TechNexion

INNOVATORS OF TECHNOLOGY

Android Pie User Manual

VER. 1.00
March 30, 2019

REVISION HISTORY

Revision	Date	Originator	Notes
1.00	March 30, 2019	TechNexion	First public release

Table of Contents

1. Introduction

1.1 About Android Pie

Android Pie (9.0) is the latest Android version in 2018, which improves its user experience and performance. Some of its customized features as below:

- UART serial test app
- Termux app
- libgpiod CLI(command-line) tool
- i2c-tools CLI tool
- Fastboot
- OTA update
- A/B system
- Bluetooth-LE
- Voice-HAT support

2. Support List of TechNexion Hardware Platform

Android Pie will be supported on below TechNexion platforms:

Initial support

- PICO-IMX8M

Future support

- PICO-IMX8MM
- EDM-IMX8M
- PICO-IMX6
- PICO-IMX7

Each hardware has its unique functions and features, please refer to the data sheet for more details if needed. All product information can be found on TechNexion official website.

3. Software Configuration

3-1 Software Revision

Name	Revision
u-boot	2018.03-g456ed24
linux kernel	4.14.78-g9d10589
Android	9.0.0-1.0.0_8m-ga

3-2 Memory Layout of the Android 9 Image

For boards using eMMC/SD as boot storage:

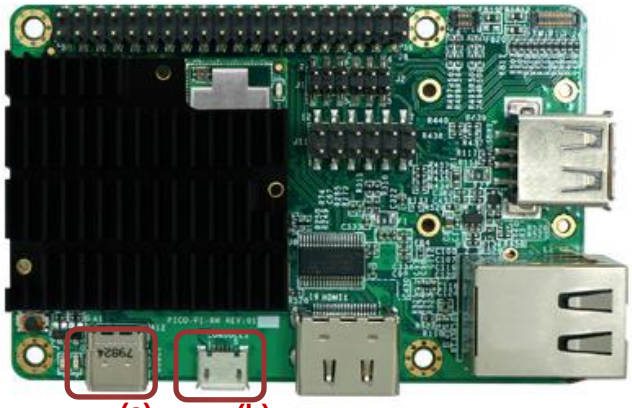
Section	Description
GPT	Partition information
Bootloader	u-boot.imx: First stage u-boot image
Partition 1 dtbo_a (backup partition)	dtbo.img
Partition 2 dtbo_b	dtbo.img
Partition 3 (FAT32) boot_a (backup partition)	boot.img: • kernel image • recovery mode ramdisk
Partition 4 (FAT32) boot_b	boot.img: • Image: kernel image • ramdisk.img: recovery mode ramdisk
Partition 5 (EXT4) system_a (backup partition)	system.img
Partition 6 (EXT4) system_b	system.img
Partition 7 misc	For recovery store bootloader message, reserve
Partition 8 metadata	For system slide show
Partition 9 presistdata	Option to operate unlock\unlock
Partition 10 (EXT4) vendor_a (backup partition)	vendor.img
Partition 11 (EXT4) vendor_b	vendor.img
Partition 12 (EXT4) userdata	Application data storage for system application, and for internal media partition, in /mnt/sdcard/dir
Partition 13 (EXT4) fbmisc	For storing the state of lock or unlock
Partition 12 vbmeta_a (backup partition)	For storing the verify boot's metadata
Partition 13 vbmeta_b	For storing the verify boot's metadata

3.3 Image Installation

Use MFGtool to flash Android 9 image to eMMC. This tool can be downloaded from the link.

3.4 Serial Debug

Plug-in a micro USB cable to the connector (b) on the PI baseboard, open any terminal communication application such as Minicom and Putty. Set 115200 bps as default speed.

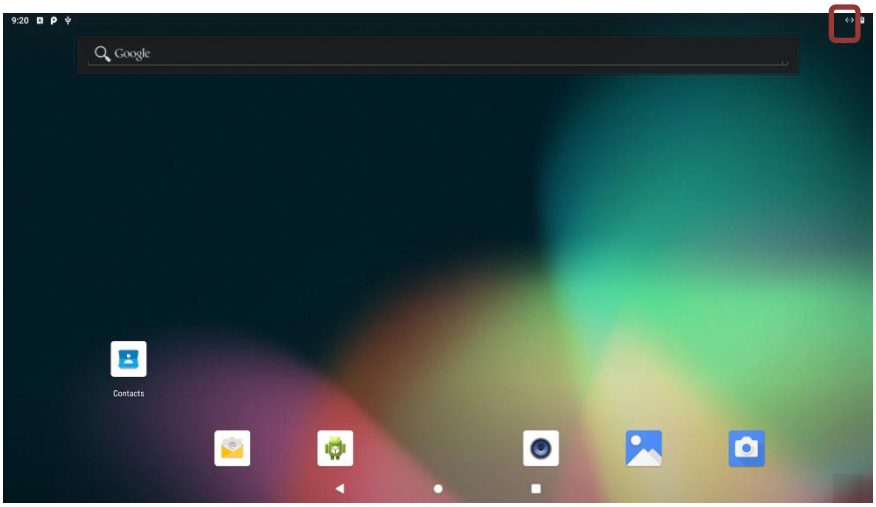


PI baseboard

Android Debug Bridge (ADB): plug-in a Type-C USB cable to the connector (a) on the PI baseboard, issue the command 'adb shell', then start debugging.

3.5 Network

- Ethernet
  Android auto runs DHCP daemon when boot. Please make sure to plug-in the cable before booting the device.

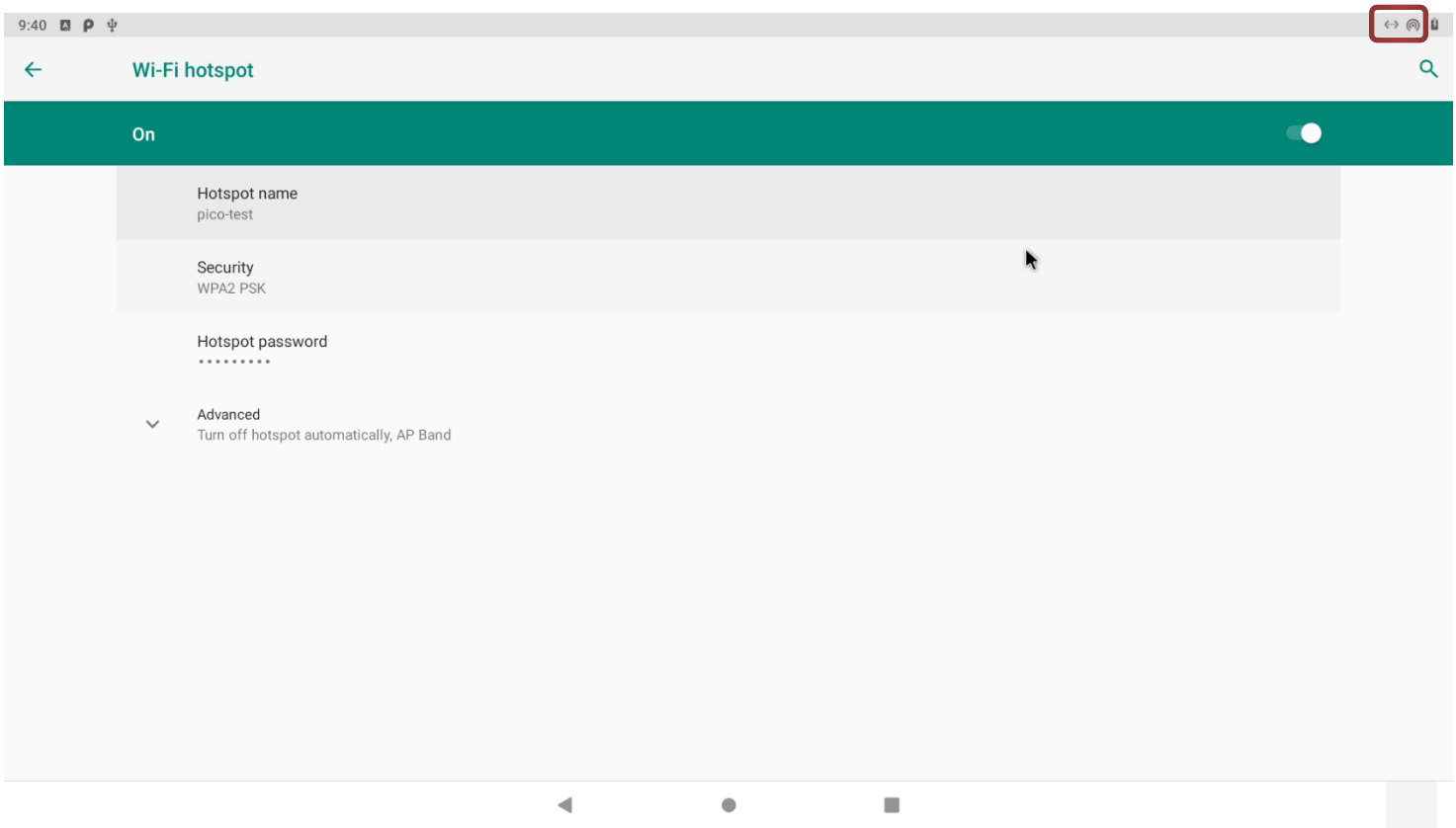


- WiFi
  - Station mode
    Support both 2.4GHz and 5GHz bands
  - AP (Access Point) mode
    Support 2.4GHz with WPA- PSK security password

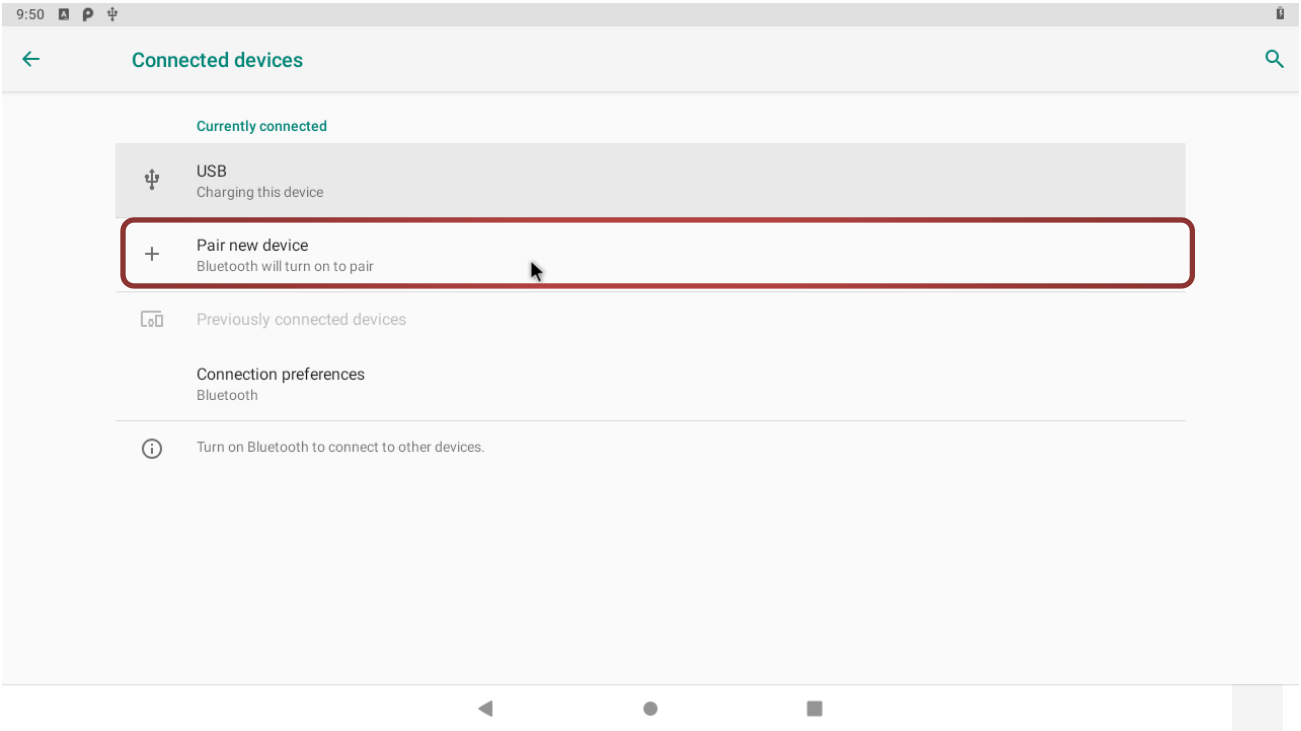
Only one networking mode can work at a time. When ethernet mode is on, it will show a failed WiFi connection icon on the top right corner of the screen. To turn on WiFi station mode, please remove the ethernet cable, the system will automatically switch to WiFi station mode. Users can also issue below command to disable the ethernet.

```
# ifconfig eth0 down
```

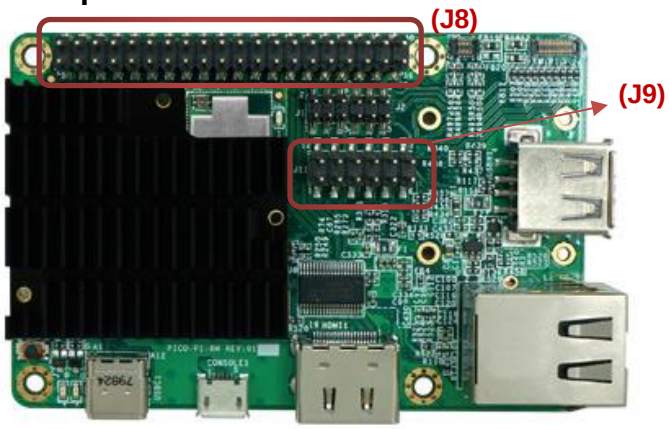
Ethernet is necessary to enable AP mode. Ethernet will work as a network node, connecting to Wide Area Network. If the ethernet cable is unplugged before booting up, it will connect to Local Area Network only.



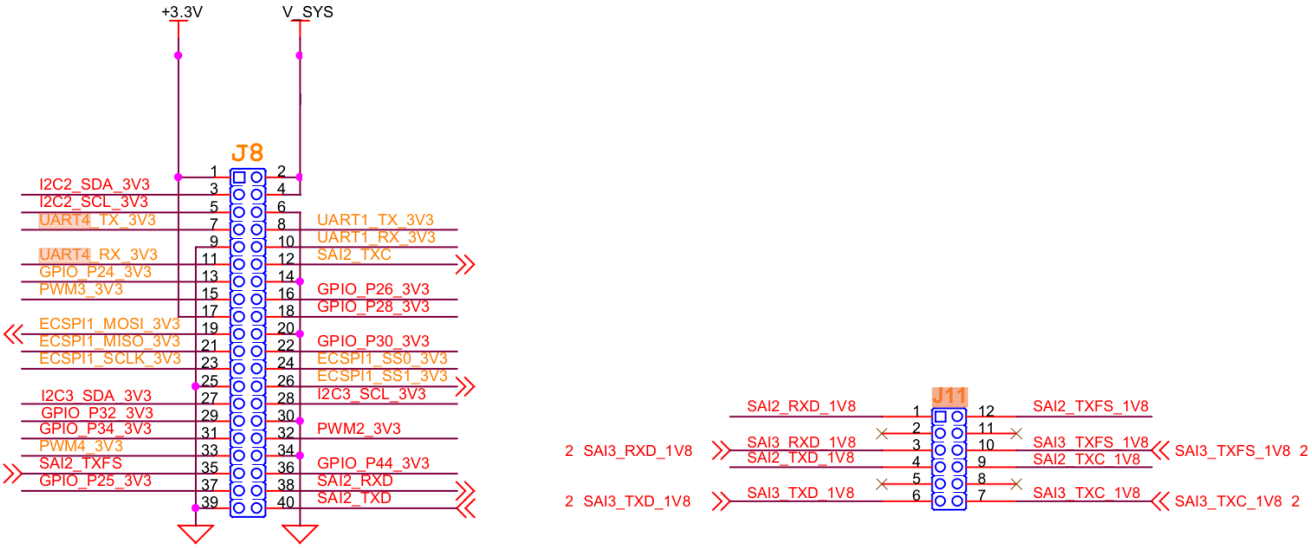
- Bluetooth modes:
  - Bluetooth Classic mode
  - Bluetooth LE mode



3.6 Expansion Pin Header



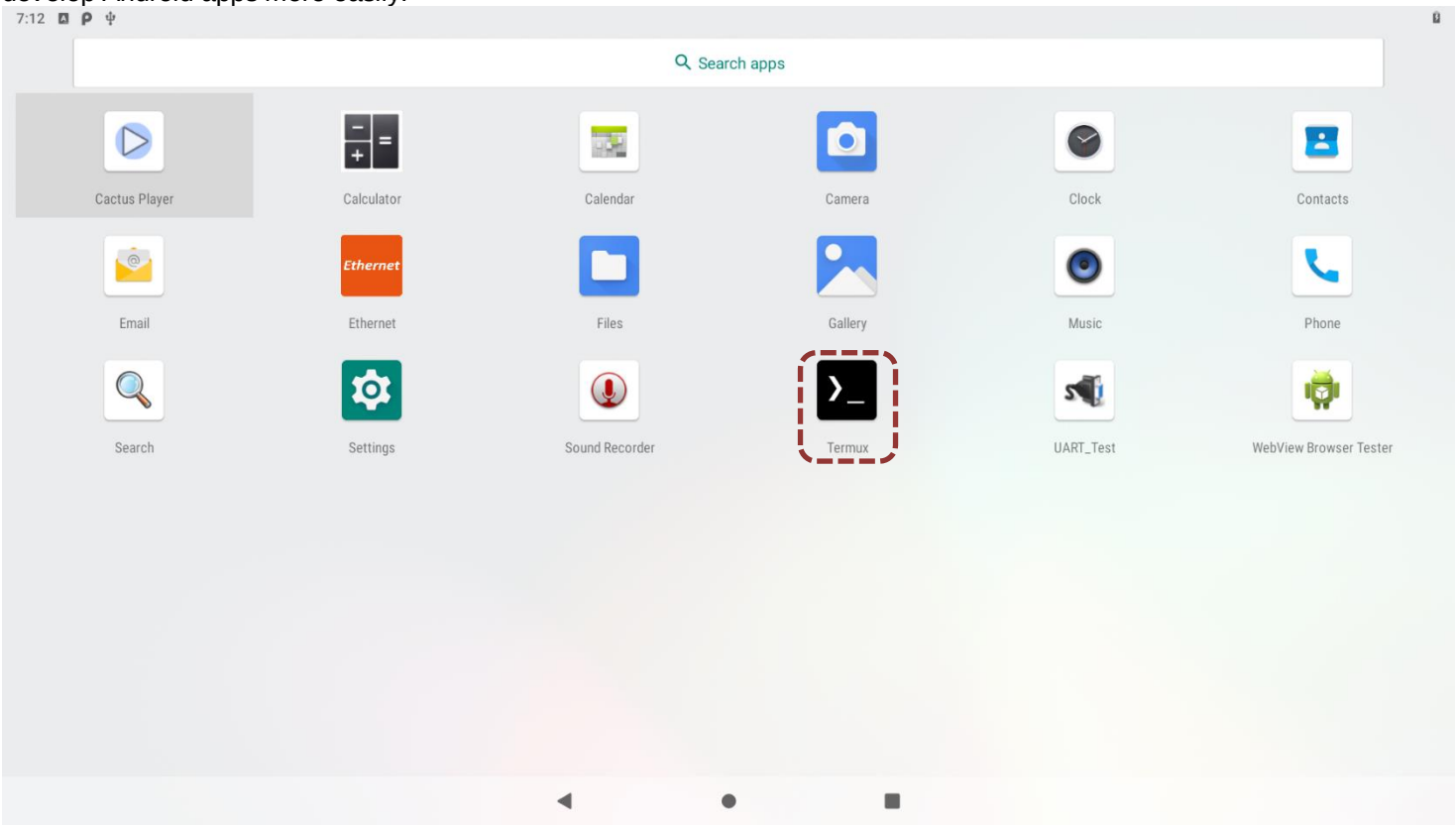
PI baseboard



PI baseboard provides expansion pin header for users to easily expand the customized I/O devices using GPIO, I^2S, I^2C, SPI and PWM low speed interfaces.

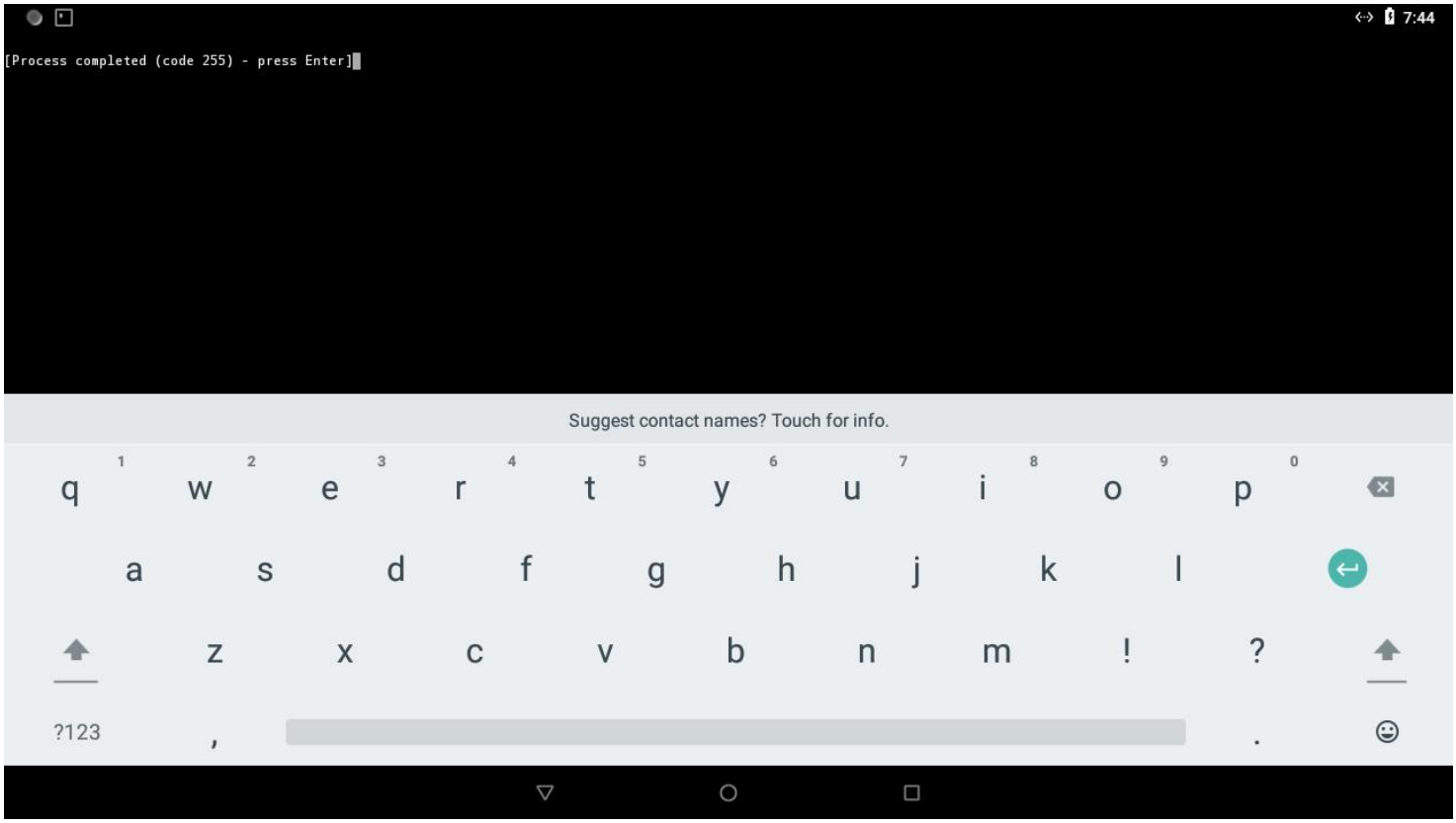
3.7 Termux app

Termux is a Linux terminal emulator for Android, which supports apt and opkg package managers. It allows Linux users to develop Android apps more easily.

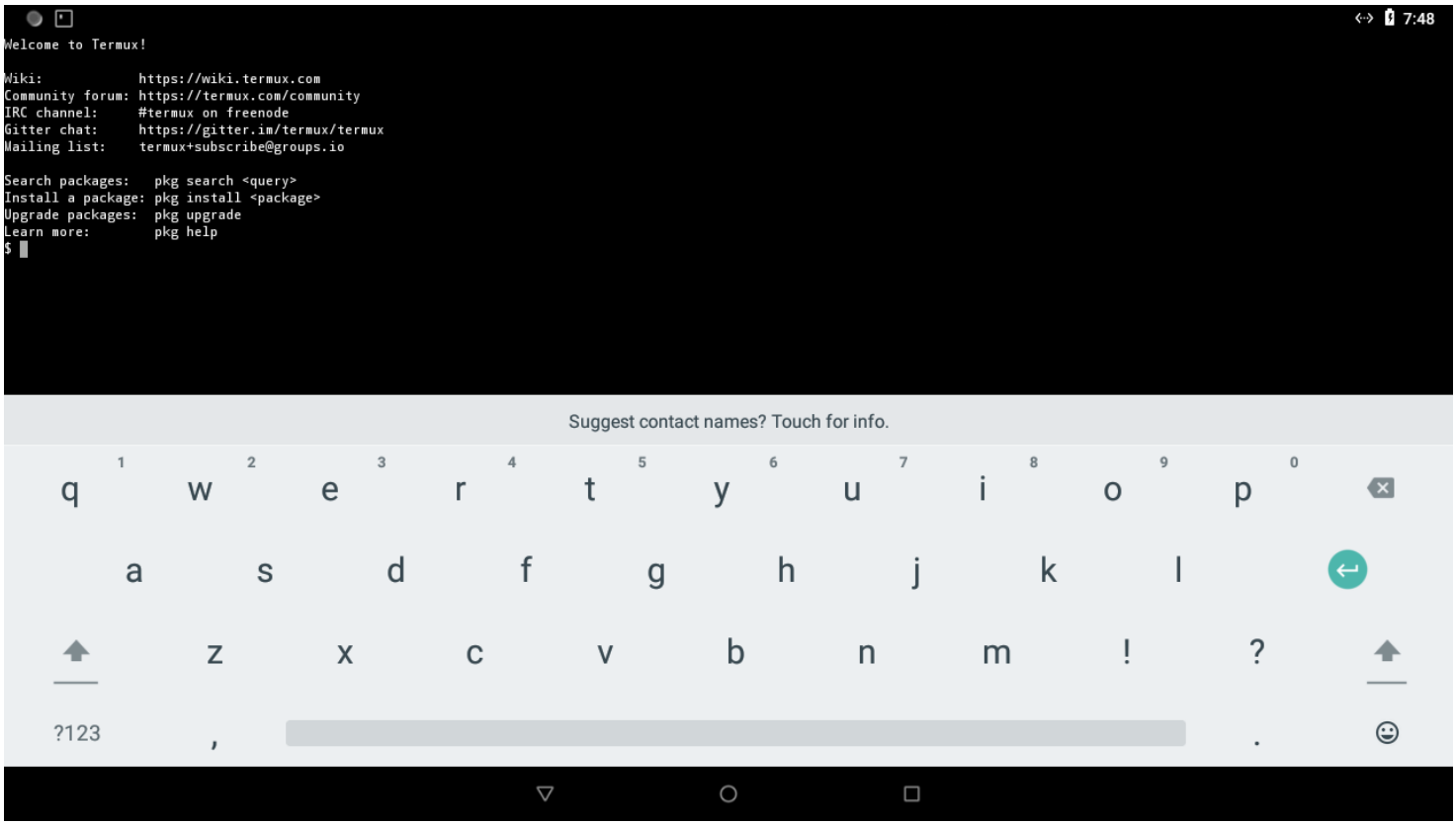


However, for security concern (selinux on Android), Termux cannot run on normal user mode. To remove security limitations, users need to issue below commands:

```
$ adb shell
$ su
# setenforce 0
```



Termux is not working when Android selinux is locked.



Termux works when Android selinux is unlocked.

3.8 Audio HAT

Audio-HAT

Audio-HAT is designed based on expansion pin header mentioned in Chapter 3.6. It connects to the expansion pin header directly. Android 9 supports Audio-HAT through sysfs. In the next distribution, it will be supported in android framework.

In the latest distribution, it provides Termux app, which can easily control the functions of Audio-HAT as following:

- 16 channel LED array, **(d)** as above picture

```
# ls /sys/class/leds/
gpio-led   pca995x:blue0  pca995x:blue4   pca995x:green2  pca995x:red1
mmc0::     pca995x:blue1  pca995x:blue5   pca995x:green3  pca995x:red2
mmc1::     pca995x:blue2  pca995x:green0  pca995x:green4  pca995x:red3
mmc2::     pca995x:blue3  pca995x:green1  pca995x:red0    pca995x:red4

echo 0 > /sys/class/leds/pca995x:blue0/brightness # (0% brightness)
echo 125 > /sys/class/leds/pca995x:blue0/brightness # (50% brightness)
echo 255 > /sys/class/leds/pca995x:blue0/brightness # (100% btightness)
```

- Button array, **(c)** as above picture
  Default button configurations as following:
  These buttons can be modified through the trigger event on kernel device tree of source code.

Prev	Play	Next	Volume Up	Volume Down	Mute	Home	Suspend

- Speakers
  1. Testing
     In Android, tinyalsa related tool can easily play the wave file. Please note the speaker only supports <= 16 bits.

```
# tinyplay test.wav -D 2 -c 2
Playing sample: 2 ch, 48000 hz, 16 bit (you can choose mono mode or stereo mode using -c parameter)
```

  2. Developing
     Please add the source code of system command application to downloaded github SDK.

- MEMS microphone
  1. Testing
     Please note the microphone only supports 32 bits.

```
# tinycap test.wav -D 0 -c 2 -r 48000 -b 32 (you can choose mono mode or stereo mode using -c parameter)
```

  2. Developing
     Please add the source code of system command application to downloaded github SDK.

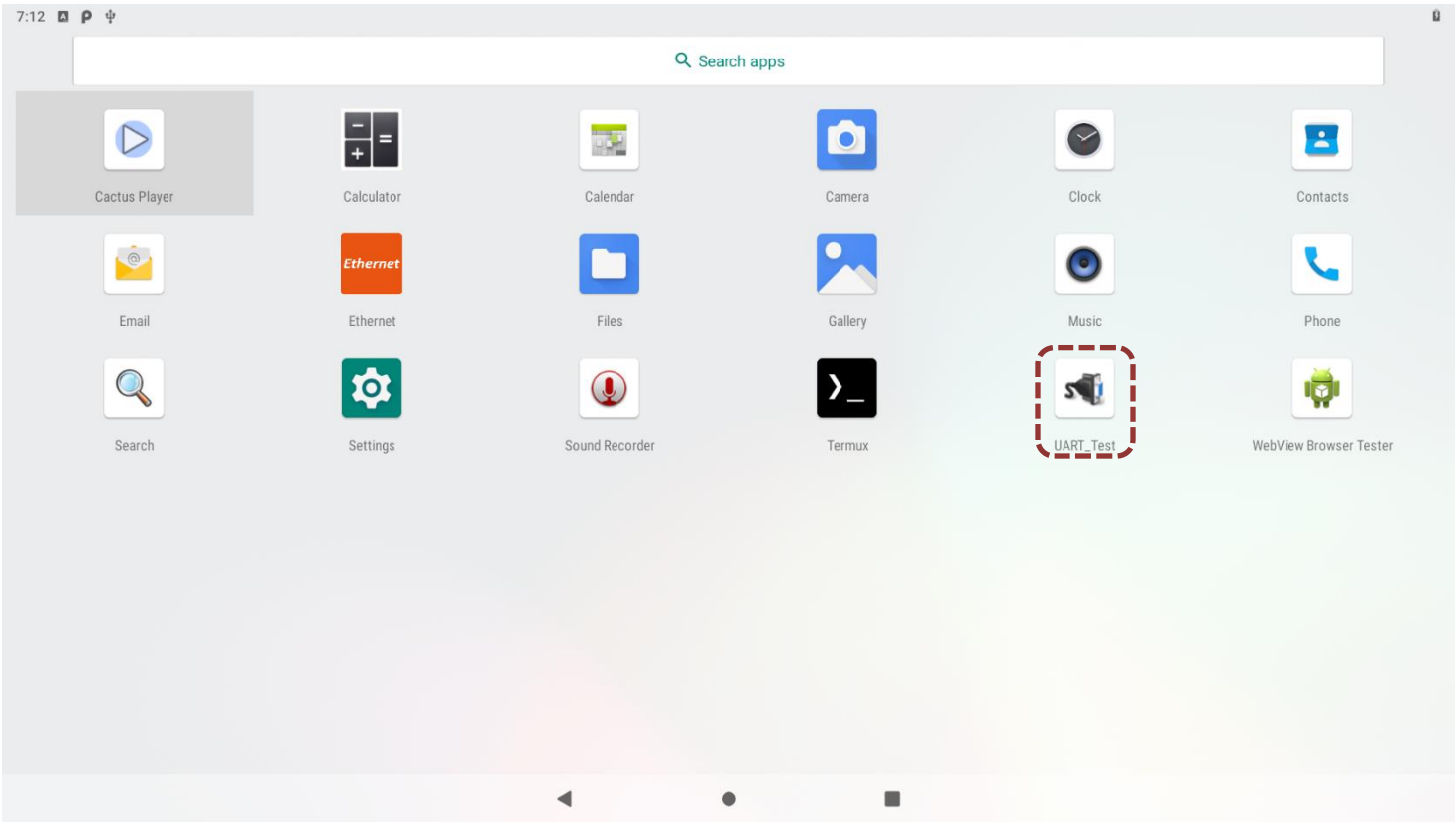
3.9 Serial Link

It supports a 2-wire RS232 port on 40-pin expansion pin header as (J8) in chapter 3.6.

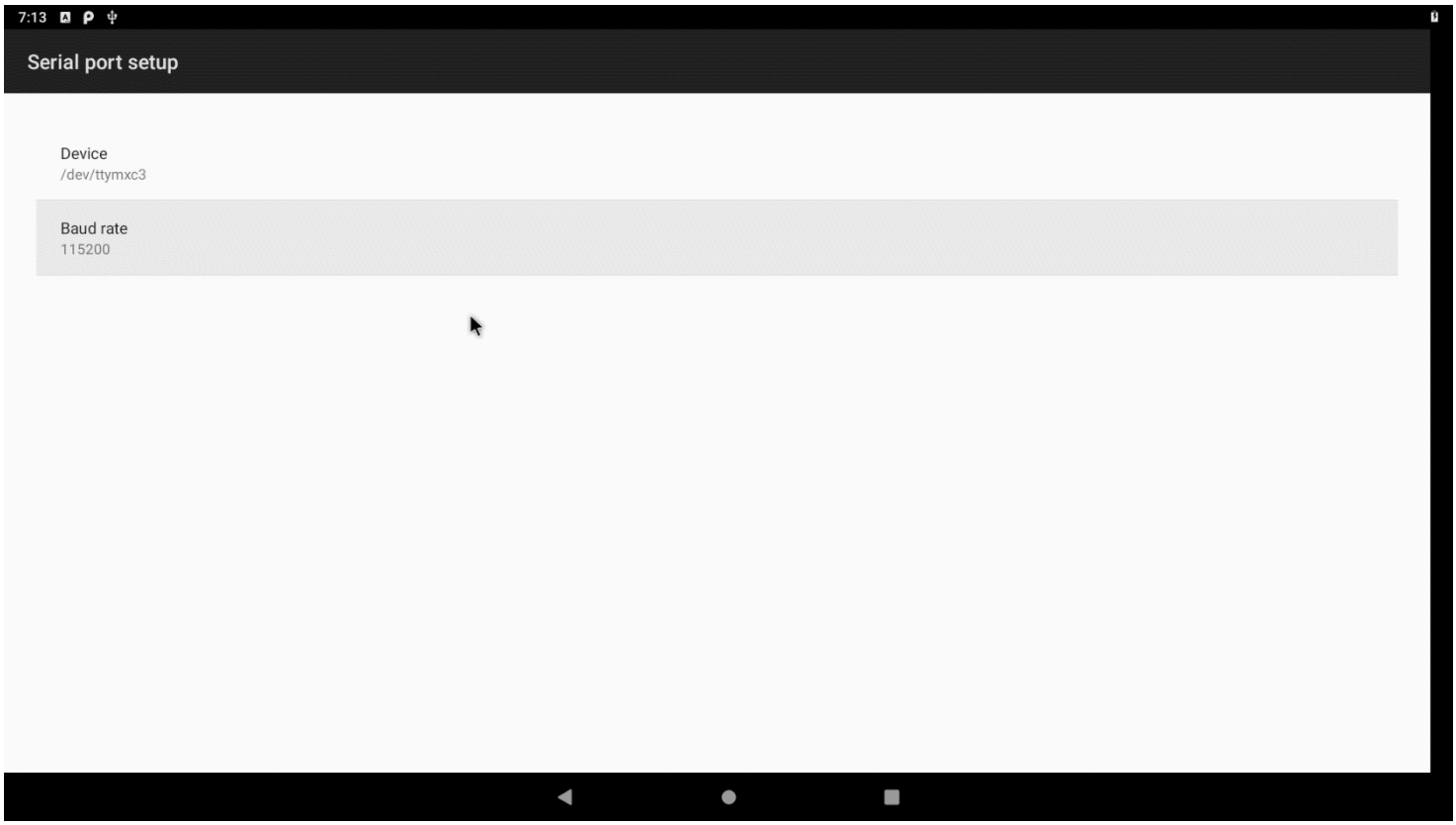
TX: Pin 7

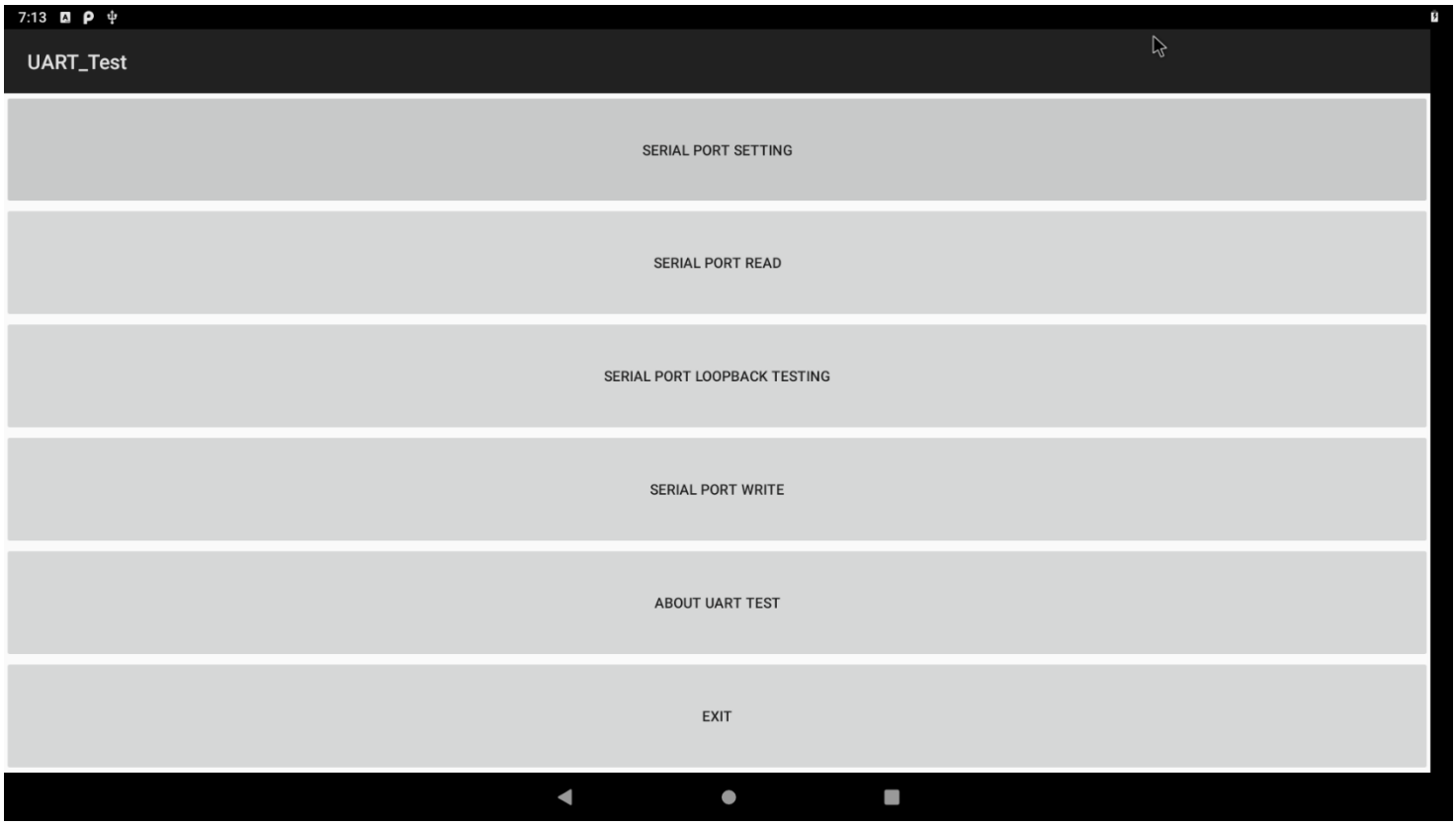
RX: Pin 11

Please open Technexion customized UART test app to do simple tests:



Click “SERIAL PORT SETTING” to config the UART node and baud rate, users can easily to test read, write and loopback functions.





3.10 Android Treble

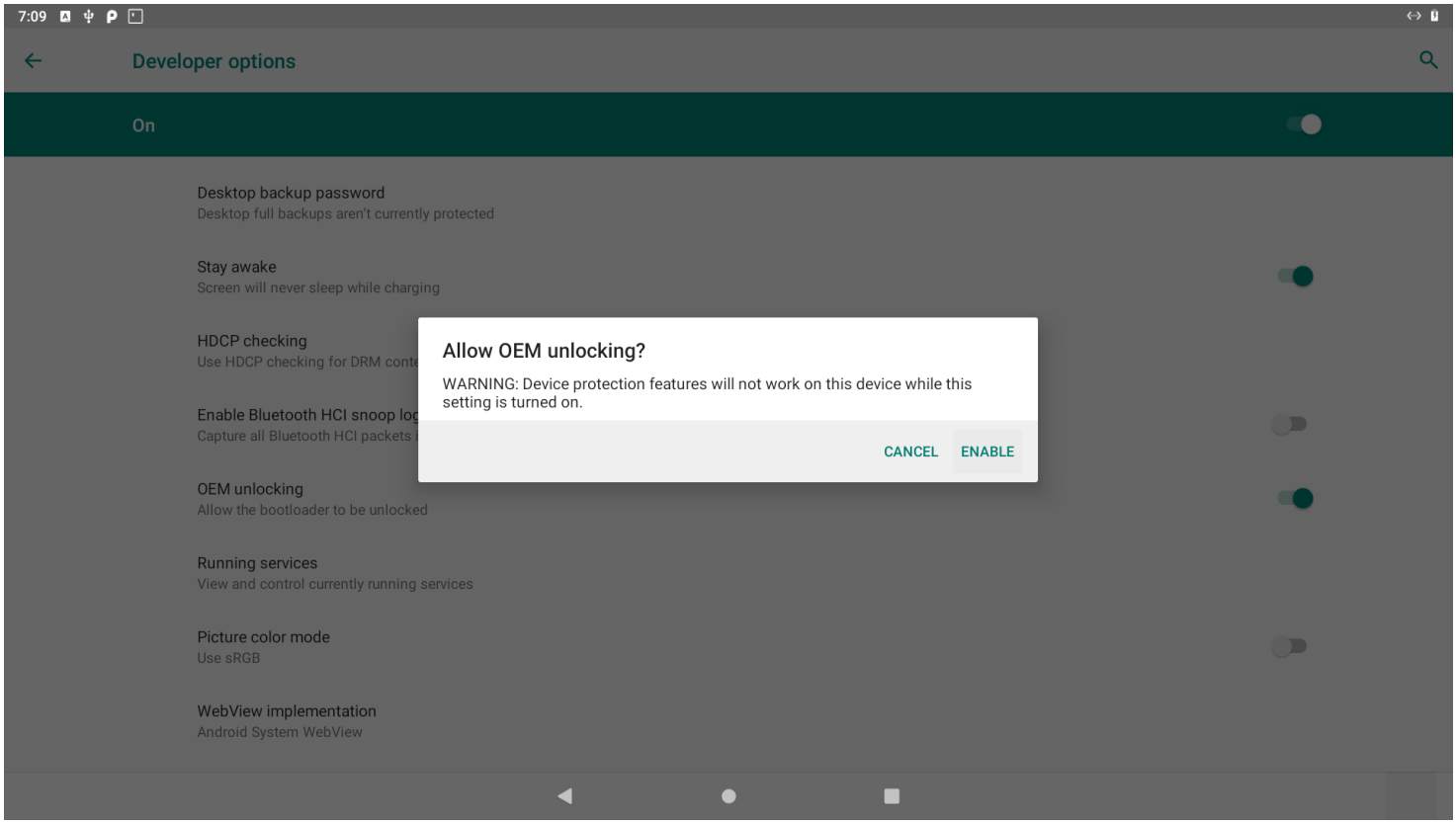
- ADB

  Connect a USB type-C cable from Host PC to hardware board, and issue the commands to debug:

```
Root permission
$ adb root
Normal permission
$ adb shell
```

- Fastboot

  In Android 9, users must use fastboot command to unlock the partition flashing permission before any upgrade behavior.



Unlock the flashing permission on developer options

In fastboot mode, please issue commands to unlock first before starting to flash new images:

```
$ sudo fastboot flashing unlock
# boot part upgrade
$ sudo fastboot flash dtbo_a dtbo-imx8mq.img
$ sudo fastboot flash dtbo_b dtbo-imx8mq.img
$ sudo fastboot flash boot_a boot.img
$ sudo fastboot flash boot_b boot.img
# system part upgrade
$ sudo fastboot flash vbmeta_a vbmeta-imxpico_8m.img
$ sudo fastboot flash vbmeta_b vbmeta-imxpico_8m.img
$ sudo fastboot flash system_a system.img
$ sudo fastboot flash system_b system.img
$ sudo fastboot flash vendor_a vendor.img
$ sudo fastboot flash vendor_b vendor.img
$ sudo fastboot reboot
```

Below features are fully supported, users can develop on our github SDK.

- A/B system
- OTA upgrade
- Treble structure of source code

4. Software Development and Upgrade

Online Github SDK includes the source code and instruction.
https://github.com/technexion-android/cookers/tree/tn-p9.0.0_1.0.0_8m-ga

5. Q & A

1. Why does video player only support portrait mode when using MIPI-DSI LCD panel on landscape mode?

Ans:
It's due to the bugs in OMX VPU library from chip vendor. Alternatively, TechNexion provides a workaround to change the parameters on user's video using ffmpeg tool:

```
Ubuntu host example
$ ffmpeg -i original_test.mov -vf "transpose=1" mipi_lcd_test.mov
$ ffmpeg -i mipi_lcd_test.mov -c copy -metadata:s:v:0 rotate=90 mipi_lcd_test_out.mov
```

2. How to remount the system/vendor partition as a writeable partition?

Ans:
Step 1. Unlock the flashing permission such as chapter 3.10 and reboot in fastboot mode.

```
# reboot bootloader
```

Step 2. Unlock the device again in fastboot mode on host side.

```
$ sudo fastboot oem unlock
$ sudo fastboot reboot
```

Step 3. Disabling the secure function using adb command on host side, then reboot again.

```
$ adb root
$ adb disable-verity
$ adb reboot
```

Step 4. Remount the all partitions as writeable partitions, for now, users can create a file to test.

```
## Host side
$ adb root
$ adb remount
$ adb shell

## Jump to Android side
$ su
# touch /system/test
# touch /vendor/test
```