ESWIN

Premier P550 MCU USER MANUAL

For P550 MCU

Rev1.0

2025-03-14

Notice

Change History

Version	Date	Descriptions
V0.1	2024-06-03	Initial edition, an engineering draft.
V0.2	2024-06-25	Update the Figure 1-3. The original one is obsolete command line.
V0.3	2024-07-30	Add SOM Console Output Redirection. Updated the figure of P550 Component location;
V0.5	2024-09-14	Change the version to v0.5
V0.6	2024-09-20	Added various figures and updated descriptions
V0.7	2024-09-26	Added MCU Burning Procedure
V1.0	2025-03-11	Add Ubuntu and MacOS system Burning Procedure

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1. Introduction

P550 MCU (MicroController Unit) acts as a BMC (Baseboard Manager Controller), which provides the following functions:

1. SOM (System On Module) power on/off with hardware key;
2. Get/Set SOM power state via software(WEB or CLI);
3. Get SOM system working status;
4. Warm/Cold reboot SOM system;
5. Get the power consumption of the SOM;
6. Get the temperature and fan speed of the SOM;
7. Get/Set the boot selection of the SOM;
8. Get/Set the network parameters;
9. Get/Set the RTC of the Carrier Board;
10. Get the board version information;
11. SOM Console Redirection;

These functions can be controlled through either the serial terminal interface of the MCU or through the GUI hosted on a local embedded webserver by the MCU through its ethernet interface (#13 in Figure 1-1).

1.1 P550 Components

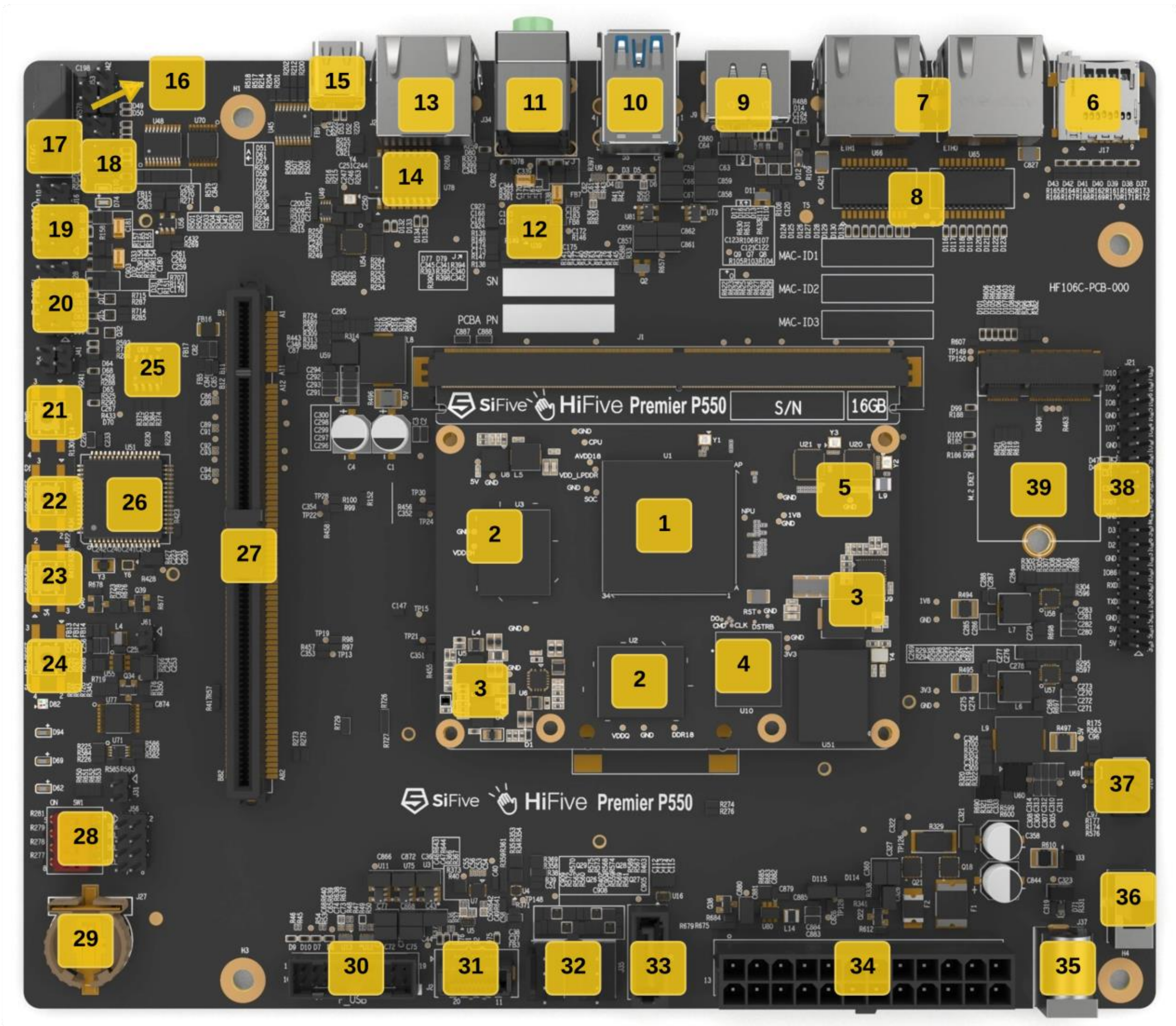


Figure 1-1: HiFive Premier P550 Component Locator

Table 1-1 HiFive Premier P550 Component Locator

#	Description	#	Description	#	Description	#	Description
1	EIC7700X SoC	11	Analog Audio jack	21	Power button	31	Type-E Connector for front panel USB Type-C Interface
2	LPDDR5 SDRAM	12	Audio Codec	22	SOC Reset Button	32	Chassis fan headers
3	Voltage Regulators/PMICs	13	MCU Ethernet RJ45 Connector	23	MCU Recovery button	33	SATA Connector
4	128GB eMMC Flash	14	MCU Ethernet	24	MCU RESET	34	ATX Power

#	Description	#	Description	#	Description	#	Description
			Transceiver		button		Connector
5	Ethernet PHYs	15	Type-C USB Connector (Terminal & Debug)	25	Carrier board EEPROM	35	DC 12V power adapter jack (2.5mm) for factory use
6	microSD Card Slot	16	SOC JTAG Selection Jumper	26	MCU (Power Control)	36	Main Power switch
7	SOC Ethernet RJ45 Connectors	17	SOC JTAG Header	27	4-lane PCIe Connector (x16 mechanical)	37	SOC Fan Header
8	Ethernet transformers	18	MCU JTAG Header	28	STRAP Settings DIP Switch	38	GPIO Header
9	HDMI Connector[1]	19	Front Panel Audio Connector	29	Coin Battery holder	39	M.2 E-Key (SDIO WiFi module)[2]
10	Dual USB Type-A Connector	20	Front Panel Connector	30	USB front panel Connectors (Type-A)		

1.2 Switch/Reset Button And Indicator LEDs

1.2.1 P550 Board Power Switch

The main power switch of P550 board is #36 as shown in Figure 1-1.

1.2.2 Keys And LEDs

There are four hardware buttons on the Carrier Board, #21, #22, #23 and #24 as shown in Figure 1-1.

- #24: MCU RESET Button: Press the button to reset the MCU and SOM
- #23: Recovery Button: Press and hold the button for more than 10 seconds to restore the

[1] Native HDMI output is not enabled in initial Freedom U-SDK release

[2] Not supported

account and network configurations to the factory settings.

- #22: SOM RESET Button: Press the button to warm reboot the SOM
- #21: SOM Power Button: Press the button to power on the SOM. Press and hold the button for more than 4 seconds to power off the SOM

On the HiFive Premier P550 board, D82 is a Tri-colored LED controlled by the MCU and its color indicates the working status of the board

- MCU powered ON, SOC not powered ON, indicator is red
- During the SOC boot up process, indicator is green
- When SOC boot up is complete the indicator blinks slowly in blue (es-bmcd daemon started successfully).

1.3 P550 and MCU connections

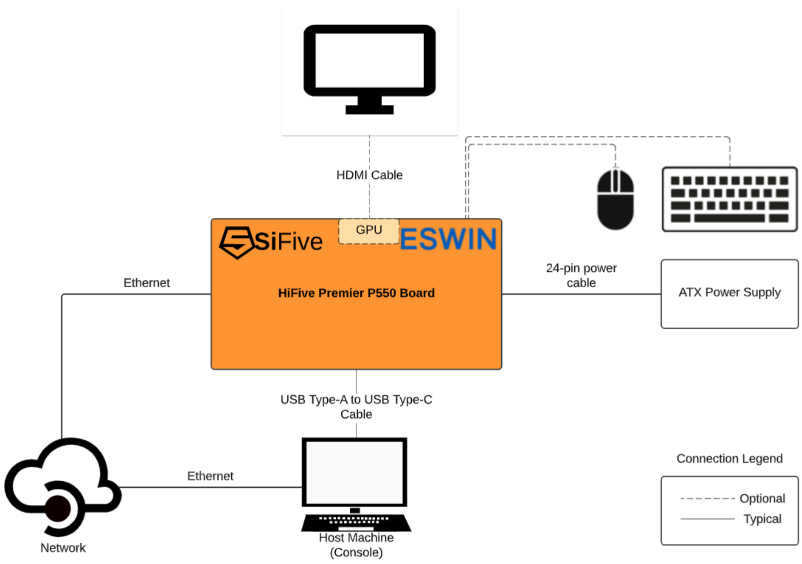


Figure 1-2: P550 MCU connections

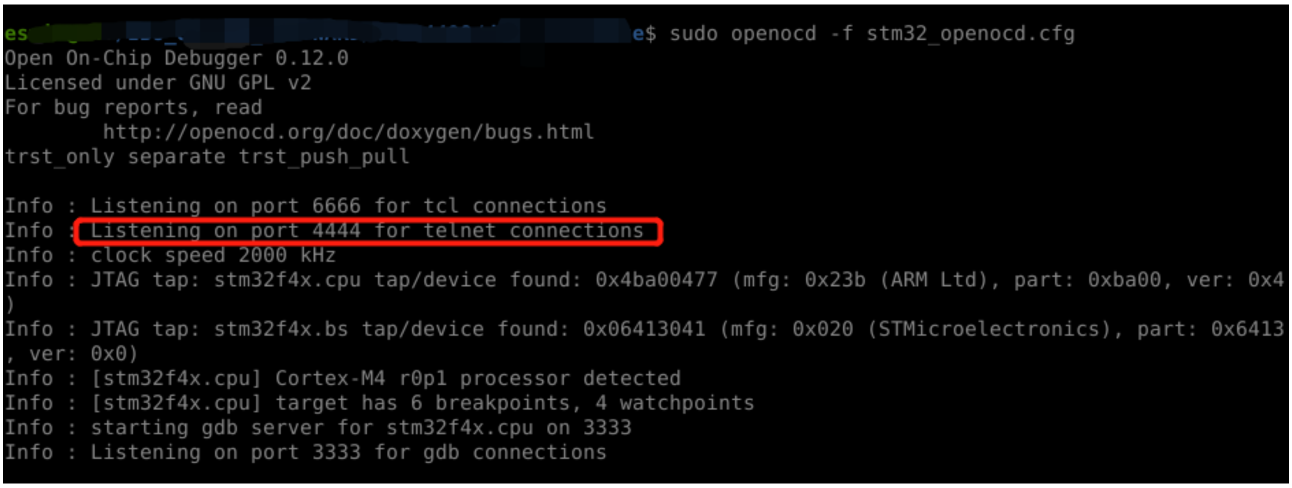
- P550 USB Type-C(#15 in Figure 1-1) <-> Host Machine USB Type-A cable
- MCU Ethernet RJ45 (#13 in Figure 1-1) < - > Ethernet < - > Host WEB-UI
- SOC Ethernet RJ45 (either or both #7 in Figure 1-1) < - > Ethernet < - > Internet
- ATX Power(#34 in Figure 1-1) connect to ATX power Supply
- MCU RESET button (#24 in Figure 1-1)

2. MCU FLASH Burning Procedure

2.1 MCU Burning Procedure For Ubuntu

1. On Ubuntu host, Install openOCD and telnet in terminal : sudo apt install –y openocd telnet

2. Download MCU firmware STM32F407VET6_BMC.elf from: https://github.com/sifive/hifive-premier-p550-tools/tree/hf-prem-wip/mcu-firmware,
3. Download openOCD config file stm32_openocd.cfg from: https://github.com/sifive/hifive-premier-p550-tools/blob/master/mcu-firmware/stm32_openocd.cfg
4. Open a terminal and use admin start command: **openocd –f** stm32_openocd.cfg the config file is save on step3

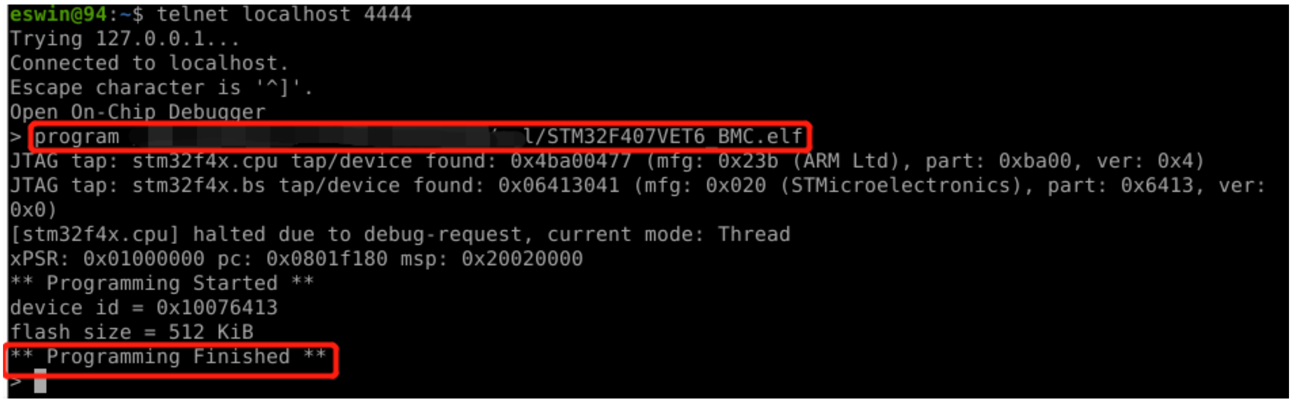


```
es[redacted]e$ sudo openocd -f stm32_openocd.cfg
Open On-Chip Debugger 0.12.0
Licensed under GNU GPL v2
For bug reports, read
        http://openocd.org/doc/doxygen/bugs.html
trst_only separate trst_push_pull

Info : Listening on port 6666 for tcl connections
Info : Listening on port 4444 for telnet connections
Info : clock speed 2000 kHz
Info : JTAG tap: stm32f4x.cpu tap/device found: 0x4ba00477 (mfg: 0x23b (ARM Ltd), part: 0xba00, ver: 0x4
)
Info : JTAG tap: stm32f4x.bs tap/device found: 0x06413041 (mfg: 0x020 (STMicroelectronics), part: 0x6413
, ver: 0x0)
Info : [stm32f4x.cpu] Cortex-M4 r0p1 processor detected
Info : [stm32f4x.cpu] target has 6 breakpoints, 4 watchpoints
Info : starting gdb server for stm32f4x.cpu on 3333
Info : Listening on port 3333 for gdb connections
```

Figure 2-1: openocd start

5. Open a new terminal window and open a telnet session to OpenOCD by using the command "telnet localhost 4444", then from within the telnet terminal issue this command to update MCU firmware, "program $PATH/STM32F407VET6_BMC.elf" (change $PATH to the real path to the MCU firmware file). Wait for a few seconds until "** Programming Finished **" is printed in the telnet window indicating that MCU firmware was successfully programmed.



```
eswin@94:~$ telnet localhost 4444
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
Open On-Chip Debugger
> program [redacted]l/STM32F407VET6_BMC.elf
JTAG tap: stm32f4x.cpu tap/device found: 0x4ba00477 (mfg: 0x23b (ARM Ltd), part: 0xba00, ver: 0x4)
JTAG tap: stm32f4x.bs tap/device found: 0x06413041 (mfg: 0x020 (STMicroelectronics), part: 0x6413, ver:
0x0)
[stm32f4x.cpu] halted due to debug-request, current mode: Thread
xPSR: 0x01000000 pc: 0x0801f180 msp: 0x20020000
** Programming Started **
device id = 0x10076413
flash size = 512 KiB
** Programming Finished **
>
```

Figure 2-2: burn firmware

6. After burning the MCU firmware, you need to reset MCU by input command: reset in telnet or push MCU RESET button on board(#24 in Figure 1-1) or power off and power on (#36 in Figure 1-1)the board.

2.2 MCU Burning Procedure For MacOS

In MacOS, use brew to install openOCD and telnet: **brew install openocd telnet**, it will take more time to install openOCD and it's dependency packages than Ubuntu system，and the usage is same as Ubuntu system.

2.3 MCU Burning Procedure For Windows

2.3.1 Environment Preparation - Install FT4232 Driver

1) Port Connections of FT4232 on HiFive Premier P550 board

- PortA : SOC MCPU JTAG
- PortB : MCU JTAG/ I2C INTERFACE(EEPROM RW)
- PortC : SOC UART0
- PortD : MCU UART

[Note] Because PortB is a multiplexing of JTAG and I2C functions, two different drivers cannot be loaded simultaneously. When using MCU JTAG to burn the MCU firmware, JTAG drivers need to be installed. When using FT4232 I2C to read and write EEPROM, I2C drivers need to be installed.

2.3.1.1 Windows P550 serial port driver installation

Download Windows P550 serial port and JTAG driver installation package: https://sysprogs.com/getfile/1372/UsbDriverTool-2.1.exe

Unzip and double click to install

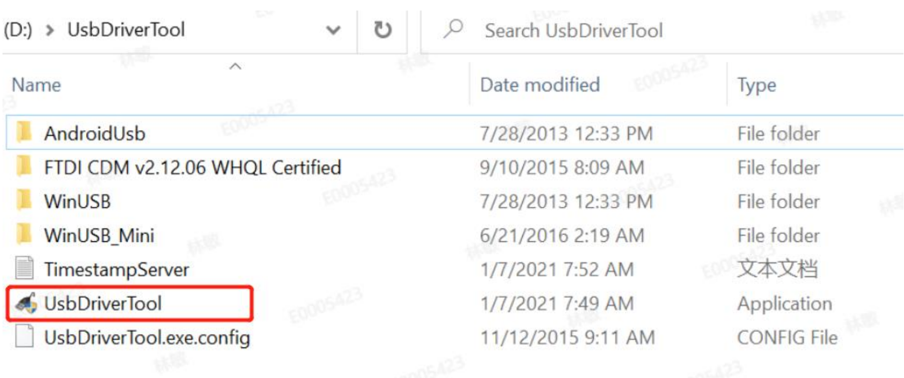


Figure 2-3: USB Driver Tool File

After connecting the USB to a Windows computer, four USB devices will show up according to the interface number. The corresponding USB device numbers in ascending order are as follows (also refer to Figure 2-4 below):

00 - SOC JTAG (eic7700X mcpu)

01 - MCU JTAG (stm32)

02 - SOC UART (eic7700X uart0)

03 - MCU UART (stm32 uart3)

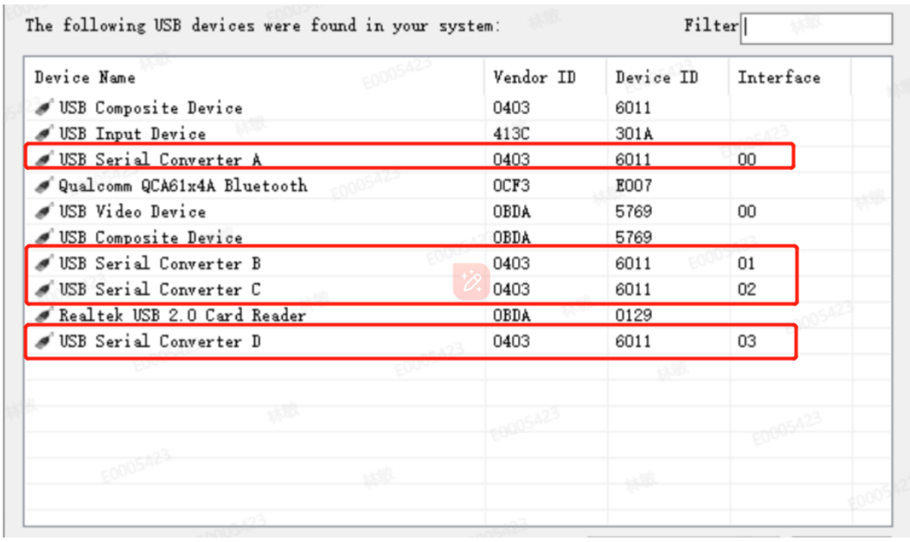


Figure 2-4: USB Devices of FT4232

To install UART driver, select 02-USB device (SOC UART) and 03-USB device (MCU UART) and right click to install "FTDI CDM" for each respectively.

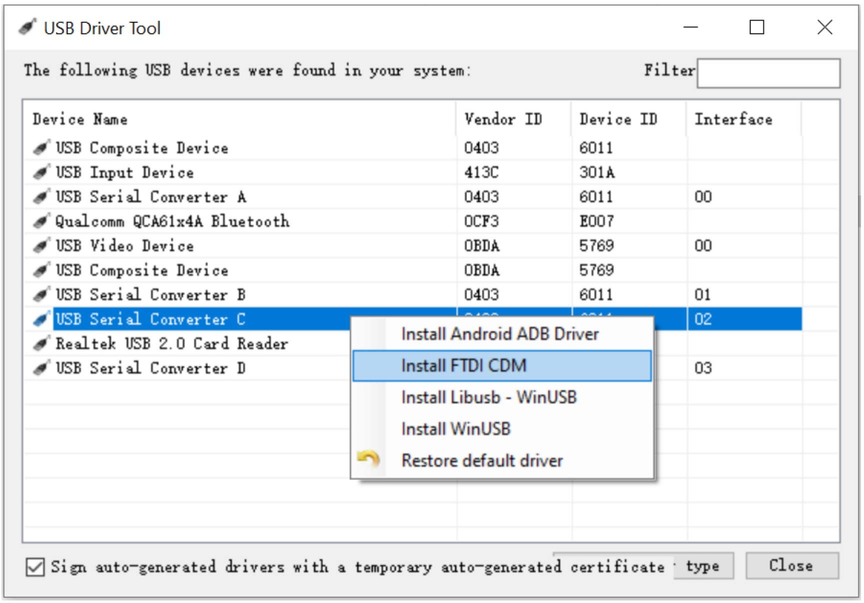


Figure 2-5: FT4232 UART Driver Selection

After installing the serial port driver, please check the corresponding serial port devices in the Device Manager under "Ports (COM & LPT) ".

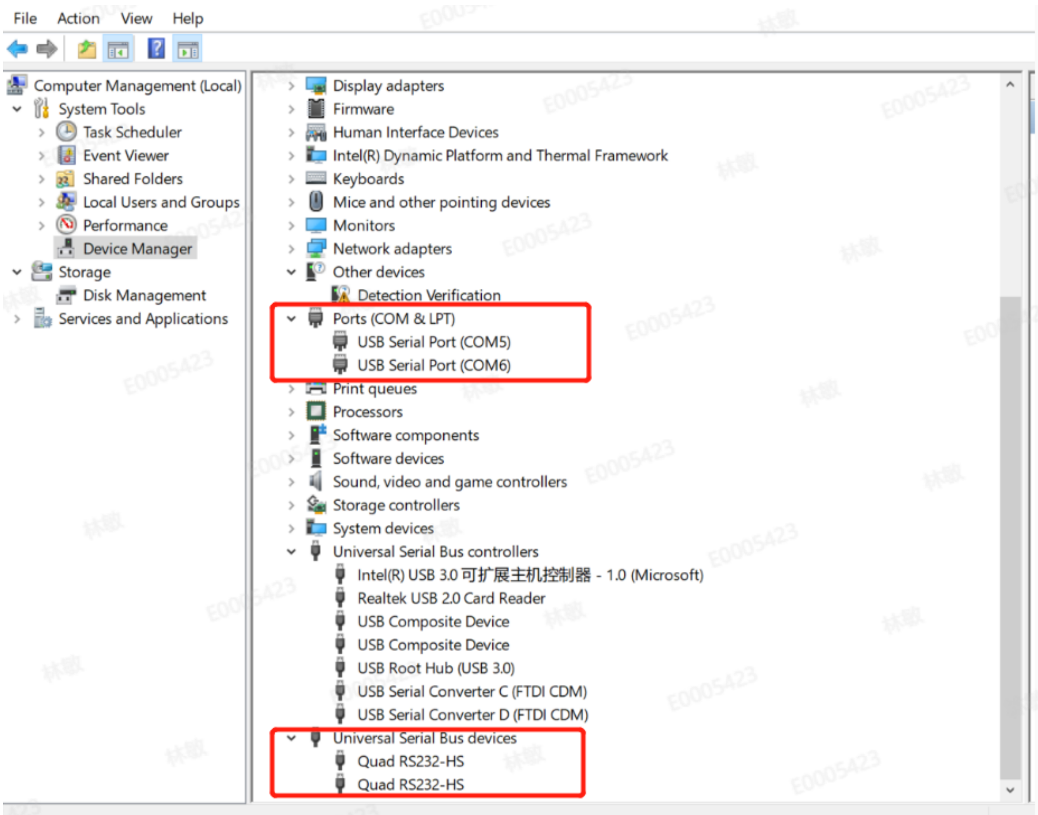


Figure 2-6: FT4232 COM Ports in Windows Device Manager

2.3.1.2 Environment Preparation - Install JTAG Drivers

Install the JTAG driver on the 01-USB device (MCU JTAG), right-click and select install WinUSB, as shown in the following figure:

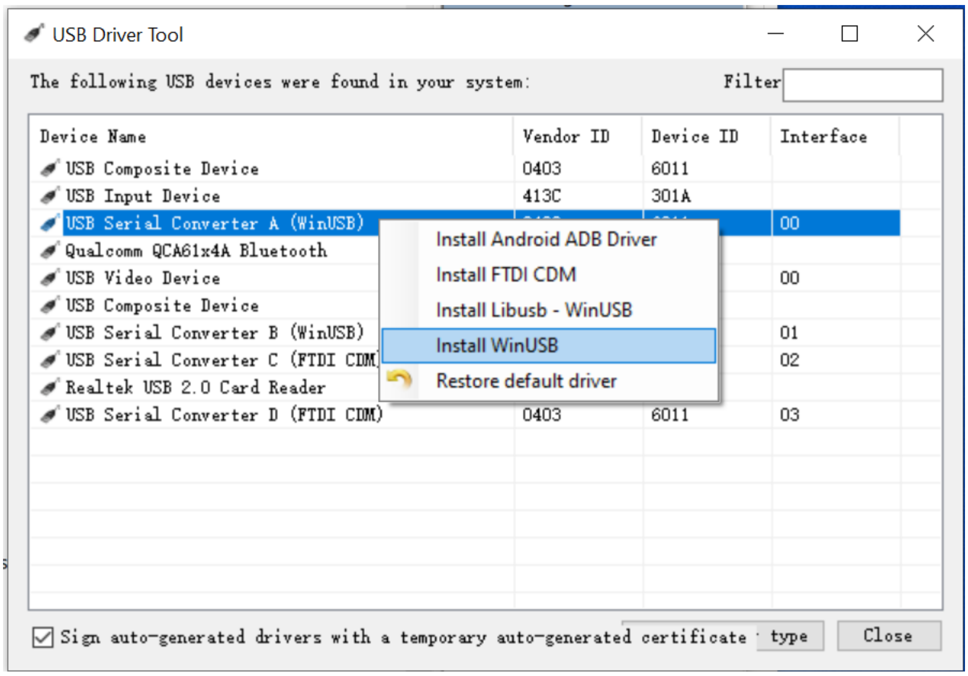


Figure 2-7: FT4232 JTAG Driver Selection

2.3.2 MCU Burning Procedure For Windows

Refer to the WEB site below to download and install OpenOCD software:

https://openocd.org/pages/getting-openocd.html

Please download OpenOCD configuration file **stm32_openocd.cfg** and MCU firmware file **STM32F407VET6_BMC.elf** from https://github.com/sifive/hifive-premier-p550-tools/tree/master/mcu-firmware

1. Open Windows Powershell
2. Execute cd ${PATH}\openocd-20231002\OpenOCD-20231002-0.12.0\bin
3. Execute .\openocd.exe -f .\stm32_openocd.cfg
4. Open another Windows terminal or Powershell and execute command "telnet 127.0.0.1 4444".
5. In the telnet session started above run this command to update MCU firmware "program $PATH/STM32F407VET6_BMC.elf" (change $PATH to the real path to the MCU firmware file)"
6. Reset MCU by input reset command in telnet or push MCU RESET buttom on board or power off and power on the board

3. Command Line Interface (CLI) and WEB Based Remote Control

Users can remotely log on to the MCU's web page through the MCU's ethernet connection using its IP address that can be obtained from the local serial port terminal of the MCU. The MCU's local serial port terminal can also be used to monitor and manage the P550 board using the command line interface.

The CLI is used through the UART terminal interface of the MCU. Connect the Type-C end of the supplied USB Type-A to Type-C cable to type-C connector (#15 in Figure 1-1) of Premier P550 board and Type-A end to your computer. In most cases this connection will enumerate as four COM ports/ttyUSB serial devices on Windows/Linux machines respectively, the highest-numbered device is the terminal interface of the MCU. For example, in the figure below the MCU serial port is ttyUSB3. Open the ttyUSBx with the configuration: 115200 8N1.

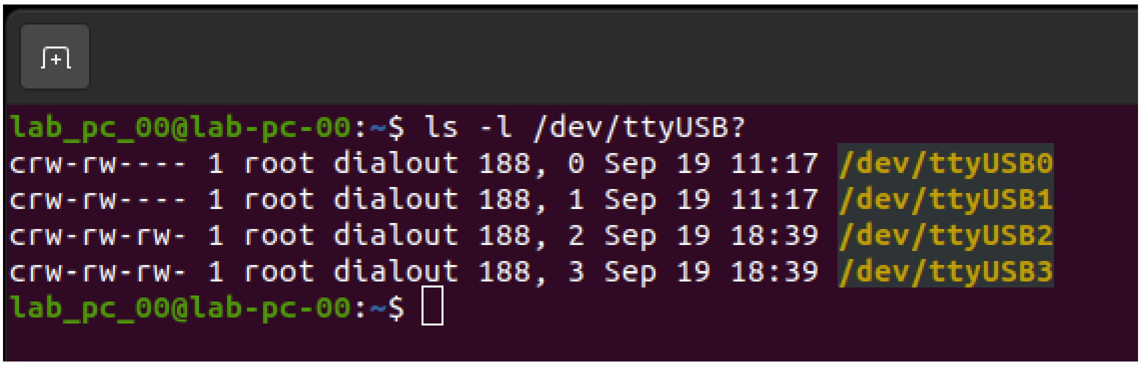


Figure 3-1: Premier P550 Board's Serial Ports displayed in Linux terminal

Press <Enter> to view the command prompt, the commands supported by the MCU can be displayed by typing ‘help’ command as shown in Figure 3-2.


```
help:
 Lists all the registered commands

stats: Displays a table with the state of each FreeRTOS task.

cbinfo-g: Display carrierboard information.

cbinfo-s <magic/format/productid/pcbr/bomr/bomv/boardsn/manu> <value in hex>: Set magicNumber...

sominfo: Display somboard information.

account-g: Show account name and password.

account-s <name> <password>: Set account name and password.

ifconfig: Display network configuration.

setip <ipaddr>: Set ip address.

setmask <ipaddr>: Set netmask address.

setgateway <ipaddr>: Set gateway address.

setmac <index,0-2> <mac,like a1:26:39:91:b0:22>: Set mac address.

bootsel-g: Show software bootsel configuration.

bootsel-s <hw/sw> <bootsel(hex), like, F>: Set software bootsel configuration.

date: Get the current date and time.

date-s <Year> <Month> <Date> <WeekDay 1-7>: Set a new date.

time-s <Hours> <Minutes> <Seconds>: Set a new time.

temp: Get the temperature and fan speed.

pd: Get the power dissipation

sompower-g: Get the som power status. ON or OFF.

sompower-s <1/0>: Power (1)ON or (0)OFF.

somwork: Get the kernel work status of the som board.

reboot <cold/warm>: cold or warm reboot the kernel on som board.

devmem-r <address in hex>: Read the memory/io address of som board.

devmem-w <address in hex,like 0x180000000> <value in hex,like 0xabcd1234>: write the memory/io address of som board.

powerlost-g: Get the som power lost attr. Enable or Disable.

powerlost-s <1/0>: (1)Enable or (0)Disable.

pwrlast-g: Get the som power last state. 1 or 0.

somconsole-g: Get the som console configuration. UART or Telnet

somconsole-s: Set the som console configuration. 0(via UART), 1(via Telnet).

echo <string to echo>

heap: Display free heap memory.

version: Get BMC version

#cmd:
```

Figure 3-2: MCU Command Line Interface Help

3.1 Get/Set Network Parameters

To access the webserver GUI the MCU's ethernet connector (#13 in Figure 1-1) should be connected to the network. Identify a suitable IP-address and your network's subnet mask and gateway address and use them to setup the MCU's ethernet port on your network using the “setip”, “setmask” and “setgateway” commands as shown in section below. You don't need to change the MAC-

Addresses.

3.1.1 CLI

- Get Carrier Board network parameters:
  - #cmd: ifconfig
    - inet 10.30.32.254 netmask: 255.255.254.0
    - gatway 10.30.32.1
    - SOM_Mac0: 8c:1f:64:13:c1:86
    - SOM_Mac1: 8c:1f:64:13:c1:87
    - MCU_Mac: 8c:1f:64:13:c1:88

- Set CarrierBoard IP:
  - #cmd: setip 10.10.207.30
    - ip addr set to 10.10.207.30(0x1ecf0a0a)

- Set CarrierBoard netmask:
  - #cmd: setmask 255.255.240.0
    - netmask addr set to 255.255.240.0(0xf0ffff)

- Set CarrierBoard gateway:
  - #cmd: setgateway 10.10.192.1
    - gateway addr set to 10.10.192.1(0x1c00a0a)

- Set MAC of CarrierBoard:
  - #cmd: setmac 2 94:47:b0:18:42:bc
    - MAC[2] addr set to 94:47:b0:18:42:bc(94:47:b0:18:42:bc)

- Set MAC 0 or MAC 1 address of SOM:
  - #cmd: setmac 0 94:47:b0:18:42:ba
    - MAC[0] addr set to 94:47:b0:18:42:bc(94:47:b0:18:42:ba)
  - #cmd: setmac 1 94:47:b0:18:42:bb
    - MAC[1] addr set to 94:47:b0:18:42:bc(94:47:b0:18:42:bb)

Note:

The new IP, netmask and gateway of Carrier Board will be validated immediately. The Carrier Board MAC will be validated after Carrier Board reboot.

The SOM MAC will be validated after SOM reboot.

The IP, netmask, and gateway address of the SOM can be configured in the SOM system(Linux system).

3.1.2 WEB GUI

Type the IP-address of the MCU's ethernet port in your WEB browser and you should see the login page as shown below:

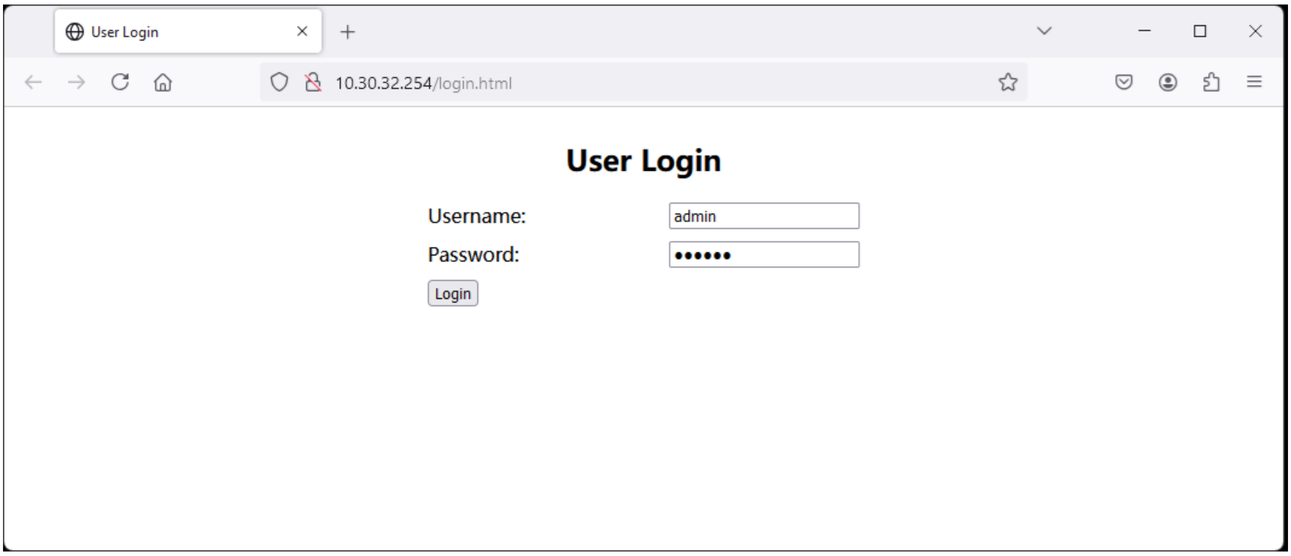


Figure 3-3: MCU WEB Page Login Screen

You can get the default username and password from the CLI using command “account-g” . Use these credentials to log into the MCU's WEB GUI.

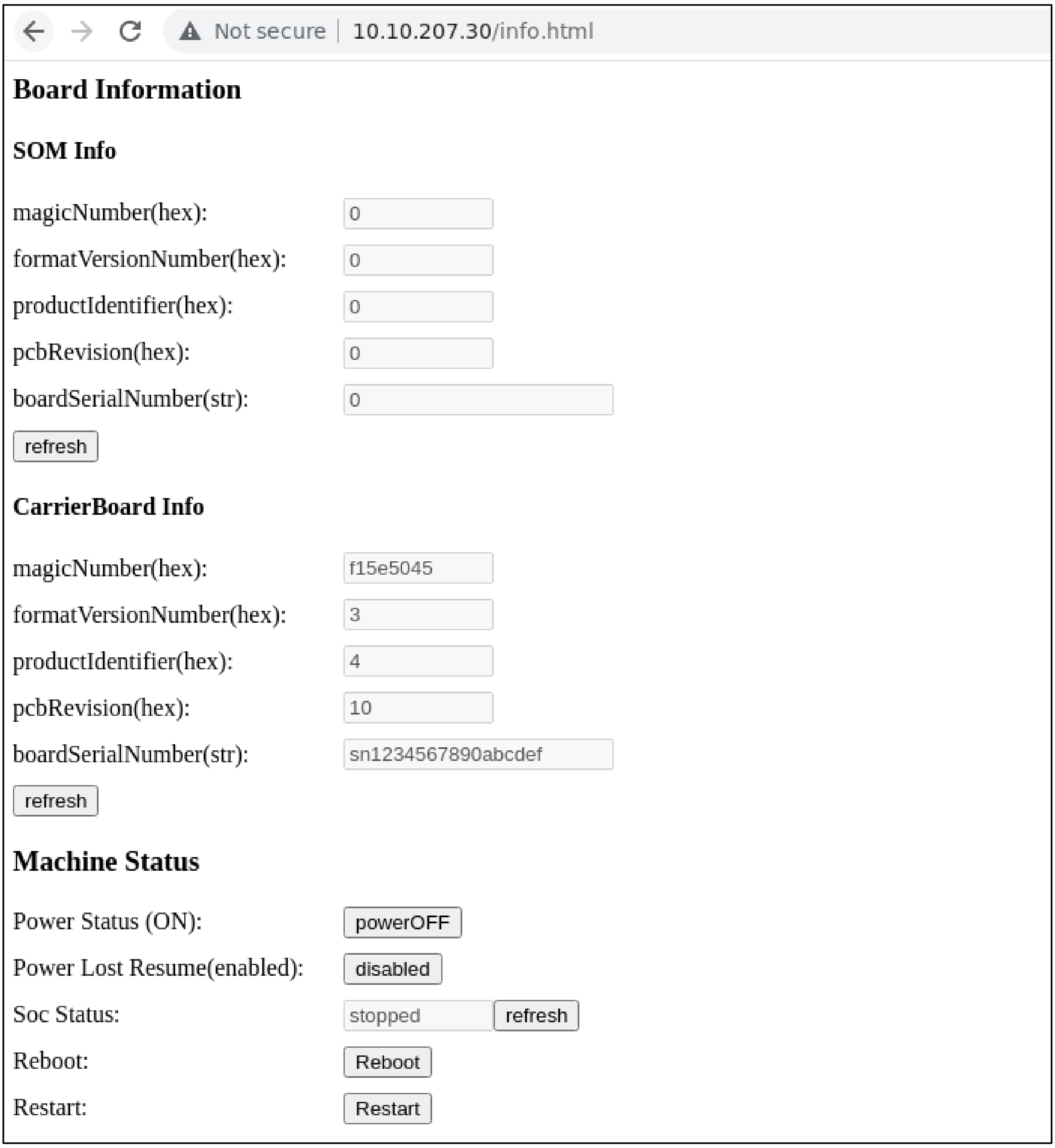


Figure 3-4: Board Information on MCU WEB Page Screen

You can modify the network settings using the fields as shown in Figure 3-4

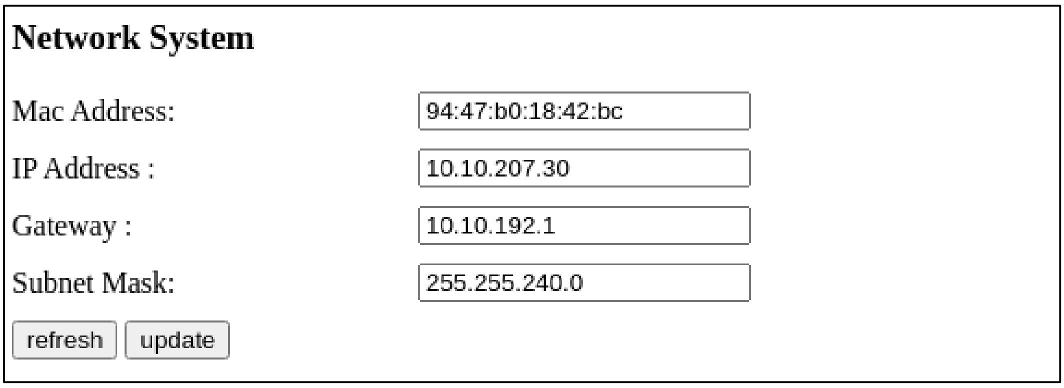


Figure 3-5: MCU Ethernet Port Network Settings on MCU WEB Page Screen

Click refresh button to get the current network parameters of MCU.

Click update to modify the network parameters.

Note: The new network parameters will be validated immediately after clicking the update button.

3.2 Get Hardware Version Information

3.2.1 WEB GUI

The hardware information of the SOM and Carrier Board will be shown on the web page after login. Click the refresh button to read the information immediately.

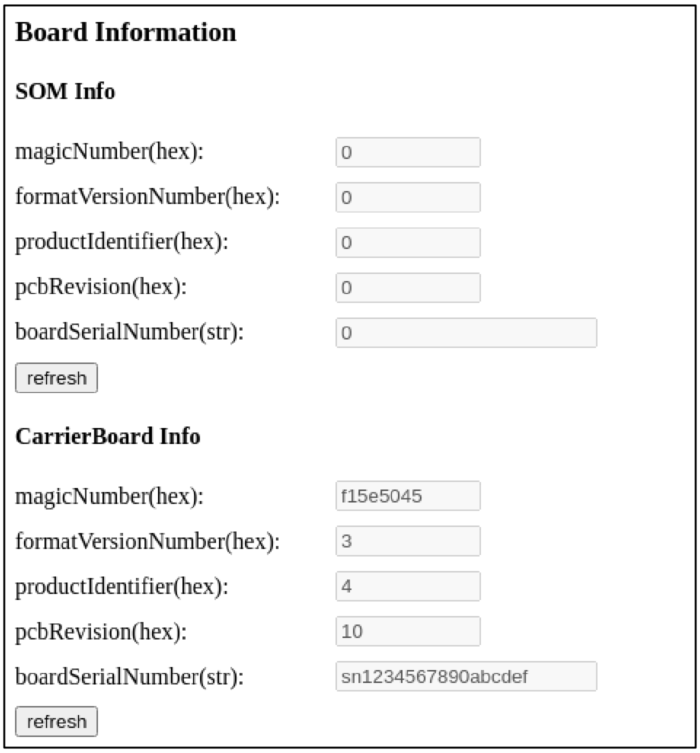


Figure 3-6: SOM and Carrier Board's Information on MCU WEB Page Screen

3.2.2 CLI

To print the Carrier Board hardware information issue the command “cbinfo-g”.

```
#cmd: cbinfo-g
[Carrierboard Information:]
magicNumber:0xf15e5045
formatVersionNumber:0x3
productIdentifier:0x4
pcbRevision:0x10
bomRevision:0x10
bomVariant:0x10
SN:sn1234567890abcdef
manufacturingTestStatus:0x10
```

Figure 3-7: Displaying Carrier Board Hardware Information in MCU CLI

Notes: Carrier Board hardware information is initialized at the time of production. It also can be updated via CLI for development.

3.3 Get/Set SOM Status

Enables turning the SOM's power ON and OFF, triggering cold (power cycled to SOM) and warm (only SOM reset asserted) restarts, and enabling/disabling “Power Lost Resume” capability.

“Power Lost Resume” capability enables the MCU to restore the SOM to the same power state it was in at the time of a power disruption, i.e., when enabled, the MCU powers up the SOM automatically when power is restored if the SOM was operating at the time of power disruption. Note that the MCU does not restore the applications that were running on the SOC on the SOM at the time of power disruption.

3.3.1 WEB GUI

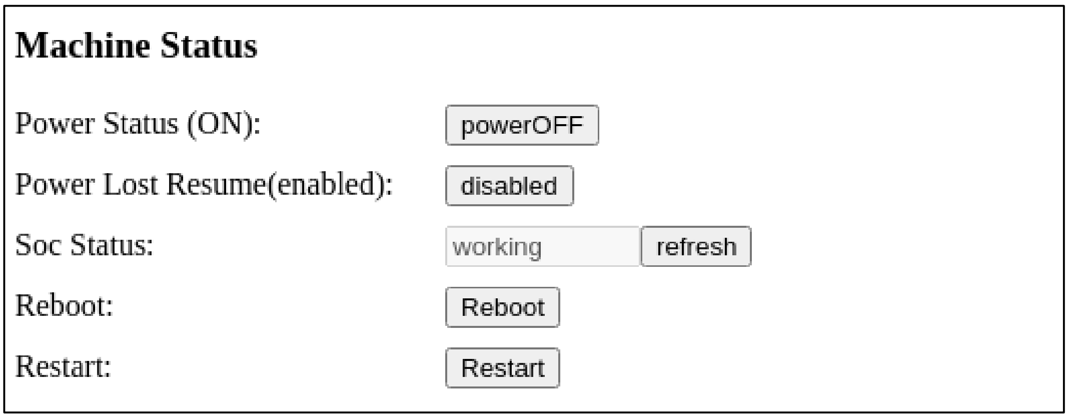


Figure 3-8: Viewing SOM Status on MCU WEB Page Screen

- Press powerOFF/powerON button in the GUI to turn SOM's power off and on.
- Press Power Lost Resume button to enable/disable the function of resuming the power state of the SOM if power is lost during operation.
- SoC Status shows the current system working status of the SOM.
- Press Reboot button to warm reboot the SOM system.
- Press Restart button to cold reboot the SOM system.

3.3.2 CLI

- Get the power status of the SOM:
  - #cmd: sompower-g
    - Som Power Status: ON

- Turn ON the power of the SOM:
  - #cmd: sompower-s 1

- Turn OFF the power of the SOM:
  - #cmd: sompower-s 0

- Get the power lost resume function status：
  - #cmd: powerlost-g
    - Som Power Lost Attr: Enable

- Som Power Lost resume function disable:
  - #cmd: powerlost-s 0

- Som Power Lost resume function enable:

   - #cmd: powerlost-s 1

- Get the SOM system working status:
   - #cmd: somwork
      - Som Work Status: Running

- Warm reboot SOM system:
   - #cmd: reboot warm

- Cold reboot SOM system:
   - #cmd: reboot cold

3.4 Get SOM Power Consumption

3.4.1 WEB GUI

Figure 3-9: SOM Power Consumption on MCU WEB Page Screen

3.4.2 CLI

- #cmd: pd
   - consumption: 11.375000(W) voltage: 12.178(V) current: 0.935(A)

3.5 Get SOM Temperature And Fan Speed

3.5.1 WEB GUI

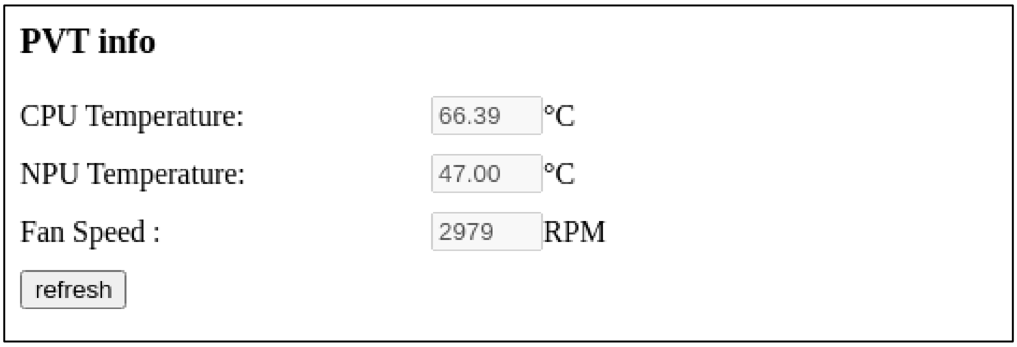


Figure 3-10: SOM Thermal Information on MCU WEB Page Screen

3.5.2 CLI

- #cmd: temp
  - cpu_temp(Celsius):65.565 npu_temp(Celsius):47.0 fan_speed(rpm):2978

3.6 Get/Set SOM bootsel

The boot selection of SOM determines the way of booting. Refer to the "Getting Started Guide" for more information about boot options.

```
If OTP security bit = 0
bootsel(bits 3-0): boot cpu: first boot: second boot
0000              SCPU        ROM          UART
0001              SCPU        ROM          EMMC
0010              SCPU        ROM          SPI NOR
0011              SCPU        ROM          USB

0100              SCPU        SPI NOR      UART
0101              SCPU        SPI NOR      EMMC
0110              SCPU        SPI NOR      SPI NOR
0111              SCPU        SPI NOR      USB

1x00              U84         SPI NOR      UART
1x01              U84         SPI NOR      EMMC
1x10              U84         SPI NOR      SPI NOR
1x11              U84         SPI NOR      USB
```

Figure 3-11: SOM Bootsel Options

3.6.1 WEB GUI

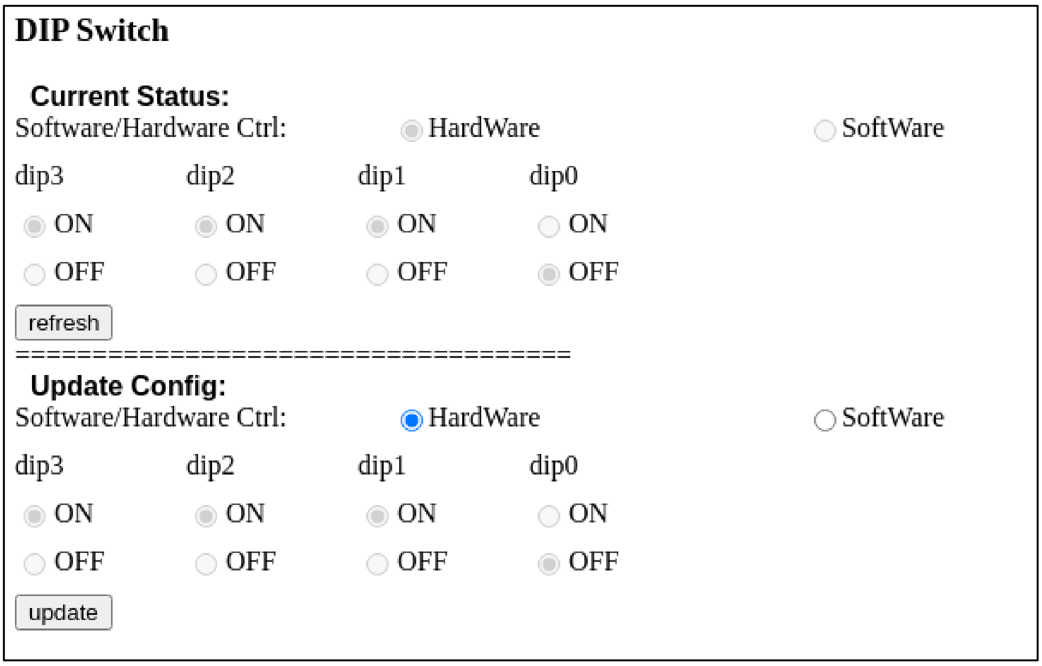


Figure 3-12: Bootsel Options on MCU WEB Page Screen

The "Current Status" section shows the status of the boot selection by the DIP switch, #28 in Figure 1-1. In the above case the hardware DIP switch setting is bootsel=2' b0010[3], i.e. the second-level boot will use SPI-FLASH.

The "Update Config" section allows overriding the DIP Switch settings and allows configuring the bootsel value through the MCU and the webserver GUI.

When "HardWare" is selected, the bootsel value is determined by the hardware DIP switch and when "SoftWare" is selected then bootsel value is determined by the MCU using the settings in this section.
Press the "update" button to validate the configuration. When rebooting the SOM, the bootsel configuration will take effect.

3.6.2 CLI

Get the bootsel status:

- #cmd: bootsel-g
    - Get: Bootsel Controlled by: HW, bootsel[3 2 1 0]:0 0 1 0

Set the bootsel, for example,the below command means: bootsel is controlled by software and the

[3] DIP Switch setting: ON=0, OFF=1

value is 2’ b0010, i.e. booting from SPI NOR flash.

- #cmd: bootsel-s sw 0x2
    - slave_addr a0, reg_addr ec len 4
    - Set: Bootsel Controlled by: SW, bootsel[3 2 1 0]:0 0 1 0

3.7 Get/Set RTC of Carrier Board

Please install the CR1220 battery first as shown in #29 in Figure 1-1.

3.7.1 WEB GUI

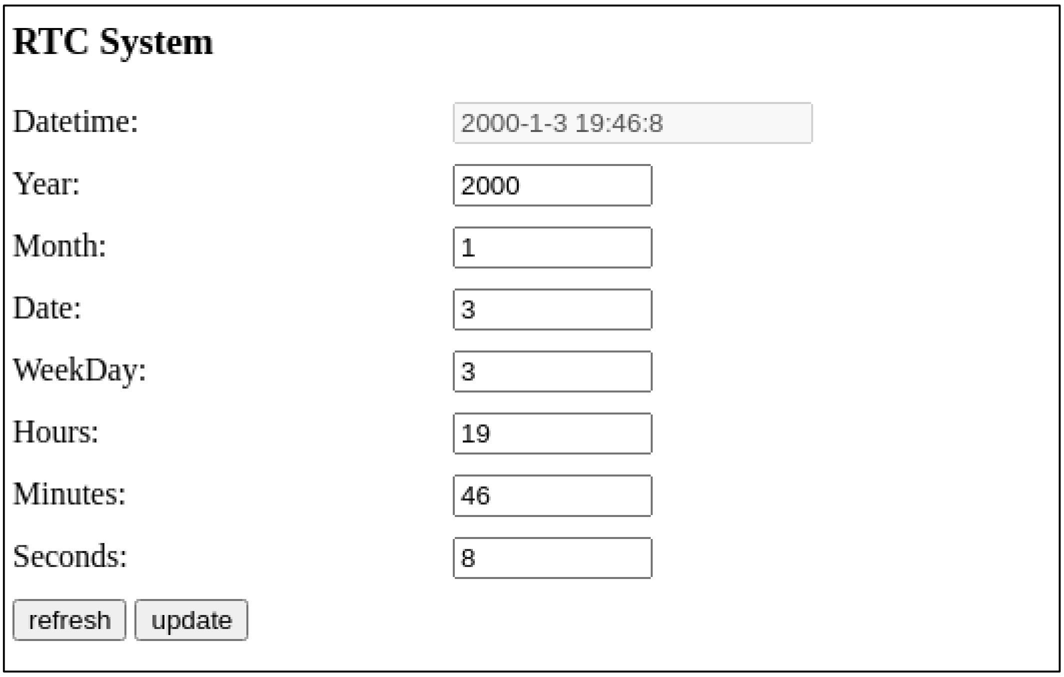


Figure 3-13: RTC Information on MCU WEB Page Screen

Click the refresh button to get the current time.
Click the update button to change the time.

3.7.2 CLI

- Get time:
    - #cmd: date
        - 2024-06- 6 Thu 16:23:49 CST

- Set date:
    - #cmd: date-s 2024 6 6 4
        - yy/mm/dd 2024/06/06 04
        - Date set to: 2024-6-6 WeekDay 4

- Set time:
    - #cmd: time-s 16 23 0
        - Time (24hr format) set to: 16:23:0

3.8 Get/Set Account

3.8.1 CLI

The web user name and password can be modified only through CLI.
Get account information:

- #cmd: account-g
    - AdminName: admin Password: 123456

- Set account:
    - #cmd: account-s admin 123456

3.9 SOM Console Output Redirection

3.9.1 WEB GUI

Figure 3-14: Selecting SOM Console Output Options through MCU WEB Page Screen

Clicking the button to switch the SOM Console output between UART and TELNET.

Clicking the refresh button to get the current redirection setting of SOM Console.

3.9.2 CLI

- #cmd: somconsole-g
    - Som Console: UART

- #cmd: somconsole-s 1

- #cmd: somconsole-g
    - Som Console: Telnet

After switching the console output to Telnet, users can telnet to MCU with the MCU's IP address and fixed port 23 (the IP address can be retrieved by “ifconfig” command).

For example: telnet 10.10.207.180 23

*NOTE：The SOM Console output will be routed to UART as default when the MCU is rebooted each time.