USB2CAN Module on Windows User Manual

1. General Description:

USB2CAN module is a plug and play and bi-directional port powered USB to CAN converter which realizes long-distance communication between your Apple computer and other devices stably though CAN- Bus connection.

With small size and convenient operation, It’s a cost-effective solution that are safe and reliable for all your data-conversion / device-protection applications for any experienced engineer interfacing to expensive industrial equipment yet simple enough for home use by an amateur hobbyist.

Support wider CAN baud rate, From 20Kbps to 1Mbps. USB2CAN module has three mode: Normal mode, Silent mode and Loopback mode.

Support Linux system , It’s a socket-can device in Linux, not need to install any driver and fully compatible with other socket-can software in Linux.such as can-utils.

Support Mac OS version equal or above 10.11 and provide development library for help customer develop own applications.

Support Win7/Win8/Win10 and provide C#/C++ demo and dynamic link libraries for help customer develop own applications.

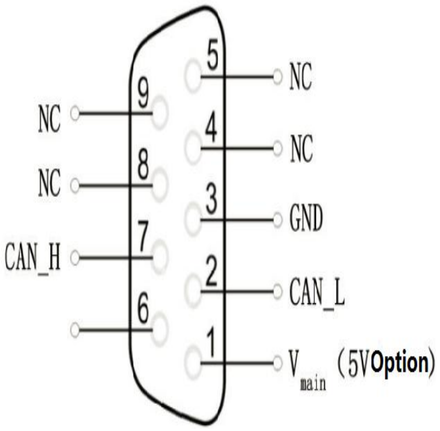
USB2CAN can also be applied to obtain the data of car via the OBD connector, but you need to configured and secondary development by yourself.

2.Technical Specification

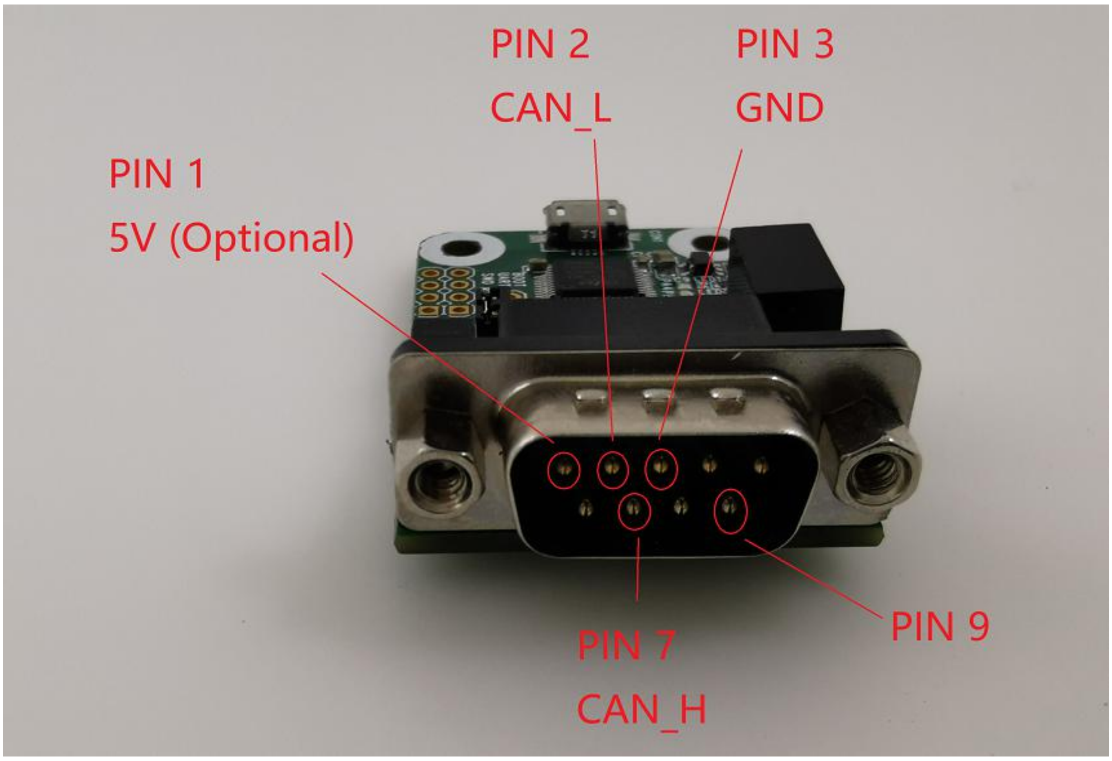
Connector	
CAN	D-SUB, 9 pins
USB	USB 2.0 Full-Speed, Micro USB
CAN Features	
Specification	2.0A (standard format) and 2.0B (extended format), ISO 11898-2 High-speed CAN
Data Rate	From 20kbps to 1Mbps can be programmed arbitrarily.
Isolation Voltage	1.5K VDC/min, 3K VDC/1s
Microcontroller	STM32F0, 48MHz
Termination	120 Ohm resistor selectable jumper
CAN Transceiver	ISO1050DUBR ,Texas Instruments
Other	
Work Temperature	-40°~ 85°
Relative humidity	15-90%, not condensing
PCBA Size (L * W * H)	56.50mm * 31.20mm * 14.20mm
Weight	15.5 g

3.Hardware Description

3.1 CAN connector Pinout

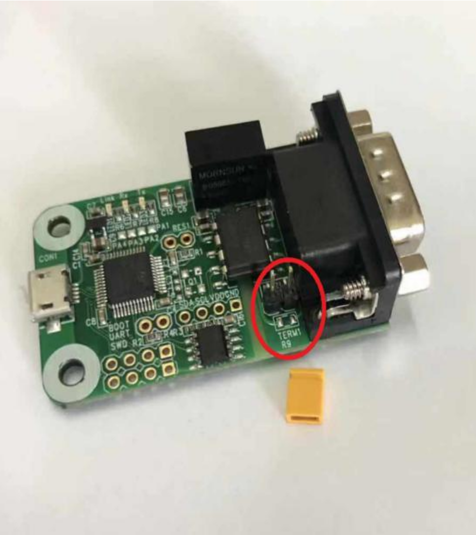


Pin	Description
1	5V/150ma output . Weld 0Ω resistor on R9 to enable this function(close to the jumper).
2	CANL bus line (dominant low)
3	CAN_GND
4	NC
5	NC
6	NC
7	CANH bus line (dominant high)
8	NC
9	NC

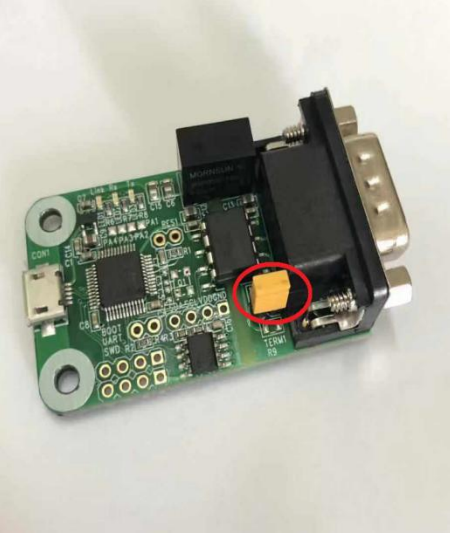


3.2 120 Ohm Resistor Setting.

A High-speed CAN bus (ISO 11898-2) must be terminated on both ends with 120 Ohms. The USB2CAN module with a on-board 120Ω selectable jumer.

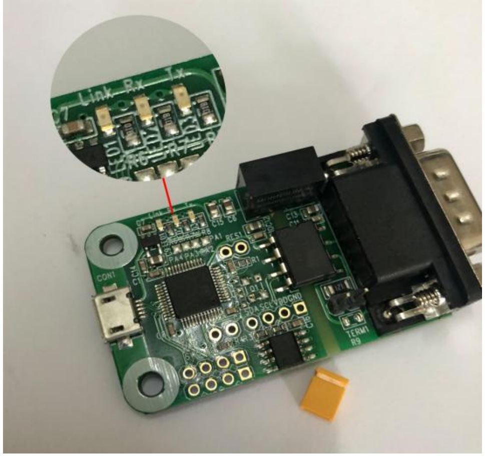


Disable 120 Ohm Resistor.



Enable120 Ohm Resistor.

3.3 LED Indicate



LED Name	Description
Link	Red led is normally on to indicate. The module is started successfully
Tx	Red led flash to indicate send data.
Rx	Red led flash to indicate receive data.

4. Download Tools And Library

You can download all software and tools from below link:

https://github.com/INNO-MAKER/usb2can

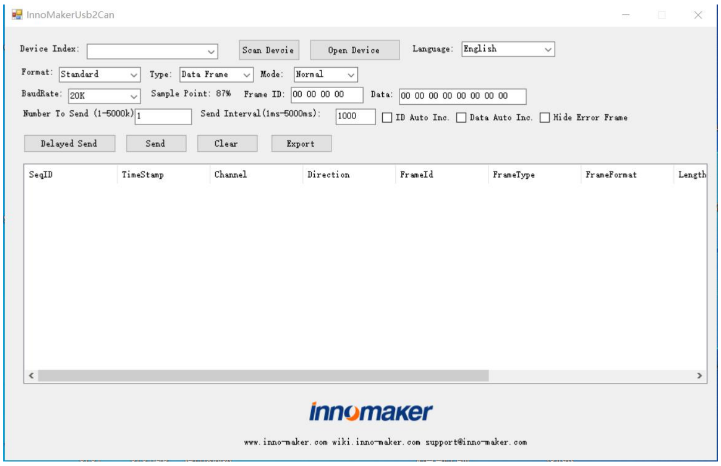
USB2CAN module is WINUSB driver ,So it’s a plug and play device in WIN8/WIN10, Not need to install any driver. If you are using WIN7/WIN XP, you need to install the WINUSB driver by zadig tools.

zadig-2.4.exe 4.9 MB 2020-06-13

Folder name	Description
InnoMaker USB2CAN Tools	USB2CAN Test Tool. For more information, Please refer to the chapter 5.
Lib	The Library function for develop USB2CAN applications. These libraries are not open source. If you have any problem and suggestion, feel free to contract us.
Tools Source Code	The source code of InnoMaker USB2CAN test tools, to show you how to use the SDK to develop a USB to CAN application.
Doc	Simple document for library description.

5. InnoMaker USB2CAN Tools

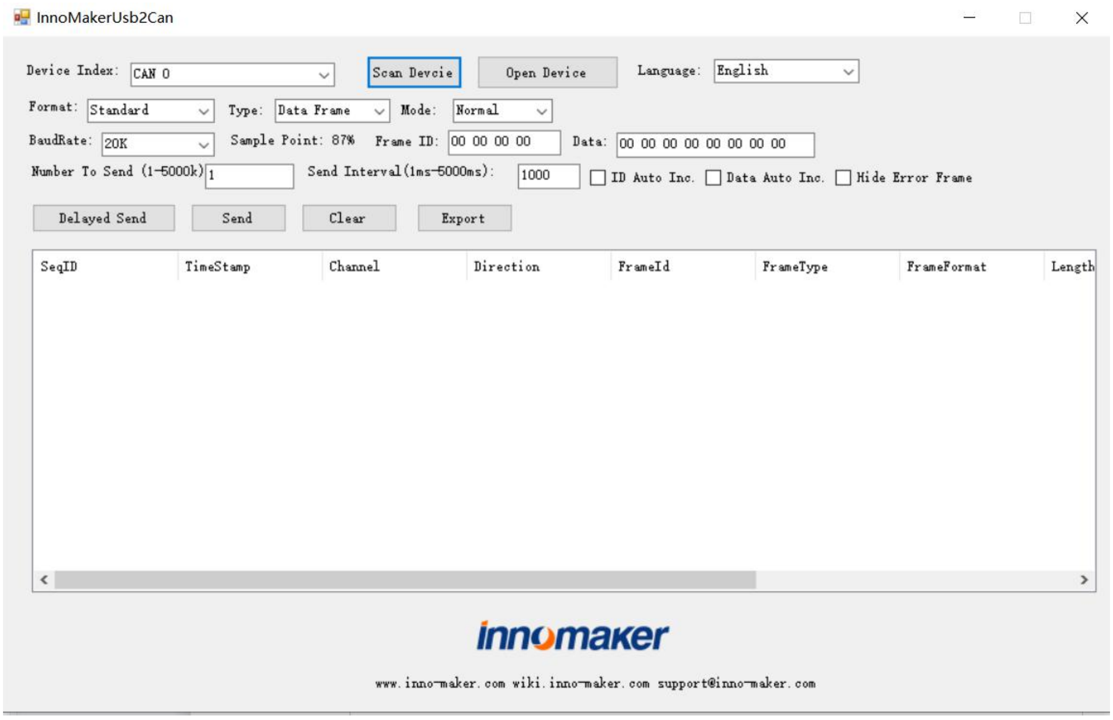
5.1 Open the USB2CAB tools.


InnoMakerUsb2Can

Device Index:
Format: Standard Type: Data Frame Mode: Normal
BaudRate: 20K Sample Point: 87% Frame ID: 00 00 00 00 Data: 00 00 00 00 00 00 00 00
Number To Send (1-5000k) 1 Send Interval(1ms-5000ms): 1000 □ ID Auto Inc. □ Data Auto Inc. □ Hide Error Frame
Language: English

5.2 Scan for devices

Plug the USB2CAN module into the USB port, click ‘Scan Device’ button. Find the USB2CAN device.


InnoMakerUsb2Can

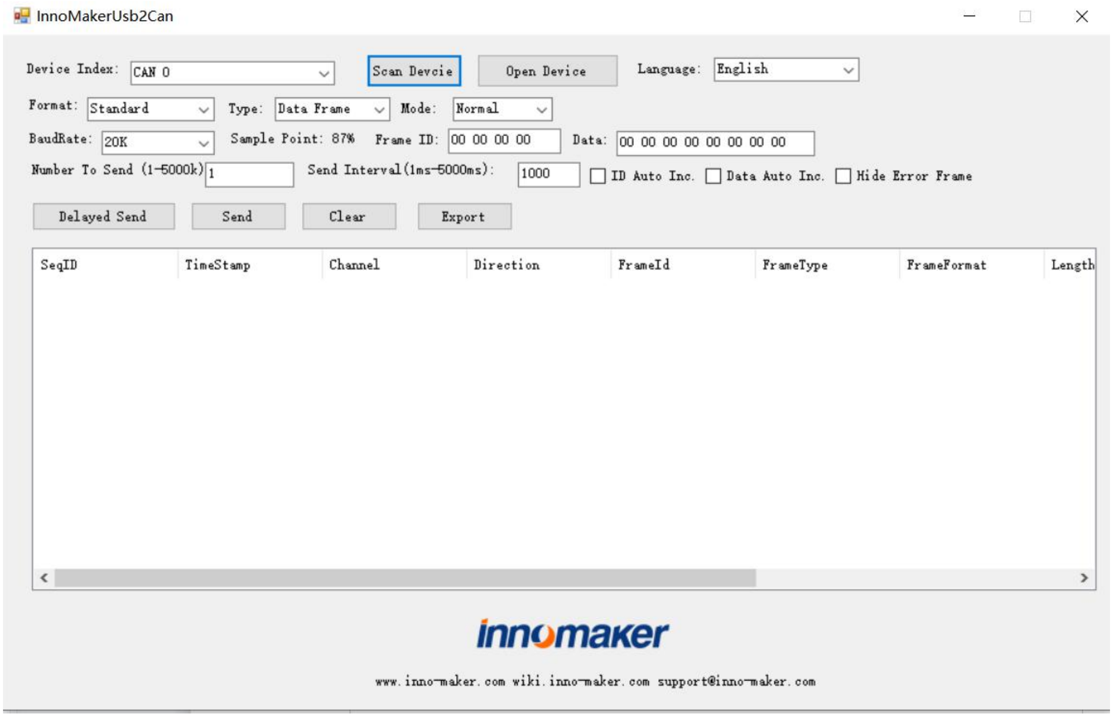
Device Index: CAN 0
Format: Standard Type: Data Frame Mode: Normal
BaudRate: 20K Sample Point: 87% Frame ID: 00 00 00 00 Data: 00 00 00 00 00 00 00 00
Number To Send (1-5000k) 1 Send Interval(1ms-5000ms): 1000 □ ID Auto Inc. □ Data Auto Inc. □ Hide Error Frame
Language: English

5.3 Setting the BandRate and working mode.

Normal mode: The CAN module will appear on the CAN-bus, and it can send and receive CAN messages， communication with other CAN devices directly.

Silent mode: The module will appear on the CAN-bus, but in a passive state. It can receive CAN messages, but cannot transmit CAN messages or answer. This mode can be used as a bus monitor because it does not affect CAN-bus communications but can observe the CAN-bus states.

Loopback mode: For USB2CAN self-test, CAN module receives its own messages.
In this mode, the send part of the CAN module is connected internally with the reception one.



InnoMakerUsb2Can

Device Index: CAN 0

Language: English

Format: Standard

Type: Data Frame

Mode: Normal

BaudRate: 20K

Sample Point: 87%

Frame ID: 00 00 00 00

Data: 00 00 00 00 00 00 00 00

Number To Send (1-5000k) 1

Send Interval(1ms-5000ms): 1000

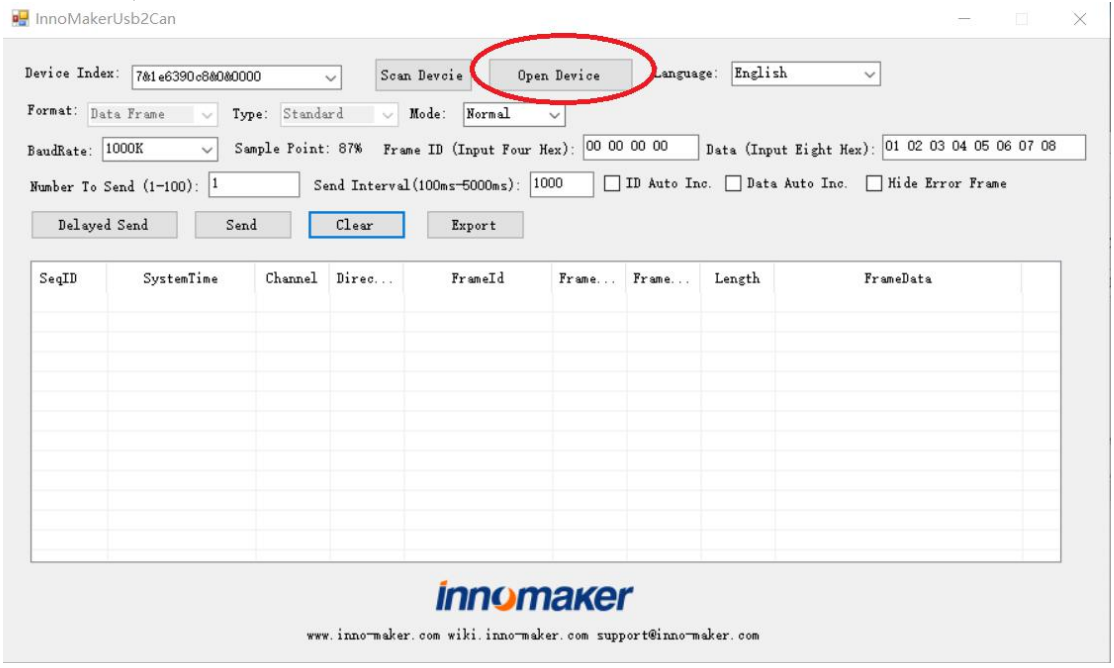
□ ID Auto Inc. □ Data Auto Inc. □ Hide Error Frame

SeqID	TimeStamp	Channel	Direction	FrameId	FrameType	FrameFormat	Length

Scan Devcie
Open Device
Delayed Send
Send
Clear
Export
innomaker
www.inno-maker.com wiki.inno-maker.com support@inno-maker.com

5.4 Start USB2CAN.

Click the Open Device to start the USB2CAN.



Device Index: 7&1e6390c8&0&0000

Language: English

Format: Data Frame

Type: Standard

Mode: Normal

BaudRate: 1000K

Sample Point: 87%

Frame ID (Input Four Hex): 00 00 00 00

Data (Input Eight Hex): 01 02 03 04 05 06 07 08

Number To Send (1-100): 1

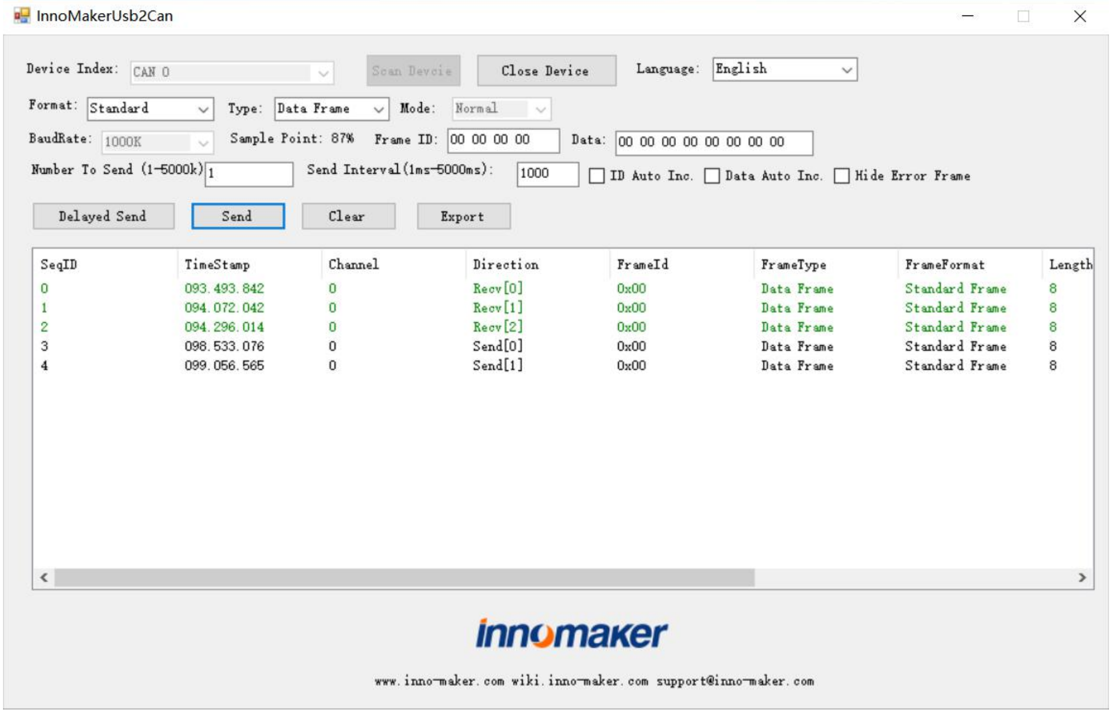
Send Interval(100ms-5000ms): 1000

□ ID Auto Inc. □ Data Auto Inc. □ Hide Error Frame

SeqID	SystemTime	Channel	Direc...	FrameId	Frame...	Frame...	Length	FrameData

5.5 Send/Receive Data

The communication result will be displayed at the bottom of the window. The send data will be marked in black, Receive data will be marked in green. Error Frame will be marked in red.



Device Index: CAN 0

Language: English

Format: Standard

Type: Data Frame

Mode: Normal

BaudRate: 1000K

Sample Point: 87%

Frame ID: 00 00 00 00

Data: 00 00 00 00 00 00 00 00

Number To Send (1-5000k) 1

Send Interval(1ms-5000ms): 1000

□ ID Auto Inc. □ Data Auto Inc. □ Hide Error Frame

SeqID	TimeStamp	Channel	Direction	FrameId	FrameType	FrameFormat	Length
0	093.493.842	0	Recv[0]	0x00	Data Frame	Standard Frame	8
1	094.072.042	0	Recv[1]	0x00	Data Frame	Standard Frame	8
2	094.296.014	0	Recv[2]	0x00	Data Frame	Standard Frame	8
3	098.533.076	0	Send[0]	0x00	Data Frame	Standard Frame	8
4	099.056.565	0	Send[1]	0x00	Data Frame	Standard Frame	8

5.6 Real Time Setting

If you want to test the USB2CAN module on In high speed and mass data mode(such as send/receive one million frames with 1 millisecond interval),
please change the base priority level,That would be very helpful.

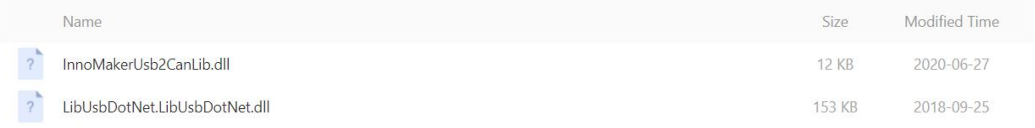
I take Windows 10 for example.
Open Task Manger
→ right click on innomaker application process
→ left click on 'go to details'
→ right click on innomaker application process
→ left click on 'set priority'
→left click on 'realtime'

6.InnoMaker Development Library

If you are not familiar with the CAN communication and WINDOWS software development, it is strongly recommended you that use the ready-made application we provide or entrust us with the development.

Released Date: 2021-07-16
Version Num: 1.2.0

6.1 Dynamic Link Libraries



Name	Size	Modified Time
InnoMakerUsb2CanLib.dll	12 KB	2020-06-27
LibUsbDotNet.LibUsbDotNet.dll	153 KB	2018-09-25

InnoMakerUsb2CanLib.dll: USB2CAN function dynamic link libraries.

LibUsbDotNetLibUsbDotNet.dll : WINDOWS USB Universal Interface dynamic link libraries.

6.2 Structure

```
public struct innomaker_host_frame
 {
       public UInt32 echo_id;//The echo-id identifies the frame from (echos the id from a
                             //previous UCAN_OUT_TX message).

      public UInt32 can_id;    //CAN ID  Reserved for dual CAN Deivce
      public Byte can_dlc;     // data len   0~8
      public Byte channel;     // channel number，
      public Byte flags;       //additional flags
      public Byte reserved;    //reserved / padding
      [MarshalAs(UnmanagedType.ByValArray, SizeConst = 8)]
```

```
         public Byte[] data;         //CAN data
         public UInt32 timestamp_us;  //times stamp
      }


public struct innomaker_device_bittming
{
   public UInt32 prop_seg;           //propagation Segment
   public UInt32 phase_seg1;       //phase segment 1 (1~15)
   public UInt32 phase_seg2;       //phase segment 2 (1~8)
   public UInt32 sjw;                   //synchronization segment (1~4)
   public UInt32 brp;                   //clock divider, USB2CAN moduel clock  is 48M
}



public enum UsbCanMode
{
        UsbCanModeNormal,         //Normal working mode
        UsbCanModeLoopback,      // Loopback mode
         UsbCanModeListenOnly,   // Listen only, not ACK
}
```

6.3 CallBack

(1) AddDeviceNotifyDelegate

public delegate void AddDeviceNotifyDelegate();
-Summary: If Device Plug In, it will call the delegate

(2) RemoveDeviceNotifyDelegate

public delegate void RemoveDeviceNotifyDelegate();
-Summary: If Device Plug Out, it will call the delegate

6.4 Function

(1) GetDllVersion

public String GetDllVersion()
-Summary: Return Current Dll Version
-Return: Current Dll Version

(2) scanInnoMakerDevices

public bool scanInnoMakerDevices()
-Summary: Scann Inno Maker Devices
-Return: Scan success return true , else return false

(3) getInnoMakerDeviceCount

public int getInnoMakerDeviceCount()
-Summary: Get Device Count
-Return: Device count

(4) getInnoMakerDevice

public InnoMakerDevice getInnoMakerDevice(int devIndex)
-Summary: Get Inno Maker device by device index
-devIndex: Device index
-return: Inno Maker Device Instance

(5) openInnoMakerDevice

public bool openInnoMakerDevice(InnoMakerDevice device)
-Summary: Open Device
-param: device
-return: if open success return true,else return false

(6) closeInnoMakerDevice

public bool closeInnoMakerDevice(InnoMakerDevice device)
-Summary: Close Device
-param: device
-return: if Close success return true, else return false

(7) asyncGetInnoMakerDeviceBuf

```
public bool asyncGetInnoMakerDeviceBuf(InnoMakerDevice device,
                                       Byte[] buf,
                                       int size,
                                       int transferredIn,
                                       int timeout)
```
-Summary: Read buffer from device async
-param: device

-param: buf, buffer reads in
-param: size, buffer size
-param: transferredIn, actually buffer length reads
-param: timeout, read buffer timeout,This is specified in milliseconds
-return: if read device success,return true,else return false

(8) syncGetInnoMakerDeviceBuf

```
public bool syncGetInnoMakerDeviceBuf(InnoMakerDevice device,
                                      Byte[] buf,
                                      int size,
                                      int transferredIn,
                                      int timeout)
```

-Summary: Read buffer from device sync
-param: device
-param: buf, buffer reads in
-param: size, buffer size
-param: transferredIn, actually buffer length reads
-param: timeout, read buffer timeout, This is specified in milliseconds.
-return: if read device success,return true,else return false

(9) asyncGetInnoMakerDeviceBuf

```
public bool asyncGetInnoMakerDeviceBuf(InnoMakerDevice device,
                                   Byte[] buf,
                                   int size,
                                   int timeout,int transferredOut)
```

-Summary: write buffer to device async
-param: device
-param: buf, buffer writes out
-param: size, buffer size
-param: transferredOut, actually buffer length writes
-param: timeout, write buffer timeout,This is specified in milliseconds.
-return: if write device success,return true,else return false

(10) syncGetInnoMakerDeviceBuf

```
public bool syncGetInnoMakerDeviceBuf(InnoMakerDevice device,
                                      Byte[] buf,
                                       int size,
                                      int timeout,
                                      int transferredOut)
```

-Summary: write buffer to device sync
-param: device
-param: buf, buffer writes out
-param: size, buffer size
-param: transferredOut, actually buffer length writes

-param: timeout, write buffer timeout
-return: if worte success,return true,else return false

(11) UrbResetDevice

public bool UrbResetDevice(InnoMakerDevice device)
-Summary: Reset Device
-param: Device Instance
-return: If reset device success return true,else return false

(12) UrbSetupDevice

public bool UrbSetupDevice(InnoMakerDevice device,
UsbCanMode canMode,
innomaker_device_bittming bittming)
-Summary: Setup device
-param: Device Instance
-param: canMode, usbCanMode
-param: bittming, usb bittming params
-return: if setup device success return true,else return false

7.Error Frame

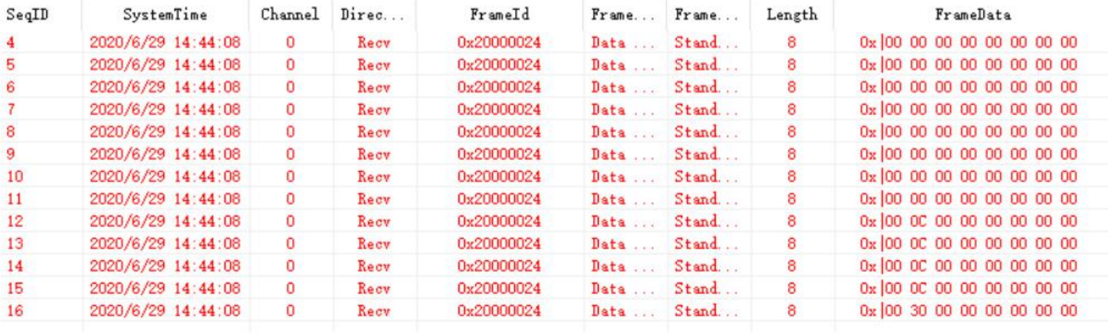
You may receive some error frame marked in red when you use the USB2CAN module. They will show you what problem does the USB2CAN module meet on your CAN Bus.

Some people would say why we haven’t meet the error frame with other tool or USB to CAN module before? The sample fact is that most of the tool filter out the error frame to avoid controversy and support. They just show nothing when there are some error on the CAN Bus. We just want to show the all raw data to help you to analyze your CAN BUS. Some error can be ignored, but some error maybe the hidden danger for your CAN BUS.

For the error frame ID description, please refer to below link:
https://github.com/linux-can/can-utils/blob/master/include/linux/can/error.h

Now we take a simple case to show you how to analyze the error frame ID. I made the incorrect connection between the USB2CAN module and the CAN Bus, to see what happens.

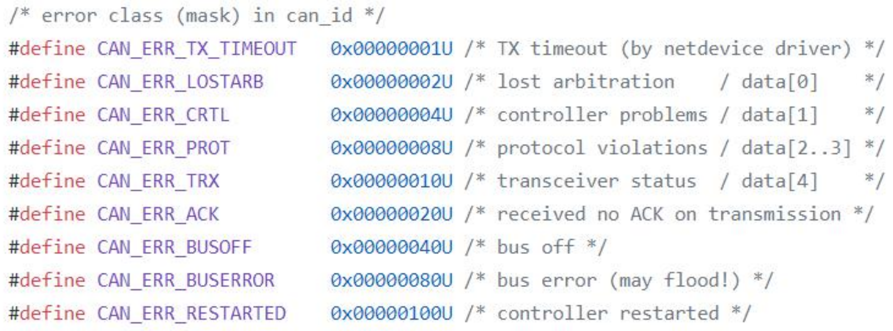
USB2ACN module   CAN BUS
H.---L
L.---H



SeqID	SystemTime	Channel	Direc...	FrameId	Frame...	Frame...	Length	FrameData
4	2020/6/29 14:44:08	0	Recv	0x20000024	Data ...	Stand...	8	0x |00 00 00 00 00 00 00 00
5	2020/6/29 14:44:08	0	Recv	0x20000024	Data ...	Stand...	8	0x |00 00 00 00 00 00 00 00
6	2020/6/29 14:44:08	0	Recv	0x20000024	Data ...	Stand...	8	0x |00 00 00 00 00 00 00 00
7	2020/6/29 14:44:08	0	Recv	0x20000024	Data ...	Stand...	8	0x |00 00 00 00 00 00 00 00
8	2020/6/29 14:44:08	0	Recv	0x20000024	Data ...	Stand...	8	0x |00 00 00 00 00 00 00 00
9	2020/6/29 14:44:08	0	Recv	0x20000024	Data ...	Stand...	8	0x |00 00 00 00 00 00 00 00
10	2020/6/29 14:44:08	0	Recv	0x20000024	Data ...	Stand...	8	0x |00 00 00 00 00 00 00 00
11	2020/6/29 14:44:08	0	Recv	0x20000024	Data ...	Stand...	8	0x |00 00 00 00 00 00 00 00
12	2020/6/29 14:44:08	0	Recv	0x20000024	Data ...	Stand...	8	0x |00 0C 00 00 00 00 00 00
13	2020/6/29 14:44:08	0	Recv	0x20000024	Data ...	Stand...	8	0x |00 0C 00 00 00 00 00 00
14	2020/6/29 14:44:08	0	Recv	0x20000024	Data ...	Stand...	8	0x |00 0C 00 00 00 00 00 00
15	2020/6/29 14:44:08	0	Recv	0x20000024	Data ...	Stand...	8	0x |00 0C 00 00 00 00 00 00
16	2020/6/29 14:44:08	0	Recv	0x20000024	Data ...	Stand...	8	0x |00 30 00 00 00 00 00 00

As Above, We received error frame Id: 0x20000024 and 2 set of 8 byte Frame Data:
data[0]=0x00, data[1]=0x0C,data[3] to data[7] are all 0x00 .
data[0]=0x00, data[1]=0x30,data[3] to data[7] are all 0x00 .

According the above error frame ID description link:



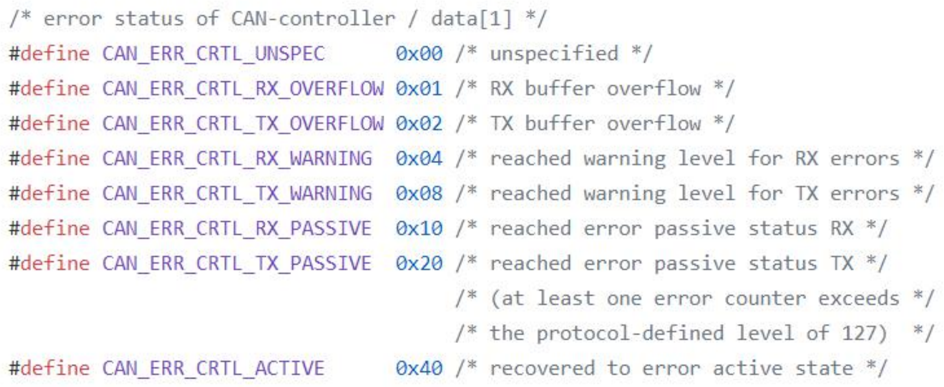
```
/* error class (mask) in can_id */
#define CAN_ERR_TX_TIMEOUT   0x00000001U /* TX timeout (by netdevice driver) */
#define CAN_ERR_LOSTARB      0x00000002U /* lost arbitration    / data[0]    */
#define CAN_ERR_CRTL         0x00000004U /* controller problems / data[1]    */
#define CAN_ERR_PROT         0x00000008U /* protocol violations / data[2..3] */
#define CAN_ERR_TRX          0x00000010U /* transceiver status  / data[4]    */
#define CAN_ERR_ACK          0x00000020U /* received no ACK on transmission */
#define CAN_ERR_BUSOFF       0x00000040U /* bus off */
#define CAN_ERR_BUSERROR     0x00000080U /* bus error (may flood!) */
#define CAN_ERR_RESTARTED    0x00000100U /* controller restarted */
```

This Error frame ID = 0x200000000 | 0x00000020|0x00000004
= 0x200000000 | CAN_ERR_ACK|CAN_ERR_CRTL

So the USB2CAN meet two problem 'received no ACK on transmission' and 'controller problems'.

For problem 'received no ACK on transmission' may case by the not CAN-BUS or other module on the CAN BUS are only listen mode(No ACK).

For problem 'controller problems', refer to the data[1] description:



```
/* error status of CAN-controller / data[1] */
#define CAN_ERR_CRTL_UNSPEC      0x00 /* unspecified */
#define CAN_ERR_CRTL_RX_OVERFLOW 0x01 /* RX buffer overflow */
#define CAN_ERR_CRTL_TX_OVERFLOW 0x02 /* TX buffer overflow */
#define CAN_ERR_CRTL_RX_WARNING  0x04 /* reached warning level for RX errors */
#define CAN_ERR_CRTL_TX_WARNING  0x08 /* reached warning level for TX errors */
#define CAN_ERR_CRTL_RX_PASSIVE  0x10 /* reached error passive status RX */
#define CAN_ERR_CRTL_TX_PASSIVE  0x20 /* reached error passive status TX */
                                      /* (at least one error counter exceeds */
                                      /* the protocol-defined level of 127)  */
#define CAN_ERR_CRTL_ACTIVE      0x40 /* recovered to error active state */
```

data[1] = 0x0C = 0x04|0x08 = CAN_ERR_CRTL_RX_WARNING|CAN_ERR_CRTL_TX_WARNING
It means the USB2CAN module can't send/receive data properly and reached warning level.

data[1] = 0x30 = 0x10|0x20 = CAN_ERR_CRTL_RX_PASSIVE | CAN_ERR_CRTL_TX_PASSIVE
It means the USB2CAN module can't send/receive data too much, USB2CAN module into error status.

Summing up the above, the error frame tell us, USB2CAN module can't get ACK from CAN BUS and can't send data to the CAN Bus. So the CAN Bus may not inexistence or the connection error.

8.User Manual Version Descriptions

Version	Description	Date	E-mail
V1.0.0.1		2020.06.28	support@inno-maker.com sales@inno-maker.com
V1.0.0.2		2021.07.19	support@inno-maker.com sales@inno-maker.com

If you have any suggestions, ideas, codes and tools please feel free to email to me. I will update the user manual and record your name and E-mail in list. Look forward to your letter and kindly share.