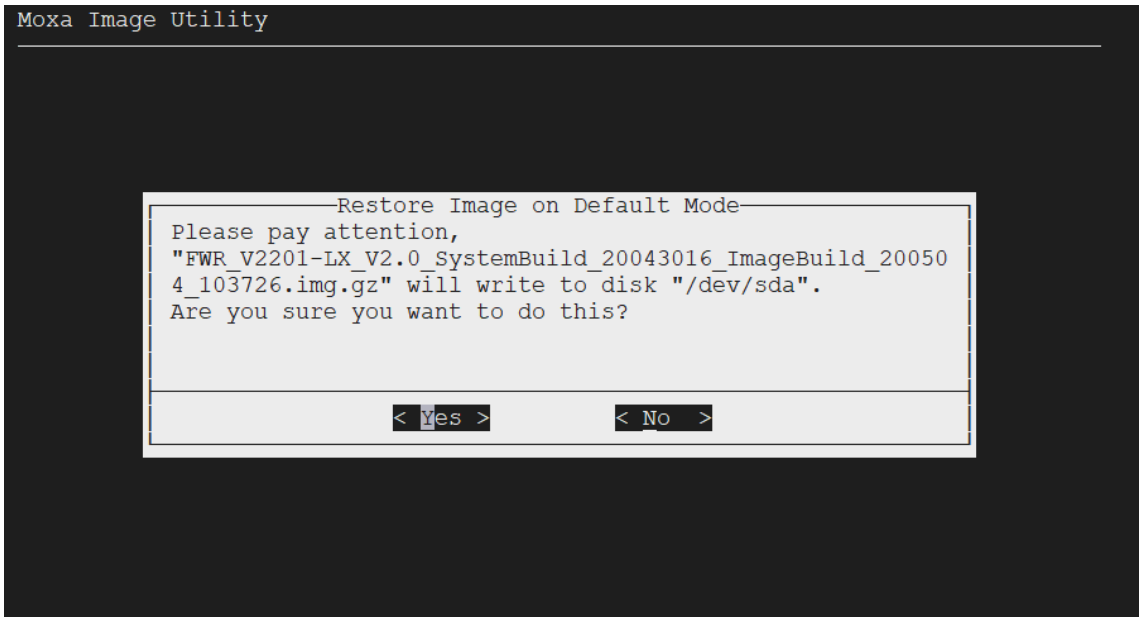
Step 3: Restore the system from the USB drive

Insert the USB disk into any one of the computer's USB ports and then reboot the computer. The system will boot from the USB disk and the Pre-installation Environment. The Moxa image utility opens up.

[Default Mode]

Selecting the **Default Mode** in the Moxa Image Utility will write the default image to the default mSATA disk. If you have multiple images or storage disks, we strongly recommend using the **Advanced Mode.**

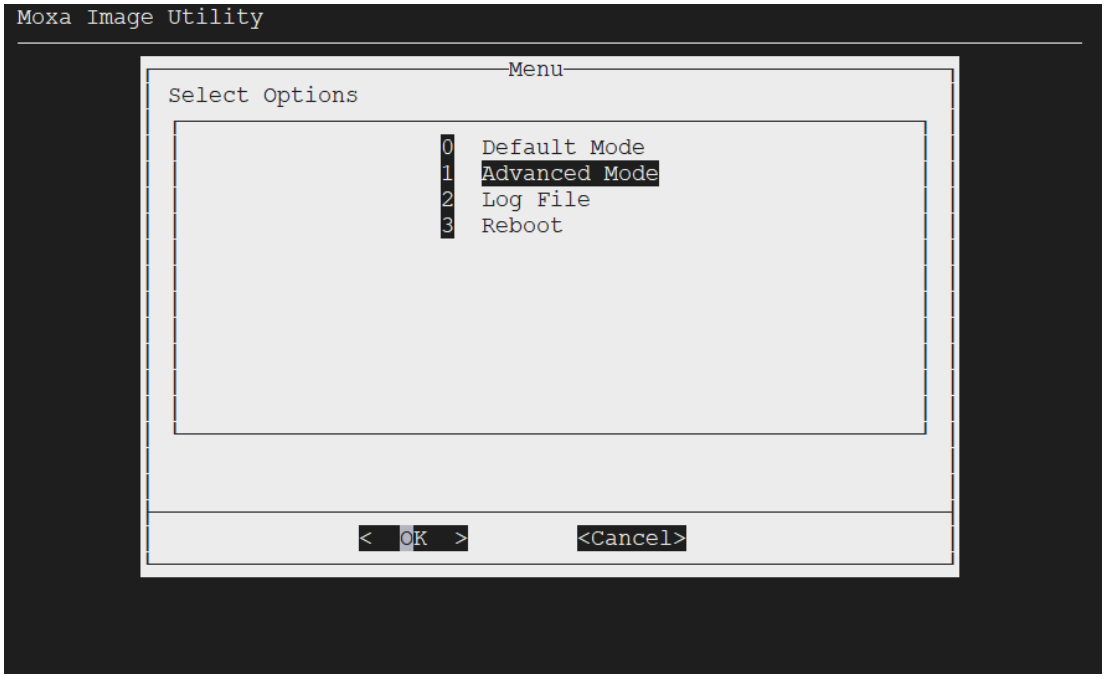




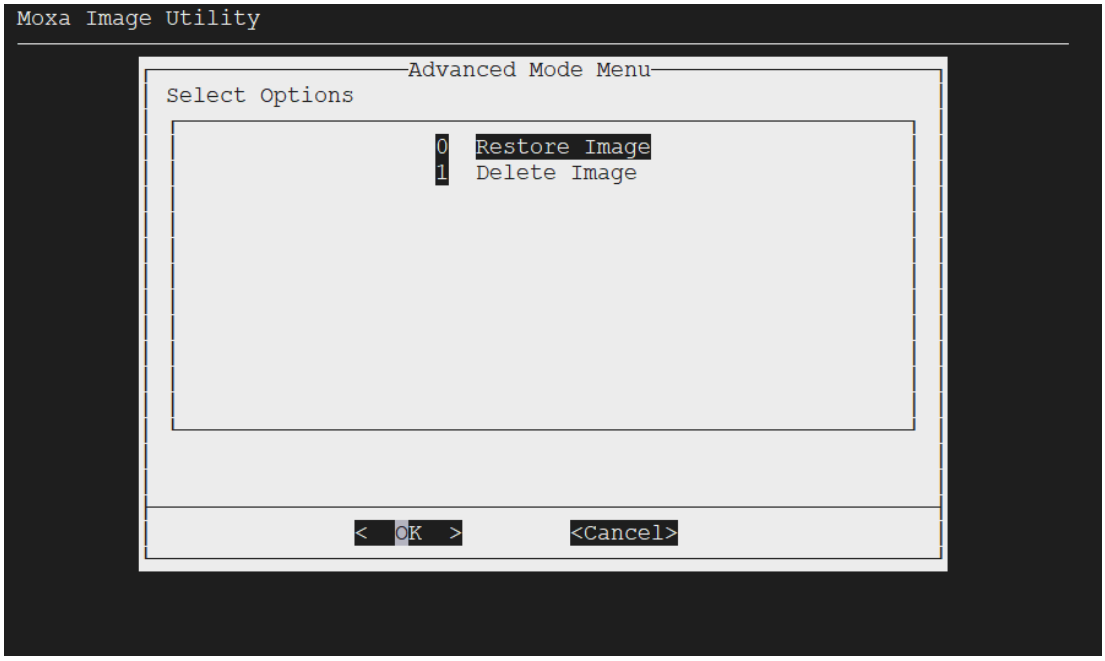
Select **Yes** and wait for the restore image process to complete. After the restore process is complete, select the **Reboot** option, remove the USB drive after the computer is powered off, and go to **Step 4**.

[Advanced Mode]

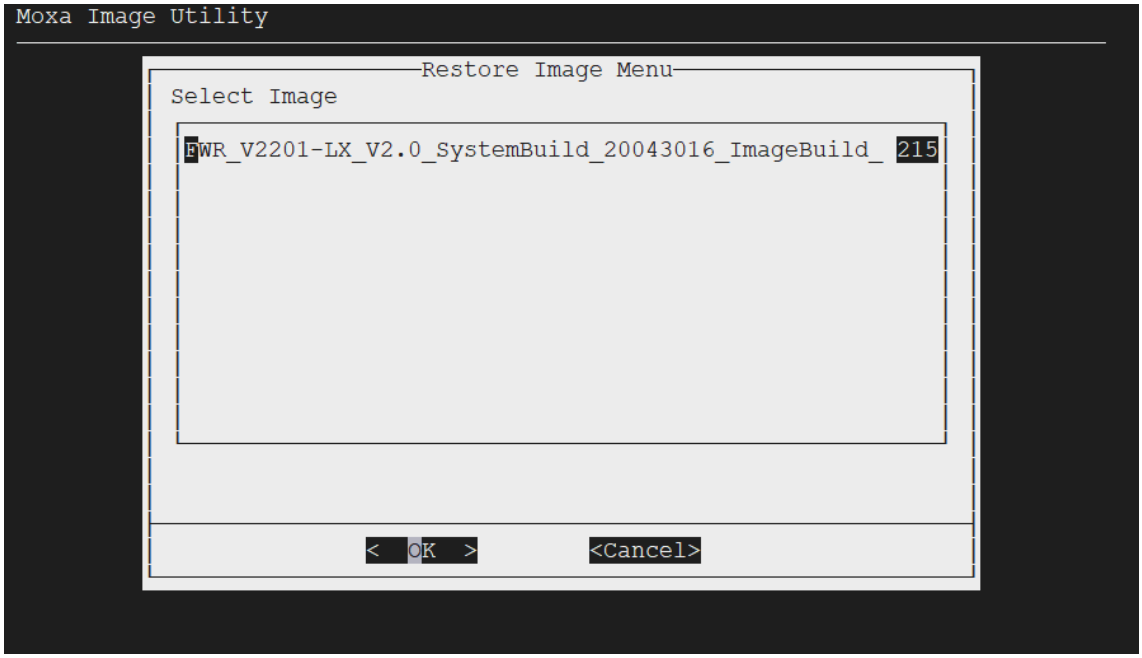
Select the **Advanced Mode** if you have multiple images or storage disks.



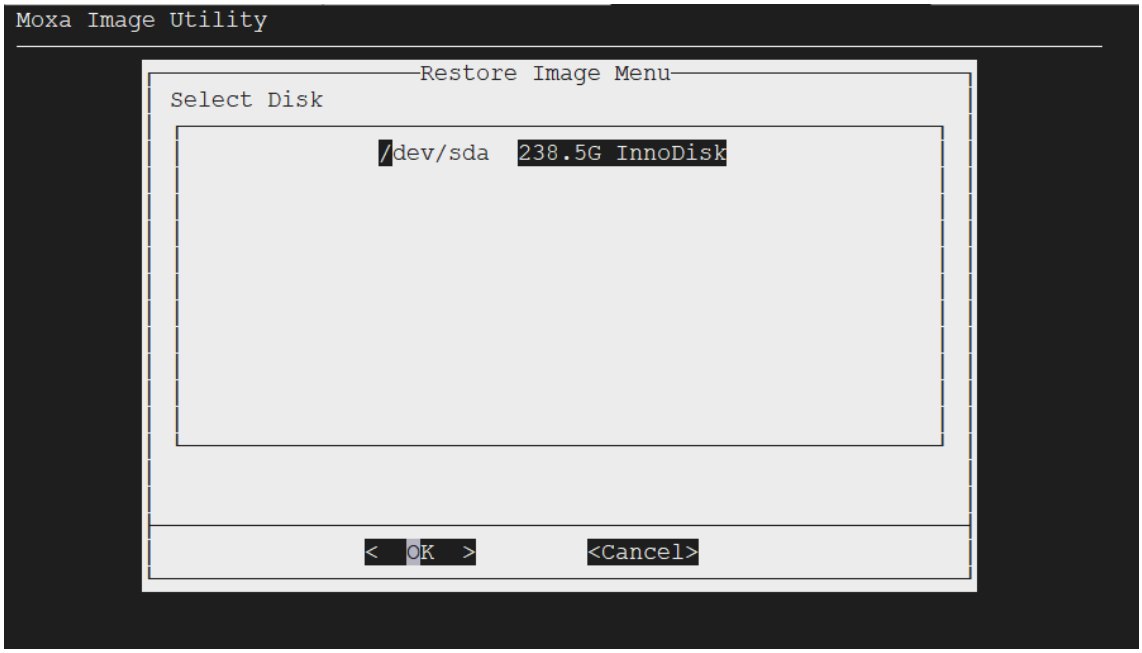
1. In the **Advanced Mode**, select **Restore Image**.



2. Select the target image.



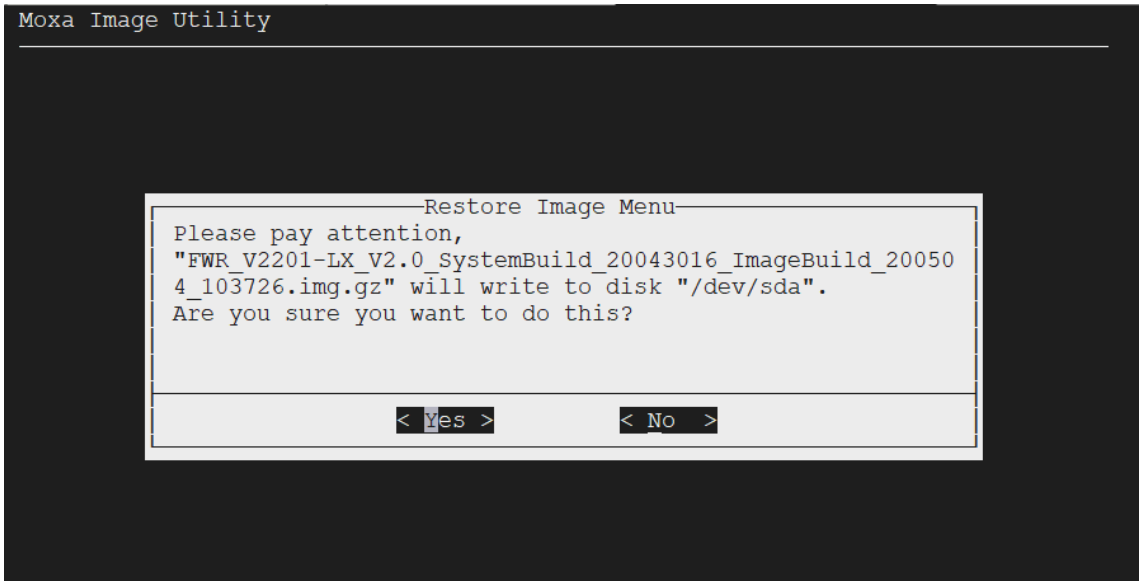
3. Select the target storage disk.



4. Reconfirm the restore task.

WARNING

This step will erase all partitions in the disk.



Select **Yes** and wait for the restore image process to complete. After the restore process is complete, select the **Reboot** option, remove the USB drive after the computer is powered off, and go to **Step 4**.

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. Remove the USB drive after the computer has been powered off.

5

Additional Settings

The following topics are covered in this chapter:

- **Getting the Product Serial Number**
- **RTC (Real-time Clock)**
- **Serial Ports**
- **Digital I/O**
- **WDT (Watchdog Timer)**
  - How the WDT Works

Getting the Product Serial Number

The product information can be read using the **dmidecode** command. You can use the following commands to get the information.

```
moxa@Moxa:~$ sudo dmidecode -t 1
# dmidecode 3.0
Getting SMBIOS data from sysfs.
SMBIOS 3.0.0 present.

Handle 0x0001, DMI type 1, 27 bytes
System Information
       Manufacturer: Moxa
       Product Name: V2201
       Version:
       Serial Number: 123456789
       UUID: 12345678-1234-5678-90AB-CDDEEFAABBCC
       Wake-up Type: Power Switch
       SKU Number:
       Family:
```

RTC (Real-time Clock)

The device node is located at **/dev/rtc**. The V2201-LX supports standard Linux simple RTC control. You must include the header file **<linux/rtc.h>**.

1. Function: RTC_RD_TIME

```
int ioctl(fd, RTC_RD_TIME, struct rtc_time *time);
Description: read time information from the RTC. It will return the value on argument
3.
```

2. Function: RTC_SET_TIME

```
int ioctl(fd, RTC_SET_TIME, struct rtc_time *time);
Description: set RTC time. Argument 3 will be passed to RTC.
```

Serial Ports

The serial ports support RS-232, RS-422, and RS-485 2-wire operation modes with flexible baudrate settings. The default operation mode is set to **RS-232**; use the **mx-uart-ctl** command to change the operation mode.

Usage: mx-uart-ctl -p <#port_number> -m <#uart_mode>
Port number: n = 0,1,2,...
uart mode: As in the following table

Interface-no	Operation Mode
None	Display current setting
0	RS-232
1	RS-485 2-wires
2	RS-422 or RS-485 4-wires

For example, to set Port 0 to RS-485 4-wire mode, use the following command:

```
root@Moxa:/home/moxa# mx-uart-ctl -p 0
Current uart mode is RS232 interface.
root@Moxa:/home/moxa# mx-uart-ctl -p 0 -m 1
Set OK.
Current uart mode is RS485-2W interface.
```

Digital I/O

Digital Output channels can be set to high or low. The default output channel mode is set to low; use the **mx-dio-ctl** command to change the operation mode.

Usage: mx-dio-ctl <-i|-o <#port number> [-s <#state>]>
I/O: -i <#DIN port number>
-o <#DOUT port number>
state -s <#state>
0 --> LOW
1 --> HIGH

For example, to see the details of the input port 0 and output port 0, use the following command:

```
root@Moxa:/home/moxa# mx-dio-ctl -i 0
DIN port 0 state: 1
root@Moxa:/home/moxa# mx-dio-ctl -o 0
DOUT port 0 state: 0
```

To set the output port 0 to high, use the following command:

```
root@Moxa:/home/moxa# mx-dio-ctl -o 0 -s 1
DOUT port 0 state: 1
```

WDT (Watchdog Timer)

The WDT works like a watchdog function and can be enabled or disabled. When the WDT function is enabled and the application does not acknowledge it, the system will reboot. The watchdog driver is loaded with default timeout of 60 seconds. The watchdog application should acknowledge the WDT within 60 seconds.

How the WDT Works

Debian supports a watchdog daemon. The watchdog daemon checks if your system is running. If programs are no longer being run, it will perform a hard reset of the system.

The V2201-LX models come with the standard watchdog driver and package preinstalled. For all other models, you need to first install the watchdog package using the **apt-get** command as follows:

```
moxa@Moxa:~$ sudo apt-get install watchdog…
```

After installing the watchdog, modify the **/etc/watchdog.conf** file to remove the '**#**' in front of the **watchdog-device** setting.

```
…
watchdog-device = /dev/watchdog
…
```

Then, enable the **watchdog** service using the **`systemctl`** command.

```
moxa@Moxa:~$ sudo systemctl enable watchdog
```

The watchdog configuration is available at **/etc/watchdog.conf**. The acknowledgement interval can be set to a number between 2 seconds and 58 seconds. In the following example, we have configured the watchdog daemon to acknowledge the WDT in 29 seconds because the watchdog daemon suggests to acknowledge twice before the watchdog timer times out and the daemon might sleep. The **`realtime`** mode is to lock itself into memory, so it is never swapped out to prevent a delay in acknowledging the watchdog. You can modify the **/etc/watchdog.conf** file to enable the watchdog as per your system requirement. The **`priority`** setting specifies the scheduled priority for realtime mode.

```
…
interval             = 29
realtime             = yes
priority             = 1
…
```

If you want to remove the watchdog from the **systemd** service, use the following command:

```
moxa@Moxa:~$ sudo systemctl disable watchdog
```

To check the watchdog daemon status, use:

```
moxa@Moxa:~# sudo systemctl status watchdog
```

The Watchdog Device IOCTL Commands

IOCTL	**WDIOC_GETSUPPORT**
Description	This returns the support of the card itself
Input	None
Output	(struct watchdog_info *) arg
Return	On success, return 0. Otherwise, return < 0 value.
IOCTL	**WDIOC_GETSTATUS**
Description	This returns the status of the card
Input	None
Output	(int *)arg
Return	On success, return 0. Otherwise, return < 0 value.
IOCTL	**WDIOC_GETBOOTSTATUS**
Description	This returns the status of the card that was reported at bootup.
Input	None
Output	(int *)arg)
Return	On success, return 0. Otherwise, return < 0 value.
IOCTL	**WDIOC_SETOPTIONS**
Description	This lets you set the options of the card. You can either enable or disable the card this way.
Input	None
Output	(int *)arg)
Return	On success, return 0. Otherwise, return < 0 value.
IOCTL	**WDIOC_KEEPALIVE**
Description	This pings the card to tell it not to reset your computer.
Input	None
Output	None
Return	On success, return 0. Otherwise, return < 0 value.
IOCTL	**WDIOC_SETTIMEOUT**
Description	Set the watchdog timeout
Input	arg: 2 to 255 seconds
Output	None
Return	On success, return 0. Otherwise, return < 0 value.

IOCTL	WDIOC_GETTIMEOUT
Description	Get the current watchdog timeout.
Input	None
Output	arg: 2 to 255 seconds
Return	On success, return 0. Otherwise, return < 0 value.

Examples

The example file **watchdog-simple.c** acknowledges (acks) the watchdog every 10 seconds.

```
#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>
#include <fcntl.h>

int main(void)
{
	int fd = open("/dev/watchdog", O_WRONLY);
	int ret = 0;
	if (fd == -1) {
		perror("watchdog");
		exit(EXIT_FAILURE);
	}
	while (1) {
		ret = write(fd, "\0", 1);
		if (ret != 1) {
			ret = -1;
			break;
		}
		sleep(10);
	}
	close(fd);
	return ret;
}
```