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This user's manual applies to the ioThinx 4530 Series models listed below:

**ioThinx 4530 Series**
- ioThinx 4533-LX Series

Detailed instructions on configuring advanced settings are covered in Chapters 3 and 4.
In this chapter, we describe how to configure basic settings for the ioThinx 4530 controller.

The following topics are covered in this chapter:

- **Connecting to the ioThinx 4530 Controller**
  - Connecting Through the Serial Console
  - Connecting Through the SSH Console

- **User Account Management**
  - Switching to the Root Account
  - Creating and Deleting User Accounts
  - Disabling the Default User Account

- **Network Settings**
  - Configuring Ethernet Interfaces

- **System Administration**
  - Querying the Firmware Version
  - Adjusting the Time
  - Setting the Time Zone

- **Determining Available Drive Space**

- **Shutting Down the Device**
Connecting to the ioThinx 4530 Controller

You will need to use a computer to connect to the ioThinx 4530 controller and to log in through the command line interface. There are two ways to connect: through the serial console port or through the Ethernet port. Refer to the ioThinx 4530 Series Hardware Manual to see how to set up the physical connections.

The default login username and password are:

Username: moxa
Password: moxa

The username and password are the same for all serial console and SSH remote log in actions. Root account login is disabled until you manually create a password for the account. The user moxa is in the sudo group so that you can operate system level commands with this user using the sudo command. For additional details, see the Sudo Mechanism section in chapter 5.

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

Connecting Through the Serial Console

This method is particularly useful when using the computer for the first time. The signal is transmitted over a direct serial connection so you do not need to know either of its two IP addresses in order to connect to the ioThinx 4530 controller. To connect through the serial console, configure your PC’s terminal software using the following settings.

<table>
<thead>
<tr>
<th>Serial Console Port Settings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baudrate</td>
</tr>
<tr>
<td>Parity</td>
</tr>
<tr>
<td>Data bits</td>
</tr>
<tr>
<td>Stop bits</td>
</tr>
<tr>
<td>Flow control</td>
</tr>
<tr>
<td>Terminal</td>
</tr>
</tbody>
</table>

Below we show how to use the terminal software to connect to the ioThinx 4530 controller in a Linux environment and in a Windows environment.

Linux Users

NOTE These steps apply to the Linux PC you are using to connect to the ioThinx 4530 controller. Do NOT apply these steps to the ioThinx 4530 controller itself.

Take the following steps to connect to the ioThinx 4530 controller from your Linux PC.

1. Install minicom from the package repository of your operating system.
   - For Centos and Fedora:
     ```
     user@PC1:~# yum -y install minicom
     ```
   - For Ubuntu and Debian:
     ```
     user@PC2:~# apt-get install minicom
     ```

2. Use the minicom -s command to enter the configuration menu and set up the serial port settings.
   ```
   user@PC1:~# minicom -s
   ```
3. Select **Serial port setup**.

```
+----[configuration]----+
<p>| Filenames and paths    |</p>
<table>
<thead>
<tr>
<th>File transfer protocols</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial port setup</td>
</tr>
<tr>
<td>Modem and dialing</td>
</tr>
<tr>
<td>Screen and keyboard</td>
</tr>
<tr>
<td>Save setup as dfl</td>
</tr>
<tr>
<td>Exit</td>
</tr>
<tr>
<td>Exit from Minicom</td>
</tr>
</tbody>
</table>
+------------------------+
```

4. Select **A** to change the serial device. Note that you need to know which device node is connected to the ioThinx 4530 controller.

```
+----[configuration]----+
| Serial Device         :
| /dev/tty8             |
| B - Lockfile Location :
| /var/lock             |
| C - Callin Program    :
|                     |
| D - Callout Program   :
|                     |
| E - Bps/Par/Bits      : 115200 8N1|
| F - Hardware Flow Control : No |
| G - Software Flow Control : No |

Change which setting? 1
```

5. Select **E** to configure the port settings according to the **Serial Console Port Settings** table provided.

6. Select **Save setup as dfl** (from the main configuration menu) to use default values.

7. Select **Exit from minicom** (from the configuration menu) to leave the configuration menu.

8. Execute **minicom** after completing the above configurations.

```
user@PC1:~# minicom
```

### Windows Users

**NOTE** These steps apply to the Windows PC you are using to connect to the ioThinx 4530 controller. Do NOT apply these steps to the ioThinx 4530 controller itself.

Take the following steps to connect to the ioThinx 4530 controller from your Windows PC.


2. Once the connection is established, the following window will open.
3. Select the **Serial** connection type and choose settings.

## Connecting Through the SSH Console

The ioThinx 4530 controller supports SSH connections over an Ethernet network. Use the following default IP addresses to connect to the ioThinx 4530 controller.

<table>
<thead>
<tr>
<th>Port</th>
<th>Default IP</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAN 1</td>
<td>192.168.127.254</td>
</tr>
<tr>
<td>LAN 2</td>
<td>192.168.126.254</td>
</tr>
</tbody>
</table>

### Linux Users

**NOTE** These steps apply to the Linux PC you are using to connect to the ioThinx 4530 controller. Do **NOT** apply these steps to the ioThinx 4530 controller itself. Before you run the `ssh` command, be sure to configure the IP address of your notebook/PC’s Ethernet interface in the range of 192.168.127.0/24 for LAN1 and 192.168.126.0/24 for LAN2.

Use the `ssh` command from a Linux computer to access the ioThinx 4530 controller’s LAN1 port.

```
user@PC1:~ ssh moxa@192.168.127.254
```

Type **yes** to complete the connection.

```
The authenticity of host '192.168.127.254' can't be established.
Are you sure you want to continue connection (yes/no)? yes_
```
ATTENTION

Rekey SSH regularly

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

When prompted for a passphrase, leave the passphrase empty and press enter.

```
moxa@Moxa:~$ cd /etc/ssh
moxa@Moxa:~$ sudo rm -rf
ssh_host_ed25519_key2       ssh_host_ecdsa_key       ssh_host_rsa_key
ssh_host_ed25519_key.pub    ssh_host_ecdsa_key.pub   ssh_host_rsa_key.pub
moxa@Moxa:~$ sudo ssh-keygen -t rsa -f /etc/ssh/ssh_host_rsa_key
moxa@Moxa:~$ sudo ssh-keygen -t dsa -f /etc/ssh/ssh_host_dsa_key
moxa@Moxa:~$ sudo ssh-keygen -t ecdsa -f /etc/ssh/ssh_host_ecdsa_key
moxa@Moxa:~$ sudo /etc/init.d/ssh restart
```

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 ioThinx 4530 controller. Do NOT apply these steps to the ioThinx 4530 controller 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 ioThinx 4530 controller in a Windows environment. The following figure shows a simple example of the configuration that is required.

```
NOTE: The ioThinx 4530 Series only supports SSH connections.
User Account Management

Switching to the Root Account

You can switch to root using `sudo -i` (or `sudo su`). 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](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 `sudo su –c` to run the command instead of using >, <, >>, <<, etc.
**Note:** The single quotes around the full command are required.

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. The 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:~# 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:~# sudo passwd test1
Enter new UNIX password:
Retype new UNIX password:
passwd: password updated successfully
```

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

```
moxa@Moxa:~# sudo userdel test1
```

Disabling the Default User Account

ATTENTION
You should first create a user account before you disable the default account.

Use the `passwd` command to lock the default user account so the user moxa cannot log in.

```
root@Moxa:~# passwd -l moxa
```

Type the following command to unlock the user moxa:

```
root@Moxa:~# passwd -u moxa
```
Network Settings

Configuring Ethernet Interfaces

After the first login, you can configure the ioThinx 4530 controller’s network settings to fit your application better. Note that it is more convenient to manipulate the network interface settings from the serial console than from an SSH login because an SSH connection can disconnect when there are network issues and the connection must be reestablished.

Modifying Network Settings via the Serial Console

In this section, we use the serial console to configure the ioThinx 4530 controller’s network settings. Follow the instructions in the Connecting to the ioThinx 4530 controller section under Getting Started to access the Console Utility of the target computer via the serial Console port and then type `cd /etc/network` to change directories.

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

Type `sudo vi interfaces` to edit the network configuration file in the `vi` editor. You can configure the ioThinx 4530 controller’s Ethernet ports to use either static or dynamic (DHCP) IP addresses.

Setting a Static IP address

To set a static IP address for the ioThinx 4530 controller, use the `iface` command to modify the default gateway, address, network, netmask, and broadcast parameters of the Ethernet interface.

```
# interfaces(5) file used by ifup(8) and ifdown(8)
# Include files from /etc/network/interfaces.d:
source-directory /etc/network/interfaces.d
auto eth0 eth1 lo
iface lo inet loopback
iface eth0 inet static
    address 192.168.127.254
    network 192.168.127.0
    netmask 255.255.255.0
    broadcast 192.168.127.255
iface eth1 inet static
    address 192.168.126.254
    network 192.168.126.0
    netmask 255.255.255.0
    broadcast 192.168.126.255
```
Setting Dynamic IP Addresses:

To configure one or both LAN ports to request an IP address dynamically use the **dhcp** option in place of **static** in the **iface** command, as follows:

<table>
<thead>
<tr>
<th>Default Setting for LAN1</th>
<th>Dynamic Setting using DHCP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>iface eth0 inet static</strong></td>
<td><strong>iface eth0 inet dhcp</strong></td>
</tr>
</tbody>
</table>

```
iface eth0 inet static
    address 192.168.127.254
    network 192.168.127.0
    netmask 255.255.255.0
    broadcast 192.168.127.255
```

```
iface eth0 inet dhcp
```

System Administration

Querying the Firmware Version

To check the ioThinx 4530 controller’s firmware version, type:

```
moxa@Moxa:~$ kversion
ioThinx 4533-LX version 1.0
```

Add the **–a** option to create a full build version:

```
moxa@Moxa:~$ kversion -a
ioThinx 4533-LX version 1.0 Build 19032720
```

Master Infomation:

45MR Module Scan Time: 0 ms

Adjusting the Time

The ioThinx 4530 controller has two time settings. One is the system time, and the other is the RTC (Real Time Clock) time kept by the ioThinx 4530 controller's hardware. 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

```
moxa@Moxa:~$ sudo date 032123192019
Thu Mar 21 23:19:00 UTC 2019
```

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

```
moxa@Moxa:~$ sudo hwclock --w
moxa@Moxa:~$ sudo hwclock
2019-03-21 02:09:00.628145+0000
```

**NOTE**

Click the following links for more information on date and time:

- [https://wiki.debian.org/DateTime](https://wiki.debian.org/DateTime)
Setting the Time Zone

There are two ways to configure the Moxa embedded computer’s timezone. 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]][,startdate[/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:~$ TZ= EST5EDT
    moxa@Moxa:~$ export TZ

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

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

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

### Using the Localtime File

The local timezone 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 ioThinx 4530 controller 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 ioThinx 4530 controller.

### Determining Available Drive Space

To determine the amount of available drive space, use the `df` command with the `-h` tag. The system will return the amount of drive space broken down by file system. Here is an example:

```bash
moxa@Moxa:~$ sudo df -h
Filesystem            Size  Used Avail Use% Mounted on
/dev/root             941M  812M   65M  93%   /
/devtmpfs            240M     0  240M   0%  /dev
/mmcblk1p3          6.0G  5.3M  5.7G   1%  /overlayfs
/overlay            6.0G  5.3M  5.7G   1%   /var
/overlay            6.0G  5.3M  5.7G   1%    /etc
/overlay            6.0G  5.3M  5.7G   1%   /home
/overlay            6.0G  5.3M  5.7G   1%    /root
/overlay            6.0G  5.3M  5.7G   1%   /sbin
/overlay            6.0G  5.3M  5.7G   1%    /bin
/overlay            6.0G  5.3M  5.7G   1%    /usr
/overlay            6.0G  5.3M  5.7G   1%    /lib
/overlay            6.0G  5.3M  5.7G   1%   /tmp
/overlay            6.0G  5.3M  5.7G   1%    /mnt
/overlay            6.0G  5.3M  5.7G   1%    /opt
/overlay            6.0G  5.3M  5.7G   1%    /media
tmpfs              248M     0  248M   0%   /dev/shm
tmpfs             248M     0  248M   0%   /dev/shm
tmpfs             248M     0  248M   0%   /dev/shm
tmpfs             248M     0  248M   0%   /dev/shm
tmpfs             248M     0  248M   0%   /dev/shm
Shutting Down the Device

To shut down the device, disconnect the power source to the computer. When the computer is powered off, main components such as the CPU, RAM, and storage devices are powered off, although an internal clock powered by a super capacitor may keep running.

You can use the Linux `shutdown` command 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:~$ sudo shutdown -h now
```
Firmware Update and System Recovery

The following topics are covered in this chapter:

- Firmware Update and Set-to-Default Functions
  - Set-to-Default
  - Firmware Update Using an SFTP Server or microSD Card
Firmware Update and Set-to-Default Functions

Set-to-Default

1. Power off the device.
2. Press and hold the reset button; while holding the reset button:
   a. Power on the device; the RDY LED will blink green while the device is booting up.
   b. After the device has booted up, the RDY LED will blink red; continue holding the reset button until the RDY LED stops blinking.
3. Release the reset button to load the factory default settings.

For additional details on the LEDs, refer to the quick installation guide or the user’s manual for your ioThinx 4530 controller.

NOTE

It should take about 20 seconds from the time the RDY LED starts blinking green until it stops blinking red.

ATTENTION

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

Back up your files before resetting the system to factory defaults. All the data stored in the ioThinx 4530 controller’s boot storage will be destroyed after resetting to factory defaults.

You can also use the `mx-set-def` command to restore the ioThinx 4530 controller to factory defaults:

```
moxa@Moxa:~$ sudo mx-set-def
```

Firmware Update Using an SFTP Server or microSD Card

Updating the Firmware

1. To update the firmware, log in to the product through the serial console. Instructions on how to connect to the serial console can be found in the ioThinx 4530 Hardware User’s Manual.
2. Put the firmware (*.sh) file to the ioThinx 4530 device via an SFTP server or MicroSD card.
3. Use the following commands to update the firmware.

```
moxa@Moxa:~$ sudo ./FWR_ioThinx_4533_V1.1.0_Build_2019_0321_1305.sh
[sudo] password for moxa:
Upgrade firmware version from [1.0] to [1.1].
This step will destroy all your firmware.
Continue ? (Y/N) :
```

4. After the firmware update is complete, the ioThinx 4530 will restart automatically. Use the kversion command to check the firmware version.
Click the following link to download the ioThinx 4530 Programming Guide:


The ioThinx 4530 Programming Guide includes the following sections:

**Tutorials:**
Shows users how to build code, use the cloud SDK, and use Python to access I/O data.

**I/O Libraries:**
Shows users how to access ioThinx 45M modules.

**Module Information:**
Shows users how to access module information.

**Rotary Switch:**
Shows users how to read the status of rotary switches.

**User Defined LED Indicator:**
Shows users how to access LED indicators.

**Error Codes:**
Provides the meaning of the return code to help users perform troubleshooting tasks.
The controller’s cycle time is defined as how much time the CPU needs to poll the status of all IO modules. This information is important since it allows users to make sure the controller can control their application within a designated time period. The cycle time calculation is based on the following table. A cycle time is calculated for each group of eight appended 45M modules. The cycle time of a group is the sum of the cycle time of the first module in the group (the times in column 1) plus the cycle times of the 2nd through 8th modules (the times in column 2) in the group. To calculate the cycle time of ioThinx 4530 Series CPU, simply add up the cycle times of all of the groups connected to the ioThinx, and then round the time up to the nearest millisecond.

<table>
<thead>
<tr>
<th>Module</th>
<th>Cycle time as 1st module in one group (µs)</th>
<th>Cycle time as 2nd to 8th module of the one group (µs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>45MR-1600</td>
<td>1200</td>
<td>100</td>
</tr>
<tr>
<td>45MR-1601</td>
<td>1200</td>
<td>100</td>
</tr>
<tr>
<td>45MR-2404</td>
<td>1300</td>
<td>100</td>
</tr>
<tr>
<td>45MR-2600</td>
<td>1200</td>
<td>100</td>
</tr>
<tr>
<td>45MR-2601</td>
<td>1200</td>
<td>100</td>
</tr>
<tr>
<td>45MR-2606</td>
<td>1200</td>
<td>100</td>
</tr>
<tr>
<td>45MR-3800</td>
<td>1300</td>
<td>200</td>
</tr>
<tr>
<td>45MR-3810</td>
<td>1300</td>
<td>200</td>
</tr>
<tr>
<td>45MR-6600</td>
<td>1500</td>
<td>300</td>
</tr>
<tr>
<td>45MR-6810</td>
<td>1500</td>
<td>300</td>
</tr>
</tbody>
</table>

We provide two examples to illustrate cycle time calculations.

**Case 1.** 4-piece 45MR-1600 and 4-piece 45MR-2601.

In this case, the eight modules form one group. The cycle time of this combination is $1900 \, \mu s = 1200 \, \mu s + 7 \times 100 \, \mu s$. The ioThinx 4530 Series will round up the cycle time to the ms level, and consequently the cycle time of this combination is 2 ms.
Case 2. 4 x 45MR-1600, 4 x 45MR-2601, 2 x 45MR-3800.

|-----------------------|-----------------------|-----------------------|-----------------------|----------------------|----------------------|---------------------|----------------------|----------------------|----------------------|

In this case, the 10 modules are separated in two groups. The first group is outlined in red above, whereas the second group is outlined in orange. The combination of modules in the first group is the same as in Case 1, which was shown to have a cycle time = 1900 µs. For the second group, the cycle time is 1500 µs = 1300 µs + 200 µs. Therefore, the total cycle time of the two groups is 3400 µs = 1900 µs + 1500 µs, which when rounded up to the nearest ms results in a total cycle time = 4 ms.