WAVESHARE USB-CAN Bus Inter face Adapter Interface Function Library Instruction Manual

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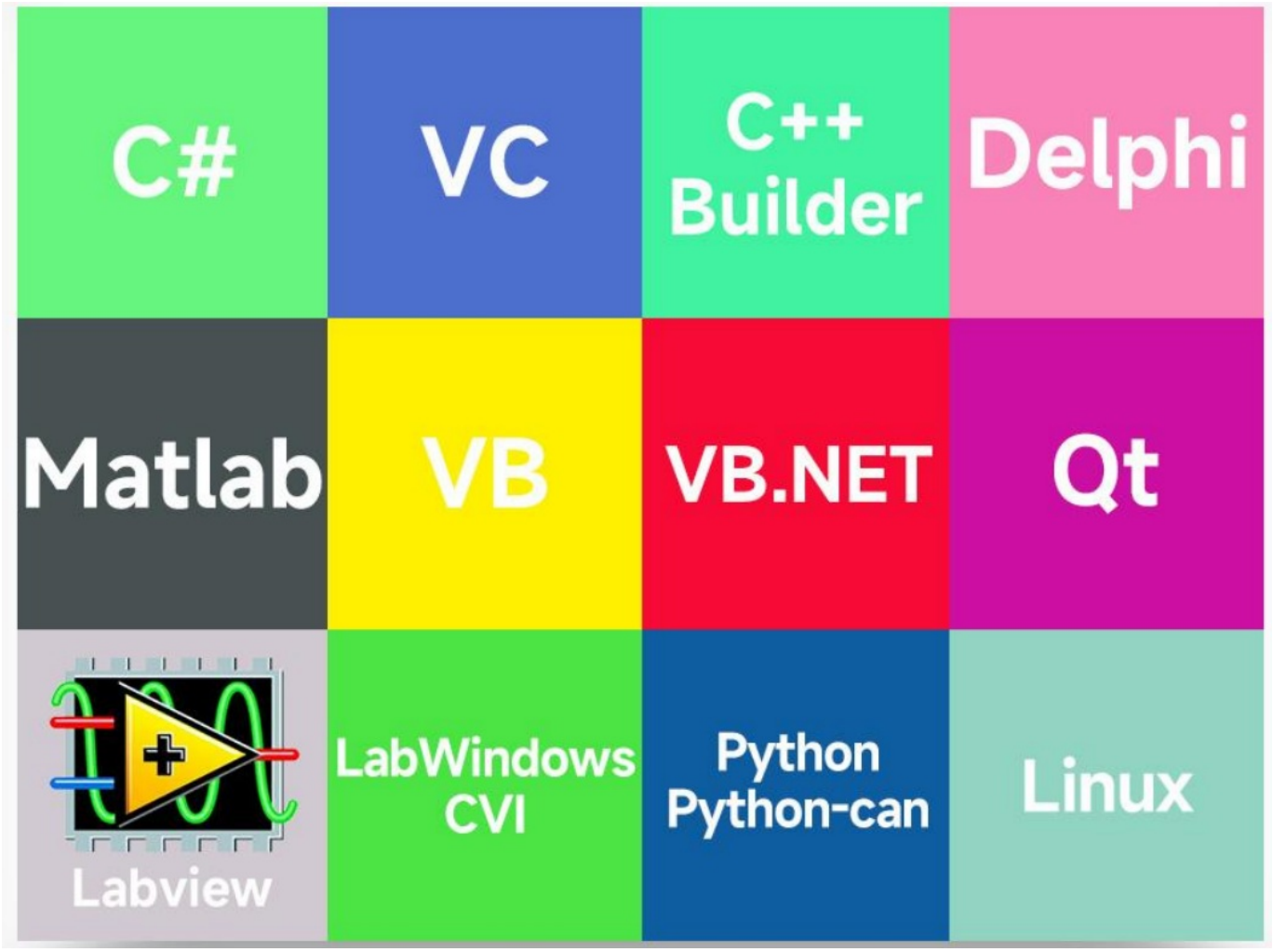
USB-CAN Bus Interface
Adapter Interface Function
Library User Instruction



Contents

1 PART ONE OVERVIEW
2 PART TWO COMPATIBLE FUNCTION LIBRARY AND DATA STRUCTURE
3 PART THREE OTHER FUNCTIONS AND DATA STRUCTURE DESCRIPTION
4 Documents / Resources
4.1 References
5 Related Posts

PART ONE OVERVIEW

If the user just use USB-CAN bus interface adapter to go on CAN bus communication test, and then he can directly use the supplied USB-CAN Tool software for sending and receiving data of the test.
If the user intends to write software program for his own products. Please carefully read the following instructions and take reference from the sample code we provide:
C++Builder C# VC VB VB.NET Delphi LabVIEW LabWindows/CVI Matlab QT Python/Python-can.
Develop library file ControlCAN.lib, ControlCAN.DLL
VC version function declaration file ControlCAN.h
VB version function declaration file: ControlCAN.bas
LabVIEW version library function package module ControlCAN.llb
Delphi version function declaration file: ControlCAN.pas

PART TWO COMPATIBLE FUNCTION LIBRARY AND DATA STRUCTURE

2.1. TYPE DEFINITION

2.1.1. Device Type

Type Definition	Type value	Description
DEV_USBCAN2	4	USBCAN-2A/USBCAN-2C/CANalyst-II MiniPCIe-CAN

2.1.2. VCI_BOARD_INFO

VCI_BOARD_INFO structure contains USB-CAN Series interface card device information.
The structure will be filled in VCI_ReadBoardInfo function.

```
typedef   struct
          _VCI_CAN_OBJ {
UINT      ID;
UINT      TimeStamp;
BYTE      TimeFlag;
BYTE      SendType;
BYTE      RemoteFlag;
BYTE      ExternFlag;
BYTE      DataLen;
BYTE      Data[8];
BYTE      Reserved[3];
}VCI_CAN_OBJ, *PVCI_CAN_OBJ;
```

Member
hw_Version
Hardware version number, hexadecimal notation. E.g. 0x0100 represents V1.00.
fw_Version
Hardware version number, hexadecimal notation. E.g. 0x0100 represents V1.00.
Page 2
dr_Version
Driver version number, hexadecimal notation. E.g. 0x0100 represents V1.00.
in_Version
Interface library version number, hexadecimal notation. E.g. 0x0100 represents V1.00.
irq_Num
System reserved.
can_Num
Represents the total number of CAN channel.
str_Serial_Num
This board card's serial number.
str_hw_Type
Hardware type, such as "USBCAN V1.00" (Note: Includes string terminator '\0').
Reserved
System reserved.

2.1.3. VCI_CAN_OBJ

In the functions VCI_Transmit and VCI_Receive, VCI_CAN_OBJ structure is used to transmit CAN message frame.

```
typedef      struct      _VCI_BOARD_INFO {
USHORT              hw_Version;
USHORT              fw_Version;
USHORT              dr_Version;
USHORT              in_Version;
USHORT              irq_Num;
BYTE          can_Num;
CHAR          str_Serial_Num[20];
CHAR          str_hw_Type[40];
USHORT        Reserved[4];
} VCI_BOARD_INFO, *PVCI_BOARD_INFO;
```

Member

ID

Message identifier. Direct ID format, right-aligned, please refer to: Annex One ID Alignment Details.

TimeStamp

Receiving the stamp information of the time frame, start timing when the CAN controller is initialized, the unit is 0. 1ms.

TimeFlag

In terms of whether to use the time stamp, 1is the effective TimeStamp. TimeFlag and TimeStamp are only meaningful when the frame is received .

SendType

Sending type. = 0 indicates Normal type, = 1 indicates Single Send.

RemoteFlag

Whether it is a remote flag. = 1 indicates remote flag, = 0 indicates data flag.

ExternFlag

Whether it is a extern flag. = 1 indicates extern flag, = 0 indicates standard flag.

DataLen

Data length(<=8) that is, the length of data.

Data

Packet data.

Reserved

System reserved.

2.1.4. VCI_INIT_CONFIG

VCI_INIT_CONFIG structure defines the initialization configuration of the CAN. The structure will be filled in VCI_InitCan function.

```
typedef      struct      _INIT_CONFIG {
DWORD              AccCode;
DWORD              AccMask;
```

```
DWORD
UCHAR       Filter;          //0,1 receives all frames. 2 standard frame filtering, 3 is an extended frame
filtering.
UCHAR       Timing0;         //SJA1000 Baud rate parameter,Timing0   (BTR0)
UCHAR       Timing1;         //SJA1000 Baud rate parameter,Timing1   (BTR1)
UCHAR              Mode;                  //mode ， 0 represents normal mode, 1represents listening-
only mode, 2
represents self-test mode.
} VCI_INIT_CONFIG, *PVCI_INIT_CONFIG;
```

Member
AccCode
Receive filtered acceptance code.
AccMask
Receive filter mask.
Reserved
Reserved.
Filter
Filtering method, allowing setting range 0-3, refer to section 2.2.3 of the filter mode table for details.
Timing0
SJA1000 Baud rate parameter, Timing0 (BTR0) .
Timing1
SJA1000 Baud rate parameter, Timing1 (BTR1) .
Mode
Operating mode, 0 = normal operation, 1 = Listen-only mode, 2 = spontaneous admission and sending test mode.
Remarks:
About the filter settings please refer to: Annex II: CANparameter setup instructions.
CAN Timing0 and Timing1 are used to set baud rate, these two parameters are only used at the initialization stage.
Conventional Baud reference table:

CAN Baud rate	Timing0(BTR0)	Timing1(BTR1)
10k bps	0x31	0x1C
20k bps	0x18	0x1C
40k bps	0x87	0xFF
50k bps	0x09	0x1C
80k bps	0x83	0xFF
100k bps	0x04	0x1C
125k bps	0x03	0x1C
200k bps	0x81	0xFA
250k bps	0x01	0x1C
400k bps	0x80	0xFA
500k bps	0x00	0x1C
666k bps	0x80	0xB6
800k bps	0x00	0x16
1000k bps	0x00	0x14
33.33 Kbps	0x09	0x6F
66.66 Kbps	0x04	0x6F
83.33 Kbps	0x03	0x6F

1. Users only need to follow SJA1000 (16MHz) to set the Baud rate parameter.
2. The adapter does not support temporarily Baud rate below 10K.

2.2. FUNCTION DESCRIPTION

2.2.1. VCI_OpenDevice

This function is used to connect devices.

DWORD __stdcall VCI_OpenDevice(DWORD DevType,DWORD DevIndex,DWORD Reserved);

Parameters:

DevType

Device type. See: Adapter device type definition.

DevIndex

Device Index, for example, when there is only one USB-CAN adapter, the index number is 0, when there are multiple USB-CAN adapters, the index numbers in an ascending order starting from 0.

Reserved

Retention parameters, fill in 0.

Returns:

Return value = 1, which means that the operation is successful; = 0 indicates that the operation failed; = -1 indicates that the device does not exist.

E.g.:

```
#include "ControlCan.h"

int     nDeviceType = 4;              /*USB-CAN2.0 */

int     nDeviceInd = 0;                /* zeroth device */

DWORD dwRel;

dwRel = VCI_OpenDevice(nDeviceType, nDeviceInd, 0);

if(dwRel != 1)

{

   MessageBox(_T("Fail to open the device!"), _T("warning"), MB_OK|MB_ICONQUESTION);

   return FALSE;

}
```

2.2.2. VCI_CloseDevice

This function is used to close the connection.

DWORD __stdcall VCI_CloseDevice(DWORD DevType,DWORD DevIndex);

Parameters:

DevType

Device type. See: Adapter device type definition.

DevIndex

Device Index, for example, when there is only one USB-CAN adapter, the index number is 0, when there are multiple USB-CAN adapters, the index numbers in an ascending order starting from 0.

Returns:

Return value = 1, which means that the operation is successful; = 0 indicates that the operation failed; = -1 indicates that the device does not exist.

E.g.:

```
#include "ControlCan.h"

int     nDeviceType = 4;                /*USB-CAN2.0 */

int     nDeviceInd = 0;                  /* zeroth device */

DWORD dwRel;

dwRel = VCI_CloseDevice(nDeviceType, nDeviceInd);

if(dwRel != 1)

{

   MessageBox(_T("Fail to close the device!"), _T("warning"), MB_OK|MB_ICONQUESTION);

   return FALSE;

}
```

2.2.3. VCI_InitCan

This function is used to initialize the specified CAN.

DWORD __stdcall VCI_InitCAN(DWORD DevType, DWORD DevIndex, DWORD CANIndex, PVCI_INIT_CONFIG pInitConfig);

Parameters:

DevType

Device type. See: Adapter device type definition.

DevIndex

Device Index, for example, when there is only one USB-CAN adapter, the index number is 0, when there are multiple USB-CAN adapters, the index numbers in an ascending order starting from 0.

CANIndex

CAN channel index, such as when there is only one CAN channel, the index number is 0, if there are two, the index number can be 0 or 1.

pInitConfig

Initialization parameter structure. Parameter list of members:

Member	Functional Description
pInitConfig->AccCode	AccCode and AccMask can work together to determine which packets can be acc epted. These two registers are used to set the ID left-aligned, that is, the highest bi t (Bit31) of the AccCode and AccMask is aligned with the highest bit of the ID value .
pInitConfig->AccMask	About ID alignment refer annexes: Annex I: ID alignment details. E.g. If you set the value of the AccCode as 0x24600000 (i.e. 0x123 is shifted to th e left by 21 bits), AccMask value is set to 0x00000000, and then only the packets with CAN message frame ID is 0x 123 can be accepted (AccMask value of 0x00000000 indicates that all bits are rele vant
	bits). If the AccCode value is set to 0x24600000, AccMask value is set to 0x60000 0 (0x03 is shifted to the left by 21 bits), and then only the packets with the CAN me ssage frame ID is 0x120 ~ 0x123 can be accepted (AccMask value 0x600000 indicates that apart from bit0 ~ bit1 other bits (bit2 ~ bit10) are relevant b it). **Note:** This filter setting examples to the standard frame, for example, high 11-bit is the valid bit; in the case of the extended frame, and then the valid ID is 29-bit. Acc Code and AccMask set high 29-bit as the valid bit!
pInitConfig->Reserved	reserved
pInitConfig->Filter	Filtering mode settings please refer to the section of the filter mode table.
pInitConfig->Timing0	Baud rateT0 setting
pInitConfig->Timing1	Baud rateT1 setting
pInitConfig->Mode	Operating mode: 0-normal operation 1-Listen-only mode 2-spontaneous admission and sending test mode (this value is excluded from the ZLG function library)

Filter mode table:

Value	Name	Description
1	Receive all types	Suitable to both standard and extended frame!
2	Only receive standard frame	Suitable to standard frame, and extended
		frame will be removed by filtration directly!
3	Only receive extended frame	Suitable to extended frame, and standard frame will be removed by filtration directly!

Returns:
Return value = 1, which means that the operation is successful; = 0 indicates that the operation failed; = -1 indicates that the device does not exist.
E.g.

```
#include "ControlCan.h"
int    nDeviceType = 4;              /*USB-CAN2.0 */
int    nDeviceInd = 0;                /* zeroth device */
DWORD dwRel;
VCI_INIT_CONFIG vic;
dwRel = VCI_OpenDevice(nDeviceType, nDeviceInd, 0);
if(dwRel != 1)
{
   MessageBox(_T("Fail to open the device!"), _T("warning"), MB_OK|MB_ICONQUESTION);
   return FALSE;
}
vic .AccCode=0x80000008;
vic .AccMask=0xFFFFFFFF;
vic.Filter=1;
vic .Timing0=0x00;
vic .Timing1=0x14;
vic .Mode=0;
dwRel = VCI_InitCAN(nDeviceType, nDeviceInd, nCANInd, &vic);
if(dwRel !=1)
{
```

```
   VCI_CloseDevice(nDeviceType, nDeviceInd);
   MessageBox(_T("fail to initialize the device!"), _T("warning"), MB_OK|MB_ICONQUESTION);
   return FALSE;
}
```

2.2.4. VCI_ReadBoardInfo

This function is used to read the adapter hardware information. Generally speaking, it can be ignored.

DWORD __stdcall VCI_ReadBoardInfo(DWORD DevType,DWORD
DevIndex,PVCI_BOARD_INFO pInfo);

Parameters:

DevType

Device type. See: Adapter device type definition.

DevIndex

Device Index, for example, when there is only one USB-CAN adapter, the index number is 0, when there are multiple USB- CAN adapters, the index numbers in an ascending order starting from 0. pInfo
VCI_BOARD_INFO is used to store device information structure pointer.

Returns:

Return value = 1, which means that the operation is successful; = 0 indicates that the operation failed; = -1 indicates that the device does not exist.

E.g.:

```
#include "ControlCan.h"
int    nDeviceType = 4;              /*USB-CAN2.0 */
int    nDeviceInd = 0;                /* zeroth device */
int    nCANInd = 0;
VCI_BOARD_INFO vbi;
DWORD dwRel;
```

```
bRel = VCI_ReadBoardInfo(nDeviceType, nDeviceInd, nCANInd, &vbi);
if(dwRel != 1)
{
   MessageBox(_T("Fail to obtain device information!"), _T("warning"), MB_OK|MB_ICONQUESTION);
   return FALSE;
}
```

2.2.5. VCI_GetReceiveNum

This function is used to specify the received but has not been read frames in the designated receiving buffer.

DWORD __stdcall VCI_GetReceiveNum(DWORD DevType,DWORD DevIndex,DWORD CANIndex);

Parameters:

DevType

Device type. See: Adapter device type definition.

DevIndex

Device Index, for example, when there is only one USB-CAN adapter, the index number is 0, when there are multiple USB- CAN adapters, the index numbers in an ascending order starting from 0.

CANIndex

CAN channel index.

Returns:

Return frames that have not been read yet.

E.g.

#include “ControlCan.h” int ret=VCI_GetReceiveNum(2,0,0);

2.2.6. VCI_ClearBuffer

This function is used to clear the receive and send buffer of the designated channel specified by

USB-CAN adapter.

DWORD __stdcall VCI_ClearBuffer(DWORD DevType,DWORD DevIndex,DWORD CANIndex);

Parameters:

DevType

Device type. See: Adapter device type definition.

DevIndex

Device Index, for example, when there is only one USB-CAN adapter, the index number is 0, when there are multiple USB- CAN adapters, the index numbers in an ascending order starting from 0.

CANIndex

CAN channel index.

Returns:

Return value = 1, which means that the operation is successful; = 0 indicates that the operation failed; = -1 indicates that the device does not exist.

E.g.:

```
#include "ControlCan.h"
int nDeviceType = 4;      /*USB-CAN2.0 */
int nDeviceInd = 0;      /* zeroth device */
int nCANInd = 0;      /* zeroth channel */
DWORD dwRel;
bRel = VCI_ClearBuffer(nDeviceType, nDeviceInd, nCANInd);
```

2.2.7. VCI_StartCAN

This function is used to start the CAN controller and the internal interrupt reception function of the adapter.

DWORD __stdcall VCI_StartCAN(DWORD DevType,DWORD DevIndex,DWORD CANIndex);

Parameters:

DevType

Device type. See: Adapter device type definition.

DevIndex

Device Index, for example, when there is only one USB-CAN adapter, the index number is 0, when there are multiple USB-CAN adapters, the index numbers in an ascending order starting from 0.

CANIndex

CAN channel index.

Returns:

Return value = 1, which means that the operation is successful; = 0 indicates that the operation failed; = -1 indicates that the device does not exist.

E.g.:

```
#include "ControlCan.h"
int    nDeviceType =        /*USB-CAN2.0 */
4; int    nDeviceInd =      /* zeroth device */
0;                          /* zeroth channel */
int    nCANInd = 0;
DWORD dwRel;
VCI_INIT_CONFIG vic;
if(VCI_OpenDevice(nDeviceType, nDeviceInd, 0) != 1)
{
   MessageBox(_T("Fail to open the device!"), _T("warning"), MB_OK|MB_ICONQUESTION);
   return FALSE;
}
if(VCI_InitCAN(nDeviceType, nDeviceInd, nCANInd, &vic) != 1)
{
   VCI_CloseDevice(nDeviceType, nDeviceInd);
   MessageBox(_T("Fail to initialize the device!"), _T("warning"), MB_OK|MB_ICONQUESTION);
   return FALSE;
}
if(VCI_StartCAN(nDeviceType, nDeviceInd, nCANInd) !=1)
{
   MessageBox(_T("Fail to start the device!"), _T("warning"), MB_OK|MB_ICONQUESTION);
   return FALSE;
}
```

2.2.8. VCI_ResetCAN

This function is used to reset the CAN controller.

DWORD __stdcall VCI_ResetCAN(DWORD DevType,DWORD DevIndex,DWORD CANIndex);

Parameters:

DevType

Device type. See: Adapter device type definition.

DevIndex

Device Index, for example, when there is only one USB-CAN adapter, the index number is 0, when there are multiple USB-CAN adapters, the index numbers in an ascending order starting from 0.

CANIndex

CAN channel index.

Returns:

Return value = 1, which means that the operation is successful; = 0 indicates that the operation failed; = -1 indicates that the device does not exist.

E.g.:

```
#include "ControlCan.h"

int    nDeviceType = 4;              /*USB-CAN2.0 */

int    nDeviceInd = 0;                /* zeroth device */

int    nCANInd = 0;

DWORD dwRel;

bRel = VCI_ResetCAN(nDeviceType, nDeviceInd, nCANInd);

if(dwRel != 1)

{
```

```
   MessageBox(_T("Fail to reset!"), _T("warning"), MB_OK|MB_ICONQUESTION);

   return FALSE;

}
```

2.2.9. VCI_Transmit

This function is used to send CAN message frame.

DWORD __stdcall VCI_Transmit(DWORD DeviceType,DWORD DeviceInd,DWORD CANInd,PVCI_CAN_OBJ pSend,DWORD Length);

Parameters:

DevType

Device type. See: Adapter device type definition.

DevIndex

Device Index, for example, when there is only one USB-CAN adapter, the index number is 0, when there are multiple USB-CAN adapters, the index numbers in an ascending order starting from 0.

CANIndex

CAN channel index. pSend

The first address of the data frame arrays that have to be sent.

Length

The number of the data frames that have to be sent, the maximum number is 1000, the recommended value is 48 under high speed.

Returns:

Return the actual number of frames already sent, the return value = -1 indicates a device error.

E.g.

```
#include "ControlCan.h"

int    nDeviceType = 4;              /*USB-CAN2.0 */

int    nDeviceInd = 0;                /* zeroth device */
```

```
int     nCANInd = 0;

DWORD dwRel;

VCI_CAN_OBJ vco[48];

ZeroMemory(&vco, sizeof(VCI_CAN_OBJ)*48);

for(int i=0;i<48;i++)

{

   vco[i].ID = i;

   vco[i].RemoteFlag = 0;

   vco[i].ExternFlag = 0;

   vco[i].DataLen = 8;

   for(int j = 0;j<8;j++)

      vco.Data[j] = j;

}

dwRel = VCI_Transmit(nDeviceType, nDeviceInd, nCANInd, &vco,48);
```

2.2.10. VCI_Receive

This function is used to request reception.

DWORD __stdcall VCI_Receive(DWORD DevType, DWORD DevIndex, DWORD CANIndex, PVCI_CAN_OBJ pReceive, ULONG Len, INT WaitTime);

Parameters:

DevType

Device type. See: Adapter device type definition.

DevIndex

Device Index, for example, when there is only one USB-CAN adapter, the index number is 0, when there are multiple USB-CAN adapters, the index numbers in an ascending order starting from 0.

CANIndex

CAN channel index.

pReceive

To receive the first set pointer of the data frames.

Len

The array length of the data frame must be more than 2500 to return normal message.

Otherwise, the return length will be zero whether the message is received or not. the adapter set a 2000-frame buffer for every channel. Based on his own system and working environment, the user can choose an appropriate array length from 2500.

WaitTime Reserved.

Returns:

Return the number of frames that actually have been read, -1 indicates device errors.

E.g.

```
#include "ControlCan.h"

int    nDeviceType = 4;              /*USB-CAN2.0 */

int    nDeviceInd = 0;                /* zeroth device */

int    nCANInd = 0;

long lRel;

VCI_CAN_OBJ vco[2500];

lRel = VCI_Receive(nDeviceType, nDeviceInd, nCANInd, &vco,2500,0);

if(lRel > 0)

{

…                                  /*data processing */

}

else if(lRel == -1)

{

…                                  /* receive error treatment */

}
```

PART THREE OTHER FUNCTIONS AND DATA STRUCTURE DESCRIPTION

This chapter describes other data types and functions of the incompatible ZLG interface library contained in USB-CAN adapter interface library ControlCAN.dll. Please do
not call these functions if use a compatible ZLG model for secondary development so as not to affect compatibility.

3.1 FUNCTION DESCRIPTION

3.1.1. VCI_UsbDeviceReset

Reset USB-CAN adapter, need to re-open the device after reset by using VCI_OpenDevice.
DWORD __stdcall VCI_UsbDeviceReset(DWORD DevType,DWORD DevIndex,DWORD Reserved
Parameters:
DevType
Device type. See: Adapter device type definition.
DevIndex
Device Index, for example, when there is only one USB-CAN adapter, the index number is 0, when there are multiple USB-CAN adapters, the index numbers in an ascending order starting from 0.
Reserved Reserved.
Returns:
Return value = 1, which means that the operation is successful; = 0 indicates that the operation failed; = -1 indicates that the device does not exist.

E.g.:

```
#include "ControlCan.h"
int    nDeviceType = 4;              /*USB-CAN2.0 */
int    nDeviceInd = 0;                /* zeroth device */
int    nCANInd = 0;
DWORD dwRel;
```

bRel = VCI_UsbDeviceReset(nDeviceType, Independence, 0);

3.1.2. VCI_FindUsbDevice2

When the same PC using multiple USB-CAN, user can use this function to find the current device.

DWORD __stdcall VCI_FindUsbDevice2(PVCI_BOARD_INFO pInfo);

Parameters:

pInfo

pInfo is used to store the parameters of the first data buffer address pointer.

Returns

Return the number of the USB-CAN adapter plugged into the computer.

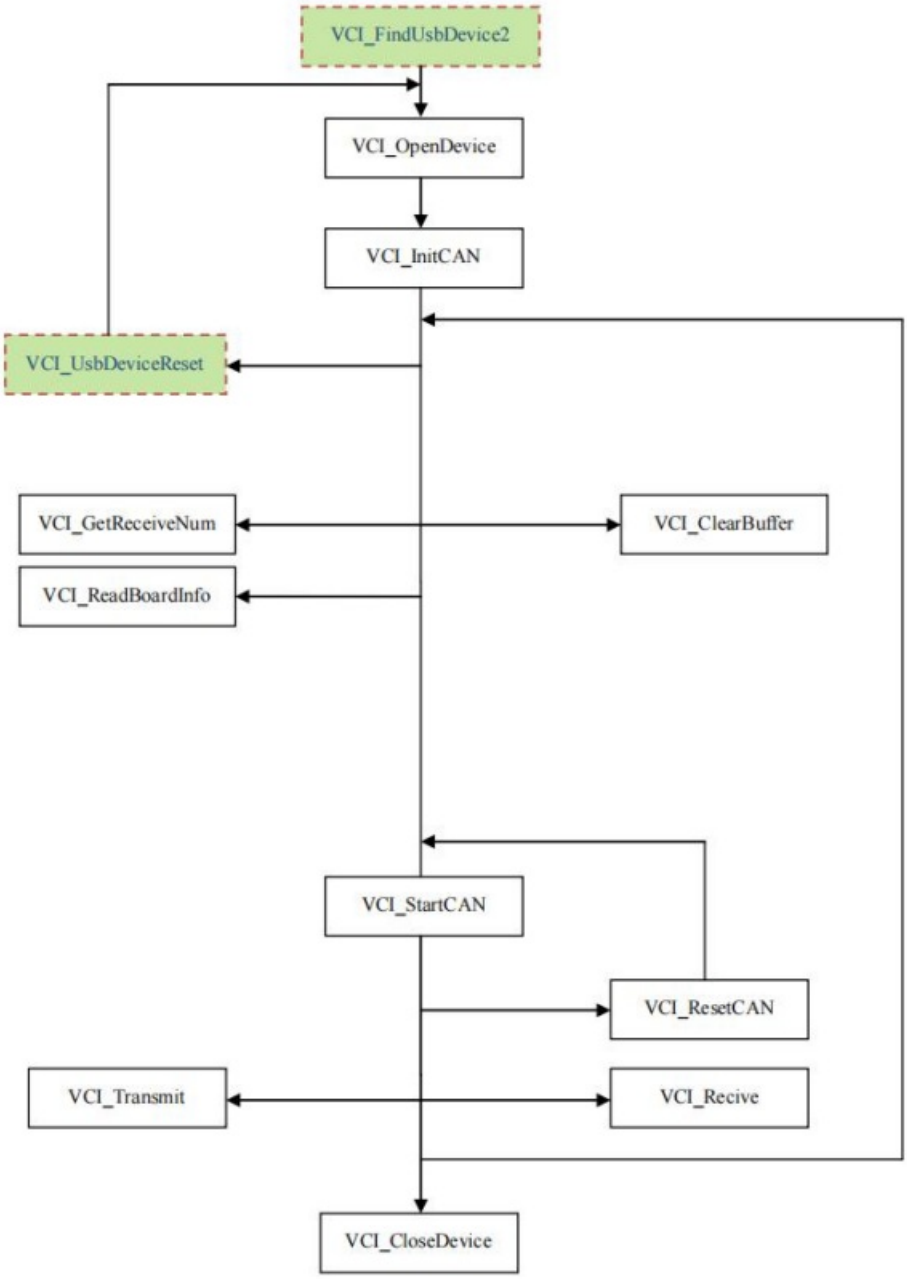
E. g.:

```
#include "ControlCan.h"
CString ProductSn[50];
VCI_BOARD_INFO pInfo [50];
int num=VCI_FindUsbDevice2(pInfo);
CString strtemp,str;
for(int i=0;i<num;i++)
{
    str="";
    for(int j=0;j<20;j++)
    {
      strtemp.Format("%c", pInfo[i]. str_Serial_Num [j]);
      str+=strtemp;
    }
    ProductSn[i]="USBCAN-"+str;
}
```

Part Four Interface Library Functions Using Process

In order to multiply device function, we provided additional functions(functions presented with a green background), these functions include: VCI_FindUsbDevice2 VCI_UsbDeviceReset. During the second

development, these functions are not necessarily to be invoked. Even these functions are ignored, all USB-CAN adapter functions can be achieved.



Documents / Resources

	WAVESHARE USB-CAN Bus Inter face Adapter Interface Function Library [pdf] Instruction Manual USB-CAN Bus Inter face Adapter Interface Function Library, USB-CAN, Bus Inter face Adapter Interface Function Library, Interface Function Library, Function Library

References

- Waveshare Electronics
- Waveshare Wiki