EMUC-B202 / EGPC-B201

Linux SocketCAN Driver

Installation Guide

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1. Hardware Installation

1.1. EMUC-B202

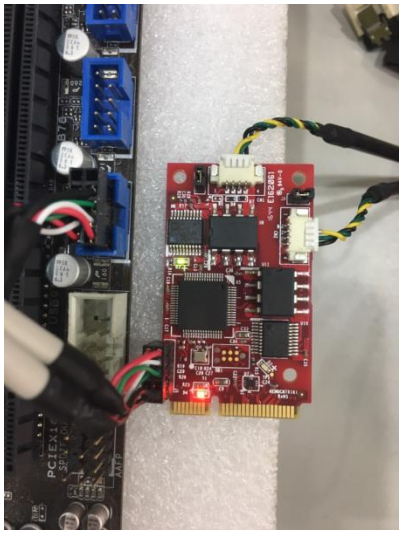
EMUC-B202 CANbus module uses USB 2.0 input interface, there are dual options to install the module.

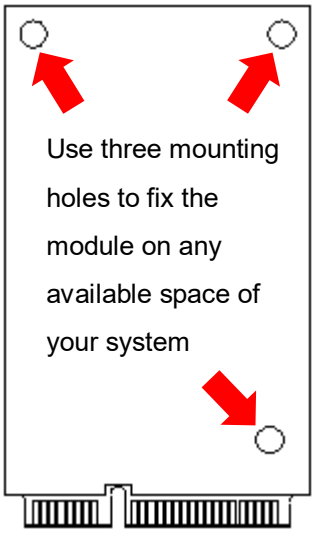
1.1.1. mPCIe Slot

Install the module to mPCIe slot which has USB 2.0 interface.

1.1.2. USB Pin Header

Don’t need to connect mPCIe golden finger, it can be connected through USB pin headers on the PCB to the motherboard. Then use three mounting holes to fix the module on any available space of your system.





NOTE: *This USB cable in the picture is not included in the package; you need to design your own USB cable.*

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1.2. EGPC-B201

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

2. Linux OS

The following sections use Ubuntu 14.04.

2.1. Driver Installation

The device will be recognized as ttyACM% (%=0, 1…) by using CDC-ACM kernel driver.

Note: *Linux kernel 2.6 and above have native CDC-ACM kernel driver. Some Linux OS may need to add CDC-ACM configuration manually in building process. In different Linux OS may have different tty name.*

Type command "dmesg" to see messages below.

Generally the name would be ttyACM0 or ttyACM1 in Linux.

```
innodisk@innodisk: ~
[  251.907006] sd 8:0:0:0: [sdb] 15794176 512-byte logical blocks: (8.08 GB/7.53
 GiB)
[  251.908001] sd 8:0:0:0: [sdb] Write Protect is off
[  251.908010] sd 8:0:0:0: [sdb] Mode Sense: 00 00 00 00
[  251.911392] sd 8:0:0:0: [sdb] Asking for cache data failed
[  251.911404] sd 8:0:0:0: [sdb] Assuming drive cache: write through
[  251.914840] sd 8:0:0:0: [sdb] Asking for cache data failed
[  251.914851] sd 8:0:0:0: [sdb] Assuming drive cache: write through
[  252.058088]  sdb: sdb1
[  252.227685] sd 8:0:0:0: [sdb] Asking for cache data failed
[  252.227693] sd 8:0:0:0: [sdb] Assuming drive cache: write through
[  252.227699] sd 8:0:0:0: [sdb] Attached SCSI removable disk
[  258.358691] FAT-fs (sdb1): Volume was not properly unmounted. Some data may b
e corrupt. Please run fsck.
[  265.242769] usb 3-2: USB disconnect, device number 2
[  274.826304] usb 3-2: new full-speed USB device number 3 using ohci-pci
[  274.999365] usb 3-2: New USB device found, idVendor=04d8, idProduct=0205
[  274.999374] usb 3-2: New USB device strings: Mfr=1, Product=2, SerialNumber=0
[  274.999379] usb 3-2: Product: innodisk USB Dual CAN
[  274.999383] usb 3-2: Manufacturer: Microchip Technology Inc.
[  275.001410] cdc_acm 3-2:1.0: This device cannot do calls on its own. It is no
t a modem.
[  275.001451] cdc_acm 3-2:1.0: ttyACM0: USB ACM device
innodisk@innodisk:~$
```

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2.2. SocketCAN

EMUC-B202 can support SocketCAN by additional driver and user space tool on Linux kernel 2.6.38 and above.

Before installing SocketCAN driver, you must confirm that the Linux Kernel include SocketCAN kernel module and recognize EMUC-B202 as ttyACM%(%=0,1,…) by using native CDC-ACM driver.

2.2.1. Build driver and user-space tool

Please copy kernel development packages into your system and type "make" command in root folder of this package.

There should be two output files:

- **emuc2socketcan.ko**: Kernel driver of EMUC SocketCAN
- **emucd_32** or **emucd_64**: User-space tool for enabling EMUC SocketCAN

```
root@innodisk:/home/innodisk/SocketCAN# make
make[1]: Entering directory `/home/innodisk/SocketCAN/driver'
make -C/lib/modules/`uname -r`/build M=/home/innodisk/SocketCAN/driver modules
make[2]: Entering directory `/usr/src/linux-headers-3.13.11.8-custom'
  CC [M]  /home/innodisk/SocketCAN/driver/main.o
  CC [M]  /home/innodisk/SocketCAN/driver/emuc_parse.o
  CC [M]  /home/innodisk/SocketCAN/driver/transceive.o
  LD [M]  /home/innodisk/SocketCAN/driver/emuc2socketcan.o
  Building modules, stage 2.
  MODPOST 1 modules
  CC      /home/innodisk/SocketCAN/driver/emuc2socketcan.mod.o
  LD [M]  /home/innodisk/SocketCAN/driver/emuc2socketcan.ko
make[2]: Leaving directory `/usr/src/linux-headers-3.13.11.8-custom'
make[1]: Leaving directory `/home/innodisk/SocketCAN/driver'
make[1]: Entering directory `/home/innodisk/SocketCAN/utility'
  Compiling 'main.c' ...
  Building 'emucd_64' VER=...
make[1]: Leaving directory `/home/innodisk/SocketCAN/utility'
root@innodisk:/home/innodisk/SocketCAN#
```

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You can type “emucd_64 -h” for help.

```
inno@inno-pc:~/svn/Trunk/EP/EMUC_B202/Linux/SocketCAN/utility$ ./emucd_64

Usage: ./emucd_64 [options] <tty> [canif-name] [canif2-name]

Options: -s <speed>[<speed>] (set CAN speed 3..7)
                4: 100  KBPS
                5: 125  KBPS
                6: 250  KBPS
                7: 500  KBPS
                8: 800  KBPS
                9: 1000 KBPS
                A: 400  KBPS
         -e <errorType>[<errorType>] (set CANbus error type)
                0: EMUC_DIS_ALL
                1: EMUC_EE_ERR
                2: EMUC_BUS_ERR
                3: EMUC_EN_ALL
         -F          (stay in foreground; no daemonize)
         -h          (show this help page)
         -v          (show version info)
         -t          (set open tty device timeout [sec])

Examples:
emucd_64 -v /dev/ttyACM0
emucd_64 -s7 /dev/ttyACM0
emucd_64 -s7 -e3 /dev/ttyACM0
emucd_64 -s79 /dev/ttyACM0 can0 can1
emucd_64 -s79 -t10 /dev/ttyACM0 can0 can1
(Note: emucd_32 for 32-bit OS)
```

./emucd_64 -s7 /dev/ttyACM0 (500 KBPS on both channel)
./emucd_64 -s79 /dev/ttyACM0 (500 KBPS on ch1, 1000 KBPS on ch2)

NOTE: *If you don’t specify interface name, default name will be “emuccan0” and “emuccan1”*

2.2.2. SocketCAN Driver Installation

There are shell scripts “start.sh” and “end.sh” to install the driver and enable SocketCAN interface.

start.sh

Please modify the baud rate and tty port setting depend on the environment needs.

```
### parameter
socket_name_1=can0
socket_name_2=can1
dev_name=ttyACM0
baudrate=7 # 4: 100 KBPS, 5: 125 KBPS,  6: 250 KBPS, 7: 500 KBPS,
           # 8: 800 KBPS, 9: 1 MBPS,   10: 400 KBPS
error_type=0 # 0: EMUC_DIS_ALL, 1: EMUC_EE_ERR, 2: EMUC_BUS_ERR, 3: EMUC_EN_ALL
```

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end.sh

```
sudo pkill -2 emucd_64
sleep 0.2
sudo rmmod emuc2socketcan
#rm /lib/modules/$(uname -r)/kernel/drivers/net/can/emuc2socketcan.ko
```

You can start/end SocketCAN interface simply by using the scripts.

-$ chmod +x start.sh

-$ ./start.sh

You can see the CAN interface name by "ifconfig" command.

```
root@innodisk:/home/innodisk/SocketCAN# ifconfig
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:10
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)

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:10
          RX bytes:0 (0.0 B)  TX bytes:0 (0.0 B)
          Base address:0x101
```

2.2.3. 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
```

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2.2.4. Boot Up Script

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

run_emucd

Please modify the baud rate and tty port setting depend on the environment needs.

```
### parameter
socket_name_1=can0
socket_name_2=can1
dev_name=ttyACM0
baudrate=7 # 4: 100 KBPS, 5: 125 KBPS,  6: 250 KBPS, 7: 500 KBPS,
           # 8: 800 KBPS, 9: 1 MBPS,   10: 400 KBPS
error_type=0 # 0: EMUC_DIS_ALL, 1: EMUC_EE_ERR, 2: EMUC_BUS_ERR, 3: EMUC_EN_ALL
```

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/EMUC_B202/Linux/SocketCAN/bootexec$ ./add_2_boot.sh
yichen@yichen-MS-7971:~/svn/Inno/Trunk/EP/EMUC_B202/Linux/SocketCAN/bootexec$
```

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

```
yichen@yichen-MS-7971:~/svn/Inno/Trunk/EP/EMUC_B202/Linux/SocketCAN/bootexec$ ./remove_boot.sh
yichen@yichen-MS-7971:~/svn/Inno/Trunk/EP/EMUC_B202/Linux/SocketCAN/bootexec$
```

2.2.5. CAN Error Frame

CAN error frame can be dumped by adding the parameter “-e” when running the emucd_32 or emucd_64 utility.

```
emucd_64 -s7 -e3 /dev/ttyACM0
```

It can be simply set the error type by editing “start.sh”.
“run_emucd” of boot up script has this parameter as well.

```
### parameter
socket_name_1=can0
socket_name_2=can1
dev_name=ttyACM0
baudrate=7 # 4: 100 KBPS, 5: 125 KBPS,  6: 250 KBPS, 7: 500 KBPS,
           # 8: 800 KBPS, 9: 1 MBPS,   10: 400 KBPS
error_type=0 # 0: EMUC_DIS_ALL, 1: EMUC_EE_ERR, 2: EMUC_BUS_ERR, 3: EMUC_EN_ALL
```

0: EMUC_DIS_ALL: disable all error frame.

1: EMUC_EE_ERR: enable EEPROM error only.

2: EMUC_BUS_ERR: enable CAN bus error only.

3: EMUC_EM_ALL: enable both EERPOM and CAN bus error.

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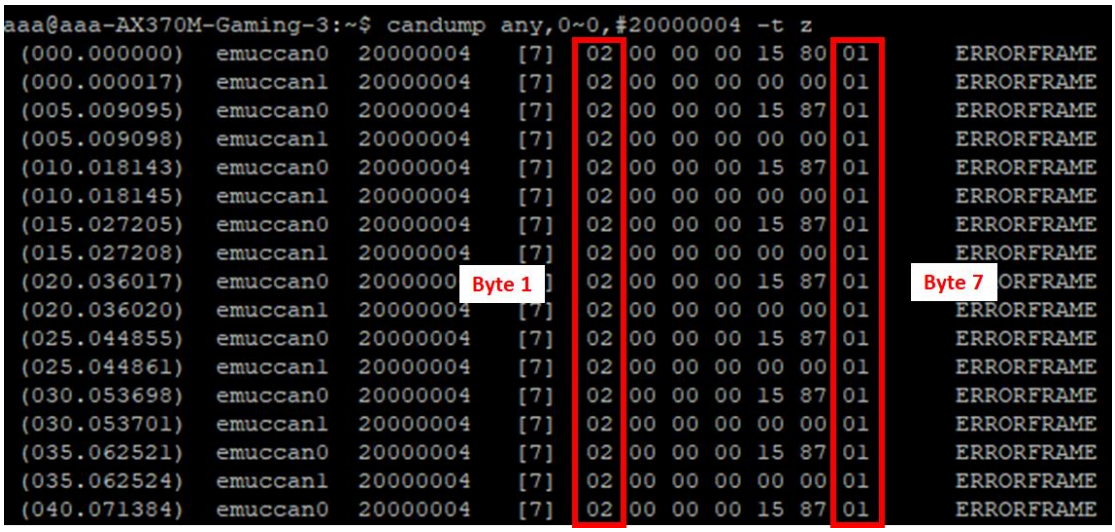
CAN error frame can be dumped through the following command of CAN-utils.



Byte1: Error Type, 0x01=EEPROM Error, 0x02=Bus Error

Byte2~Byte7: Bus Error Register, please refer to *3.2.Register mapping table of CAN error status.*

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3. Appendix

3.1. Example of CAN acceptance filter

The filter mask is used to determine which bits in the identifier of the received f are compared with the filter

- If a mask bit is set to a zero, the corresponding ID bit will automatically be accepted, regardless of the value of the filter bit.

- If a mask bit is set to a one, the corresponding ID bit will be compare with the value of the filter bit; if they match it is accepted otherwise the frames is rejected.

Example 1:

We wish to accept only frames with ID of 00001567 (hexadecimal values)

- set filter to 00001567
- set mask to 1FFFFFFF

When a frame arrives its ID is compared with the filter and all bits must match; any frame that does not match ID 00001567 is rejected

Example 2:

We wish to accept only frames with IDs of 00001560 through to 0000156F

- set filter to 00001560
- set mask to 1FFFFFF0

When a frame arrives its ID is compared with the filter and all bits except bits 0 to 3 must match; any other frame is rejected

Example 3:

We wish to accept only frames with IDs of 00001560 through to 00001567

- set filter to 00001560
- set mask to 1FFFFFF8

When a frame arrives its ID is compared with the filter and all bits except bits 0 to 2 must match; any other frame is rejected

Example 4:

We wish to accept any frame

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- set filter to 0
- set mask to 0

All frames are accepted

3.2. Register mapping table of CAN error status

bit 21 TXBO: Transmitter in Error State Bus OFF (TERRCNT >= 256)

bit 20 TXBP: Transmitter in Error State Bus Passive (TERRCNT >= 128)

bit 19 RXBP: Receiver in Error State Bus Passive (RERRCNT >= 128)

bit 18 TXWARN: Transmitter in Error State Warning (128 > TERRCNT >= 96)

bit 17 RXWARN: Receiver in Error State Warning (128 > RERRCNT >= 96)

bit 16 EWARN: Transmitter or Receiver is in Error State Warning

bit 15-8 TERRCNT<7:0>: Transmit Error Counter

bit 7-0 RERRCNT<7:0>: Receive Error Counter

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

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