



MC-CPU-CM4-Gx Industrial Controller

Startup Guide

eMMC Version

Startup Guide

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4. Connecting the Display

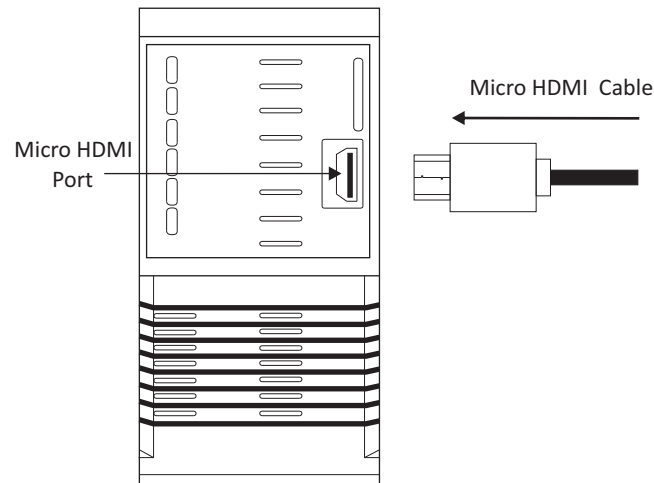


Figure 4: Connect Standard HDMI to Micro HDMI cable in to Micro HDMI port on the device

CPU module include a Micro HDMI display output port. So, use Micro HDMI to Standard HDMI cable. Connect the cable before turn on the CPU module as shown in Figure 4.

5. Connecting with Power

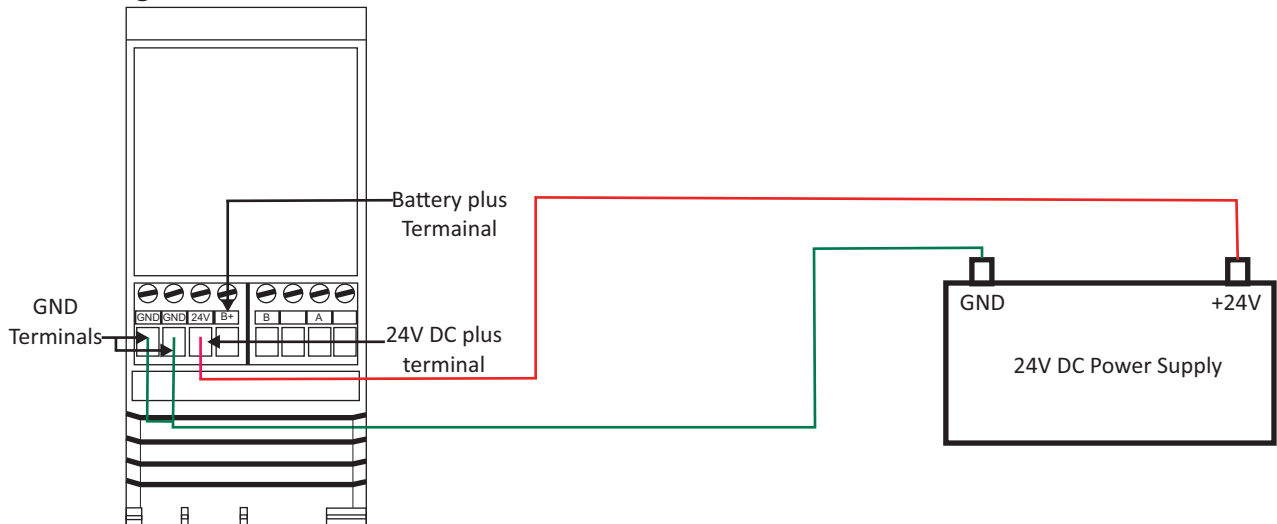


Figure 5: The power up wiring diagram of the CPU module

Use 24V DC power supply for power up the device as shown in Figure 5. When power supplied correctly The LED indication bulb will on. But if batter based supply use for power up the CPU module connect battery positive terminal in to the 'B+' slot in module. If all above instruction were followed correctly the display connected to CPU module will show boot process OS kernel details. After few seconds the Home screen will appear on the display. As shown in Figure 6 below.

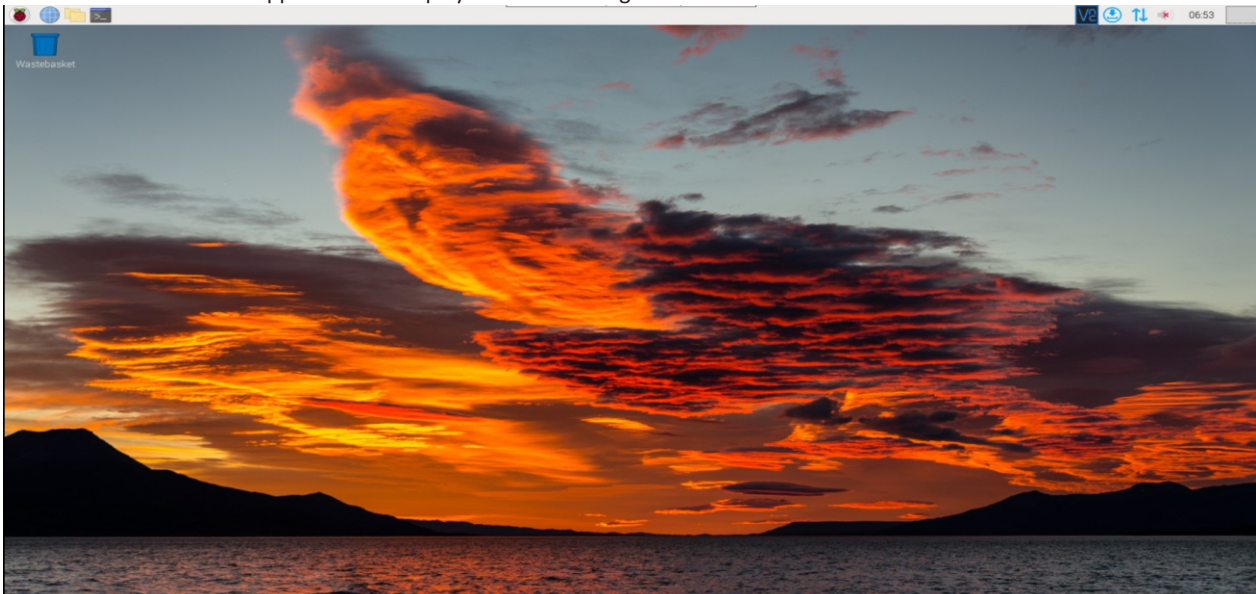


Figure 6: The Home screen after CPU module finished the boot process

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Introduction

SenOper MC-CPU-CM4-Gx CPU module is most suitable product available in market as Industrial Controller.

This smart industrial controller have capability for operate with multiple expansion modules that support for Analog Inputs, Fast Inputs, Temperature, GSM/LTE, Transistor Outputs & Digital Inputs.

This CPU module powered by Raspberry Pi Compute Module 4, Moreover the operating system is powered by Debian.

MC-CPU-CM4-Gx CPU module include Ethernet, Wi-Fi, Bluetooth as connectivity options.

For other data communication functions USB type A ports, and RS-485 methods were integrated with this CPU module.

The CPU module support for SPI, I2C protocols for interfacing with expansion modules. Further, CPU module support for program by C/C++, Python & Node Red.

The primary storage of this version is eMMC drive.



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1. Connecting with Ethernet

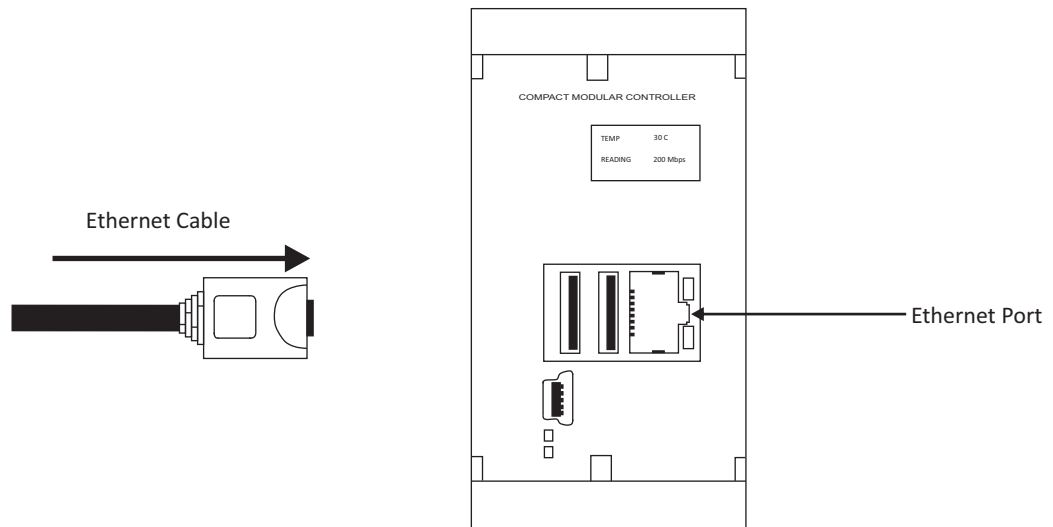


Figure 1: Connect Rj45 cable in to Ethernet port on the device

For make the connectivity between CPU module and internet the Rj45 network cable connect in to the Ethernet port locate the front face of the device as in Figure 1. The Ethernet can reach 100 Mbps data transfer rate.

2. Connecting USB Device

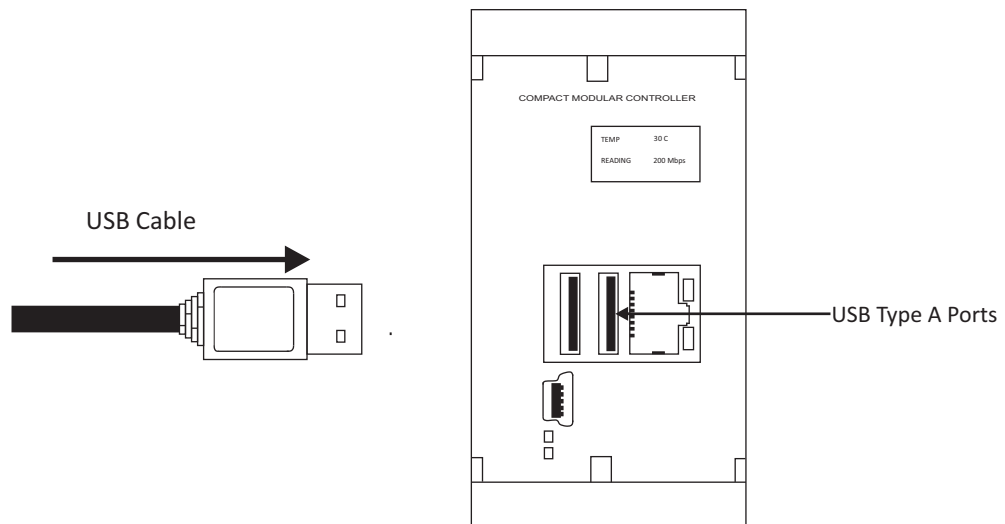


Figure 2: Connect USB support device in to USB port on the device

USB Type A Port use to connect USB keyboard, Mouse or other USB based communication device with the CPU module.

3. Insert the Micro SD card

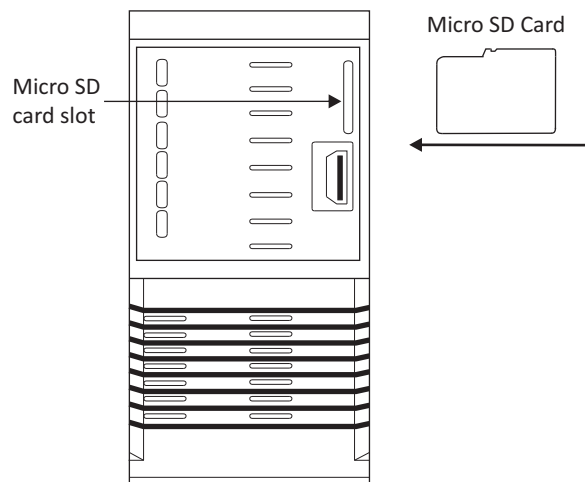


Figure 3: Insert the MicroSD card in to the slot in CPU module.

Before power up the CPU module the Micro SD card should inserted as shown in Figure 3. This SD card provided include operating system for run the CPU module. In (Section) explained detail wise to install required libraries.

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6. Setup Display Resolution

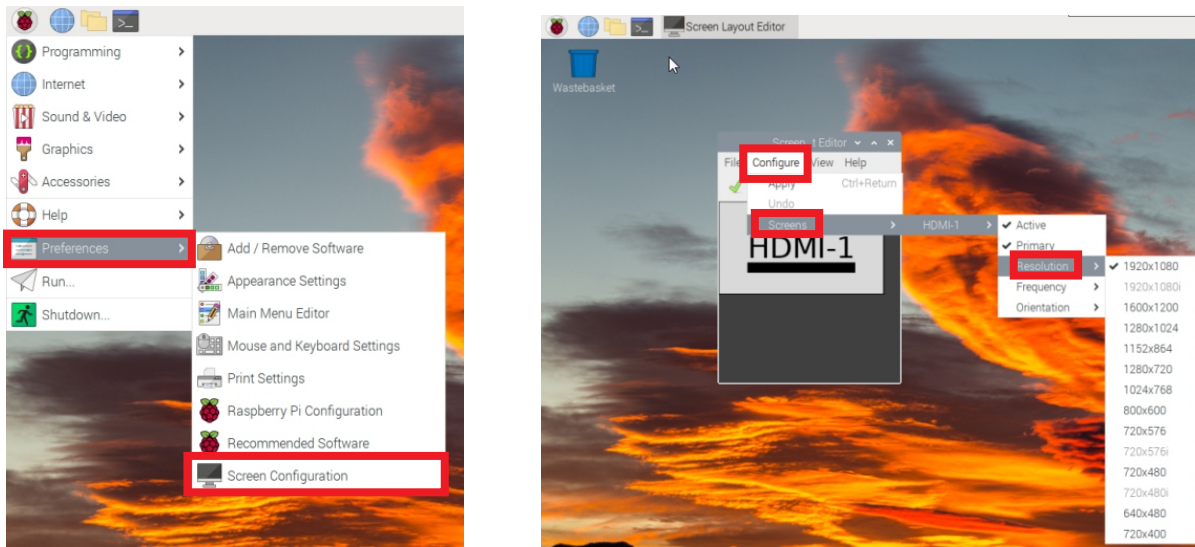


Figure 7: Display Resolution Setup

1. According to Figure 7 follow **Applications Menu > Preference > Screen Configuration**. Then Screen Layout Editor window will appear. Then follow **Configure > Screens > HDMI > Resolution** and then select appropriate resolution.
2. Then green color tick and click 'OK' on appeared window according to Figure 8.

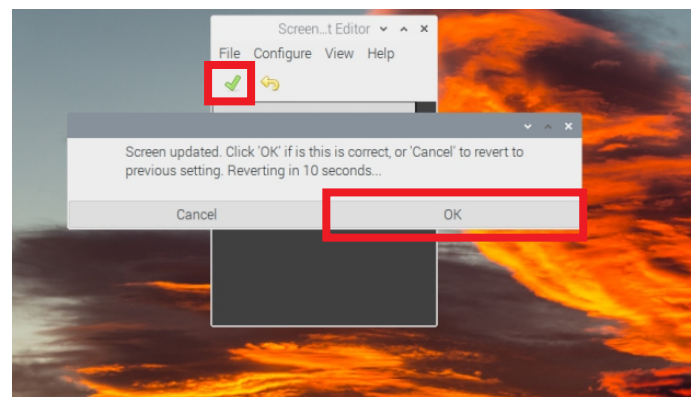


Figure 8: Save Display settings

7. Enable Interfaces

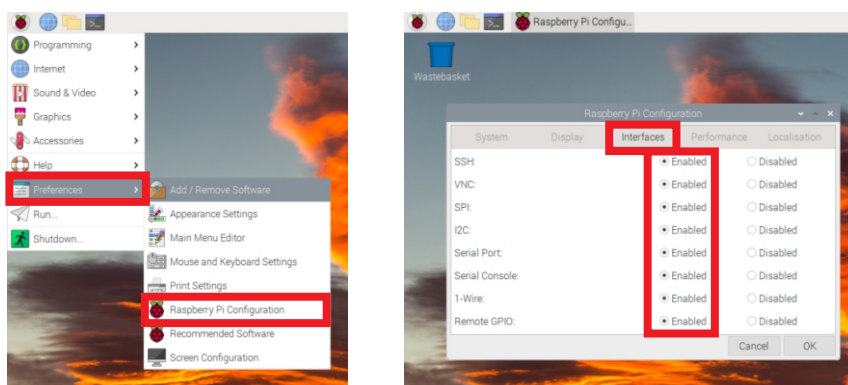


Figure 9: Enable Interfaces through Raspberry Pi Configuration

1. According to the Figure 9 open Raspberry Pi Configuration window following **Applications Menu > Preference > Raspberry Pi Configuration**.
2. Then select 'Interface' set SSH, VNC, SPI, I2C, Serial Port, 1-Wire, Remote GPIO to 'Enable' and press 'OK'.
3. After finished above steps reboot the CPU module.

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8. Install required libraries.

To properly function with expansion modules require set of libraries. Those libraries are listed below.

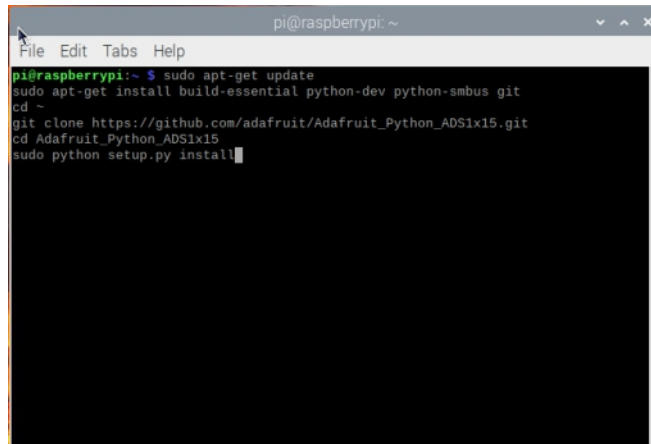
1. Adafruit_ADS1x15
2. smbus
3. Serial
4. spidev
5. numpy
6. RPi.GPIO

8.1 Install Adafruit_ADS1x15 library

Open terminal window, then copy and paste code lines noted below. Then press 'Enter' to run the code.

Source Install

```
sudo apt-get update
sudo apt-get install build-essential python-dev python-smbus git
cd ~
git clone https://github.com/adafruit/Adafruit_Python_ADS1x15.git
cd Adafruit_Python_ADS1x15
sudo python setup.py install
```



Then copy and paste code lines noted below and press 'Enter' to run the code.

Python Package Index Install

```
sudo apt-get update
sudo apt-get install build-essential python-dev python-smbus python-pip
sudo pip install adafruit-ads1x15
```

Now the library installation is successfully finished.

8.2 Install smbus library

smbus is I2C tool useful for I2C supported expansion modules programming.

The OS version provided with this product is **Bullseye Release**. So use code lines noted below. Copy below code lines and paste on terminal window, then press 'Enter' to run the code.

```
sudo apt-get update
sudo apt-get install python3-smbus python3-dev i2c-tools
```

After terminal installation finished run below code line for check I2C address

Note: Run this code line after I2C supported expansion module connected

```
sudo i2cdetect -y 1
```


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8.3 Install Serial library

Open terminal window, the copy and past code lines notes below. Then press 'Enter' to run the code.

```
python -m pip install pyserial
```

If the above code line not support or error shows in terminal window use below code lines.

```
conda install pyserial
or
conda install -c conda-forge pyserial
```

If the any above code line not support or error shows in terminal window use below code lines.

```
sudo pip uninstall pyserial
sudo pip install pyserial
sudo pip3 uninstall pyserial
sudo pip3 install pyserial
```

8.4 Install spidev library

spidev library is useful for program expansion modules that supports SPI.

Open terminal window, the copy and past code lines notes below. Then press 'Enter' to run the code.

If the Python Dev not installed run below codes in terminal window and reboot

```
sudo apt-get install python-dev
```

Then run the below noted codes in terminal window.

```
mkdir python-spi
cd python-spi
wget https://raw.githubusercontent.com/doceme/py-spidev/master/setup.py
wget https://raw.githubusercontent.com/doceme/py-spidev/master/spidev_module.c
sudo python setup.py install
```

After installation completed reboot the device.

8.5 Install numpy library

Open terminal window, the copy and past code lines notes below. Then press 'Enter' to run the code.

```
pip3 install numpy
```

If the above code was not supported or error occurs on terminal window try below code lines.

```
pip3 uninstall numpy
sudo apt-get install python3-numpy
```

8.6 Install RPi.GPIO library

Method 1 - From repository installation

Open terminal window, the copy and past code lines notes below. Then press 'Enter' to run the code.

```
sudo apt-get update
```

Attempt to install RPi.GPIO library.

```
sudo apt-get install rpi.gpio
```

Method 2 - Manual installation

Download the library.

```
wget https://pypi.python.org/packages/source/R/RPi.GPIO/RPi.GPIO-0.5.11.tar.gz
```

Extract the downloaded file and extract to new folder.

```
tar -xvf RPi.GPIO-0.5.11.tar.gz
```

Browse to new directory.

```
cd RPi.GPIO-0.5.11
```

Install the library.

```
sudo python setup.py install
```

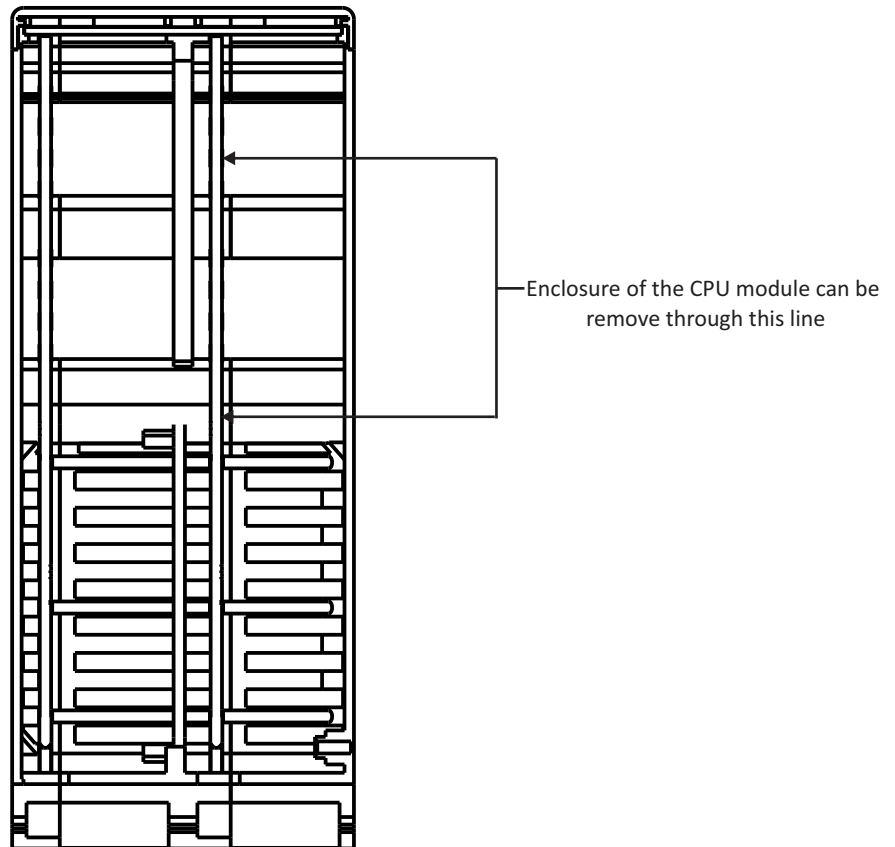
Remove the directory and archive file

```
cd ~
sudo rm -rf RPi.GPIO-0.*
```


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9. Flashing OS to the eMMC

*First the enclosure of the CPU module should remove the mini jumper should connect with eMMC mode pin. This connection disables the CPU modules to eMMC boot mode.



For Windows User.

Under Windows, an installer is available to install the required drivers and boot tool automatically. Alternatively, a user can compile and run it using Cygwin and/or install the drivers manually.

1. Now download and run **rpiboot_setup.exe** Windows installer to install the drivers and boot tool into PC (Please ensure you are not writing to any USB devices whilst the installer is running.).
2. Connect the CPU Module to your host PC via USB cable.
3. Apply power to the CPU Module; Windows should now find the hardware and install the driver.
4. Once the driver installation is complete, run the **rpiboot_setup.exe** tool that was previously installed to PC.
5. After a few seconds, the Compute Module eMMC will pop up under Windows as a disk (USB mass storage device).
6. Now format the eMMC storage such like **SD Card Formatter** (Make sure and note the drive letter).
7. Now download and install **Raspberry Pi Imager** tool in to PC (Also you can use tool like **Win32DiskImager**).
8. Click **CHOOSE OS** and select **Raspberry PI OS (32-bit)** version .
9. Then click **CHOOSE STORAGE** and select correct storage drive letter.
10. Now click **WRITE** for write image to eMMC.
11. After write completed open the eMMC storage drive and open **config.txt** file replace the code lines in page 9 after clear existing code lines and **save** the file.

Note: If you download Raspberry Pi OS Image from our web site (<http://sensoper.com/>) no need to do changes in config.txt file.

For more details and install Linux user follow this link below.

<https://www.raspberrypi.com/documentation/computers/compute-module.html#flashing-the-compute-module-emmc>

12. After the config.txt file changes completed remove the jumper that was earlier connected for eMMC boot disable.
13. Now you can boot the CPU module and use normally (Follow Section 8 for required libraries).

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```
# For more options and information see
# http://rpf.io/configtxt
# Some settings may impact device functionality. See link above for details

# uncomment if you get no picture on HDMI for a default "safe" mode
#hdmi_safe=1

# uncomment this if your display has a black border of unused pixels visible
# and your display can output without overscan
disable_overscan=1

# uncomment the following to adjust overscan. Use positive numbers if console
# goes off screen, and negative if there is too much border
#overscan_left=16
#overscan_right=16
#overscan_top=16
#overscan_bottom=16

# uncomment to force a console size. By default it will be display's size minus
# overscan.
#framebuffer_width=1280
dtoverlay=i2c-rtc,ds3231,i2c_csi_dsi #framebuffer_height=720

# uncomment if hdmi display is not detected and composite is being output
#hdmi_force_hotplug=1

# uncomment to force a specific HDMI mode (this will force VGA)
hdmi_group=0
#hdmi_mode=4

# uncomment to force a HDMI mode rather than DVI. This can make audio work in
# DMT (computer monitor) modes
hdmi_drive=2

# uncomment to increase signal to HDMI, if you have interference, blanking, or
# no display
config_hdmi_boost=4

# uncomment for composite PAL
#sdtv_mode=2

#uncomment to overclock the arm. 700 MHz is the default.
#arm_freq=800

# Uncomment some or all of these to enable the optional hardware interfaces
dtparam=i2c_arm=on
#dtparam=i2s=on
dtparam=spi=on

# Uncomment this to enable infrared communication.
#dtoverlay=gpio-ir,gpio_pin=17
#dtoverlay=gpio-ir-tx,gpio_pin=18

# Additional overlays and parameters are documented /boot/overlays/README

# Enable audio (loads snd_bcm2835)
dtparam=audio=on

[pi4]
# Enable DRM VC4 V3D driver on top of the dispmanx display stack
dtoverlay=vc4-fkms-v3d
max_framebuffers=2

[all]
#dtoverlay=vc4-fkms-v3d

dtoverlay=dwc2,dr_mode=host

dtoverlay=gpio-no-irq
dtparam=i2c_vc=on

dtoverlay=i2c-rtc,pcf85063a,i2c_csi_dsi

dtparam=i2c=on
dtparam=i2c_arm_baudrate=400000
enable_uart=1
dtoverlay=i2c-rtc,ds3231

dtoverlay=disable-bt

enable_uart=1
```

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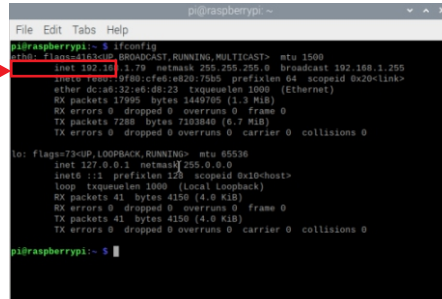
10. Access with VNC.

1. First download and install VNC viewer on you PC through below link.

<https://www.realvnc.com/en/connect/download/viewer/>

2. Open terminal window and type '**ifconfig**' and run the command . Then network details of the CPU module will appear on terminal window as shown in Figure 10 below.

IP Address of the CPU Module



```

pi@raspberrypi:~$ ifconfig
eth0: flags=4096<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 192.168.1.79 netmask 255.255.255.0 broadcast 192.168.1.255
    ether dc:a6:32:e6:08:23 txqueuelen 1000 (Ethernet)
    RX packets 17995 bytes 1440768 (1.3 MiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
    inet6 ::1 prefixlen 128 scopeid 0x10<host>
    loop txqueuelen 1000 (Local Loopback)
    RX packets 41 bytes 4150 (4.0 KiB)
    RX errors 0 dropped 0 overruns 0 frame 0
    TX packets 41 bytes 4150 (4.0 KiB)
    TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

pi@raspberrypi:~$
  
```

Figure 10: CPU Module network details

3. Open VNC Viewer on PC and type the IP address of CPU module on to address bar according to Figure 11. Then press 'Enter'.

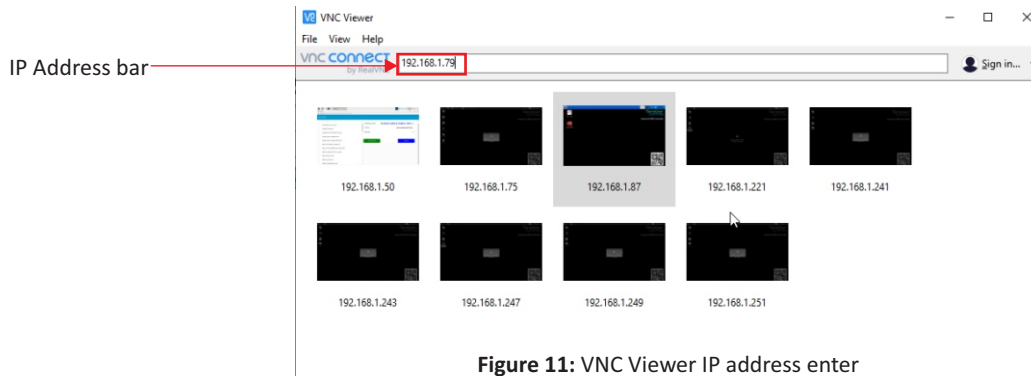


Figure 11: VNC Viewer IP address enter

4. Now enter the Username and password on appeared window shown in Figure 12 below. Default User name is '**PI**' and password is '**raspberry**' click 'OK'.

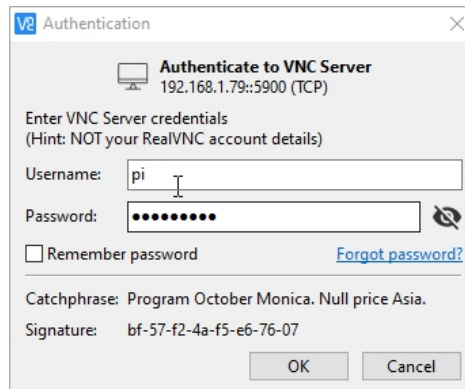


Figure 12: VNC Viewer IP address enter

5. Now new window will appear that shows Home screen of the CPU module. With VNC possible to operate the CPU module without External display.

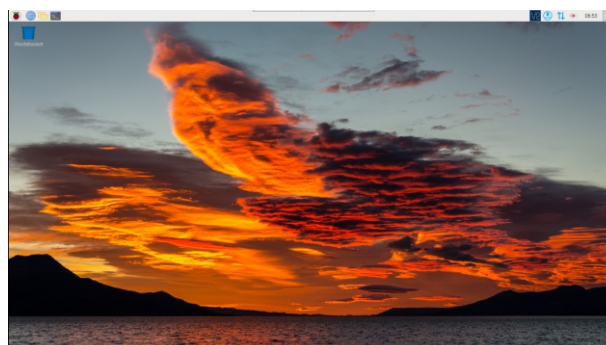


Figure 13: VNC view of the CPU module display.

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11. Connect expansion module and RUN a example code.

1. After following instructions in previous sections. Connect a selected expansion module in to the 40 pin board to board connector in CPU Module (Explained in MC-CPU-CM4-Gx datasheet).
2. Follow the **File Manager > Pi > Rpi_Moduler_test**, then open **Rpi_Moduler_test** folder.
3. In **Rpi_Moduler_test** folder include example program for every expansion module.
4. Select the example program that matches with the expansion module shown in Figure 14.

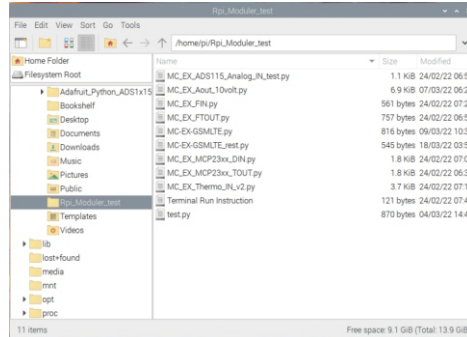


Figure 14: The example programs for expansion modules.

5. The python program will open on default Thonny python IDE. Click RUN for start the program shown in Figure 15.



Figure 15: The example programs open in Thonny Python IDE.

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12. Revision History .

The table shown below include the revision history of this document.

Revision Number	Date	Substantial Changes
0	18/3/2022	First Edition of Startup guide
1	-	-

Technical Support

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