



ExP2 Fintek Series

mPCIe/M.2 to Serial COM

User Manual

Rev 1.2

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Revision History

Revision	Date	Description
1.0	2023/03/28	Initial Release
1.1	2023/09/12	Add boot config and boot up script
1.2	2024/04/15	Add 2.10 FAQ and 2.10.1 workaround document for RHEL kernel 5.14 API type not compatible with mainstream kernel.

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Overview

This manual describes how to implement ExP2 Fintek series mPCIe/M.2 to Serial COM cards of the following products.

Product No.	RS232	RS485	RS422	Switch Method
EMP2-X206	O	O	O	Software
EMP2-X406	O	O	O	Software
EMP2-X207	O	X	X	Fixed Mode
EMP2-X407	O	X	X	Fixed Mode
EGP2-X203	O	X	X	Fixed Mode
EGP2-X403	O	X	X	Fixed Mode
EGP2-X204	O	O	O	Software
EGP2-X404	O	O	O	Software

1. Windows

1.1. Install Driver

This section is applicable to ALL products. Double click the driver package to start. Need reboot after installing the driver.

FPCIECOM_20221205.00_WHQL

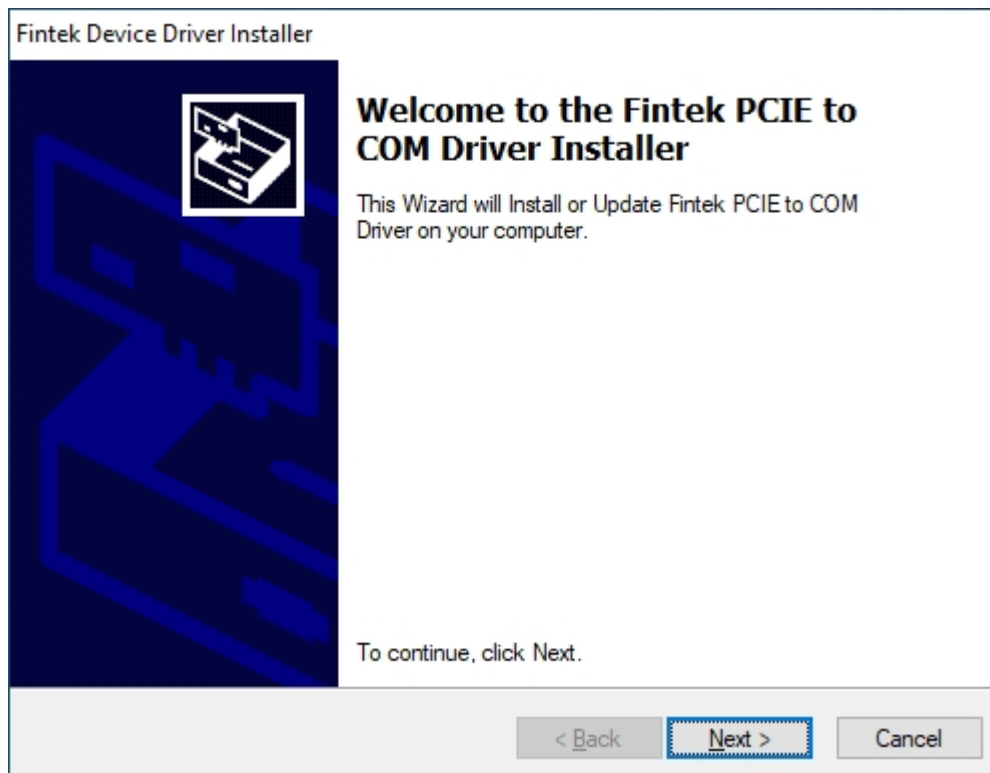
Name

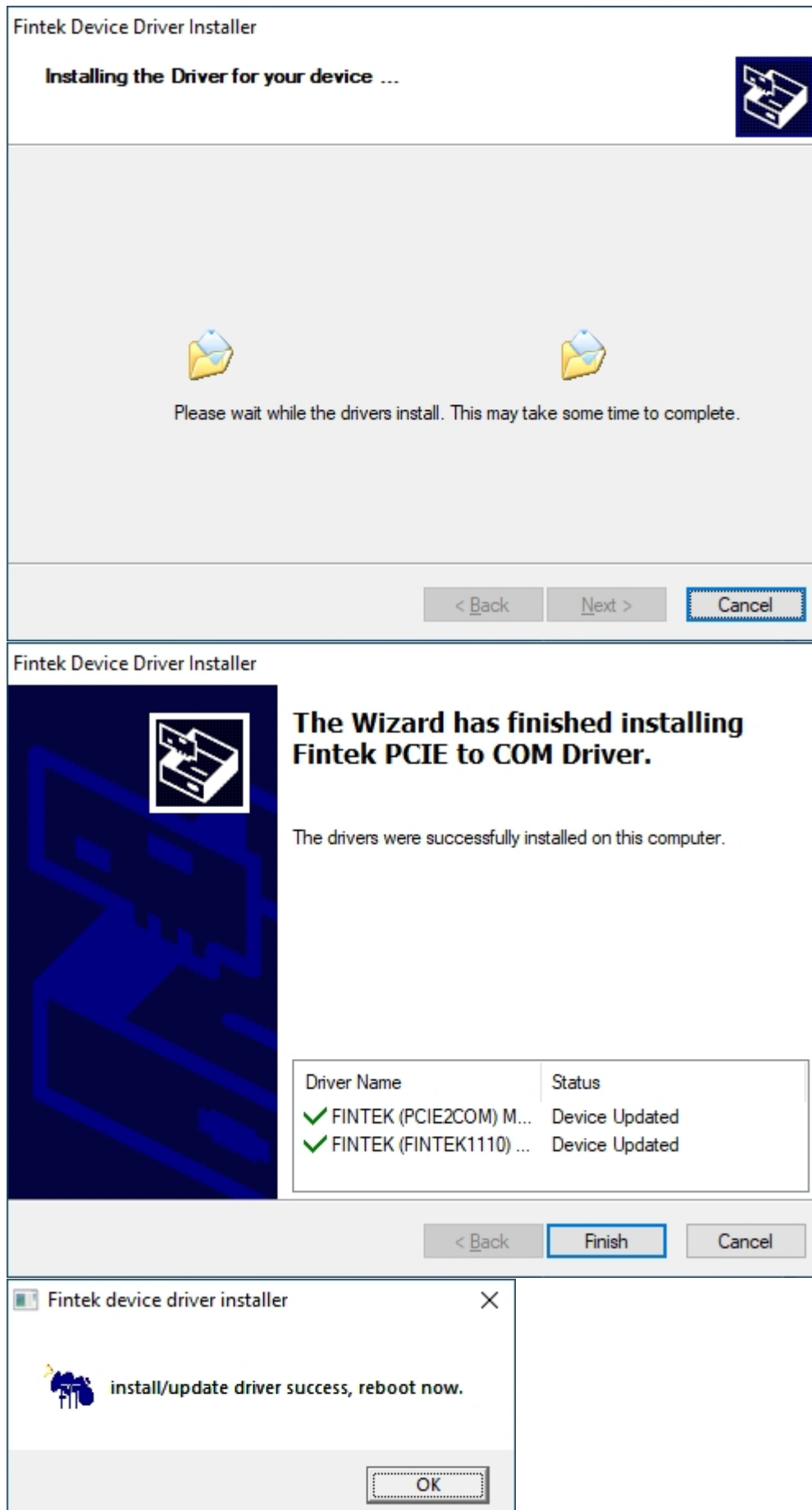
X64

X86

FPCIE2COM.cfg

Setup





1.2. Fix mode module

Can use directly after installing driver.

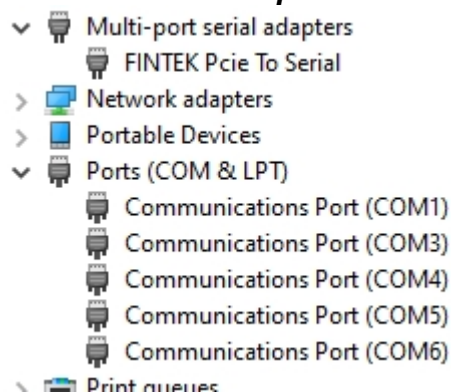
Product No.	RS232	RS485	RS422	Switch Method
EMP2-X207	O	X	X	Fixed Mode
EMP2-X407	O	X	X	Fixed Mode
EGP2-X203	O	X	X	Fixed Mode
EGP2-X403	O	X	X	Fixed Mode

1.3. Switch Mode Module by Software

This section is applicable to following products.

Product No.	RS232	RS485	RS422	Switch Method
EMP2-X206	O	O	O	Software
EMP2-X406	O	O	O	Software
EGP2-X204	O	O	O	Software
EGP2-X404	O	O	O	Software

In Device Manager, right click the mouse to enter “properties” in **“Communications ports”**.



Communications Port (COM3) Properties

General
Advance Setting
Driver
Details
Events
Resources


Communications Port (COM3)

Communications Parameters

Bits per second: 115200

Data bits: 8

Parity: none

Stop bits: 1

Flow control: none

Restore Defaults

COM Port Mode: 232

COM Port Num: 232

OK
Cancel

Communications Port (COM3) Properties

General
Advance Setting
Driver
Details
Events
Resources


Communications Port (COM3)

Communications Parameters

Bits per second: 115200

Data bits: 8

Parity: none

Stop bits: 1

Flow control: none

Restore Defaults

COM Port Mode: 485
☒ Enable Termination

COM Port Num: COM3(Using)

OK
Cancel

Communications Port (COM3) Properties

General Advance Setting Driver Details Events Resources

 Communications Port (COM3)

Communications Parameters

Bits per second: 115200

Data bits: 8

Parity: none

Stop bits: 1

Flow control: none

Restore Defaults

COM Port Mode: 422 ☒ Enable Termination

COM Port Num: COM3(Using)

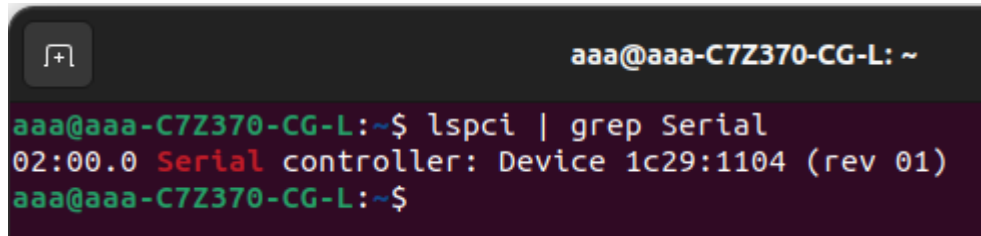
OK Cancel

2. Linux

Here we use Ubuntu 22.04 for example.

2.1. lspci

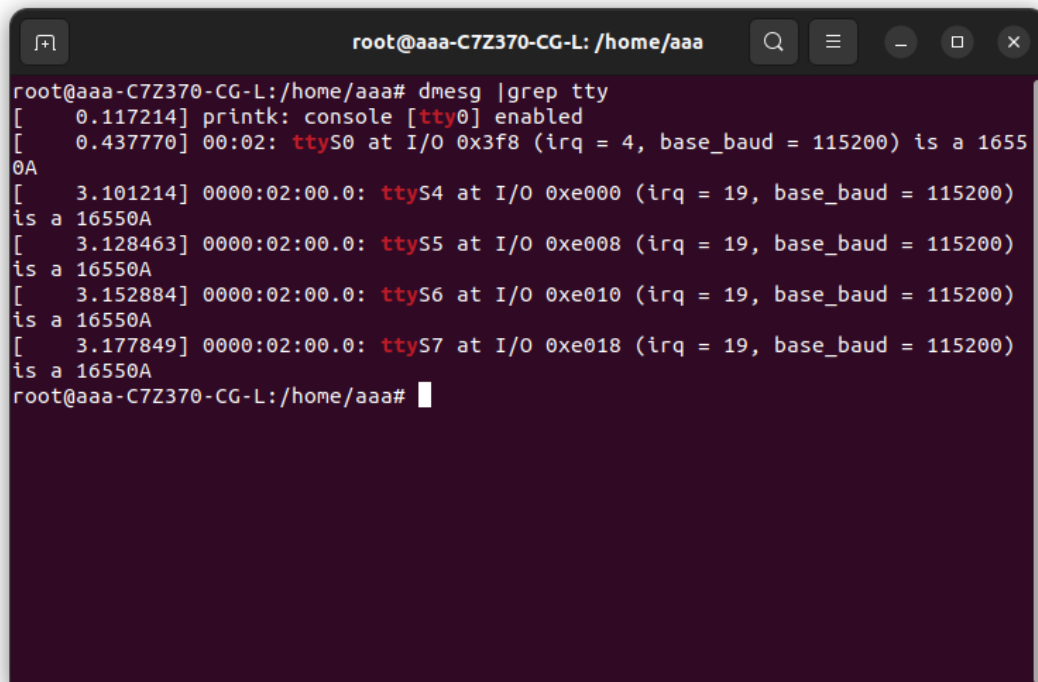
Check if the device exists in the system.

A terminal window with a dark background. The prompt is 'aaa@aaa-C7Z370-CG-L: ~'. The command 'lspci | grep Serial' is entered. The output shows '02:00.0 Serial controller: Device 1c29:1104 (rev 01)'.

```
aaa@aaa-C7Z370-CG-L: ~  
aaa@aaa-C7Z370-CG-L:~$ lspci | grep Serial  
02:00.0 Serial controller: Device 1c29:1104 (rev 01)  
aaa@aaa-C7Z370-CG-L:~$
```

2.2. dmesg |grep tty

Shows how many Fintek serial ports are in the system, in this case ttyS4 to ttyS7.

A terminal window with a dark background. The prompt is 'root@aaa-C7Z370-CG-L: /home/aaa'. The command 'dmesg |grep tty' is entered. The output shows several lines of kernel messages related to tty devices, including 'ttyS0', 'ttyS4', 'ttyS5', 'ttyS6', and 'ttyS7'.

```
root@aaa-C7Z370-CG-L: /home/aaa  
root@aaa-C7Z370-CG-L:/home/aaa# dmesg |grep tty  
[ 0.117214] printk: console [tty0] enabled  
[ 0.437770] 00:02: ttyS0 at I/O 0x3f8 (irq = 4, base_baud = 115200) is a 16550A  
[ 3.101214] 0000:02:00.0: ttyS4 at I/O 0xe000 (irq = 19, base_baud = 115200) is a 16550A  
[ 3.128463] 0000:02:00.0: ttyS5 at I/O 0xe008 (irq = 19, base_baud = 115200) is a 16550A  
[ 3.152884] 0000:02:00.0: ttyS6 at I/O 0xe010 (irq = 19, base_baud = 115200) is a 16550A  
[ 3.177849] 0000:02:00.0: ttyS7 at I/O 0xe018 (irq = 19, base_baud = 115200) is a 16550A  
root@aaa-C7Z370-CG-L:/home/aaa#
```

2.3. Boot Config

1. Prepare tools:

- Ubuntu
 - \$ sudo apt-get update
 - \$ sudo apt-get dist-upgrade
 - \$ sudo reboot
 - \$ sudo apt-get install gcc make kernel-package

2. Boot Configuration:

- Ubuntu
 - \$ sudo nano /etc/default/grub
 - add "8250.nr_uarts=32 initcall_blacklist=serial_pci_driver_init" to "GRUB_CMDLINE_LINUX_DEFAULT"
 - \$ sudo update-grub
 - \$ sudo reboot

```
aaa@aaa-C7Z370-CG-L:/etc/default$ pwd
/etc/default
aaa@aaa-C7Z370-CG-L:/etc/default$ cat grub
# If you change this file, run 'update-grub' afterwards to update
# /boot/grub/grub.cfg.
# For full documentation of the options in this file, see:
#   info -f grub -n 'Simple configuration'

GRUB_DEFAULT=0
GRUB_TIMEOUT_STYLE=hidden
GRUB_TIMEOUT=0
GRUB_DISTRIBUTOR=`lsb_release -i -s 2> /dev/null || echo Debian`
GRUB_CMDLINE_LINUX_DEFAULT="8250.nr_uarts=32 initcall_blacklist=serial_pci_driver_init quiet splash"
GRUB_CMDLINE_LINUX=""
```

2.4. Install Driver

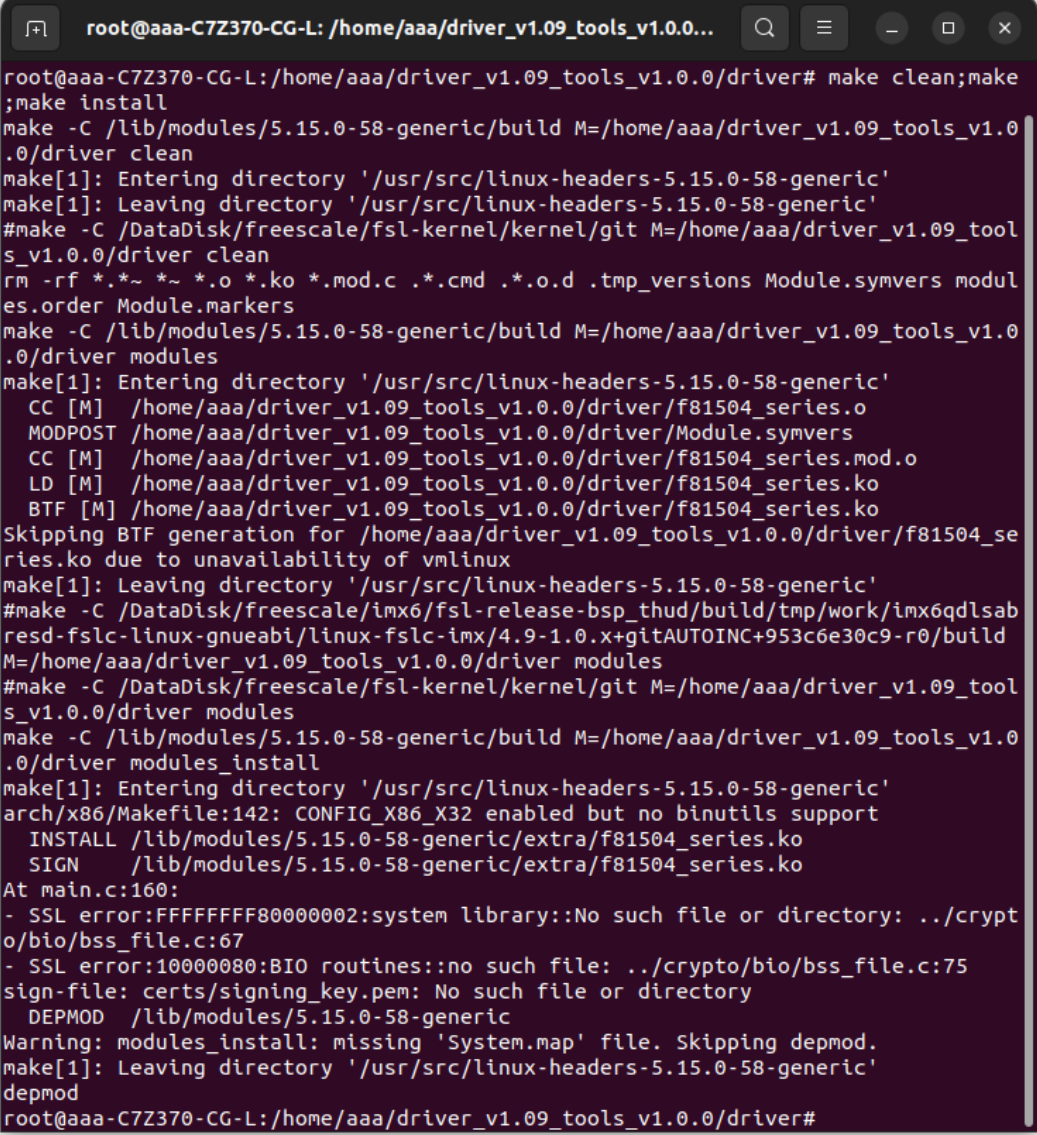
This section is applicable to ALL products.

Step1. Go to driver folder.

Step2. Type command `#make`.

Step3. Type command `#make install`

Step4. Type command `#reboot`



```
root@aaa-C7Z370-CG-L: /home/aaa/driver_v1.09_tools_v1.0.0...
root@aaa-C7Z370-CG-L:/home/aaa/driver_v1.09_tools_v1.0.0/driver# make clean;make
;make install
make -C /lib/modules/5.15.0-58-generic/build M=/home/aaa/driver_v1.09_tools_v1.0.0/driver clean
make[1]: Entering directory '/usr/src/linux-headers-5.15.0-58-generic'
make[1]: Leaving directory '/usr/src/linux-headers-5.15.0-58-generic'
#make -C /DataDisk/freescale/fsl-kernel/kernel/git M=/home/aaa/driver_v1.09_tools_v1.0.0/driver clean
rm -rf *.~ *.o *.ko *.mod.c *.cmd *.o.d .tmp_versions Module.symvers modules.order Module.markers
make -C /lib/modules/5.15.0-58-generic/build M=/home/aaa/driver_v1.09_tools_v1.0.0/driver modules
make[1]: Entering directory '/usr/src/linux-headers-5.15.0-58-generic'
CC [M] /home/aaa/driver_v1.09_tools_v1.0.0/driver/f81504_series.o
MODPOST /home/aaa/driver_v1.09_tools_v1.0.0/driver/Module.symvers
CC [M] /home/aaa/driver_v1.09_tools_v1.0.0/driver/f81504_series.mod.o
LD [M] /home/aaa/driver_v1.09_tools_v1.0.0/driver/f81504_series.ko
BTF [M] /home/aaa/driver_v1.09_tools_v1.0.0/driver/f81504_series.ko
Skipping BTF generation for /home/aaa/driver_v1.09_tools_v1.0.0/driver/f81504_series.ko due to unavailability of vmlinux
make[1]: Leaving directory '/usr/src/linux-headers-5.15.0-58-generic'
#make -C /DataDisk/freescale/imx6/fsl-release-bsp_thud/build/tmp/work/imx6qdl-sabresd-fslc-linux-gnueabi/linux-fslc-imx/4.9-1.0.x+gitAUTOINC+953c6e30c9-r0/build M=/home/aaa/driver_v1.09_tools_v1.0.0/driver modules
#make -C /DataDisk/freescale/fsl-kernel/kernel/git M=/home/aaa/driver_v1.09_tools_v1.0.0/driver modules
make -C /lib/modules/5.15.0-58-generic/build M=/home/aaa/driver_v1.09_tools_v1.0.0/driver modules_install
make[1]: Entering directory '/usr/src/linux-headers-5.15.0-58-generic'
arch/x86/Makefile:142: CONFIG_X86_X32 enabled but no binutils support
INSTALL /lib/modules/5.15.0-58-generic/extra/f81504_series.ko
SIGN /lib/modules/5.15.0-58-generic/extra/f81504_series.ko
At main.c:160:
- SSL error:FFFFFFFF80000002:system library::No such file or directory: ../crypto/bio/bss_file.c:67
- SSL error:10000080:BI0 routines::no such file: ../crypto/bio/bss_file.c:75
sign-file: certs/signing_key.pem: No such file or directory
DEPMOD /lib/modules/5.15.0-58-generic
Warning: modules_install: missing 'System.map' file. Skipping depmod.
make[1]: Leaving directory '/usr/src/linux-headers-5.15.0-58-generic'
depmod
root@aaa-C7Z370-CG-L:/home/aaa/driver_v1.09_tools_v1.0.0/driver#
```

2.5. Install Mode-Control Tool “serial_f81504_tool”

This section is applicable to following products.

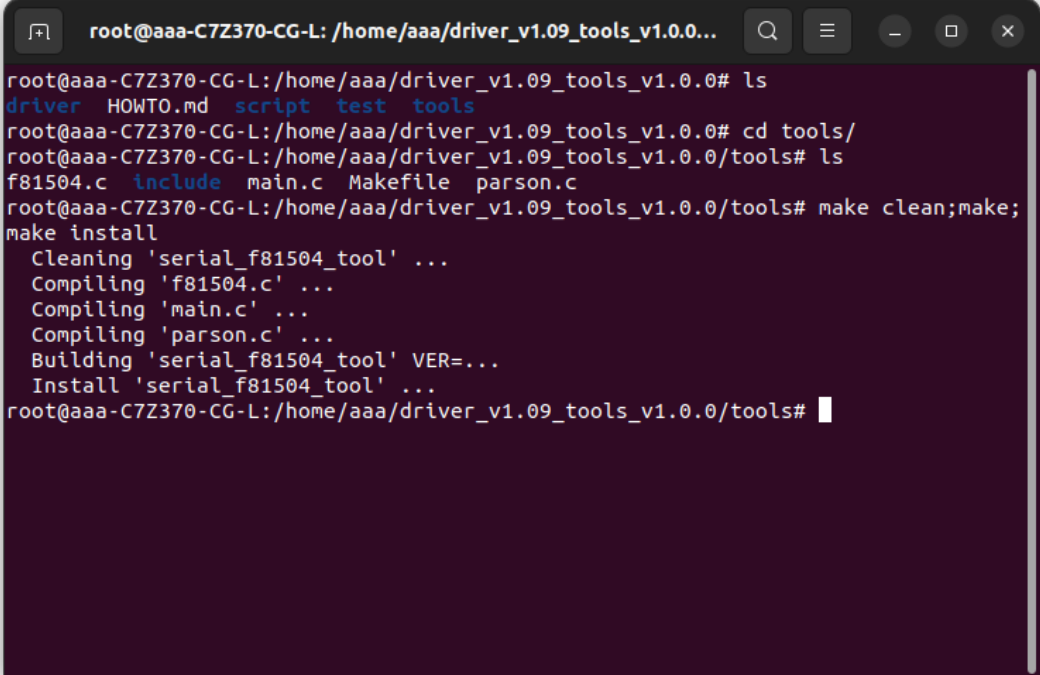
Product No.	RS232	RS485	RS422	Switch Method
EMP2-X206	O	O	O	Software
EMP2-X406	O	O	O	Software
EGP2-X204	O	O	O	Software
EGP2-X404	O	O	O	Software

Step1. Go to tools folder.

Step2. Type command “#make”.

Step3. Type command “#make install”

Step4. Type command “#reboot”



```

root@aaa-C7Z370-CG-L: /home/aaa/driver_v1.09_tools_v1.0.0...
root@aaa-C7Z370-CG-L:/home/aaa/driver_v1.09_tools_v1.0.0# ls
driver  HOWTO.md  script  test  tools
root@aaa-C7Z370-CG-L:/home/aaa/driver_v1.09_tools_v1.0.0# cd tools/
root@aaa-C7Z370-CG-L:/home/aaa/driver_v1.09_tools_v1.0.0/tools# ls
f81504.c  include  main.c  Makefile  parson.c
root@aaa-C7Z370-CG-L:/home/aaa/driver_v1.09_tools_v1.0.0/tools# make clean;make;
make install
Cleaning 'serial_f81504_tool' ...
Compiling 'f81504.c' ...
Compiling 'main.c' ...
Compiling 'parson.c' ...
Building 'serial_f81504_tool' VER=...
Install 'serial_f81504_tool' ...
root@aaa-C7Z370-CG-L:/home/aaa/driver_v1.09_tools_v1.0.0/tools#

```

2.6. serial_f81504_tool README

```

root@aaa-C7Z370-CG-L: /home/aaa
root@aaa-C7Z370-CG-L:/home/aaa# serial_f81504_tool
version: v1.0.0
Syntax: serial_f81504_tool [-option ...]
Option:
-h : Show usage
-c : Target of config path (default: /etc/serial_f81504.cfg)
-t : tty port (ex: ttyS4)
-m : tty mode (ex: RS422 or 0)
    Mode table (M0/M1/M2):
        0: 000 - RS422
        1: 001 - RS232
        2: 010 - RS485
        4: 100 - RS422R (with termination)
        6: 110 - RS485R (with termination)
-w : Without save config
-i : Initialize device by config
-l : Display all tty port and exit
-r : Reset config to default
-o : show option for debug
Sample:
Change tty's mode:
    serial_f81504_tool -t ttyS4 -m RS422
Change tty's mode without save config:
    serial_f81504_tool -t ttyS4 -m RS422 -w
Initialize device by config (default: /etc/serial_f81504.cfg):
    serial_f81504_tool -i
Initialize device by target config
    serial_f81504_tool -i -c ./init.cfg
Display all tty port:
    serial_f81504_tool -l
Reset config to default:
    serial_f81504_tool -r
root@aaa-C7Z370-CG-L:/home/aaa#

```

2.7. Fix mode module

Can use directly after installing driver.

Product No.	RS232	RS485	RS422	Switch Method
EMP2-X207	O	X	X	Fixed Mode
EMP2-X407	O	X	X	Fixed Mode
EGP2-X203	O	X	X	Fixed Mode
EGP2-X403	O	X	X	Fixed Mode

2.8. Switch Mode by Software

This section is applicable to following products.

Product No.	RS232	RS485	RS422	Switch Method
EMP2-X206	O	O	O	Software
EMP2-X406	O	O	O	Software
EGP2-X204	O	O	O	Software
EGP2-X404	O	O	O	Software

After installing driver and control tools, you can simply execute below command to initial the COM ports.

Notice, all serial_f81504_tool control tools need to be executed as root.

- **COMMAND: serial_f81504_tool -i**
The serial_f81504_tool -i will help you check if the driver has been loaded on the system and setup all ports following the configuration file (/etc/serial_f81504.cfg). If the configuration file did not exist, it will create a default one for you, all ports will be configured as RS232 mode by default.

Notice that, the serial_f81504_tool -i must be executed after system boot up every time to make sure the driver loaded well and all ports be configured as you want.

- **COMMAND: serial_f81504_tool -t <port> -m <mode>**
The <port> specify which port you want to configure, And the <mode> specify the target mode, Mode table (M0/M1/M2):
 0: 000 - **RS422**
 1: 001 - **RS232**
 2: 010 - **RS485**
 4: 100 - **RS422R** (with termination)
 6: 110 - **RS485R** (with termination)

```
root@aaa-C7Z370-CG-L: /home/aaa
root@aaa-C7Z370-CG-L:/home/aaa# serial_f81504_tool -t ttyS4 -m RS485
version: v1.0.0
ttyS4 already set mode to RS485 !!
root@aaa-C7Z370-CG-L:/home/aaa# serial_f81504_tool -t ttyS5 -m RS485
version: v1.0.0
ttyS5 already set mode to RS485 !!
root@aaa-C7Z370-CG-L:/home/aaa#
```

- COMMAND: serial_f81504_tool -l
You can check currently setting

```
root@aaa-C7Z370-CG-L: /home/aaa
root@aaa-C7Z370-CG-L:/home/aaa# serial_f81504_tool -i
version: v1.0.0
ttyS4 already set mode to RS485 !!
ttyS5 already set mode to RS485 !!
root@aaa-C7Z370-CG-L:/home/aaa# serial_f81504_tool -l
version: v1.0.0
Address      Name      Transceiver  Mode
E000         ttyS4     F81439       RS485
E008         ttyS5     F81439       RS485
E010         ttyS6     F81439       RS232
E018         ttyS7     F81439       RS232
root@aaa-C7Z370-CG-L:/home/aaa#
```

- COMMAND: serial_f81504_tool -r (need reboot system after setting)
Reset all port to default mode RS232.

2.9. Boot Up Script

We provide Linux boot up script to initial serial interface automatically after system boot up.

Run the following command in the “release” folder to add boot up script.

```
- $ chmod +x add_2_boot.sh
- $ ./add_2_boot.sh
```

Run the following command in the “release” folder to remove boot up script.

```
- $ chmod +x remove_boot.sh
- $ ./remove_boot.sh
```

2.10. FAQ

2.10.1. For RHEL kernel 5.14

F81504 will build failed on RHEL kernel 5.14.

```
root@localhost: /home/code/ddd/old/hpeter/fintek/F81504-Series/fintek
[root@localhost fintek]# make
make -C /lib/modules/5.14.0-362.8.1.el9_3.x86_64/build M=/home/code/ddd/old/hpeter/fintek/F81504-Series/fintek modules
make[1]: 進入目錄「/usr/src/kernels/5.14.0-362.8.1.el9_3.x86_64」
CC [M] /home/code/ddd/old/hpeter/fintek/F81504-Series/fintek/f81504_series.o
/home/code/ddd/old/hpeter/fintek/F81504-Series/fintek/f81504_series.c: 在函式「f81504_register_port」中:
/home/code/ddd/old/hpeter/fintek/F81504-Series/fintek/f81504_series.c:495:31: 錯誤: assignment to「void (*)(struct uart_port *, struct ktermios *, const struct ktermios *)」 from incompatible pointer type「void (*)(struct uart_port *, struct ktermios *, struct ktermios *)」 [-Werror=incompatible-pointer-types]
495 |         port->set_termios = f81504_set_termios;
    |         ^
cc1: 視某些警告為錯誤
make[2]: *** [scripts/Makefile.build:299: /home/code/ddd/old/hpeter/fintek/F81504-Series/fintek/f81504_series.o] 錯誤 1
make[1]: *** [Makefile:1928: /home/code/ddd/old/hpeter/fintek/F81504-Series/fintek] 錯誤 2
make[1]: 離開目錄「/usr/src/kernels/5.14.0-362.8.1.el9_3.x86_64」
make: *** [Makefile:10: default] 錯誤 2
[root@localhost fintek]#
```

dasd_mod.h	i2c-algo-pcf.h	mbus.h	pl320-ipc.h	soundcard.h	zstd_lib.h
davinci_emac.h	i2c-dev.h	mc146818rtc.h	platform_data	sound.h	zutil.h
dax.h	i2c.h	mc6821.h	platform_device.h	soundwire	

```
[root@localhost linux]# vi serial_core.h
[root@localhost linux]# uname -a
Linux localhost.localdomain 5.14.0-362.8.1.el9_3.x86_64 #1 SMP PREEMPT_DYNAMIC Tue Oct 3 11:12:36 EDT 2023 x86_64 x86_64 x86_64 GNU/Linux
[root@localhost linux]# cat /etc/redhat-release
Red Hat Enterprise Linux release 9.3 (Plow)
[root@localhost linux]#
```

It's due to the RHEL kernel API not the same with mainstream's. Customer must modify f81504_serial.c near line 290, **change the #if 1 to #if 0 and re-build driver.**

```
284: #if LINUX_VERSION_CODE >= KERNEL_VERSION(2, 6, 36)
285: #if LINUX_VERSION_CODE >= KERNEL_VERSION(6, 1, 0)
286: void f81504_set_termios(struct uart_port *port, struct ktermios *termios,
287:                        const struct ktermios *old)
288: #else
289: #if 1
290: void f81504_set_termios(struct uart_port *port, struct ktermios *termios,
291:                        struct ktermios *old)
292: #else
293: // for centos stream kernel 5.14.0-390-el9
294: void f81504_set_termios(struct uart_port *port, struct ktermios *termios,
295:                        const struct ktermios *old)
296: #endif
297: #endif
298: {
299:     struct pci_dev *dev = container_of(port->dev, struct pci_dev, dev);
300:     struct f81504_priv *priv = pci_get_drvdata(dev);
301:     unsigned int baud = tty_termios_baud_rate(termios);
```

Contact us

Headquarters (Taiwan)

5F., No. 237, Sec. 1, Datong Rd., Xizhi Dist., New Taipei City 221, Taiwan

Tel: +886-2-77033000

Email: sales@innodisk.com

Branch Offices:

USA

usasales@innodisk.com

+1-510-770-9421

Europe

eusales@innodisk.com

+31-40-3045-4008

Japan

jpsales@innodisk.com

+81-3-6667-0161

China

sales_cn@innodisk.com

+86-755-2167-3689

www.innodisk.com

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