ExPC Fintek PCIe CAN Series

EGPC-B4S1
EGPC-B2S1
EGPC-B1S1
EMPC-B2S1

User Manual

Rev 1.3

Revision History

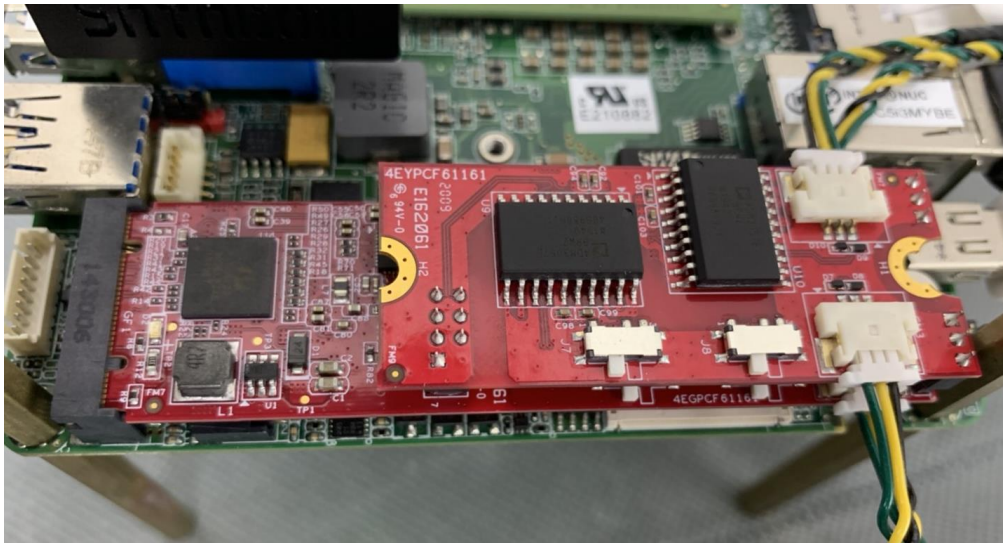
Revision	Date	Description
1.0	2020/06/18	Initial Release
1.1	2022/5/16	Merge all Fintek CAN user manual
1.2	2022/8/26	Add Software API Description
1.3	2023/4/27	Correct API function name and add new function

Table of Contents

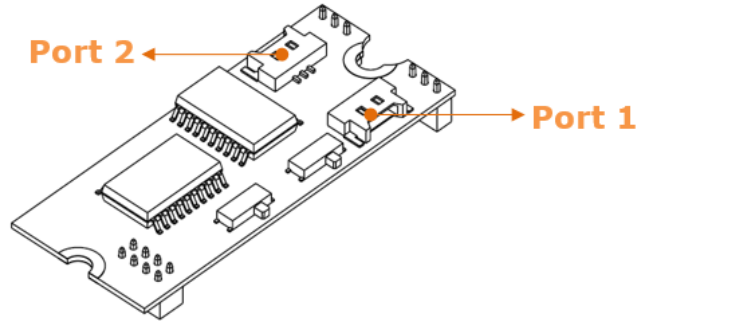
1. Hardware Installation

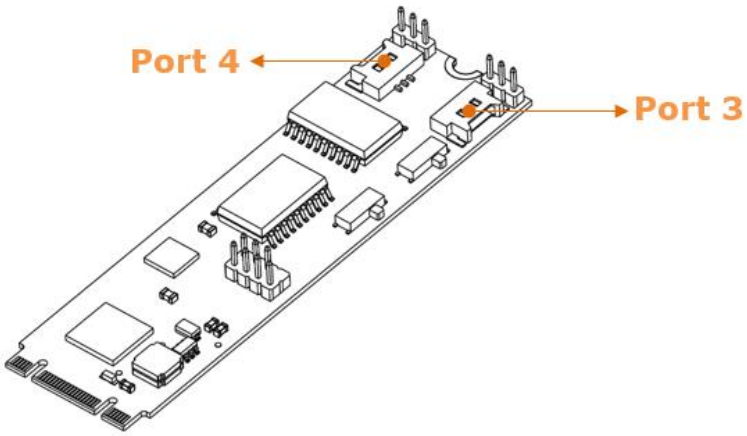
1.1. EGPC-B4S1

Install the module to M.2 B-M key slot which has PCIe interface.



The following picture shows the port order in majority platform.

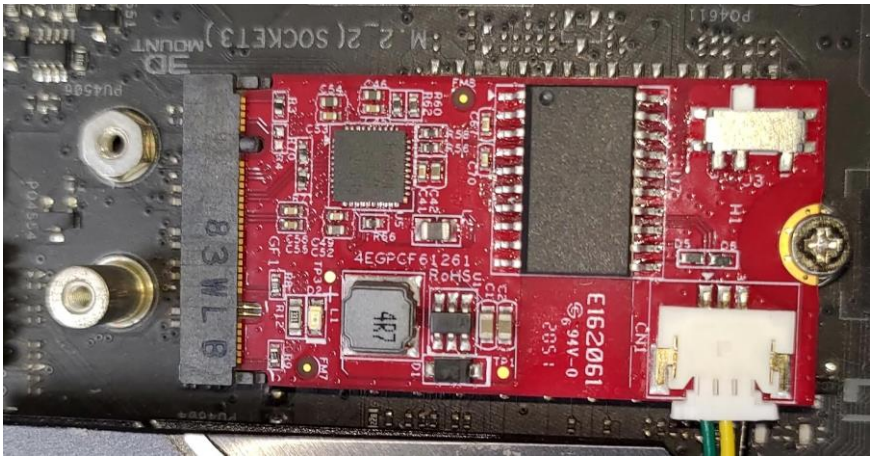




NOTE: *Some platforms may show opposite port order in Windows.*

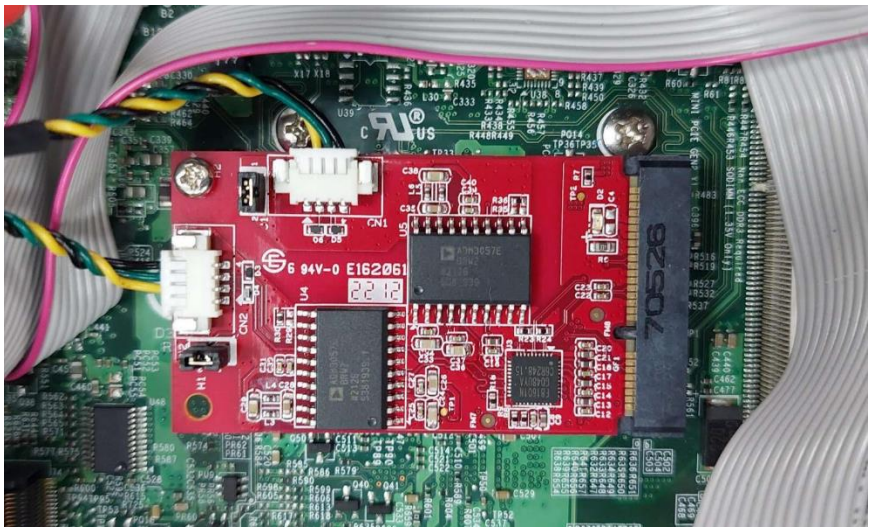
1.2. EGPC-B1S1

Install the module to M.2 B-M key slot which has PCIe interface.



1.3. EMPC-B2S1

Install the module to mPCIe slot which has PCIe interface.



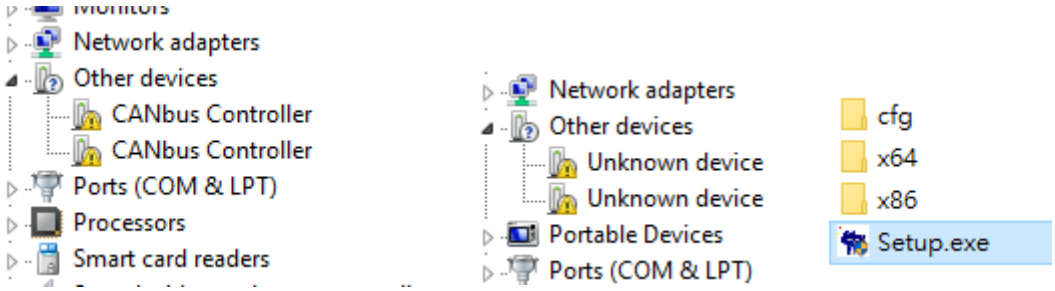
2. Windows OS

The following uses EGPC-B4S1 for driver installation and test as the example.

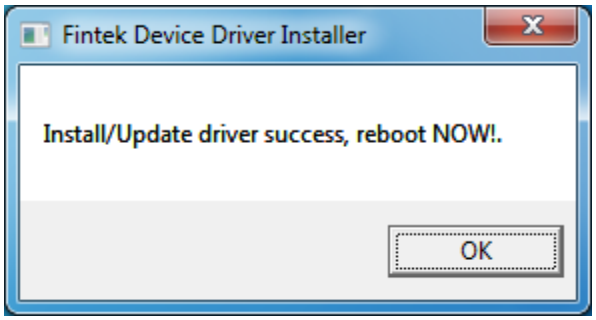
2.1. Driver Installation

The device named “CAN bus Controller” or “Unknown device” can be found in “Device Manager”.

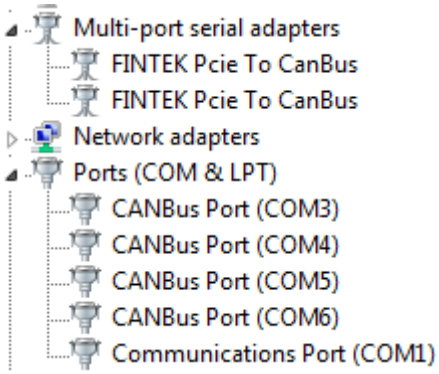
Run the driver package as administrator.



After installing, please reboot.



After reboot, CAN bus ports can be found in the device manager.



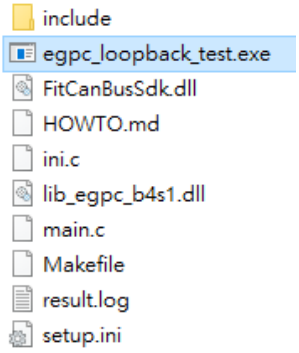
NOTE: *Drivers for Windows 64bit need to be signed with digital certificate. The driver is signed with SHA-2 certificate*

Windows 7 must be installed the hotfix KB3033929 to support SHA-2 code signing.

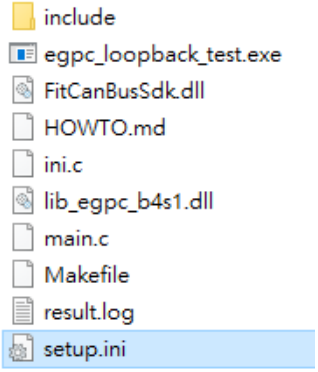
https://technet.microsoft.com/en-ie/library/security/3033929

2.2. Loop Back Test Program

We provide a loop back test program with source code in Windows to verify the module.



The test program can be configured by edit “setup.ini”. In majority cases, just keep the default setting.



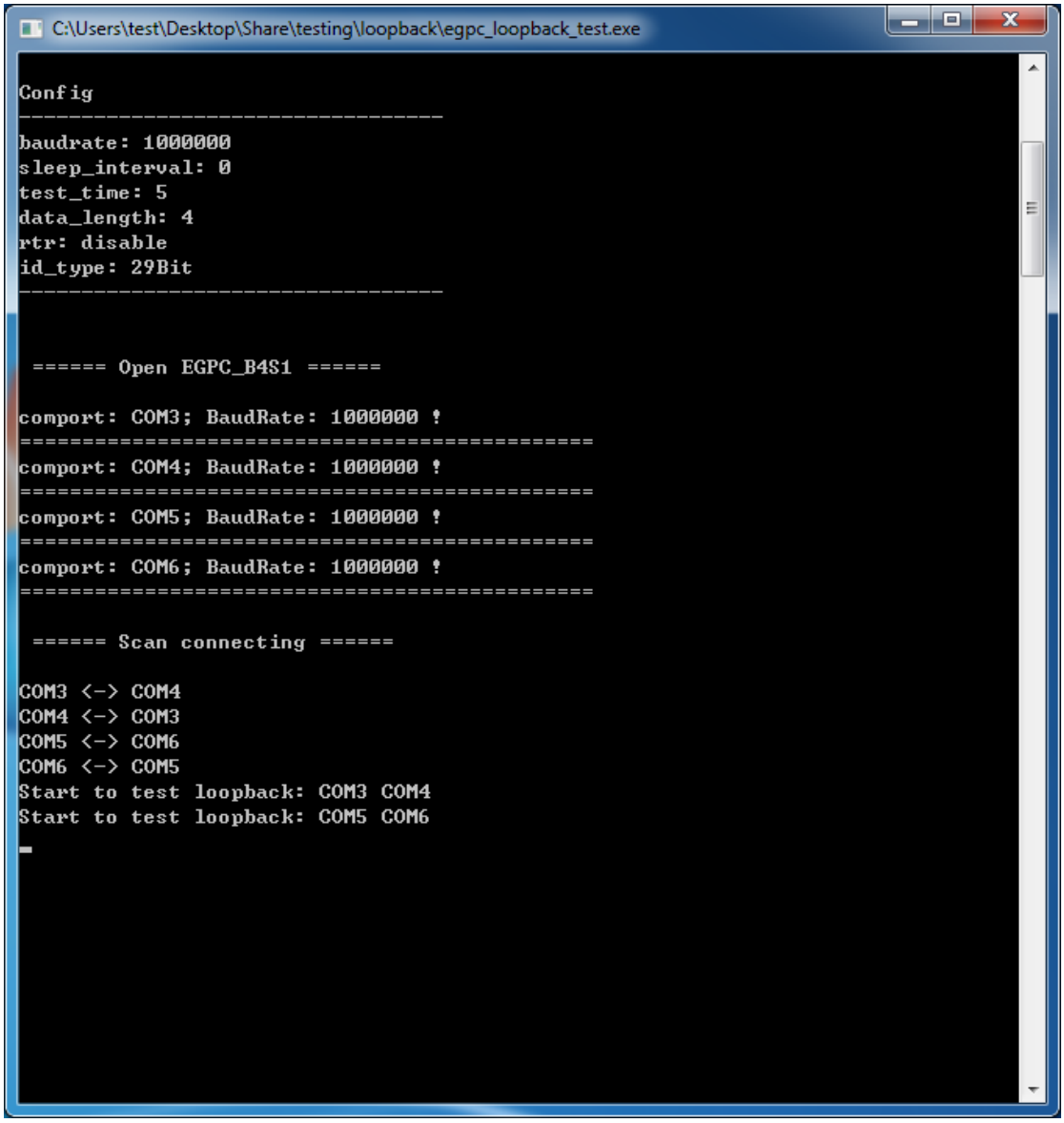
If your CAN card is 4 port version, keep COM_Qty at 4, don’t care COM port number setting.

```
;
; some setting for EGPC-B4S1 loopback test
;
[test]
COM_Qty=4                ; support: 2 port, 4 port
COM_1th=COM4             ; if COM_Qty=4, it is a don't care condition
COM_2nd=COM5             ; if COM_Qty=4, it is a don't care condition
```

If your CAN card is 2 port version, please modify COM_Qty to 2 and specify the COM port number.

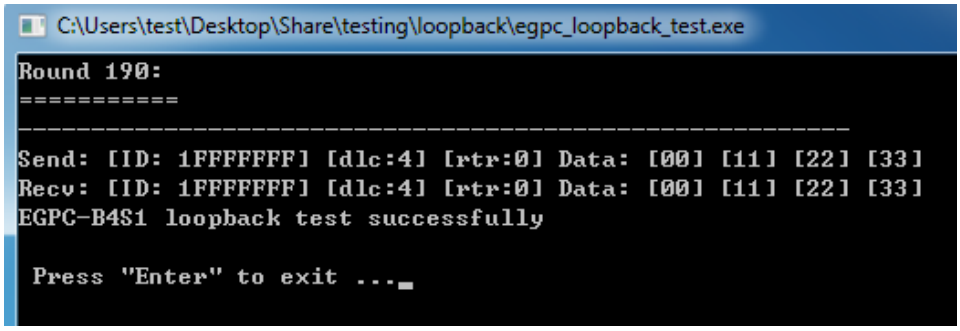
```
;
; some setting for EGPC-B4S1 loopback test
;
[test]
COM_Qty=2                ; support: 2 port, 4 port
COM_1th=COM4             ; if COM_Qty=4, it is a don't care condition
COM_2nd=COM5             ; if COM_Qty=4, it is a don't care condition
```

Please connect any two ports with each other by using an adapter (MINI GENDER CHANGER) and connect the other two as well. Then run the “EGPC_B4S1_Sample.exe” directly.
The test program will detect which ports are connected with each other then run the test automatically.

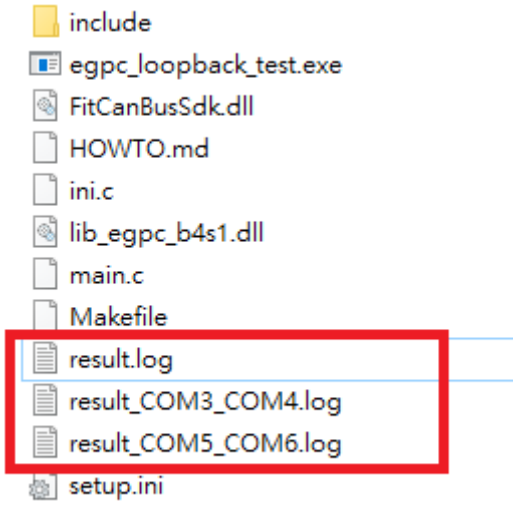


When the program is running, for example, CAN1 sends a frame to CAN2, after CAN2 receives the frame CAN2 will check if the frame is correct or not. Then turn to CAN2 sends and CAN1 receives.

If the received CAN port doesn't receive the frame or the received frame is incorrect, the program will terminate and show the result is failed.



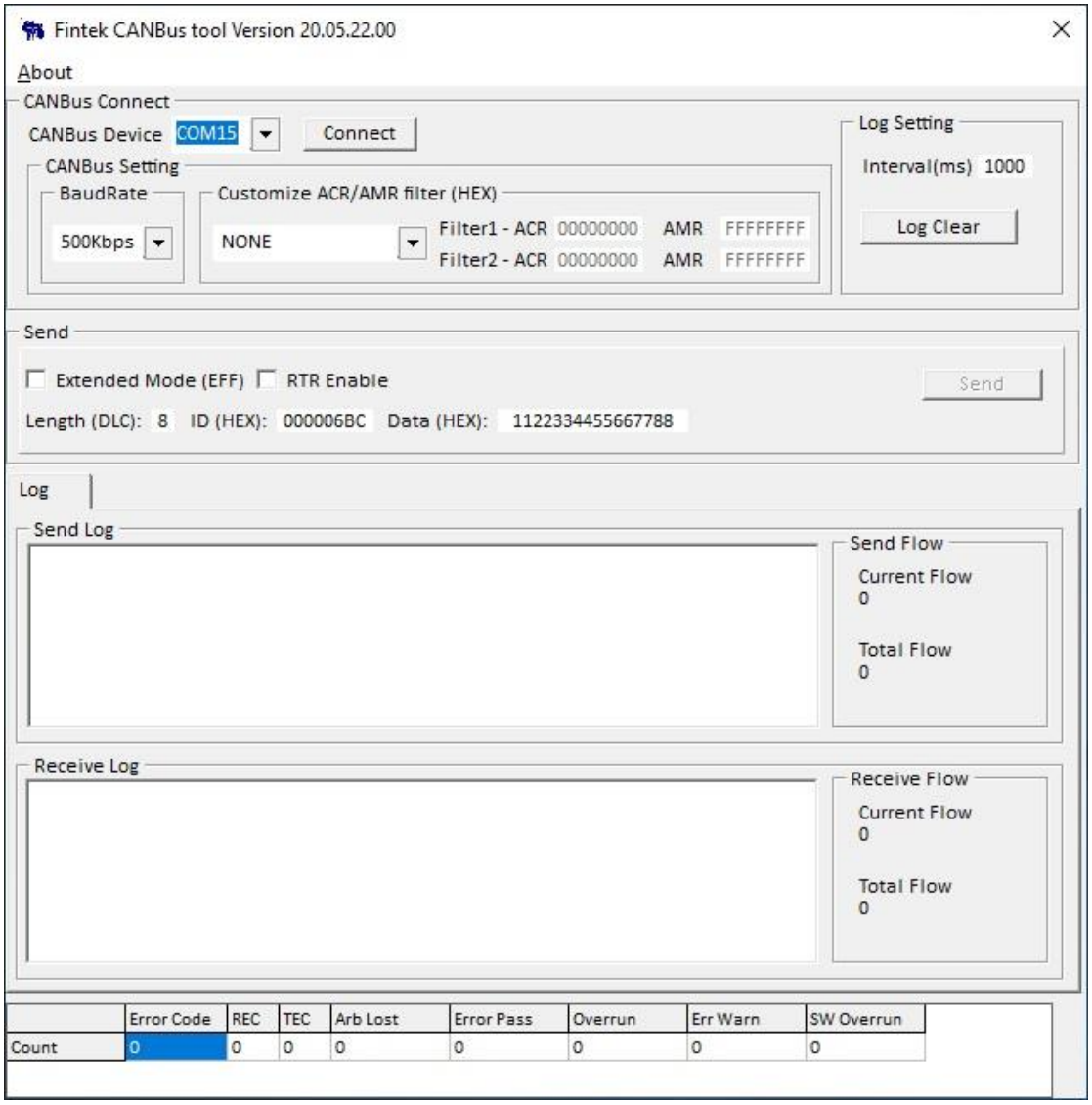
Test results will be saved to the following logs.



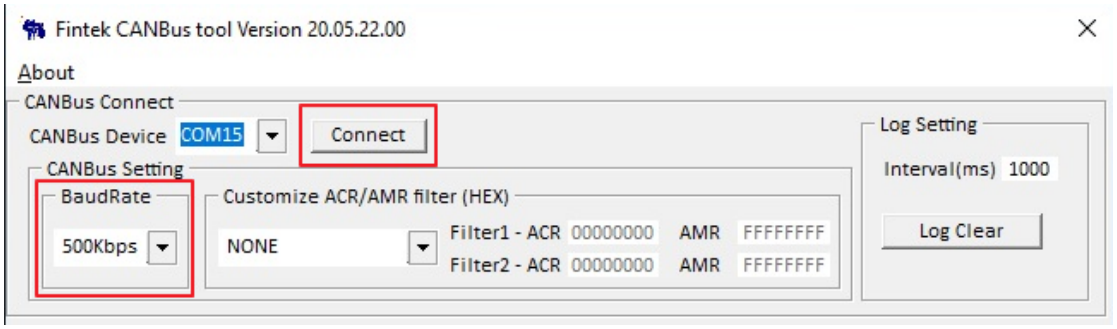
```
========== 2020/06/01 14:57:20 ==========
comport: COM3, COM4
baudrate  = 1000000
interval  = 0 [ms]
test_time = 60 [sec]
EGPC-B4S1 loopback test successfully

========== 2020/06/01 15:00:49 ==========
comport: COM3, COM4
baudrate  = 1000000
interval  = 0 [ms]
test_time = 60 [sec]
EGPC-B4S1 loopback test successfully

========== 2020/06/01 15:04:09 ==========
comport: COM3, COM4
baudrate  = 1000000
interval  = 0 [ms]
test_time = 60 [sec]
EGPC-B4S1 loopback test successfully

========== 2020/06/01 15:07:29 ==========
comport: COM3, COM4
baudrate  = 1000000
interval  = 0 [ms]
test_time = 60 [sec]
EGPC-B4S1 loopback test successfully

========== 2020/06/01 15:10:49 ==========
comport: COM3, COM4
baudrate  = 1000000
interval  = 0 [ms]
test_time = 60 [sec]
```

2.3. GUI CAN bus Tool

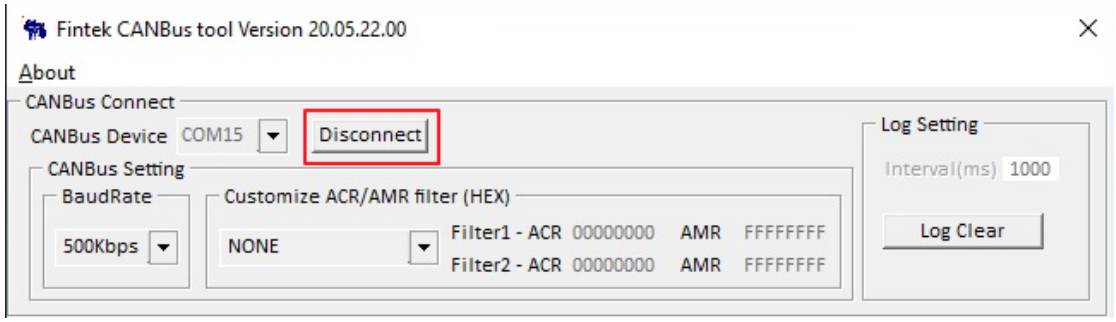
We provide GUI CAN bus tool in Windows to verify the module.



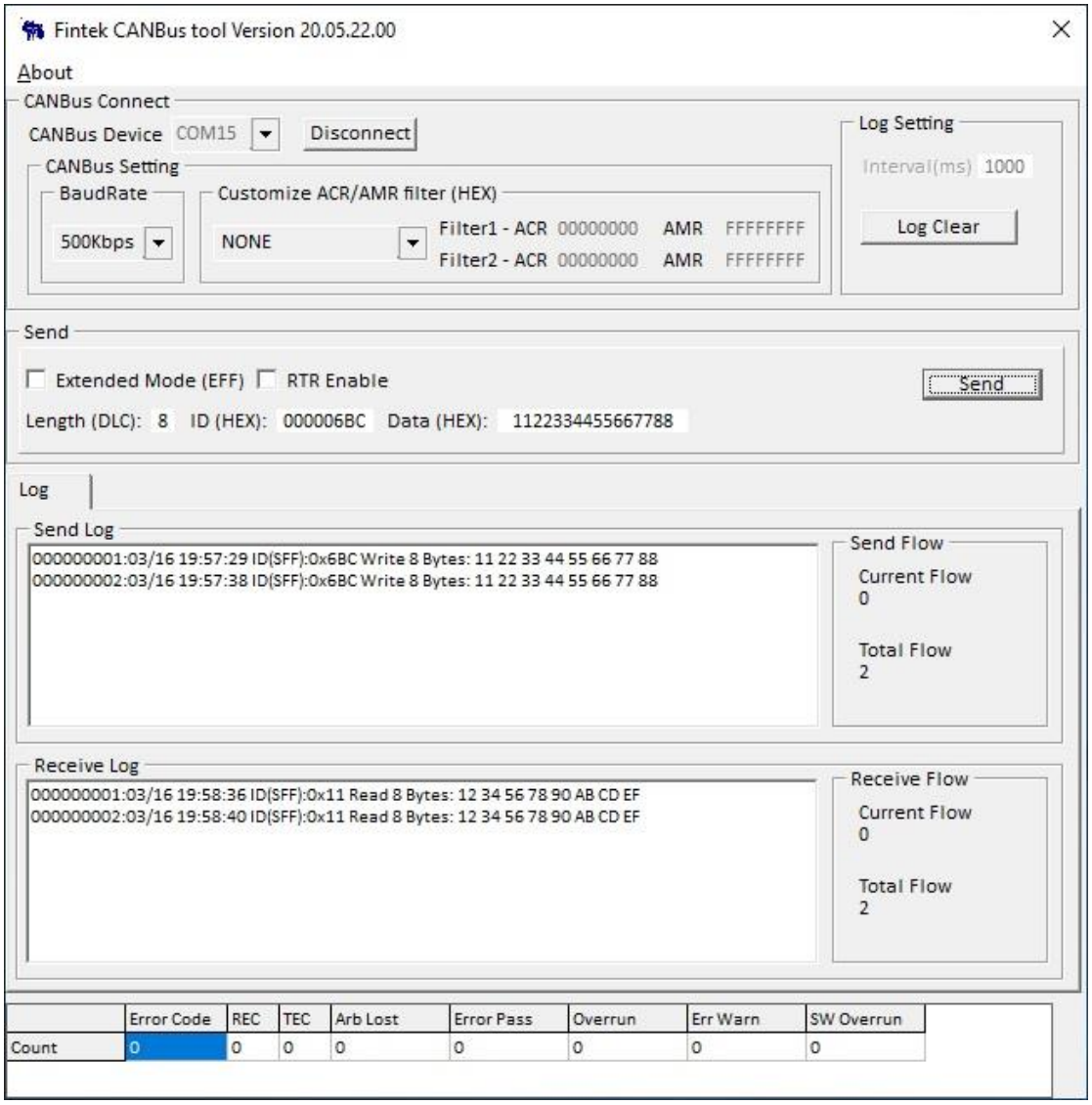
Before testing, please set BaudRate, and then click "Connect" to start CAN.



After successfully starting CAN, the button will change from "Connect" to "Disconnect".



Using the CAN bus tool, you can monitor whether CAN frames are received and sent from the CAN bus network.



2.4. Software API

EGPC API is based on a dynamic library (DLL) in Windows to control ExPC Fintek PCIe CAN series product.

Please refer to the following table for ExPC APIs:

ID	Function Name
4.1	EGPCOpen
4.2	EGPCOpenInactive
4.3	EGPCInitCAN
4.4	EGPCClose
4.5	EGPCSetBaudRate
4.6	EGPCGetBaudRate
4.7	EGPCSetFilter
4.8	EGPCClearFilter
4.9	EGPCReceive
4.10	EGPCSend
4.11	EGPCReset
4.12	EGPCShowVer
4.13	EGPCWarnStr

2.4.1. EGPCOpen

long EGPCOpen(char* sComPortNumber)

Function: Open CAN bus virtual COM Port.

Parameters:

sComPortNumber: COM port Number

Return Value:

If the function succeeds, the return value is zero. If the function fails, the return value is nonzero and the error code generated by the API. Refer to section **Error Codes** to find more information.

2.4.2. EGPCOpenInactive

long EGPCOpenInactive (char* sComPortNumber)

Function: Open CAN bus virtual COM Port with inactive mode

Parameters:

sComPortNumber: COM port Number

Return Value:

If the function succeeds, the return value is zero. If the function fails, the return value is nonzero and the error code generated by the API. Refer to section **Error Codes** to find more information.

2.4.3. EGPCInitCAN

long EGPCInitCAN (char* sComPortNumber, int status)

Function: Set CAN port to active/inactive.

Parameters:

sComPortNumber: COM port Number

status: CAN status value.

inactive: 0 or STS_INACTIVE

active: 1 or STS_ACTIVE

Return Value:

If the function succeeds, the return value is zero. If the function fails, the return value is nonzero and the error code generated by the API. Refer to section **Error Codes** to find more information.

2.4.4. EGPCClose

long EGPCClose(char* sComPortNumber)

Function: Close CAN bus virtual COM Port.

Parameters:

sComPortNumber: COM port Number

Return Value:

If the function succeeds, the return value is zero. If the function fails, the return value is nonzero and the error code generated by the API. Refer to section **Error Codes** to find more information.

2.4.5. EGPCSetBaudRate

long EGPCSetBaudRate(char* sComPortNumber, DWORD BaudRate)

Function: Set CAN bus port Baud Rate.

Parameters:

sComPortNumber: COM port Number

BaudRate:

1M : 1000000 or EGPC_BAUDRATE_1M

800K : 800000 or EGPC_BAUDRATE_800K

500K : 500000 or EGPC_BAUDRATE_500K

250K : 250000 or EGPC_BAUDRATE_250K

100K : 100000 or EGPC_BAUDRATE_100K

50K : 50000 or EGPC_BAUDRATE_50K

20K : 20000 or EGPC_BAUDRATE_20K

10K : 10000 or EGPC_BAUDRATE_10K

Return Value:

If the function succeeds, the return value is zero. If the function fails, the return value is nonzero and the error code generated by the API. Refer to section **Error Codes** to find more information.

2.4.6. EGPCGetBaudRate

long EGPCGetBaudRate(char* sComPortNumber, DWORD* BaudRate)

Function: Get CAN bus port Baud Rate.

Parameters:

sComPortNumber: COM port Number

***BaudRate:**

1M:1000000

800K:800000

500K:500000

250K:250000

100K:100000

50K:50000

20K:20000

10K:10000

Return Value:

If the function succeeds, the return value is zero. If the function fails, the return value is nonzero and the error code generated by the API. Refer to section **Error Codes** to find more information.

2.4.7. EGPCSetFilter

long EGPCSetFilter(char* sComPortNumber, DWORD pattern, DWORD mask)

Function: Set CAN bus port Filter. Default: pattern:0; mask:0, all frame will be received

Parameters:

sComPortNumber: COM port Number

pattern: Specified CAN ID pattern to filter

mask: Specified the mask for filter

Return Value:

If the function succeeds, the return value is filter total count - 1 (0-14, MAX: 15). If the function fails, the return value is error code generated by the API. Refer to section **Error Codes** to find more information.

2.4.8. EGPCClearFilter

long EGPCClearFilter(char* sComPortNumber)

Function: Clear CAN bus port Filter

Parameters:

sComPortNumber: COM port Number

Return Value:

If the function succeeds, the return value is zero. If the function fails, the return value is nonzero and the error code generated by the API. Refer to section **Error Codes** to find more information.

2.4.9. EGPCReceive

long EGPCReceive(char* sComPortNumber, CanFrameInforProc callback)

Function: Receive CAN bus frame from virtual COM Port.

Parameters:

sComPortNumber: COM port Number

callback:

```
typedef void(CALLBACK *CanFrameInforProc)(long error, CanFrameInfor* msg);
    struct CanFrameInfor {
            int type;
            bool rtr;
            DWORD id;
            BYTE data_len;
            BYTE data[CAN BUS_MAX_DATA_SIZE];
    };
    enum CanFrameInfor type {
            CP_29Bit,
            CP_11Bit
    };
    enum CanFrameInfor rtr {
            DISABLE_RTR,
            ENABLE_RTR
    };
```

Return Value:

If the function succeeds, the return value is zero. If the function fails, the callback parameter "error" is nonzero and the error code generated by it. Refer to section **Error Codes** to find more information.

2.4.10. EGPCSend

long EGPCSend(char* sComPortNumber, CanFrameInfor* msg)

Function: Send CAN bus frame via virtual COM Port.

Parameters:

sComPortNumber: COM port number.

msg: The send frame, include frame format, frame id, frame length and frame data.

```
struct CanFrameInfor {
    int type;
    bool rtr;
    DWORD id;
    BYTE data_len;
    BYTE data[CAN BUS_MAX_DATA_SIZE];
};
enum CanFrameInfor type {
    CP_29Bit,
    CP_11Bit
};
enum CanFrameInfor rtr {
    DISABLE_RTR,
    ENABLE_RTR
};
```

Return Value:

If the function succeeds, the return value is zero. If the function fails, the return value is nonzero and the error code generated by the API. Refer to section **Error Codes** to find more information.

2.4.11. EGPCReset

long EGPCReset(char* sComPortNumber)

Function: Reset CAN bus port.

Parameters:

sComPortNumber: COM port Number

Return Value:

If the function succeeds, the return value is zero. If the function fails, the return value is nonzero and the error code generated by the API. Refer to section **Error Codes** to find more information.

2.4.12. EGPCShowVer

viod EGPCShowVer(char* ver_info)

Function: get module version

Parameters:

ver_info: module version information.

2.4.13. EGPCWarnStr

const char* EGPCWarnStr (void)

Function: Show last warning message.

2.4.14. Error Codes

The below table lists errors that Fintek CAN bus functions API returns in response to calls.

Error Code	Description
0x80000005	CAN number ERROR
0x80000007	Thread ERROR
0x8005FFFF	FATAL ERROR(bus off)
0x80050FFF	CAN BUFFER FULL
0x800500XX	ClearCommError ERROR
0x80060002	INVALID HANDLE VALUE
0x80060003	No response from device
0x80060008	CAN function called fail
0x80060101	CAN communication fail
0x80060201	Write fail
0x80060202	Read fail
other	CAN ERROR: bit [31:24]: Receive Error Counter bit [23:16]: Transmit Error Counter bit[15:8]: Error Code Capture bit[7]: Bus Error bit[6]: Arbitration Lost bit[5]: Error Passive bit[3]: Data Overrun bit[2]: Error Warning

3. Linux OS

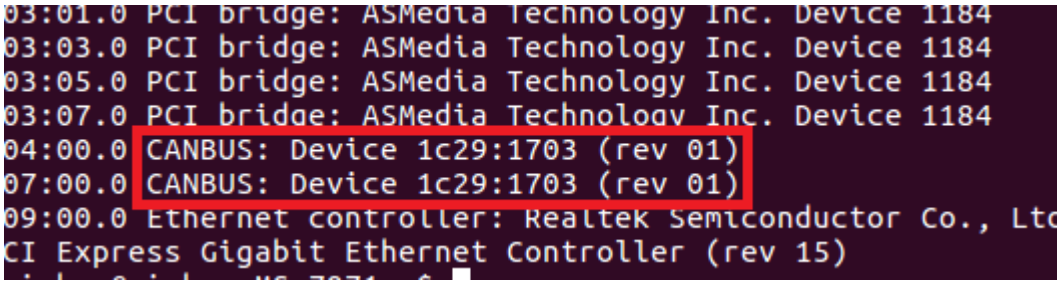
The following uses EGPC-B4S1 for driver installation and test as the example.

3.1. SocketCAN Driver Installation

SocketCAN driver of ExPC Fintek PCIe CAN bus Series supports Linux kernel 2.6.38 and above.

Please follow the steps to install SocketCAN driver.

Use “lspci” command to make sure the device is recognized by OS.



Follow the step below to install the SocketCAN driver.

- Change to root privilege.
    - $ sudo su
- Prepare the kernel tree & compiler tools for your distribution.
    - $ apt-get update
    - $ apt-get install build-essential gcc
- Change directory to the SocketCAN folder, then build SocketCAN driver
    - $ make clean; make; make install

```
root@yichen-MS-7971: /SocketCAN

root@yichen-MS-7971:/SocketCAN# make clean;make;make install
make[1]: Entering directory '/SocketCAN/driver'
make -C /lib/modules/4.4.0-148-generic/build M=/SocketCAN/driver clean
make[2]: Entering directory '/usr/src/linux-headers-4.4.0-148-generic'
  CLEAN   /SocketCAN/driver/.tmp_versions
  CLEAN   /SocketCAN/driver/Module.symvers
make[2]: Leaving directory '/usr/src/linux-headers-4.4.0-148-generic'
rm -rf *.*~ *~ *.o *.ko *.mod.c .*.cmd .*.o.d .tmp_versions Module.symvers modul
es.order Module.markers
rm -f /lib/modules/4.4.0-148-generic/kernel/drivers/char/f81601.ko
make[1]: Leaving directory '/SocketCAN/driver'
make[1]: Entering directory '/SocketCAN/driver'
make -C /lib/modules/4.4.0-148-generic/build M=/SocketCAN/driver modules
make[2]: Entering directory '/usr/src/linux-headers-4.4.0-148-generic'
  CC [M]  /SocketCAN/driver/f81601.o
  Building modules, stage 2.
  MODPOST 1 modules
  CC      /SocketCAN/driver/f81601.mod.o
  LD [M]  /SocketCAN/driver/f81601.ko
make[2]: Leaving directory '/usr/src/linux-headers-4.4.0-148-generic'
#make -C /DataDisk/old/hpeter/allwinner/loboris/test/sunxi_jwrdegoede  M=/Socket
CAN/driver modules
#make -C /DataDisk/hpeter/DMA-210UII/samsung_android_kernel_3.0 M=/SocketCAN/dri
ver modules
#make -C /DataDisk/freescale/android_x86-6.0-r2/out/target/product/x86/obj/kerne
l M=/SocketCAN/driver modules
#make -C /DataDisk/freescale/imx/build/tmp/work/imx6qsabresd-poky-linux-gnueabi/
linux-imx/4.9.11-r0/build modules M=/SocketCAN/driver
make[1]: Leaving directory '/SocketCAN/driver'
make[1]: Entering directory '/SocketCAN/driver'
# make -C /lib/modules/4.4.0-148-generic/build M=/SocketCAN/driver modules_insta
ll
# make -C /lib/modules/`uname -r`/build M=/SocketCAN/driver modules_install
cp f81601.ko /lib/modules/4.4.0-148-generic/kernel/drivers/char
depmod -a
make[1]: Leaving directory '/SocketCAN/driver'
root@yichen-MS-7971:/SocketCAN#
```

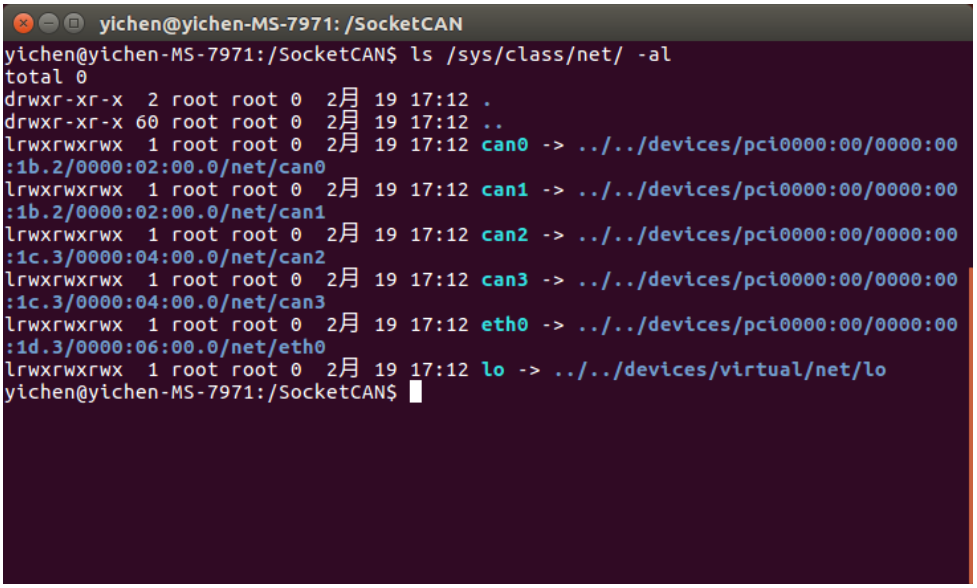
- Module probe
  - $ modprobe f81601

```
yichen@yichen-MS-7971: /SocketCAN
yichen@yichen-MS-7971:/SocketCAN$ modprobe f81601
```

- Use the following command to check driver version
  - $ dmesg | grep ‘Fintek’

```
root@yichen-MS-7971: /SocketCAN/release
root@yichen-MS-7971:/SocketCAN/release# dmesg | grep 'Fintek'
[    1.952371] f81601 0000:02:00.0: Fintek F81601 Driver version: v1.09
```

- Use the following command to check CAN BUS device is available (can0/… etc.)
  - $ ls /sys/class/net/ -al

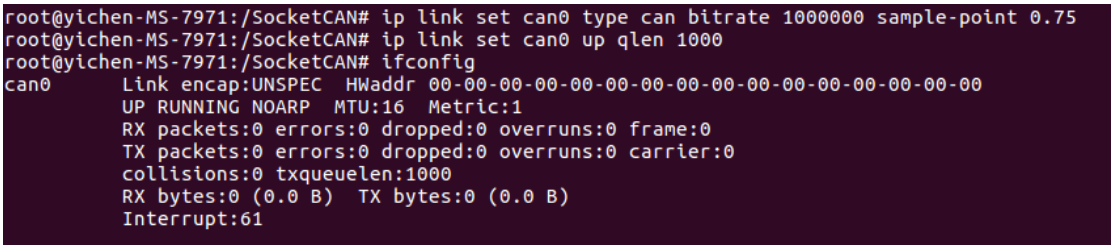


- Use the following command to start SocketCAN port

  (reference script: Linux/SocketCAN/release/start_socketcan.sh)

  Ip link set *(port name)* type can bitrate *(baud rate value)* sample-point (value)

  - $ ip link set can0 type can bitrate 1000000 sample-point 0.75
  - $ ip link set can0 up qlen 1000
  - $ ifconfig



The following is the sample point of supported baud rate. Please modify the sample-point by different baud rate setting.

Baud Rate	Sample-point
1000000	0.75
800000	0.80
500000	0.875
250000	0.875
125000	0.875
100000	0.875
50000	0.875
20000	0.875
10000	0.875

- Repeat the “ip link” command to active all CAN bus ports.

```
can0      Link encap:UNSPEC  HWaddr 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
          UP RUNNING NOARP  MTU:16  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
          Interrupt:66

can1      Link encap:UNSPEC  HWaddr 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
          UP RUNNING NOARP  MTU:16  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
          Interrupt:66

can2      Link encap:UNSPEC  HWaddr 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
          UP RUNNING NOARP  MTU:16  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
          Interrupt:67

can3      Link encap:UNSPEC  HWaddr 00-00-00-00-00-00-00-00-00-00-00-00-00-00-00-00
          UP RUNNING NOARP  MTU:16  Metric:1
          RX packets:0 errors:0 dropped:0 overruns:0 frame:0
          TX packets:0 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
          Interrupt:67
```

- End can0 (reference script: Linux/SocketCAN/release/end_socketcan.sh)
    - $ ip link set can0 down

```
root@yichen-MS-7971: /SocketCAN
root@yichen-MS-7971:/SocketCAN# ip link set can0 down
root@yichen-MS-7971:/SocketCAN#
```

- Run the following command in the “release” folder to add/remove boot up script.
  - $ chmod +x add_2_boot.sh
  - $ ./add_2_boot.sh

```
yichen@yichen-MS-7971:~/svn/Inno/Trunk/EP/EGPC_B4S1/Linux/SocketCAN/release$ ./add_2_boot.sh
yichen@yichen-MS-7971:~/svn/Inno/Trunk/EP/EGPC_B4S1/Linux/SocketCAN/release$
```

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

```
yichen@yichen-MS-7971:~/svn/Inno/Trunk/EP/EGPC_B4S1/Linux/SocketCAN/release$ ./remove_boot.sh
yichen@yichen-MS-7971:~/svn/Inno/Trunk/EP/EGPC_B4S1/Linux/SocketCAN/release$
```

NOTE: *You also can use “start_socketcan.sh” and “end_socketcan.sh” to initial or remove EGPC SocketCAN driver, please provide the “execute” permission by using “chmod +x” then run the scripts.*

3.2. CAN-utils

After SocketCAN setup is finished, you can use open source project “can-utils” to test by “cansend” and “candump”.
(https://github.com/linux-can/can-utils).

- Install CAN-utils
  - $ apt-get install can-utils
- use can0 to send and can1 to receive.

```
yichen@yichen-MS-7971:~$ cansend can0 111#1122334455667788
yichen@yichen-MS-7971:~$ cansend can0 111#1122334455667788
yichen@yichen-MS-7971:~$ cansend can0 111#1122334455667788
yichen@yichen-MS-7971:~$ cansend can0 111#R1
yichen@yichen-MS-7971:~$ cansend can0 111#R2
yichen@yichen-MS-7971:~$ cansend can0 111#R3
yichen@yichen-MS-7971:~$
```

```
yichen@yichen-MS-7971:~$ candump can1
  can1  111   [8]  11 22 33 44 55 66 77 88
  can1  111   [8]  11 22 33 44 55 66 77 88
  can1  111   [8]  11 22 33 44 55 66 77 88
  can1  111   [1]  remote request
  can1  111   [2]  remote request
  can1  111   [3]  remote request
```

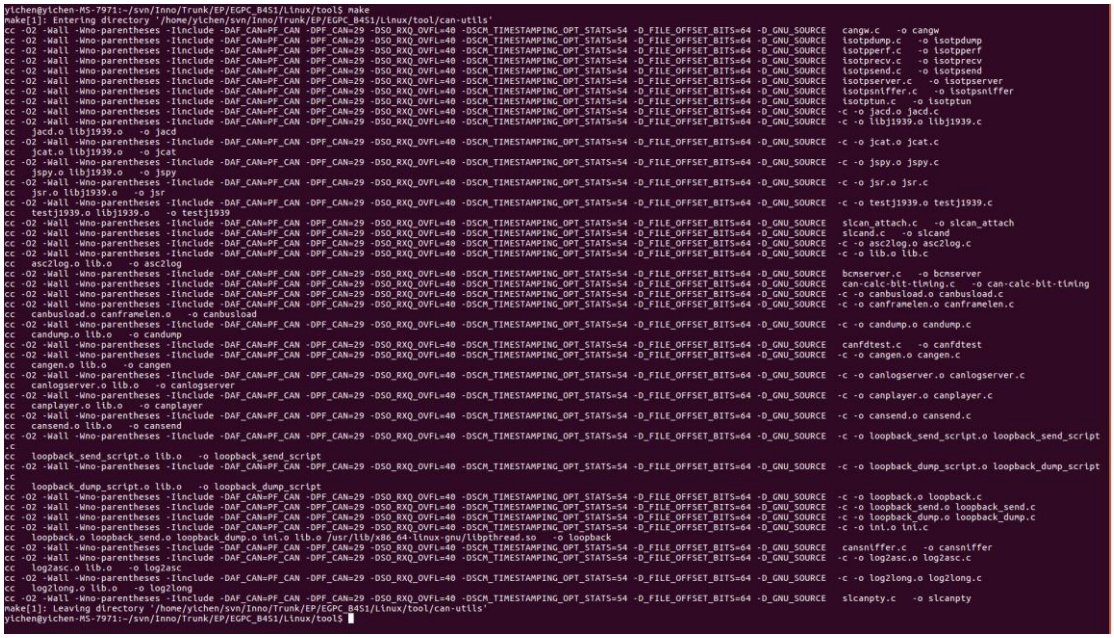
3.3. Loop Back Test Program

We provide a SocketCAN loop back test program with source code in Linux to verify the module. Please connect CAN ports the same as the description in "*2.2. Loop Back Test Program*".

The test program can be configured by edit "setup.ini". In majority cases, just keep the default setting.

- Change to root privilege.
    - $ sudo su

-Change the directory to the "tool" folder and run "Make".



-Run the test

- $ ./loopback

```
yichen@yichen-MS-7971:~/svn/Inno/Trunk/EP/EGPC_B4S1/Linux/tool$ ./loopback

Config
---------------------------------
pair_1_device_1: can0
pair_1_device_2: can1
pair_2_device_1: can2
pair_2_device_2: can3
sleep_interval: 200
test_time: 1
data_length: 8
rtr: disable
id_type: 29Bit
---------------------------------


Config

Config
---------------------------------
send_CAN: can0
id_type: 29Bit
rtr: Disable
data_length: 8
sleep_interval: 200
test_time: 1
---------------------------------

send can frame: 1FFFFFFF#1122334455667788

---------------------------------
send_CAN: can2
id_type: 29Bit
rtr: Disable
data_length: 8
sleep_interval: 200
test_time: 1
---------------------------------

send can frame: 1FFFFFFF#1122334455667788

Elapsed time: 000.160294 (sec)
Elapsed time: 000.314360 (sec)
Elapsed time: 000.471596 (sec)
Elapsed time: 000.627987 (sec)
Elapsed time: 000.786241 (sec)
Elapsed time: 000.946617 (sec)
Elapsed time: 001.105472 (sec)
Elapsed time: 001.261737 (sec)
Elapsed time: 001.418679 (sec)
Elapsed time: 001.572617 (sec)
Interval: 001.609711 (sec)
Pair1:
tx_cnt:5129, rx_cnt:5129
Result: PASS!
Pair2:
tx_cnt:5113, rx_cnt:5113
Result: PASS!
yichen@yichen-MS-7971:~/svn/Inno/Trunk/EP/EGPC_B4S1/Linux/tool$
```

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

+31-40-3045-400

Japan

jpsales@innodisk.com

+81-3-6667-0161

China

sales_cn@innodisk.com

+86-755-21673689

www.innodisk.com

April 27, 2023