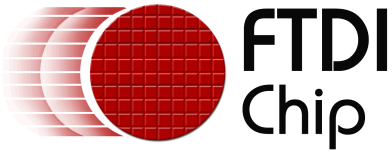

Future Technology Devices International Ltd.

D2XX Programmer's Guide

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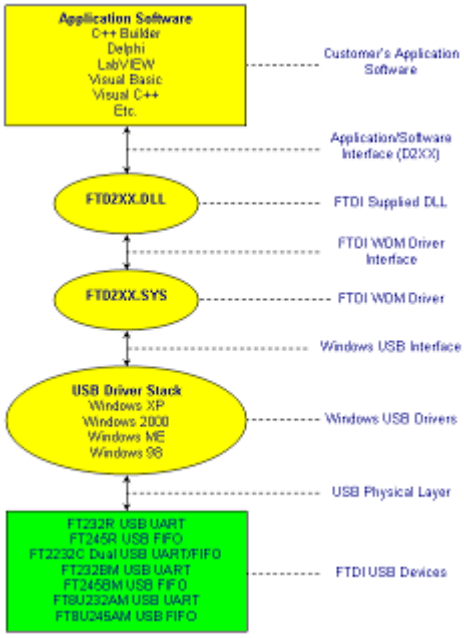
1 Welcome to the FTD2XX Programmer's Guide

FTDIs "D2XX Direct Drivers" for Windows offer an alternative solution to our VCP drivers which allows application software to interface with FT232R USB UART, FT245R USB FIFO, FT2232C Dual USB UART/FIFO, FT232BM USB UART, FT245BM USB FIFO, FT8U232AM USB UART and FT8U245AM USB FIFO devices using a DLL instead of a Virtual COM Port.



The architecture of the D2XX drivers consists of a Windows WDM driver that communicates with the device via the Windows USB stack and a DLL which interfaces the application software (written in Visual C++, C++ Builder, Delphi, VB etc.) to the WDM driver. An INF installation file, uninstaller program and D2XX programmers guide complete the package.

The document is divided into four parts:

- **Classic Interface Functions** 5 which explains the original functions with some more recent additions
- **EEPROM Interface** 55 which allows application software to read/program the various fields in the FT232R/FT245R internnal EEPROM or external 93C46/93C56/93C66 EEPROM for other devices, including a user defined area which can be used for application specific purposes.
- **Extended API Functions** 68 which allow control of the additional features available from our 2nd generation devices onwards.
- **FT-Win32 API** 75 which is a more sophisticated alternative to the Classic Interface - our equivalent to the native Win 32 API calls that are used to control a legacy serial port. Using the FT-Win32 API, existing Windows legacy Comms applications can easily be converted to use the D2XX interface simply by replacing the standard Win32 API calls with the equivalent FT-Win32 API calls.

Please note that the Classic Interface and the FT-Win32 API interface are alternatives.
Developers should choose one or the other: the two sets of functions should not be mixed.

Main Differences Between Windows and Windows CE D2XX Drivers

- Location IDs are not supported by Windows CE
- FT_ResetPort and FT_CyclePort are not available
- Windows CE does not support overlapped IO for

2 Classic Interface Functions

Introduction

An FTD2XX device is an FT232R USB UART, FT245R USB FIFO, FT2232C Dual USB UART/FIFO, FT232BM USB UART, FT245BM USB FIFO, FT8U232AM USB UART or FT8U245AM USB FIFO interfacing to Windows application software using FTDIs WDM driver FTD2XX.SYS. The FTD2XX.SYS driver has a programming interface exposed by the dynamic link library FTD2XX.DLL and this document describes that interface.

Overview

FT_ListDevices 8 returns information about the FTDI devices currently connected. In a system with multiple devices this can be used to decide which of the devices the application software wishes to access (using FT_OpenEx below).

Before the device can be accessed, it must first be opened. FT_Open 11 and FT_OpenEx 12 return a handle that is used by all functions in the Classic Programming Interface to identify the device. When the device has been opened successfully, I/O can be performed using FT_Read 15 and FT_Write 17. When operations are complete, the device is closed using FT_Close 14.

Once opened, additional functions are available to reset the device (FT_ResetDevice 18); purge receive and transmit buffers (FT_Purge 29); set receive and transmit timeouts (FT_SetTimeouts 30); get the receive queue status (FT_GetQueueStatus 31); get the device status (FT_GetStatus 34); set and reset the break condition (FT_SetBreakOn 32, FT_SetBreakOff 33); and set conditions for event notification (FT_SetEventNotification 35).

For FT232R devices, FT2232C devices used in UART mode, FT232BM and FT8U232AM devices, functions are available to set the Baud rate (FT_SetBaudRate 19), and set a non-standard Baud rate (FT_SetDivisor 20); set the data characteristics such as word length, stop bits and parity (FT_SetDataCharacteristics 21); set hardware or software handshaking (FT_SetFlowControl 22); set modem control signals (FT_SetDtr 23, FT_ClrDtr 24, FT_SetRts 25, FT_ClrRts 26); get modem status (FT_GetModemStatus 27); set special characters such as event and error characters (FT_SetChars 28).

For FT245R devices, FT2232C devices used in FIFO mode, FT245BM and FT8U245AM devices, these functions are redundant and can effectively be ignored.

Reference

Type definitions 102 of the functional parameters and return codes used in the D2XX classic programming interface are contained in the appendix 101.

2.1 FT_SetVIDPID

A Linux specific command to include your own VID and PID within the internal device list table.

FT_STATUS **FT_SetVIDPID** (D*WORD dwVID*, DWORD *dwPID*)

Parameters

dwVID	Device VID.
dwPID	Device PID.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

The driver will support a limited set of VID and PID matched devices (VID 0x0403 with PIDs 0x6001, 0x6010, 0x6006 only). In order to use the driver with alternative VID and PIDs the FT_SetVIDPID function must be used prior to calling FT_ListDevices 8, FT_Open 11, FT_OpenEx 12 or FT_CreateDeviceInfoList 48.

2.2 FT_GetVIDPID

A Linux specific command to retrieve the current VID and PID within the internal device list table.

FT_STATUS **FT_GetVIDPID** (D*WORD * pdwVID*, DWORD * p*dwPID*)

Parameters

pdwVID	Pointer to DWORD that will contain the internal VID.
pdwPID	Pointer to DWORD that will contain the internal PID.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

See FT_SetVIDPID 6.

2.3 FT_ListDevices

Get information concerning the devices currently connected. This function can return information such as the number of devices connected, the device serial number and device description strings, and the location IDs of connected devices.

FT_STATUS **FT_ListDevices** (PVOID *pvArg1*, PVOID *pvArg2*, DWORD *dwFlags*)

Parameters

pvArg1	Meaning depends on dwFlags.
pvArg2	Meaning depends on dwFlags.
dwFlags	Determines format of returned information.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

This function can be used in a number of ways to return different types of information. A more powerful way to get device information is to use the FT_CreateDeviceInfoList 48, FT_GetDeviceInfoList 49 and FT_GetDeviceInfoDetail 51 functions as they return all the available information on devices.

In its simplest form, it can be used to return the number of devices currently connected. If *FT_LIST_NUMBER_ONLY* bit is set in *dwFlags*, the parameter *pvArg1* is interpreted as a pointer to a DWORD location to store the number of devices currently connected.

It can be used to return device information: if *FT_OPEN_BY_SERIAL_NUMBER* bit is set in *dwFlags*, the serial number string will be returned; if *FT_OPEN_BY_DESCRIPTION* bit is set in *dwFlags*, the product description string will be returned; if *FT_OPEN_BY_LOCATION* bit is set in *dwFlags*, the Location ID will be returned; if none of these bits is set, the serial number string will be returned by default.

It can be used to return device string information for a single device. If *FT_LIST_BY_INDEX* and *FT_OPEN_BY_SERIAL_NUMBER* or *FT_OPEN_BY_DESCRIPTION* bits are set in *dwFlags*, the parameter *pvArg1* is interpreted as the index of the device, and the parameter *pvArg2* is interpreted as a pointer to a buffer to contain the appropriate string. Indexes are zero-based, and the error code *FT_DEVICE_NOT_FOUND* is returned for an invalid index.

It can be used to return device string information for all connected devices. If *FT_LIST_ALL* and *FT_OPEN_BY_SERIAL_NUMBER* or *FT_OPEN_BY_DESCRIPTION* bits are set in *dwFlags*, the parameter *pvArg1* is interpreted as a pointer to an array of pointers to buffers to contain the appropriate strings and the parameter *pvArg2* is interpreted as a pointer to a DWORD location to store the number of devices currently connected. Note that, for *pvArg1*, the last entry in the array of pointers to buffers should be a NULL pointer so the array will contain one more location than the number of devices connected.

The location ID of a device is returned if *FT_LIST_BY_INDEX* and *FT_OPEN_BY_LOCATION* bits are set in *dwFlags*. In this case the parameter *pvArg1* is interpreted as the index of the device, and the parameter *pvArg2* is interpreted as a pointer to a variable of type long to contain the location

ID. Indexes are zero-based, and the error code *FT_DEVICE_NOT_FOUND* is returned for an invalid index. **Please note that Windows CE and Linux do not support location IDs**.

The location IDs of all connected devices are returned if *FT_LIST_ALL* and *FT_OPEN_BY_LOCATION* bits are set in *dwFlags*. In this case, the parameter *pvArg1* is interpreted as a pointer to an array of variables of type long to contain the location IDs, and the parameter *pvArg2* is interpreted as a pointer to a DWORD location to store the number of devices currently connected.

Examples

The examples that follow use these variables.

```
FT_STATUS ftStatus;
DWORD numDevs;
```

Get the number of devices currently connected

```
ftStatus = FT_ListDevices(&numDevs,NULL,FT_LIST_NUMBER_ONLY);
if (ftStatus == FT_OK) {
    // FT_ListDevices OK, number of devices connected is in numDevs
}
else {
    // FT_ListDevices failed
}
```

Get serial number of first device

```
DWORD devIndex = 0; // first device
char Buffer[64]; // more than enough room!

ftStatus =
FT_ListDevices((PVOID)devIndex,Buffer,FT_LIST_BY_INDEX|FT_OPEN_BY_SERIAL_NUMBER);
if (ftStatus == FT_OK) {
    // FT_ListDevices OK, serial number is in Buffer
}
else {
    // FT_ListDevices failed
}
```

Note that indexes are zero-based. If more than one device is connected, incrementing devIndex will get the serial number of each connected device in turn.

Get device descriptions of all devices currently connected

```
char *BufPtrs[3];     // pointer to array of 3 pointers
char Buffer1[64];             // buffer for description of first device
char Buffer2[64];             // buffer for description of second device

// initialize the array of pointers
BufPtrs[0] = Buffer1;
BufPtrs[1] = Buffer2;
BufPtrs[2] = NULL;            // last entry should be NULL

ftStatus = FT_ListDevices(BufPtrs,&numDevs,FT_LIST_ALL|FT_OPEN_BY_DESCRIPTION);
if (ftStatus == FT_OK) {
    // FT_ListDevices OK, product descriptions are in Buffer1 and Buffer2, and
    // numDevs contains the number of devices connected
}
else {
    // FT_ListDevices failed
}
```

Note that this example assumes that two devices are connected. If more devices are connected, then the size of the array of pointers must be increased and more description buffers allocated.

Get locations of all devices currently connected

```
long locIdBuf[16];

ftStatus = FT_ListDevices(locIdBuf,&numDevs,FT_LIST_ALL|FT_OPEN_BY_LOCATION);
if (ftStatus == FT_OK) {
    // FT_ListDevices OK, location IDs are in locIdBuf, and
    // numDevs contains the number of devices connected
}
else {
    // FT_ListDevices failed
}
```

Note that this example assumes that no more than 16 devices are connected. If more devices are connected, then the size of the array of pointers must be increased.

2.4 FT_Open

Open the device and return a handle which will be used for subsequent accesses.

FT_STATUS **FT_Open** (int *iDevice*, FT_HANDLE **ftHandle*)

Parameters

iDevice	Must be 0 if only one device is attached. For multiple devices 1, 2 etc.
ftHandle	Pointer to a variable of type FT_HANDLE where the handle will be stored. This handle must be used to access the device.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

Although this function can be used to open multiple devices by setting *iDevice* to 0, 1, 2 etc. there is no ability to open a specific device. To open named devices, use the function FT_OpenEx 12.

Example

This sample shows how to open a device.

```
FT_HANDLE ftHandle;
FT_STATUS ftStatus;

ftStatus = FT_Open(0,&ftHandle);
if (ftStatus == FT_OK) {
    // FT_Open OK, use ftHandle to access device
}
else {
    // FT_Open failed
}
```

2.5 FT_OpenEx

Open the specified device and return a handle that will be used for subsequent accesses. The device can be specified by its serial number, device description or location.

This function can also be used to open multiple devices simultaneously. Multiple devices can be opened at the same time if they can be distinguished by serial number or device description. Alternatively, multiple devices can be opened at the same time using location IDs - location information derived from their physical locations on USB. Location IDs can be obtained using the utility USBView and are given in hexadecimal format.

FT_STATUS **FT_OpenEx** (PVOID *pvArg1*, DWORD *dwFlags*, FT_HANDLE **ftHandle*)

Parameters

pvArg1	Meaning depends on dwFlags, but it will normally be interpreted as a pointer to a null terminated string.
dwFlags	FT_OPEN_BY_SERIAL_NUMBER, FT_OPEN_BY_DESCRIPTION or FT_OPEN_BY_LOCATION.
ftHandle	Pointer to a variable of type FT_HANDLE where the handle will be stored. This handle must be used to access the device.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

The meaning of *pvArg1* depends on *dwFlags*: if *dwFlags* is *FT_OPEN_BY_SERIAL_NUMBER*, *pvArg1* is interpreted as a pointer to a null-terminated string that represents the serial number of the device; if *dwFlags* is *FT_OPEN_BY_DESCRIPTION*, *pvArg1* is interpreted as a pointer to a null-terminated string that represents the device description; if *dwFlags* is *FT_OPEN_BY_LOCATION*, *pvArg1* is interpreted as a long value that contains the location ID of the device. **Please note that Windows CE and Linux do not support location IDs**.

ftHandle is a pointer to a variable of type *FT_HANDLE* where the handle is to be stored. This handle must be used to access the device.

Examples

The examples that follow use these variables.

```
FT_STATUS ftStatus;
FT_STATUS ftStatus2;
FT_HANDLE ftHandle1;
FT_HANDLE ftHandle2;
long dwLoc;
```

Open a device with serial number "FT000001"

```
ftStatus = FT_OpenEx("FT000001",FT_OPEN_BY_SERIAL_NUMBER,&ftHandle1);
```

```
if (ftStatus == FT_OK) {
	// success - device with serial number "FT000001" is open
}
else {
	// failure
}
```

Open a device with device description "USB Serial Converter"

```
ftStatus = FT_OpenEx("USB Serial Converter",FT_OPEN_BY_DESCRIPTION,&ftHandle1);
if (ftStatus == FT_OK) {
	// success - device with device description "USB Serial Converter" is open
}
else {
	// failure
}
```

Open 2 devices with serial numbers "FT000001" and "FT999999"

```
ftStatus = FT_OpenEx("FT000001",FT_OPEN_BY_SERIAL_NUMBER,&ftHandle1);
ftStatus2 = FT_OpenEx("FT999999",FT_OPEN_BY_SERIAL_NUMBER,&ftHandle2);
if (ftStatus == FT_OK && ftStatus2 == FT_OK) {
	// success - both devices are open
}
else {
	// failure - one or both of the devices has not been opened
}
```

Open 2 devices with descriptions "USB Serial Converter" and "USB Pump Controller"

```
ftStatus = FT_OpenEx("USB Serial Converter",FT_OPEN_BY_DESCRIPTION,&ftHandle1);
ftStatus2 = FT_OpenEx("USB Pump Controller",FT_OPEN_BY_DESCRIPTION,&ftHandle2);
if (ftStatus == FT_OK && ftStatus2 == FT_OK) {
	// success - both devices are open
}
else {
	// failure - one or both of the devices has not been opened
}
```

Open a device at location 23

```
dwLoc = 0x23;
ftStatus = FT_OpenEx(dwLoc,FT_OPEN_BY_LOCATION,&ftHandle1);
if (ftStatus == FT_OK) {
	// success - device at location 23 is open
}
else {
	// failure
}
```

Open 2 devices at locations 23 and 31

```
dwLoc = 0x23;
ftStatus = FT_OpenEx(dwLoc,FT_OPEN_BY_LOCATION,&ftHandle1);
dwLoc = 0x31;
ftStatus2 = FT_OpenEx(dwLoc,FT_OPEN_BY_LOCATION,&ftHandle2);
if (ftStatus == FT_OK && ftStatus2 == FT_OK) {
	// success - both devices are open
}
else {
	// failure - one or both of the devices has not been opened
}
```

2.6 FT_Close

Close an open device.

FT_STATUS **FT_Close** (FT_HANDLE *ftHandle*)

Parameters

ftHandle	Handle of the device.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

2.7 FT_Read

Read data from the device.

FT_STATUS **FT_Read** (FT_HANDLE *ftHandle*, LPVOID *lpBuffer*, DWORD *dwBytesToRead*, LPDWORD *lpdwBytesReturned*)

Parameters

ftHandle	Handle of the device.
lpBuffer	Pointer to the buffer that receives the data from the device.
dwBytesToRead	Number of bytes to be read from the device.
lpdwBytesReturned	Pointer to a variable of type DWORD which receives the number of bytes read from the device.

Return Value

FT_OK if successful, FT_IO_ERROR otherwise.

Remarks

FT_Read always returns the number of bytes read in *lpdwBytesReturned*.

This function does not return until *dwBytesToRead* have been read into the buffer. The number of bytes in the receive queue can be determined by calling FT_GetStatus 34 or FT_GetQueueStatus 31, and passed to FT_Read 15 as *dwBytesToRead* so that the function reads the device and returns immediately.

When a read timeout value has been specified in a previous call to FT_SetTimeouts 30, FT_Read 15 returns when the timer expires or *dwBytesToRead* have been read, whichever occurs first. If the timeout occurred, FT_Read 15 reads available data into the buffer and returns *FT_OK*.

An application should use the function return value and *lpdwBytesReturned* when processing the buffer. If the return value is *FT_OK*, and *lpdwBytesReturned* is equal to *dwBytesToRead* then FT_Read 15 has completed normally. If the return value is *FT_OK*, and *lpdwBytesReturned* is less then *dwBytesToRead* then a timeout has occurred and the read has been partially completed. Note that if a timeout occurred and no data was read, the return value is still *FT_OK*.

A return value of *FT_IO_ERROR* suggests an error in the parameters of the function, or a fatal error like USB disconnect has occurred.

Example

This sample shows how to read all the data currently available.

```
FT_HANDLE ftHandle;
FT_STATUS ftStatus;
DWORD EventDWord;
DWORD TxBytes;
DWORD BytesReceived;
char RxBuffer[256];
```

```
ftStatus = FT_Open(0, &ftHandle);
if(ftStatus != FT_OK) {
        // FT_Open failed
        return;
}

FT_GetStatus(ftHandle,&RxBytes,&TxBytes,&EventDWord);
if (RxBytes > 0) {
    ftStatus = FT_Read(ftHandle,RxBuffer,RxBytes,&BytesReceived);
    if (ftStatus == FT_OK) {
        // FT_Read OK
    }
    else {
        // FT_Read Failed
    }
}

FT_Close(ftHandle);
```

This sample shows how to read with a timeout of 5 seconds.

```
FT_HANDLE ftHandle;
FT_STATUS ftStatus;
DWORD RxBytes = 10;
DWORD BytesReceived;
char RxBuffer[256];

ftStatus = FT_Open(0, &ftHandle);
if(ftStatus != FT_OK) {
        // FT_Open failed
        return;
}

FT_SetTimeouts(ftHandle,5000,0);
ftStatus = FT_Read(ftHandle,RxBuffer,RxBytes,&BytesReceived);
if (ftStatus == FT_OK) {
    if (BytesReceived == RxBytes) {
        // FT_Read OK
    }
    else {
        // FT_Read Timeout
    }
}
else {
    // FT_Read Failed
}

FT_Close(ftHandle);
```

2.8 FT_Write

Write data to the device.

FT_STATUS **FT_Write** (FT_HANDLE *ftHandle,* LPVOID *lpBuffer,* DWORD *dwBytesToWrite,* LPDWORD *lpdwBytesWritten*)

Parameters

ftHandle	Handle of the device.
lpBuffer	Pointer to the buffer that contains the data to be written to the device.
dwBytesToWrite	Number of bytes to write to the device.
lpdwBytesWritten	Pointer to a variable of type DWORD which receives the number of bytes written to the device.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

2.9 FT_ResetDevice

This function sends a reset command to the device.

FT_STATUS **FT_ResetDevice** (FT_HANDLE *ftHandle*)

Parameters

ftHandle	Handle of the device.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

2.10 FT_SetBaudRate

This function sets the Baud rate for the device.

FT_STATUS **FT_SetBaudRate** (FT_HANDLE *ftHandle*, DWORD *dwBaudRate*)

Parameters

ftHandle	Handle of the device.
dwBaudRate	Baud rate.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

2.11 FT_SetDivisor

This function sets the Baud rate for the device. It is used to set non-standard Baud rates.

FT_STATUS **FT_SetDivisor** (FT_Handle *ftHandle*, USHORT *usDivisor*)

Parameters

ftHandle	Handle of the device.
usDivisor	Divisor.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

The application note "Setting Baud rates for the FT8U232AM" is available from the Application Notes section of the FTDI website describes how to calculate the divisor for a non-standard Baud rate.

2.12 FT_SetDataCharacteristics

This function sets the data characteristics for the device.

FT_STATUS **FT_SetDataCharacteristics** (FT_HANDLE *ftHandle,* UCHAR *uWordLength,* UCHAR *uStopBits,*UCHAR *uParity*)

Parameters

ftHandle	Handle of the device.
uWordLength	Number of bits per word - must be FT_BITS_8 or FT_BITS_7.
uStopBits	Number of stop bits - must be FT_STOP_BITS_1 or FT_STOP_BITS_2.
uParity	FT_PARITY_NONE, FT_PARITY_ODD, _FT_PARITY_EVEN, FT_PARITY_MARK, FT_PARITY SPACE.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

2.13 FT_SetFlowControl

This function sets the flow control for the device.

FT_STATUS **FT_SetFlowControl** (FT_HANDLE *ftHandle,* USHORT us*FlowControl,* UCHAR u*Xon,*UCHAR u*Xoff*)

Parameters

ftHandle	Handle of the device.
usFlowControl	Must be one of FT_FLOW_NONE, FT_FLOW_RTS_CTS, FT_FLOW_DTR_DSR or FT_FLOW_XON_XOFF.
uXon	Character used to signal Xon. Only used if flow control is FT_FLOW_XON_XOFF.
uXoff	Character used to signal Xoff. Only used if flow control is FT_FLOW_XON_XOFF.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

2.14 FT_SetDtr

This function sets the Data Terminal Ready (DTR) control signal.

FT_STATUS **FT_SetDtr** (FT_HANDLE *ftHandle*)

Parameters

ftHandle	Handle of the device.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Example

This sample shows how to set DTR.

```
FT_HANDLE ftHandle;
FT_STATUS ftStatus;

ftStatus = FT_Open(0, &ftHandle);
if(ftStatus != FT_OK) {
        // FT_Open failed
        return;
}
ftStatus = FT_SetDtr(ftHandle);
if (ftStatus == FT_OK) {
    // FT_SetDtr OK
}
else {
    // FT_SetDtr failed
}

FT_Close(ftHandle);
```

2.15 FT_ClrDtr

This function clears the Data Terminal Ready (DTR) control signal.

FT_STATUS **FT_ClrDtr** (FT_HANDLE *ftHandle*)

Parameters

ftHandle	Handle of the device.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Example

This sample shows how to clear DTR.

```
FT_HANDLE ftHandle;
FT_STATUS ftStatus;

ftStatus = FT_Open(0, &ftHandle);
if(ftStatus != FT_OK) {
        // FT_Open failed
        return;
}

ftStatus = FT_ClrDtr(ftHandle);
if (ftStatus == FT_OK) {
    // FT_ClrDtr OK
}
else {
    // FT_ClrDtr failed
}

FT_Close(ftHandle);
```

2.16 FT_SetRts

This function sets the Request To Send (RTS) control signal.

FT_STATUS **FT_SetRts** (FT_HANDLE *ftHandle*)

Parameters

ftHandle	Handle of the device.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Example

This sample shows how to set RTS.

```
FT_HANDLE ftHandle;
FT_STATUS ftStatus;

ftStatus = FT_Open(0, &ftHandle);
if(ftStatus != FT_OK) {
        // FT_Open failed
        return;
}

ftStatus = FT_SetRts(ftHandle);
if (ftStatus == FT_OK) {
    // FT_SetRts OK
}
else {
    // FT_SetRts failed
}

FT_Close(ftHandle);
```

2.17 FT_ClrRts

This function clears the Request To Send (RTS) control signal.

FT_STATUS **FT_ClrRts** (FT_HANDLE *ftHandle*)

Parameters

ftHandle	Handle of the device.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Example

This sample shows how to clear RTS.

```
FT_HANDLE ftHandle;
FT_STATUS ftStatus;

ftStatus = FT_Open(0, &ftHandle);
if(ftStatus != FT_OK) {
        // FT_Open failed
        return;
}

ftStatus = FT_ClrRts(ftHandle);
if (ftStatus == FT_OK) {
    // FT_ClrRts OK
}
else {
    // FT_ClrRts failed
}

FT_Close(ftHandle);
```

2.18 FT_GetModemStatus

Gets the modem status from the device.

FT_STATUS **FT_GetModemStatus** (FT_HANDLE *ftHandle,* LPDWORD *lpdwModemStatus*)

Parameters

ftHandle	Handle of the device.
lpdwModemStatus	Pointer to a variable of type DWORD which receives the modem status from the device. Status lines are bit-mapped as follows: CTS = 0x10 DSR = 0x20 RI = 0x40 DCD = 0x80

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

2.19 FT_SetChars

This function sets the special characters for the device.

FT_STATUS **FT_SetChars** (FT_HANDLE *ftHandle,* UCHAR *uEventCh,* UCHAR *uEventChEn,* UCHAR *uErrorCh,* UCHAR *uErrorChEn*)

Parameters

ftHandle	Handle of the device.
uEventCh	Event character.
uEventChEn	0 if event character disabled, non-zero otherwise.
uErrorCh	Error character.
uErrorChEn	0 if error character disabled, non-zero otherwise.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

2.20 FT_Purge

This function purges receive and transmit buffers in the device.

FT_STATUS **FT_Purge** (FT_HANDLE *ftHandle,* DWORD *dwMask*)

Parameters

ftHandle	Handle of the device.
dwMask	Any combination of FT_PURGE_RX and FT_PURGE_TX.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

2.21 FT_SetTimeouts

This function sets the read and write timeouts for the device.

FT_STATUS **FT_SetTimeouts** (FT_HANDLE *ftHandle,* DWORD *dwReadTimeout,* DWORD *dwWriteTimeout*)

Parameters

ftHandle	Handle of the device.
dwReadTimeout	Read timeout in milliseconds.
dwWriteTimeout	Write timeout in milliseconds.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Example

This sample shows how to set a read timeout of 5 seconds and a write timeout of 1 second.

```
FT_HANDLE ftHandle;
FT_STATUS ftStatus;

ftStatus = FT_Open(0, &ftHandle);
if(ftStatus != FT_OK) {
        // FT_Open failed
        return;
}
ftStatus = FT_SetTimeouts(ftHandle,5000,1000);
if (ftStatus == FT_OK) {
    // FT_SetTimeouts OK
}
else {
    // FT_SetTimeouts failed
}

FT_Close(ftHandle);
```

2.22 FT_GetQueueStatus

Gets the number of characters in the receive queue.

FT_STATUS **FT_GetQueueStatus** (FT_HANDLE *ftHandle*, LPDWORD *lpdwAmountInRxQueue*)

Parameters

ftHandle	Handle of the device.
lpdwAmountInRxQueue	Pointer to a variable of type DWORD which receives the number of characters in the receive queue.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

2.23 FT_SetBreakOn

Sets the BREAK condition for the device.

FT_STATUS **FT_SetBreakOn** (FT_HANDLE *ftHandle*)

Parameters

ftHandle	Handle of the device.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Example

This sample shows how to set the BREAK condition for the device.

```
FT_HANDLE ftHandle;
FT_STATUS ftStatus;

ftStatus = FT_Open(0, &ftHandle);
if(ftStatus != FT_OK) {
        // FT_Open failed
        return;
}

ftStatus = FT_SetBreakOn(ftHandle);
if (ftStatus == FT_OK) {
    // FT_SetBreakOn OK
}
else {
    // FT_SetBreakOn failed
}

FT_Close(ftHandle);
```

2.24 FT_SetBreakOff

Resets the BREAK condition for the device.

FT_STATUS **FT_SetBreakOff** (FT_HANDLE *ftHandle*)

Parameters

ftHandle	Handle of the device.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Example

This sample shows how to reset the BREAK condition for the device.

```
FT_HANDLE ftHandle;
FT_STATUS ftStatus;

ftStatus = FT_Open(0, &ftHandle);
if(ftStatus != FT_OK) {
        // FT_Open failed
        return;
}

ftStatus = FT_SetBreakOff(ftHandle);
if (ftStatus == FT_OK) {
    // FT_SetBreakOff OK
}
else {
    // FT_SetBreakOff failed
}

FT_Close(ftHandle);
```

2.25 FT_GetStatus

Gets the device status including number of characters in the receive queue, number of characters in the transmit queue, and the current event status.

FT_STATUS **FT_GetStatus** (FT_HANDLE *ftHandle,* LPDWORD *lpdwAmountInRxQueue*, LPDWORD *lpdwAmountInTxQueue*, LPDWORD *lpdwEventStatus*)

Parameters

ftHandle	Handle of the device.
lpdwAmountInRxQueue	Pointer to a variable of type DWORD which receives the number of characters in the receive queue.
lpdwAmountInTxQueue	Pointer to a variable of type DWORD which receives the number of characters in the transmit queue.
lpdwEventStatus	Pointer to a variable of type DWORD which receives the current state of the event status.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

For an example of how to use this function, see the sample code in FT_SetEventNotification 35.

2.26 FT_SetEventNotification

Sets conditions for event notification.

FT_STATUS **FT_SetEventNotification** (FT_HANDLE *ftHandle,* DWORD *dwEventMask,* PVOID *pvArg*)

Parameters

ftHandle	Handle of the device.
dwEventMask	Conditions that cause the event to be set.
pvArg	Interpreted as the handle of an event.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

An application can use this function to setup conditions which allow a thread to block until one of the conditions is met. Typically, an application will create an event, call this function, then block on the event. When the conditions are met, the event is set, and the application thread unblocked.

dwEventMask is a bit-map that describes the events the application is interested in. *pvArg* is interpreted as the handle of an event which has been created by the application. If one of the event conditions is met, the event is set.

If *FT_EVENT_RXCHAR* is set in *dwEventMask*, the event will be set when a character has been received by the device. If *FT_EVENT_MODEM_STATUS* is set in *dwEventMask*, the event will be set when a change in the modem signals has been detected by the device.

Windows and Windows CE Example

This example shows how to wait for a character to be received or a change in modem status.

First, create the event and call **FT_SetEventNotification**.

```
FT_HANDLE ftHandle; // handle of an open device
FT_STATUS ftStatus;
HANDLE hEvent;
DWORD EventMask;

hEvent = CreateEvent(
                     NULL,
                     false, // auto-reset event
                     false, // non-signalled state
                     ""
                     );
EventMask = FT_EVENT_RXCHAR | FT_EVENT_MODEM_STATUS;
ftStatus = FT_SetEventNotification(ftHandle,EventMask,hEvent);
```

Sometime later, block the application thread by waiting on the event, then when the event has occurred, determine the condition that caused the event, and process it accordingly.

```
WaitForSingleObject(hEvent,INFINITE);

DWORD EventDWord;
DWORD RxBytes;
DWORD TxBytes;

FT_GetStatus(ftHandle,&RxBytes,&TxBytes,&EventDWord);
if (EventDWord & FT_EVENT_MODEM_STATUS) {
    // modem status event detected, so get current modem status
    FT_GetModemStatus(ftHandle,&Status);
    if (Status & 0x00000010) {
                // CTS is high
    }
    else {
                // CTS is low
    }
    if (Status & 0x00000020) {
                // DSR is high
    }
    else {
                // DSR is low
    }
}
if (RxBytes > 0) {
    // call FT_Read() to get received data from device
}
```

Linux Example

This example shows how to wait for a character to be received or a change in modem status.

First, create the event and call **FT_SetEventNotification**.

```
FT_HANDLE ftHandle;
FT_STATUS ftStatus;
EVENT_HANDLE eh;
DWORD EventMask;

ftStatus = FT_Open(0, &ftHandle);
if(ftStatus != FT_OK) {
        // FT_Open failed
        return;
}

pthread_mutex_init(&eh.eMutex, NULL);
pthread_cond_init(&eh.eCondVar, NULL);

EventMask = FT_EVENT_RXCHAR | FT_EVENT_MODEM_STATUS;
ftStatus = FT_SetEventNotification(ftHandle, EventMask, (PVOID)&eh);
```

Sometime later, block the application thread by waiting on the event, then when the event has occurred, determine the condition that caused the event, and process it accordingly.

```
pthread_mutex_lock(&eh.eMutex);
pthread_cond_wait(&eh.eCondVar, &eh.eMutex);
pthread_mutex_unlock(&eh.eMutex);

DWORD EventDWord;
DWORD RxBytes;
DWORD TxBytes;
DWORD Status;
FT_GetStatus(ftHandle,&RxBytes,&TxBytes,&EventDWord);
if (EventDWord & FT_EVENT_MODEM_STATUS) {
    // modem status event detected, so get current modem status
    FT_GetModemStatus(ftHandle,&Status);
    if (Status & 0x00000010) {
                // CTS is high
    }
    else {
```

```
                    // CTS is low
        }
        if (Status & 0x00000020) {
                    // DSR is high
        }
        else {
                    // DSR is low
        }
    }
    if (RxBytes > 0) {
        // call FT_Read() to get received data from device
    }

    FT_Close(ftHandle);
```

2.27 FT_IoCtl

Undocumented function.

FT_STATUS **FT_IoCtl** (FT_HANDLE *ftHandle*, DWORD *dwIoControlCode*, LPVOID *lpInBuf*, DWORD *nInBufSize*, LPVOID *lpOutBuf*, DWORD *nOutBufSize*, LPDWORD *lpBytesReturned*, LPOVERLAPPED *lpOverlapped*)

2.28 FT_SetWaitMask

Undocumented function.

FT_STATUS **FT_SetWaitMask** (FT_HANDLE *ftHandle*, DWORD *dwMask*)

2.29 FT_WaitOnMask

Undocumented function.

FT_STATUS **FT_WaitOnMask** (FT_HANDLE *ftHandle*, DWORD *dwMask*)

2.30 FT_GetDeviceInfo

Get device information.

FT_STATUS **FT_GetDeviceInfo** (FT_HANDLE ft*Handle*, FT_DEVICE **pftType,* LPDWORD *lpdwID*, PCHAR *pcSerialNumber*, PCHAR *pcDescription*, PVOID *pvDummy*)

Parameters

ftHandle	Handle of the device.
pftType	Pointer to unsigned long to store device type.
lpdwId	Pointer to unsigned long to store device ID.
pcSerialNumber	Pointer to buffer to store device serial number as a null-terminated string.
pcDescription	Pointer to buffer to store device description as a null-terminated string.
pvDummy	Reserved for future use - should be set to NULL.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

This function is used to return the device type, device ID, device description and serial number.

The device ID is encoded in a DWORD - the most significant word contains the vendor ID, and the least significant word contains the product ID. So the returned ID 0x04036001 corresponds to the device ID VID_0403&PID_6001.

Example

This example shows how to get information about a device.

```
FT_HANDLE ftHandle;
FT_DEVICE ftDevice;
FT_STATUS ftStatus;
DWORD deviceID;
char SerialNumber[16];
char Description[64];

ftStatus = FT_Open(0, &ftHandle);
if(ftStatus != FT_OK) {
        // FT_Open failed
        return;
}

ftStatus = FT_GetDeviceInfo(
                        ftHandle,
                        &ftDevice,
                        &deviceID,
                        SerialNumber,
                        Description,
```

```
                        NULL
                        );

if (ftStatus == FT_OK) {
                if (ftDevice == FT_DEVICE_2232C)
                        ; // device is FT2232C
                else if (ftDevice == FT_DEVICE_BM)
                        ; // device is FTU232BM
                else if (ftDevice == FT_DEVICE_AM)
                        ; // device is FT8U232AM
                else
                        ; // unknown device (this should not happen!)
                // deviceID contains encoded device ID
                // SerialNumber, Description contain 0-terminated strings
}
else {
                // FT_GetDeviceType FAILED!
}

FT_Close(ftHandle);
```

2.31 FT_SetResetPipeRetryCount

Set the ResetPipeRetryCount.

FT_STATUS **FT_SetResetPipeRetryCount** (FT_HANDLE ft*Handle*, DWORD *dwCount*)

Parameters

ftHandle	Handle of the device.
dwCount	Unsigned long containing required ResetPipeRetryCount.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

This function is used to set the ResetPipeRetryCount. ResetPipeRetryCount controls the maximum number of times that the driver tries to reset a pipe on which an error has occurred. ResetPipeRequestRetryCount defaults to 50. It may be necessary to increase this value in noisy environments where a lot of USB errors occur.

Not available in Linux.

Example

This example shows how to set the ResetPipeRetryCount to 100.

```
FT_HANDLE ftHandle;    // valid handle returned from FT_OpenEx
FT_STATUS ftStatus;
DWORD dwRetryCount;

dwRetryCount = 100;
ftStatus = FT_SetResetPipeRetryCount(ftHandle,dwRetryCount);
if (ftStatus == FT_OK) {
        // ResetPipeRetryCount set to 100
}
else {
        // FT_SetResetPipeRetryCount FAILED!
}
```

2.32 FT_StopInTask

Stops the driver's IN task.

FT_STATUS **FT_StopInTask** (FT_HANDLE ft*Handle*)

Parameters

ftHandle	Handle of the device.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

This function is used to put the driver's IN task (read) into a wait state. It can be used in situations where data is being received continuously, so that the device can be purged without more data being received. It is used together with FT_RestartInTask 45 which sets the IN task running again.

Example

This example shows how to use FT_StopInTask.

```
FT_HANDLE ftHandle;
FT_STATUS ftStatus;

ftStatus = FT_Open(0, &ftHandle);
if(ftStatus != FT_OK) {
        // FT_Open failed
        return;
}

do {
        ftStatus = FT_StopInTask(ftHandle);
} while (ftStatus != FT_OK);

//
// Do something - for example purge device
//

do {
        ftStatus = FT_RestartInTask(ftHandle);
} while (ftStatus != FT_OK);

FT_Close(ftHandle);
```

2.33 FT_RestartInTask

Restart the driver's IN task.

FT_STATUS **FT_RestartInTask** (FT_HANDLE ft*Handle*)

Parameters

ftHandle	Handle of the device.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

This function is used to restart the driver's IN task (read) after it has been stopped by a call to FT_StopInTask 44.

Example

This example shows how to use FT_RestartInTask.

```
FT_HANDLE ftHandle;
FT_STATUS ftStatus;

ftStatus = FT_Open(0, &ftHandle);
if(ftStatus != FT_OK) {
        // FT_Open failed
        return;
}

do {
        ftStatus = FT_StopInTask(ftHandle);
} while (ftStatus != FT_OK);

//
// Do something - for example purge device
//

do {
        ftStatus = FT_RestartInTask(ftHandle);
} while (ftStatus != FT_OK);

FT_Close(ftHandle);
```

2.34 FT_ResetPort

Send a reset command to the port.

FT_STATUS **FT_ResetPort** (FT_HANDLE ft*Handle*)

Parameters

ftHandle	Handle of the device.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

This function is used to attempt to recover the port after a failure. It is not equivalent to an unplug-replug event.

Not available in Windows CE and Linux.

Example

This example shows how to reset the port.

```
FT_HANDLE ftHandle;    // valid handle returned from FT_OpenEx
FT_STATUS ftStatus;

ftStatus = FT_ResetPort(ftHandle);
if (ftStatus == FT_OK) {
        // Port has been reset
}
else {
        // FT_ResetPort FAILED!
}
```

2.35 FT_CyclePort

Send a cycle command to the USB port.

FT_STATUS **FT_CyclePort** (FT_HANDLE *ftHandle*)

Parameters

ftHandle	Handle of the device.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

The effect of this function is the same as disconnecting then reconnecting the device from USB. Possible use of this function is in situations where a fatal error has occurred and it is difficult, or not possible, to recover without unplugging and replugging the USB cable. This function can also be used after re-programming the EEPROM to force the FTDI device to read the new EEPROM contents which previously required a physical disconnect-reconnect.

As the current session is not restored when the driver is reloaded, the application must be able to recover after calling this function.

Not available in Windows 98, Windows CE and Linux.

For FT2232C devices, FT_CyclePort will only work under Windows XP.

Example

This example shows how to cycle the port.

```
FT_HANDLE ftHandle;    // valid handle returned from FT_OpenEx
FT_STATUS ftStatus;

ftStatus = FT_CyclePort(ftHandle);
if (ftStatus == FT_OK) {
        // Port has been cycled.
}
else {
        // FT_CyclePort FAILED!
}
```

2.36 FT_CreateDeviceInfoList

This function builds a device information list and returns the number of D2XX devices connected to the system. The list contains information about both unopen and open devices.

FT_STATUS **FT_CreateDeviceInfoList** (LPDWORD *lpdwNumDevs*)

Parameters

lpdwNumDevs	Pointer to unsigned long to store the number of devices connected.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

An application can use this function to get the number of devices attached to the system. It can then allocate space for the device information list and retrieve the list using FT_GetDeviceInfoList 49.

If the devices connected to the system change, the device info list will not be updated until FT_CreateDeviceInfoList 48 is called again.

Example

This example shows how to call FT_CreateDeviceInfoList.

```
FT_STATUS ftStatus;
DWORD numDevs;

//
// create the device information list
//
ftStatus = FT_CreateDeviceInfoList(&numDevs);
if (ftStatus == FT_OK) {
        printf("Number of devices is %d\n",numDevs);
}
else {
        // FT_CreateDeviceInfoList failed
}
```

2.37 FT_GetDeviceInfoList

This function returns a device information list and the number of D2XX devices in the list.

FT_STATUS **FT_GetDeviceInfo** (FT_DEVICE_LIST_INFO_NODE **pDest*, LPDWORD *lpdwNumDevs*)

Parameters

**pDest*	Pointer to an array of FT_DEVICE_LIST_INFO_NODE structures.
lpdwNumDevs	Pointer to the number of elements in the array.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

This function should only be called after calling FT_CreateDeviceInfoList 48. If the devices connected to the system change, the device info list will not be updated until FT_CreateDeviceInfoList 48 is called again.

Location ID information is not returned for devices that are open when FT_CreateDeviceInfoList 48 is called.

The array of FT_DEVICE_LIST_INFO_NODES contains all available data on each device. The structure of FT_DEVICE_LIST_INFO_NODES is given in the Appendix 102. The storage for the list must be allocated by the application. The number of devices returned by FT_CreateDeviceInfoList 48 can be used to do this.

When programming in Visual Basic, LabVIEW or similar languages, FT_GetDeviceInfoDetail 51 may be required instead of this function.

Please note that Windows CE and Linux do not support location IDs. As such, the Location ID parameter in the structure will be empty under Windows CE and Linux.

Example

This example shows how to call FT_GetDeviceInfoList.

```
FT_STATUS ftStatus;
FT_DEVICE_LIST_INFO_NODE *devInfo;
DWORD numDevs;

//
// create the device information list
//
ftStatus = FT_CreateDeviceInfoList(&numDevs);
if (ftStatus == FT_OK) {
        printf("Number of devices is %d\n",numDevs);
}

//
```

```
// allocate storage for list based on numDevs
//
devInfo = (FT_DEVICE_LIST_INFO_NODE*)malloc(sizeof(FT_DEVICE_LIST_INFO_NODE)*numDevs);

//
// get the device information list
//
ftStatus = FT_GetDeviceInfoList(devInfo,&numDevs);
if (ftStatus == FT_OK) {
    for (int i = 0; i < numDevs; i++) {
        printf("Dev %d:\n",i);
               printf("  Flags=0x%x\n",devInfo[i].Flags);
               printf("  Type=0x%x\n",devInfo[i].Type);
               printf("  ID=0x%x\n",devInfo[i].ID);
               printf("  LocId=0x%x\n",devInfo[i].LocId);
               printf("  SerialNumber=%s\n",devInfo[i].SerialNumber);
               printf("  Description=%s\n",devInfo[i].Description);
               printf("  ftHandle=0x%x\n",devInfo[i].ftHandle);
        }
}
```

2.38 FT_GetDeviceInfoDetail

This function returns an entry from the device information list.

FT_STATUS **FT_GetDeviceInfoDetail** (DWORD *dwIndex*, LPDWORD *lpdwFlags*, LPDWORD *lpdwType*, LPDWORD *lpdwID*, LPDWORD *lpdwLocId*, PCHAR *pcSerialNumber*, PCHAR *pcDescription*, FT_HANDLE **ftHandle*)

Parameters

dwIndex	Index of the entry in the device info list.
lpdwFlags	Pointer to unsigned long to store the flag value.
lpdwType	Pointer to unsigned long to store device type.
lpdwID	Pointer to unsigned long to store device ID.
lpdwLocId	Pointer to unsigned long to store the device location ID.
pcSerialNumber	Pointer to buffer to store device serial number as a null-terminated string.
pcDescription	Pointer to buffer to store device description as a null-terminated string.
**ftHandle*	Pointer to a variable of type FT_HANDLE where the handle will be stored.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

This function should only be called after calling FT_CreateDeviceInfoList 48. If the devices connected to the system change, the device info list will not be updated until FT_CreateDeviceInfoList 48 is called again.

The index value is zero-based.

The flag value is a 4-byte bit map containing miscellaneous data. Bit 0 (least significant bit) of this number indicates if the port is open (1) or closed (0). The remaining bits (1 - 31) are reserved at this time.

Location ID information is not returned for devices that are open when FT_CreateDeviceInfoList 48 is called.

To return the whole device info list as an array of FT_DEVICE_LIST_INFO_NODE structures, use FT_GetDeviceInfoList 49.

Please note that Windows CE and Linux do not support location IDs. As such, the Location ID parameter in the structure will be empty under Windows CE and Linux.

Example

This example shows how to call FT_GetDeviceInfoDetail.

```
FT_STATUS ftStatus;
FT_HANDLE ftHandleTemp;
DWORD numDevs;
DWORD Flags;
DWORD ID;
DWORD Type;
DWORD LocId;
char SerialNumber[16];
char Description[64];

//
// create the device information list
//
ftStatus = FT_CreateDeviceInfoList(&numDevs);
if (ftStatus == FT_OK) {
        printf("Number of devices is %d\n",numDevs);
}

//
// get information for device 0
//
ftStatus = FT_GetDeviceInfoDetail(0, &Flags, &Type, &ID, &LocId, SerialNumber,
Description, &ftHandleTemp);
if (ftStatus == FT_OK) {
        printf("Dev 0:\n");
        printf("  Flags=0x%x\n",Flags);
        printf("  Type=0x%x\n",Type);
        printf("  ID=0x%x\n",ID);
        printf("  LocId=0x%x\n",LocId);
        printf("  SerialNumber=%s\n",SerialNumber);
        printf("  Description=%s\n",Description);
        printf("  ftHandle=0x%x\n",ftHandleTemp);
}
```

2.39 FT_GetDriverVersion

This function returns the D2XX driver version number.

FT_STATUS **FT_GetDriverVersion** (FT_HANDLE *ftHandle*, LPDWORD *lpdwDriverVersion*)

Parameters

ftHandle	Handle of the device.
lpdwDriverVersion	Pointer to the driver version number.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

A version number consists of major, minor and build version numbers contained in a 4-byte field (unsigned long). Byte0 (least significant) holds the build version, Byte1 holds the minor version, and Byte2 holds the major version. Byte3 is currently set to zero.

For example, driver version "3.01.02" is represented as 0x00030102. Note that a device has to be opened before this function can be called.

Not available in Windows CE or Linux.

Example

This example shows how to call FT_GetDriverVersion.

```
FT_HANDLE ftHandle;
FT_STATUS status;
DWORD dwDriverVer;

//
// Get driver version
//

status = FT_Open(0,&ftHandle);
if (status == FT_OK) {
        status = FT_GetDriverVersion(ftHandle,&dwDriverVer);
        if (status == FT_OK)
                printf("Driver version = 0x%x\n",dwDriverVer);
        else
                printf("error reading driver version\n");
                FT_Close(ftHandle);
}
```

2.40 FT_GetLibraryVersion

This function returns D2XX DLL version number.

FT_STATUS **FT_GetLibraryVersion** (LPDWORD *lpdwDLLVersion*)

Parameters

lpdwDLLVersion	Pointer to the DLL version number.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

A version number consists of major, minor and build version numbers contained in a 4-byte field (unsigned long). Byte0 (least significant) holds the build version, Byte1 holds the minor version, and Byte2 holds the major version. Byte3 is currently set to zero.

For example, driver version "3.01.02" is represented as 0x00030102. Note that this function does not take a handle, and so it can be called without opening a device.

Not available in Windows CE or Linux.

Example

This example shows how to call FT_GetLibraryVersion.

```
FT_STATUS status;
DWORD dwLibraryVer;

//
// Get DLL version
//

status = FT_GetLibraryVersion(&dwLibraryVer);
if (status == FT_OK)
        printf("Library version = 0x%x\n",dwLibraryVer);
else
        printf("error reading library version\n");
```

3 EEPROM Programming Interface Functions

Introduction

FTDI has included EEPROM programming support in the D2XX library. This section describes that interface.

Overview

Functions are provided to program the EEPROM (FT_EE_Program 62, FT_EE_ProgramEx 64, FT_WriteEE 57), read the EEPROM (FT_EE_Read 59, FT_EE_ReadEx 61, FT_ReadEE 56) and erase the EEPROM (FT_EraseEE 58).

Unused space in the EEPROM is called the User Area (EEUA). Functions are provided to access the EEUA. FT_EE_UASize 67 gets it's size, FT_EE_UAWrite 66 writes data into it and FT_EE_UARead 65 is used to read it's contents.

Reference

Type definitions 102 of the functional parameters and return codes used in the D2XX EEPROM programming interface are contained in the appendix 101.

3.1 FT_ReadEE

Read a value from an EEPROM location.

FT_STATUS **FT_ReadEE** (FT_HANDLE *ftHandle*, DWORD *dwWordOffset*, LPWORD *lpwValue*)

Parameters

ftHandle	Handle of the device.
dwWordOffset	EEPROM location to read from.
lpwValue	Pointer to the value read from the EEPROM.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

3.2 FT_WriteEE

Write a value to an EEPROM location.

FT_STATUS **FT_WriteEE** (FT_HANDLE *ftHandle*, DWORD *dwWordOffset*, WORD *wValue*)

Parameters

ftHandle	Handle of the device.
dwWordOffset	EEPROM location to write to.
wValue	Value to write to EEPROM.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

3.3 FT_EraseEE

Erase the EEPROM.

FT_STATUS **FT_EraseEE** (FT_HANDLE *ftHandle*)

Parameters

ftHandle	Handle of the device.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

This function will erase the entire contents of an EEPROM, including the user area.

3.4 FT_EE_Read

Read the contents of the EEPROM.

FT_STATUS **FT_EE_Read** (FT_HANDLE *ftHandle*, PFT_PROGRAM_DATA *pData*)

Parameters

ftHandle	Handle of the device.
pData	Pointer to structure of type FT_PROGRAM_DATA.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

This function interprets the parameter *pData* as a pointer to a struct of type *FT_PROGRAM_DATA* that contains storage for the data to be read from the EEPROM.

The function does not perform any checks on buffer sizes, so the buffers passed in the *FT_PROGRAM_DATA* struct must be big enough to accommodate their respective strings (including null terminators). The sizes shown in the following example are more than adequate and can be rounded down if necessary. The restriction is that the Manufacturer string length plus the Description string length is less than or equal to 40 characters.

Note that the DLL must be informed which version of the *FT_PROGRAM_DATA* structure is being used. This is done through the *Signature1*, *Signature2* and *Version* elements of the structure. *Signature1* should always be *0x00000000*, *Signature2* should always be *0xFFFFFFFF* and *Version* can be set to use whichever version is required. For compatibility with all current devices *Version* should be set to the latest version of the *FT_PROGRAM_DATA* structure which is defined in FTD2XX.h 108.

Example

```
FT_HANDLE ftHandle;
FT_STATUS ftStatus = FT_Open(0, &ftHandle);
if (ftStatus != FT_OK) {
    // FT_Open FAILED!
}

FT_PROGRAM_DATA ftData;
char ManufacturerBuf[32];
char ManufacturerIdBuf[16];
char DescriptionBuf[64];
char SerialNumberBuf[16];

ftData.Signature1 = 0x00000000;
ftData.Signature2 = 0xffffffff;
ftData.Version = 0x00000002;          // EEPROM structure with FT232R extensions
ftData.Manufacturer = ManufacturerBuf;
ftData.ManufacturerId = ManufacturerIdBuf;
ftData.Description = DescriptionBuf;
ftData.SerialNumber = SerialNumberBuf;
```

```
ftStatus = FT_EE_Read(ftHandle, &ftData);
if (ftStatus == FT_OK) {
    // FT_EE_Read OK, data is available in ftData
}
else {
    // FT_EE_Read FAILED!
}
```

3.5 FT_EE_ReadEx

Read the contents of the EEPROM and pass strings separately.

FT_STATUS **FT_EE_ReadEx** (FT_HANDLE *ftHandle*, PFT_PROGRAM_DATA *pData*, char **Manufacturer*, char **ManufacturerId*, char **Description*, char **SerialNumber*)

Parameters

ftHandle	Handle of the device.
pData	Pointer to a structure of type FT_PROGRAM_DATA.
**Manufacturer*	Pointer to a null-terminated string containing the manufacturer name.
**ManufacturerID*	Pointer to a null-terminated string containing the manufacturer ID.
**Description*	Pointer to a null-terminated string containing the device description.
**SerialNumber*	Pointer to a null-terminated string containing the device serial number.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

This variation of the standard FT_EE_Read 59 function was included to provide support for languages such as LabVIEW where problems can occur when string pointers are contained in a structure.

This function interprets the parameter *pData* as a pointer to a struct of type *FT_PROGRAM_DATA* that contains storage for the data to be read from the EEPROM.

The function does not perform any checks on buffer sizes, so the buffers passed in the *FT_PROGRAM_DATA* structure must be big enough to accommodate their respective strings (including null terminators). The sizes shown in the following example are more than adequate and can be rounded down if necessary. The restriction is that the Manufacturer string length plus the Description string length is less than or equal to 40 characters.

Note that the DLL must be informed which version of the *FT_PROGRAM_DATA* structure is being used. This is done through the *Signature1*, *Signature2* and *Version* elements of the structure. *Signature1* should always be *0x00000000*, *Signature2* should always be *0xFFFFFFFF* and *Version* can be set to use whichever version is required. For compatibility with all current devices *Version* should be set to the latest version of the *FT_PROGRAM_DATA* structure which is defined in FTD2XX.h 108.

The string parameters in the *FT_PROGRAM_DATA* structure should be passed as DWORDs to avoid overlapping of parameters. All string pointers are passed out separately from the *FT_PROGRAM_DATA* structure.

3.6 FT_EE_Program

Program the EEPROM.

FT_STATUS **FT_EE_Program** (FT_HANDLE *ftHandle*, PFT_PROGRAM_DATA *pData*)

Parameters

ftHandle	Handle of the device.
pData	Pointer to structure of type FT_PROGRAM_DATA.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

This function interprets the parameter *pData* as a pointer to a struct of type FT_PROGRAM_DATA that contains the data to write to the EEPROM. The data is written to EEPROM, then read back and verified.

If the SerialNumber field in FT_PROGRAM_DATA is NULL, or SerialNumber points to a NULL string, a serial number based on the ManufacturerId and the current date and time will be generated.

Note that the DLL must be informed which version of the *FT_PROGRAM_DATA* structure is being used. This is done through the *Signature1*, *Signature2* and *Version* elements of the structure. *Signature1* should always be *0x00000000*, *Signature2* should always be *0xFFFFFFFF* and *Version* can be set to use whichever version is required. For compatibility with all current devices *Version* should be set to the latest version of the *FT_PROGRAM_DATA* structure which is defined in FTD2XX.h 108.

If *pData* is NULL, the structure version will default to 0 (original BM series) and the device will be programmed with the default data:
{0x0403, 0x6001, "FTDI", "FT", "USB HS Serial Converter", "", 44, 1, 0, 1, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, 0}

Example

```
// Version 2 structure for programming a BM device.
// Other elements would need non-zero values for FT2232C, FT232R or FT245R devices.

FT_PROGRAM_DATA ftData = {
        0x00000000,                     // Header - must be 0x00000000
        0xFFFFFFFF,                     // Header - must be 0xffffffff
        0x00000002,                     // Header - FT_PROGRAM_DATA version
        0x0403,                         // VID
        0x6001,                         // PID
        "FTDI",                         // Manufacturer
        "FT",                           // Manufacturer ID
        "USB HS Serial Converter",      // Description
        "FT000001",                     // Serial Number
        44,                             // MaxPower
        1,                              // PnP
```

```
            0,                              // SelfPowered
            1,                              // RemoteWakeup
            1,                              // non-zero if Rev4 chip, zero otherwise
            0,                              // non-zero if in endpoint is isochronous
            0,                              // non-zero if out endpoint is isochronous
            0,                              // non-zero if pull down enabled
            1,                              // non-zero if serial number to be used
            0,                              // non-zero if chip uses USBVersion
            0x0110                          // BCD (0x0200 => USB2)
            //
            // FT2232C extensions (Enabled if Version = 1 or Version = 2)
            //
            0,                              // non-zero if Rev5 chip, zero otherwise
            0,                              // non-zero if in endpoint is isochronous
            0,                              // non-zero if in endpoint is isochronous
            0,                              // non-zero if out endpoint is isochronous
            0,                              // non-zero if out endpoint is isochronous
            0,                              // non-zero if pull down enabled
            0,                              // non-zero if serial number to be used
            0,                              // non-zero if chip uses USBVersion
            0x0,                            // BCD (0x0200 => USB2)
            0,                              // non-zero if interface is high current
            0,                              // non-zero if interface is high current
            0,                              // non-zero if interface is 245 FIFO
            0,                              // non-zero if interface is 245 FIFO CPU target
            0,                              // non-zero if interface is Fast serial
            0,                              // non-zero if interface is to use VCP drivers
            0,                              // non-zero if interface is 245 FIFO
            0,                              // non-zero if interface is 245 FIFO CPU target
            0,                              // non-zero if interface is Fast serial
            0,                              // non-zero if interface is to use VCP drivers
            //
            // FT232R extensions (Enabled if Version = 2)
            //
            0,                              // Use External Oscillator
            0,                              // High Drive I/Os
            0,                              // Endpoint size
            0,                              // non-zero if pull down enabled
            0,                              // non-zero if serial number to be used
            0,                              // non-zero if invert TXD
            0,                              // non-zero if invert RXD
            0,                              // non-zero if invert RTS
            0,                              // non-zero if invert CTS
            0,                              // non-zero if invert DTR
            0,                              // non-zero if invert DSR
            0,                              // non-zero if invert DCD
            0,                              // non-zero if invert RI
            0,                              // Cbus Mux control
            0,                              // Cbus Mux control
            0,                              // Cbus Mux control
            0,                              // Cbus Mux control
            0,                              // Cbus Mux control
            0                               // non-zero if using D2XX drivers
    };
    FT_HANDLE ftHandle;

    FT_STATUS ftStatus = FT_Open(0, &ftHandle);
    if (ftStatus == FT_OK) {
        ftStatus = FT_EE_Program(ftHandle, &ftData);
        if (ftStatus == FT_OK) {
            // FT_EE_Program OK!
        }
        else {
            // FT_EE_Program FAILED!
            }
    }
```

3.7 FT_EE_ProgramEx

Program the EEPROM and pass strings separately.

FT_STATUS **FT_EE_ProgramEx** (FT_HANDLE *ftHandle*, PFT_PROGRAM_DATA *pData*, char **Manufacturer*, char **ManufacturerId*, char **Description*, char **SerialNumber*)

Parameters

ftHandle	Handle of the device.
pData	Pointer to a structure of type FT_PROGRAM_DATA.
**Manufacturer*	Pointer to a null-terminated string containing the manufacturer name.
**ManufacturerID*	Pointer to a null-terminated string containing the manufacturer ID.
**Description*	Pointer to a null-terminated string containing the device description.
**SerialNumber*	Pointer to a null-terminated string containing the device serial number.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

This variation of the FT_EE_Program 62 function was included to provide support for languages such as LabVIEW where problems can occur when string pointers are contained in a structure.

This function interprets the parameter *pData* as a pointer to a struct of type FT_PROGRAM_DATA that contains the data to write to the EEPROM. The data is written to EEPROM, then read back and verified.

The string pointer parameters in the FT_PROGRAM_DATA structure should be allocated as DWORDs to avoid overlapping of parameters. The string parameters are then passed in separately.

If the SerialNumber field is NULL, or SerialNumber points to a NULL string, a serial number based on the ManufacturerId and the current date and time will be generated.

Note that the DLL must be informed which version of the *FT_PROGRAM_DATA* structure is being used. This is done through the *Signature1*, *Signature2* and *Version* elements of the structure. *Signature1* should always be *0x00000000*, *Signature2* should always be *0xFFFFFFFF* and *Version* can be set to use whichever version is required. For compatibility with all current devices *Version* should be set to the latest version of the *FT_PROGRAM_DATA* structure which is defined in FTD2XX.h 108.

If *pData* is NULL, the structure version will default to 0 (original BM series) and the device will be programmed with the default data:
{0x0403, 0x6001, "FTDI", "FT", "USB HS Serial Converter", "", 44, 1, 0, 1, FALSE, FALSE, FALSE, FALSE, FALSE, FALSE, 0}

3.8 FT_EE_UARead

Read the contents of the EEUA.

FT_STATUS **FT_EE_UARead** (FT_HANDLE *ftHandle*, PUCHAR *pucData*, DWORD *dwDataLen*, LPDWORD *lpdwBytesRead*)

Parameters

ftHandle	Handle of the device.
pucData	Pointer to a buffer that contains storage for data to be read.
dwDataLen	Size, in bytes, of buffer that contains storage for the data to be read.
lpdwBytesRead	Pointer to a DWORD that receives the number of bytes read..

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

This function interprets the parameter *pucData* as a pointer to an array of bytes of size *dwDataLen* that contains storage for the data to be read from the EEUA. The actual number of bytes read is stored in the DWORD referenced by *lpdwBytesRead*.

If *dwDataLen* is less than the size of the EEUA, then *dwDataLen* bytes are read into the buffer. Otherwise, the whole of the EEUA is read into the buffer.

An application should check the function return value and *lpdwBytesRead* when **FT_EE_UARead** returns.

Example

```
FT_HANDLE ftHandle;
FT_STATUS ftStatus = FT_Open(0, &ftHandle);

if (ftStatus != FT_OK) {
    // FT_Open FAILED!
}

unsigned char Buffer[64];
DWORD BytesRead;

ftStatus = FT_EE_UARead(ftHandle, Buffer, 64, &BytesRead);
if (ftStatus == FT_OK) {
    // FT_EE_UARead OK
    // User Area data stored in Buffer
    // Number of bytes read from EEUA stored in BytesRead
}
else {
    // FT_EE_UARead FAILED!
}
```

3.9 FT_EE_UAWrite

Write data into the EEUA.

FT_STATUS **FT_EE_UAWrite** (FT_HANDLE *ftHandle*, PUCHAR *pucData*, DWORD *dwDataLen*)

Parameters

ftHandle	Handle of the device.
pucData	Pointer to a buffer that contains the data to be written.
dwDataLen	Size, in bytes, of buffer that contains the data to be written.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

This function interprets the parameter *lpData* as a pointer to an array of bytes of size *dwDataLen* that contains the data to be written to the EEUA. It is a programming error for *dwDataLen* to be greater than the size of the EEUA.

Example

```
FT_HANDLE ftHandle;
FT_STATUS ftStatus = FT_Open(0, &ftHandle);

if (ftStatus != FT_OK) {
    // FT_Open FAILED!
}

char *buffer = "Hello, World";

ftStatus = FT_EE_UAWrite(ftHandle, (unsigned char*)buffer, 12);
if(ftStatus != FT_OK) {
        // FT_EE_UAWRITE failed
}
else {
        // FT_EE_UAWRITE failed
}
```

3.10 FT_EE_UASize

Get size of EEUA.

FT_STATUS **FT_EE_UASize** (FT_HANDLE *ftHandle*, LPDWORD *lpdwSize*)

Parameters

ftHandle	Handle of the device.
lpdwSize	Pointer to a DWORD that receives the size, in bytes, of the EEUA.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Example

```
FT_HANDLE ftHandle;
FT_STATUS ftStatus = FT_Open(0, &ftHandle);

if (ftStatus != FT_OK) {
    // FT_Open FAILED!
}

DWORD EEUA_Size;

ftStatus = FT_EE_UASize(ftHandle, &EEUA_Size);
if (ftStatus == FT_OK) {
    // FT_EE_UASize OK
    // EEUA_Size contains the size, in bytes, of the EEUA
}
else {
    // FT_EE_UASize FAILED!
}
```

4 Extended API Functions

Introduction

FTDI's FT232R USB UART (4th generation), FT245R USB FIFO (4th generation), FT2232C Dual USB UART/FIFO (3rd generation), FT232BM USB UART (2nd generation) and FT245BM USB FIFO (2nd generation) offer extra functionality, including programmable features, to their predecessors. The programmable features are supported by extensions to the D2XX driver, and the programming interface is exposed by FTD2XX.DLL.

Overview

New features include a programmable receive buffer timeout and bit bang mode. The receive buffer timeout is controlled via the latency timer functions FT_GetLatencyTimer 69 and FT_SetLatencyTimer 70. Bit bang modes and other FT2232C bit modes are controlled via the functions FT_GetBitMode 71 and FT_SetBitMode 72. Before these functions can be accessed, the device must first be opened. The Win32API function, CreateFile, returns a handle that is used by all functions in the programming interface to identify the device.

Reference

Type definitions 102 of the functional parameters and return codes used in the D2XX extended programming interface are contained in the appendix 101.

4.1 FT_GetLatencyTimer

Get the current value of the latency timer.

FT_STATUS **FT_GetLatencyTimer** (FT_HANDLE *ftHandle*, PUCHAR *pucTimer*)

Parameters

ftHandle	Handle of the device.
pucTimer	Pointer to unsigned char to store latency timer value.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

In the FT8U232AM and FT8U245AM devices, the receive buffer timeout that is used to flush remaining data from the receive buffer was fixed at 16 ms. In all other FTDI devices, this timeout is programmable and can be set at 1 ms intervals between 2ms and 255 ms. This allows the device to be better optimized for protocols requiring faster response times from short data packets.

Example

```
HANDLE ftHandle;
FT_STATUS ftStatus;
UCHAR LatencyTimer;

ftStatus = FT_Open(0, &ftHandle);
if(ftStatus != FT_OK) {
        // FT_Open failed
        return;
}

ftStatus = FT_GetLatencyTimer(ftHandle, &LatencyTimer);
if (ftStatus == FT_OK) {
  // LatencyTimer contains current value
}
else {
  // FT_GetLatencyTimer FAILED!
}

FT_Close(ftHandle);
```

4.2 FT_SetLatencyTimer

Set the latency timer.

FT_STATUS **FT_SetLatencyTimer** (FT_HANDLE *ftHandle*, UCHAR *ucTimer*)

Parameters

ftHandle	Handle of the device.
ucTimer	Required value, in milliseconds, of latency timer. Valid range is 2 - 255.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

In the FT8U232AM and FT8U245AM devices, the receive buffer timeout that is used to flush remaining data from the receive buffer was fixed at 16 ms. In all other FTDI devices, this timeout is programmable and can be set at 1 ms intervals between 2ms and 255 ms. This allows the device to be better optimized for protocols requiring faster response times from short data packets.

Example

```
HANDLE ftHandle;
FT_STATUS ftStatus;
UCHAR LatencyTimer = 10;

ftStatus = FT_Open(0, &ftHandle);
if(ftStatus != FT_OK) {
        // FT_Open failed
        return;
}

ftStatus = FT_SetLatencyTimer(ftHandle, LatencyTimer);
if (ftStatus == FT_OK) {
  // LatencyTimer set to 10 milliseconds
}
else {
  // FT_SetLatencyTimer FAILED!
}

FT_Close(ftHandle);
```

4.3 FT_GetBitMode

Gets the instantaneous value of the data bus.

FT_STATUS **FT_GetBitMode** (FT_HANDLE *ftHandle*, PUCHAR *pucMode*)

Parameters

ftHandle	Handle of the device.
pucMode	Pointer to unsigned char to store bit mode value.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

For a description of available bit modes for the FT2232C, see the application note "Bit Mode Functions for the FT2232C".
For a description of Bit Bang Mode for the FT232BM and FT245BM, see the application note "FT232BM/FT245BM Bit Bang Mode".
These application notes are available for download from the Application Notes page in the Documents section of the FTDI website.

Example

```
HANDLE ftHandle;
UCHAR BitMode;
FT_STATUS ftStatus;

ftStatus = FT_Open(0, &ftHandle);
if(ftStatus != FT_OK) {
        // FT_Open failed
        return;
}

ftStatus = FT_GetBitMode(ftHandle, &BitMode);
if (ftStatus == FT_OK) {
  // BitMode contains current value
}
else {
  // FT_GetBitMode FAILED!
}

FT_Close(ftHandle);
```

4.4 FT_SetBitMode

Set the value of the bit mode.

FT_STATUS **FT_SetBitMode** (FT_HANDLE *ftHandle*, UCHAR *ucMask*, UCHAR *ucMode*)

Parameters

ftHandle	Handle of the device.
ucMask	Required value for bit mode mask. This sets up which bits are inputs and outputs. A bit value of 0 sets the corresponding pin to an input, a bit value of 1 sets the corresponding pin to an output. In the case of CBUS Bit Bang, the upper nibble of this value controls which pins are inputs and outputs, while the lower nibble controls which of the outputs are high and low.
ucMode	Mode value. Can be one of the following: 0x0 = Reset 0x1 = Asynchronous Bit Bang 0x2 = MPSSE (FT2232C devices only) 0x4 = Synchronous Bit Bang (FT232R, FT245R and FT2232C devices only) 0x8 = MCU Host Bus Emulation Mode (FT2232C devices only) 0x10 = Fast Opto-Isolated Serial Mode (FT2232C devices only) 0x20 = CBUS Bit Bang Mode (FT232R devices only)

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

For a description of Bit Bang Mode for the FT232BM and FT245BM, see the application note "FT232BM/FT245BM Bit Bang Mode".
For a description of available bit modes for the FT2232C, see the application note "Bit Mode Functions for the FT2232C".
For a description of the Bit Bang modes available for the FT232R and FT245R devices, see the application note "Bit Bang Modes for the FT232R and FT245R".
Application notes are available for download from the Application Notes page in the Documents section of the FTDI website.

Note that to use CBUS Bit Bang for the FT232R, the CBUS must be configured for CBUS Bit Bang in the EEPROM.

Example

```
HANDLE ftHandle;
FT_STATUS ftStatus;
UCHAR Mask = 0xff;
UCHAR Mode = 1;  // Set asynchronous bit-bang mode

ftStatus = FT_Open(0, &ftHandle);
```

```
if(ftStatus != FT_OK) {
        // FT_Open failed
        return;
}

ftStatus = FT_SetBitMode(ftHandle, Mask, Mode);
if (ftStatus == FT_OK) {
  // 0xff written to device
}
else {
  // FT_SetBitMode FAILED!
}

FT_Close(ftHandle);
```

4.5 FT_SetUSBParameters

Set the USB request transfer size.

FT_STATUS **FT_SetUSBParameters** (FT_HANDLE *ftHandle*, DWORD *dwInTransferSize*, DWORD *dwOutTransferSize*)

Parameters

ftHandle	Handle of the device.
dwInTransferSize	Transfer size for USB IN request.
dwOutTransferSize	Transfer size for USB OUT request.

Return Value

FT_OK if successful, otherwise the return value is an FT error code.

Remarks

Previously, USB request transfer sizes have been set at 4096 bytes and have not been configurable. This function can be used to change the transfer sizes to better suit the application requirements. Transfer sizes must be set to a multiple of 64 bytes between 64 bytes and 64k bytes.

When FT_SetUSBParameters is called, the change comes into effect immediately and any data that was held in the driver at the time of the change is lost.

Note that, at present, only *dwInTransferSize* is supported.

Example

```
HANDLE ftHandle;
FT_STATUS ftStatus;
DWORD InTransferSize = 16384;

ftStatus = FT_Open(0, &ftHandle);
if(ftStatus != FT_OK) {
        // FT_Open failed
        return;
}

ftStatus = FT_SetUSBParameters(ftHandle, InTransferSize, 0);
if (ftStatus == FT_OK) {
  // In transfer size set to 16 Kbytes
}
else {
  // FT_SetUSBParameters FAILED!
}

FT_Close(ftHandle);
```

5 FT-Win32 API Functions

Introduction

The D2XX interface also incorporates functions based on Win32 API and Win32 COMM API calls. This facilitates the porting of communications applications from VCP to D2XX.

Linux support for these functions has been added to allow porting windows VCP applications to Linux as well as providing improved event detection. Every effort has been made to keep the continuity between the Linux and Windows implementation of these funcitons as much as possible. The notable differences have been documented within.

Overview

Before the device can be accessed, it must first be opened. FT_W32_CreateFile 76 returns a handle that is used by all functions in the programming interface to identify the device. When the device has been opened successfully, I/O can be performed using FT_W32_ReadFile 79 and FT_W32_WriteFile 82. When operations are complete, the device is closed using FT_W32_CloseHandle 78.

Reference

Type definitions 102 of the functional parameters and return codes used in the FT-Win32 interface are contained in the appendix 101.

5.1 FT_W32_CreateFile

Open the specified device and return a handle which will be used for subsequent accesses. The device can be specified by its serial number, device description, or location.

This function must be used if overlapped I/O is required.

FT_HANDLE **FT_W32_CreateFile** (LPCSTR *lpszName*, DWORD *dwAccess*, DWORD *dwShareMode*, LPSECURITY_ATTRIBUTES *lpSecurityAttributes*, DWORD *dwCreate*, DWORD *dwAttrsAndFlags*, HANDLE *hTemplate*)

Parameters

lpszName	Pointer to a null terminated string that contains the name of the device. The name of the device can be its serial number or description as obtained from the FT_ListDevices function.
dwAccess	Type of access to the device. Access can be GENERIC_READ, GENERIC_WRITE or both. **Ignored in Linux.**
dwShareMode	How the device is shared. This value must be set to 0.
lpSecurityAttributes	This parameter has no effect and should be set to NULL.
dwCreate	This parameter must be set to OPEN_EXISTING. **Ignored in Linux.**
dwAttrsAndFlags	File attributes and flags. This parameter is a combination of FILE_ATTRIBUTE_NORMAL, FILE_FLAG_OVERLAPPED if overlapped I/O is used, FT_OPEN_BY_SERIAL_NUMBER if *lpszName* is the devices serial number, and FT_OPEN_BY_DESCRIPTION if *lpszName* is the devices description.
hTemplate	This parameter must be NULL

Return Value

If the function is successful, the return value is a handle.
If the function is unsuccessful, the return value is the Win32 error code INVALID_HANDLE_VALUE.

Remarks

The meaning of *pvArg1* depends on *dwAttrsAndFlags*: if *FT_OPEN_BY_SERIAL_NUMBER* or *FT_OPEN_BY_DESCRIPTION* is set in *dwAttrsAndFlags*, *pvArg1* contains a pointer to a null terminated string that contains the device's serial number or description; if *FT_OPEN_BY_LOCATION* is set in *dwAttrsAndFlags*, *pvArg1* is interpreted as a value of type long that contains the location ID of the device.

dwAccess can be *GENERIC_READ*, *GENERIC_WRITE* or both; *dwShareMode* must be set to 0; *lpSecurityAttributes* must be set to NULL; *dwCreate* must be set to *OPEN_EXISTING*; *dwAttrsAndFlags* is a combination of *FILE_ATTRIBUTE_NORMAL*, *FILE_FLAG_OVERLAPPED* if overlapped I/O is used, *FT_OPEN_BY_SERIAL_NUMBER* or *FT_OPEN_BY_DESCRIPTION* or *FT_OPEN_BY_LOCATION*; *hTemplate* must be NULL.

Windows CE does not support overlapped IO or location IDs.

Examples

The examples that follow use these variables.

```
FT_STATUS ftStatus;
FT_HANDLE ftHandle;
char Buf[64];
```

Open a device for overlapped I/O using its serial number

```
ftStatus = FT_ListDevices(0,Buf,FT_LIST_BY_INDEX|FT_OPEN_BY_SERIAL_NUMBER);

ftHandle = FT_W32_CreateFile(Buf,GENERIC_READ|GENERIC_WRITE,0,0,
                                    OPEN_EXISTING,
                                    FILE_ATTRIBUTE_NORMAL | FILE_FLAG_OVERLAPPED |
                                    FT_OPEN_BY_SERIAL_NUMBER,
                                    0);

if (ftHandle == INVALID_HANDLE_VALUE)
        ; // FT_W32_CreateDevice failed
```

Open a device for non-overlapped I/O using its description

```
ftStatus = FT_ListDevices(0,Buf,FT_LIST_BY_INDEX|FT_OPEN_BY_DESCRIPTION);

ftHandle = FT_W32_CreateFile(Buf,GENERIC_READ|GENERIC_WRITE,0,0,
                                    OPEN_EXISTING,
                                    FILE_ATTRIBUTE_NORMAL | FT_OPEN_BY_DESCRIPTION,
                                    0);

if (ftHandle == INVALID_HANDLE_VALUE)
        ; // FT_W32_CreateDevice failed
```

Open a device for non-overlapped I/O using its location

```
long locID;

ftStatus = FT_ListDevices(0,&locID,FT_LIST_BY_INDEX|FT_OPEN_BY_LOCATION);

ftHandle = FT_W32_CreateFile((PVOID) locID,GENERIC_READ|GENERIC_WRITE,0,0,
                                    OPEN_EXISTING,
                                    FILE_ATTRIBUTE_NORMAL | FT_OPEN_BY_LOCATION,
                                    0);

if (ftHandle == INVALID_HANDLE_VALUE)
        ; // FT_W32_CreateDevice failed
```

5.2 FT_W32_CloseHandle

Close the specified device.

BOOL **FT_W32_CloseHandle** (FT_HANDLE *ftHandle*)

Parameters

ftHandle Handle of the device.

Return Value

If the function is successful, the return value is nonzero.
If the function is unsuccessful, the return value is zero.

Example

This example shows how to close a device after opening it for non-overlapped I/O using its description.

```
FT_STATUS ftStatus;
FT_HANDLE ftHandle;
char Buf[64];

ftStatus = FT_ListDevices(0,Buf,FT_LIST_BY_INDEX|FT_OPEN_BY_DESCRIPTION);
ftHandle = FT_W32_CreateFile(Buf,GENERIC_READ|GENERIC_WRITE,0,0,
OPEN_EXISTING,
FILE_ATTRIBUTE_NORMAL | FT_OPEN_BY_DESCRIPTION,
0);
if (ftHandle == INVALID_HANDLE_VALUE){
  // FT_W32_CreateDevice failed}
else {
  // FT_W32_CreateFile OK, so do some work, and eventually ...
  FT_W32_CloseHandle(ftHandle);
}
```

5.3 FT_W32_ReadFile

Read data from the device.

BOOL **FT_W32_ReadFile** (FT_HANDLE *ftHandle*, LPVOID *lpBuffer*, DWORD *dwBytesToRead*, LPDWORD *lpdwBytesReturned*, LPOVERLAPPED *lpOverlapped*)

Parameters

ftHandle	Handle of the device.
lpBuffer	Pointer to a buffer that receives the data from the device.
dwBytesToRead	Number of bytes to read from the device.
lpdwBytesReturned	Pointer to a variable that receives the number of bytes read from the device.
lpOverlapped	Pointer to an overlapped structure. **Ignored in Linux.**

Return Value

If the function is successful, the return value is nonzero.
If the function is unsuccessful, the return value is zero.

Remarks

This function supports both non-overlapped and overlapped I/O, **except under Windows CE and Linux where only non-overlapped IO is supported**.

Non-overlapped I/O

The parameter, *lpOverlapped,* must be NULL for non-overlapped I/O.

This function always returns the number of bytes read in *lpdwBytesReturned*.

This function does not return until *dwBytesToRead* have been read into the buffer. The number of bytes in the receive queue can be determined by calling FT_GetStatus 34 or FT_GetQueueStatus 31, and passed as *dwBytesToRead* so that the function reads the device and returns immediately.

When a read timeout has been setup in a previous call to FT_W32_SetCommTimeouts 97, this function returns when the timer expires or *dwBytesToRead* have been read, whichever occurs first. If a timeout occurred, any available data is read into *lpBuffer* and the function returns a non-zero value.

An application should use the function return value and *lpdwBytesReturned* when processing the buffer. If the return value is non-zero and *lpdwBytesReturned* is equal to *dwBytesToRead* then the function has completed normally. If the return value is non-zero and *lpdwBytesReturned* is less then *dwBytesToRead* then a timeout has occurred, and the read request has been partially completed. Note that if a timeout occurred and no data was read, the return value is still non-zero.

A return value of *FT_IO_ERROR* suggests an error in the parameters of the function, or a fatal error like USB disconnect has occurred.

Overlapped I/O

When the device has been opened for overlapped I/O, an application can issue a request and perform some additional work while the request is pending. This contrasts with the case of non-overlapped I/O in which the application issues a request and receives control again only after the request has been completed.

The parameter, *lpOverlapped,* must point to an initialized OVERLAPPED structure.

If there is enough data in the receive queue to satisfy the request, the request completes immediately and the return code is non-zero. The number of bytes read is returned in *lpdwBytesReturned*.

If there is not enough data in the receive queue to satisfy the request, the request completes immediately, and the return code is zero, signifying an error. An application should call FT_W32_GetLastError 84 to get the cause of the error. If the error code is ERROR_IO_PENDING, the overlapped operation is still in progress, and the application can perform other processing. Eventually, the application checks the result of the overlapped request by calling FT_W32_GetOverlappedResult 85.
If successful, the number of bytes read is returned in *lpdwBytesReturned*.

Example

This example shows how to read 256 bytes from the device using non-overlapped I/O.

```
FT_HANDLE ftHandle; // setup by FT_W32_CreateFile for non-overlapped i/o
char Buf[256];
DWORD dwToRead = 256;
DWORD dwRead;

if (FT_W32_ReadFile(ftHandle, Buf, dwToRead, &dwRead, &osWrite)) {
  if (dwToRead == dwRead){
    // FT_W32_ReadFile OK}
  else{
    // FT_W32_ReadFile timeout}
{
else{
  // FT_W32_ReadFile failed}
```

This example shows how to read 256 bytes from the device using overlapped I/O.

```
FT_HANDLE ftHandle; // setup by FT_W32_CreateFile for overlapped i/o
char Buf[256];
DWORD dwToRead = 256;
DWORD dwRead;
OVERLAPPED osRead = { 0 };

if (!FT_W32_ReadFile(ftHandle, Buf, dwToRead, &dwRead, &osWrite)) {
  if (FT_W32_GetLastError(ftHandle) == ERROR_IO_PENDING) {
    // write is delayed so do some other stuff until ...
    if (!FT_W32_GetOverlappedResult(ftHandle, &osRead, &dwRead, FALSE)){
      // error}
    else {
      if (dwToRead == dwRead){
        // FT_W32_ReadFile OK}
      else{
        // FT_W32_ReadFile timeout}
    }
  }
}
else {
  // FT_W32_ReadFile OK
```

```
}
```

5.4 FT_W32_WriteFile

Write data to the device.

BOOL **FT_W32_WriteFile** (FT_HANDLE *ftHandle*, LPVOID *lpBuffer*, DWORD *dwBytesToWrite*, LPDWORD *lpdwBytesWritten*, LPOVERLAPPED *lpOverlapped*)

Parameters

ftHandle	Handle of the device.
lpBuffer	Pointer to the buffer that contains the data to write to the device.
dwBytesToWrite	Number of bytes to be written to the device.
lpdwBytesWritten	Pointer to a variable that receives the number of bytes written to the device.
lpOverlapped	Pointer to an overlapped structure. **Ignored in Linux.**

Return Value

If the function is successful, the return value is nonzero.
If the function is unsuccessful, the return value is zero.

Remarks

This function supports both non-overlapped and overlapped I/O, **except under Windows CE and Linux where only non-overlapped IO is supported**.

Non-overlapped I/O

The parameter, *lpOverlapped,* must be NULL for non-overlapped I/O.

This function always returns the number of bytes written in *lpdwBytesWritten*.

This function does not return until *dwBytesToWrite* have been written to the device.

When a write timeout has been setup in a previous call to FT_W32_SetCommTimeouts 97, this function returns when the timer expires or *dwBytesToWrite* have been written, whichever occurs first. If a timeout occurred, *lpdwBytesWritten* contains the number of bytes actually written, and the function returns a non-zero value.

An application should always use the function return value and *lpdwBytesWritten*. If the return value is non-zero and *lpdwBytesWritten* is equal to *dwBytesToWrite* then the function has completed normally. If the return value is non-zero and *lpdwBytesWritten* is less then *dwBytesToWrite* then a timeout has occurred, and the write request has been partially completed. Note that if a timeout occurred and no data was written, the return value is still non-zero.

Overlapped I/O

When the device has been opened for overlapped I/O, an application can issue a request and perform some additional work while the request is pending. This contrasts with the case of non-overlapped I/O in which the application issues a request and receives control again only after the

request has been completed.

The parameter, *lpOverlapped,* must point to an initialized OVERLAPPED structure.

This function completes immediately, and the return code is zero, signifying an error. An application should call FT_W32_GetLastError 84 to get the cause of the error. If the error code is ERROR_IO_PENDING, the overlapped operation is still in progress, and the application can perform other processing. Eventually, the application checks the result of the overlapped request by calling FT_W32_GetOverlappedResult 85.

If successful, the number of bytes written is returned in *lpdwBytesWritten*.

Example

This example shows how to write 128 bytes to the device using non-overlapped I/O.

```
FT_HANDLE ftHandle; // setup by FT_W32_CreateFile for overlapped i/o
char Buf[128]; // contains data to write to the device
DWORD dwToWrite = 128;
DWORD dwWritten;

if (FT_W32_WriteFile(ftHandle, Buf, dwToWrite, &dwWritten, &osWrite)) {
  if (dwToWrite == dwWritten){
    // FT_W32_WriteFile OK}
  else{
    // FT_W32_WriteFile timeout}
  }
else{
  // FT_W32_WriteFile failed}
```

This example shows how to write 128 bytes to the device using overlapped I/O.

```
FT_HANDLE ftHandle; // setup by FT_W32_CreateFile for overlapped i/o
char Buf[128]; // contains data to write to the device
DWORD dwToWrite = 128;
DWORD dwWritten;
OVERLAPPED osWrite = { 0 };

if (!FT_W32_WriteFile(ftHandle, Buf, dwToWrite, &dwWritten, &osWrite)) {
  if (FT_W32_GetLastError(ftHandle) == ERROR_IO_PENDING) {
    // write is delayed so do some other stuff until ...
    if (!FT_W32_GetOverlappedResult(ftHandle, &osWrite, &dwWritten, FALSE)){
      // error}
    else {
      if (dwToWrite == dwWritten){
        // FT_W32_WriteFile OK}
      else{
        // FT_W32_WriteFile timeout}
    }
  }
}
else {
  // FT_W32_WriteFIle OK
}
```

5.5 FT_W32_GetLastError

Gets the last error that occurred on the device.

DWORD **FT_W32_GetLastError** (FT_HANDLE *ftHandle*)

Parameters

ftHandle	Handle of the device.

Return Value

If the function is successful, the return value is nonzero.
If the function is unsuccessful, the return value is zero.

Remarks

This function is normally used with overlapped I/O and so is **not supported in Windows CE**. For a description of its use, see FT_W32_ReadFile 79 and FT_W32_WriteFile 82.
In Linux this function returns a DWORD that directly maps to the FT Errors (for example the FT_INVALID_HANDLE error number).

5.6 FT_W32_GetOverlappedResult

Gets the result of an overlapped operation.

BOOL **FT_W32_GetOverlappedResult** (FT_HANDLE *ftHandle*, LPOVERLAPPED *lpOverlapped*, LPDWORD *lpdwBytesTransferred*, BOOL *bWait*)

Parameters

ftHandle	Handle of the device.
lpOverlapped	Pointer to an overlapped structure.
ldwBytesTransferred	Pointer to a variable that receives the number of bytes transferred during the overlapped operation.
bWait	Set to TRUE if the function does not return until the operation has been completed.

Return Value

If the function is successful, the return value is nonzero.
If the function is unsuccessful, the return value is zero.

Remarks

This function is used with overlapped I/O and so is **not supported in Windows CE or Linux**. For a description of its use, see FT_W32_ReadFile 79 and FT_W32_WriteFile 82.

5.7 FT_W32_ClearCommBreak

Puts the communications line in the non-BREAK state.

BOOL **FT_W32_ClearCommBreak** (FT_HANDLE *ftHandle*)

Parameters

ftHandle	Handle of the device.

Return Value

If the function is successful, the return value is nonzero.
If the function is unsuccessful, the return value is zero.

Example

This example shows how put the line in the non-BREAK state.

```
FT_HANDLE ftHandle; // setup by FT_W32_CreateFile

if (!FT_W32_ClearCommBreak(ftHandle)){
  // FT_W32_ClearCommBreak failed}
else{
  // FT_W32_ClearCommBreak OK}
```

5.8 FT_W32_ClearCommError

Gets information about a communications error and get current status of the device.

BOOL **FT_W32_ClearCommError** (FT_HANDLE *ftHandle*, LPDWORD *lpdwErrors*, LPFTCOMSTAT *lpftComstat*)

Parameters

ftHandle	Handle of the device.
lpdwErrors	Variable that contains the error mask.
lpftComstat	Pointer to FTCOMSTAT structure.

Return Value

If the function is successful, the return value is nonzero.
If the function is unsuccessful, the return value is zero.

Example

This example shows how to use this function.

```
static COMSTAT oldCS = {0};
static DWORD dwOldErrors = 0;

FT_HANDLE ftHandle; // setup by FT_W32_CreateFile
COMSTAT newCS;
DWORD dwErrors;
BOOL bChanged = FALSE;

if (!FT_W32_ClearCommError(ftHandle, &dwErrors, (FTCOMSTAT *)&newCS))
  ; // FT_W32_ClearCommError failed

if (dwErrors != dwOldErrors) {
  bChanged = TRUE;
  dwErrorsOld = dwErrors;
}

if (memcmp(&oldCS, &newCS, sizeof(FTCOMSTAT))) {
  bChanged = TRUE;
  oldCS = newCS;
}

if (bChanged) {
  if (dwErrors & CE_BREAK)
    ; // BREAK condition detected
  if (dwErrors & CE_FRAME)
    ; // Framing error detected
  if (dwErrors & CE_RXOVER)
    ; // Receive buffer has overflowed
  if (dwErrors & CE_TXFULL)
    ; // Transmit buffer full
  if (dwErrors & CE_OVERRUN)
    ; // Character buffer overrun
  if (dwErrors & CE_RXPARITY)
    ; // Parity error detected
  if (newCS.fCtsHold)
    ; // Transmitter waiting for CTS
  if (newCS.fDsrHold)
    ; // Transmitter is waiting for DSR
  if (newCS.fRlsdHold)
    ; // Transmitter is waiting for RLSD
  if (newCS.fXoffHold)
```

```
    ; // Transmitter is waiting because XOFF was received
  if (newCS.fXoffSent)
    ; //
  if (newCS.fEof)
    ; // End of file character has been received
  if (newCS.fTxim)
    ; // Tx immediate character queued for transmission
  // newCS.cbInQue contains number of bytes in receive queue
  // newCS.cbOutQue contains number of bytes in transmit queue
}
```

5.9 FT_W32_EscapeCommFunction

Perform an extended function.

BOOL **FT_W32_EscapeCommFunction** (FT_HANDLE *ftHandle*, DWORD *dwFunc*)

Parameters

ftHandle	Handle of the device.
dwFunc	The extended function to perform can be one of the following values:
CLRDTR	Clear the DTR signal
CLRRTS	Clear the RTS signal
SETDTR	Set the DTR signal
SETRTS	Set the RTS signal
SETBREAK	Set the BREAK condition
CLRBREAK	Clear the BREAK condition

Return Value

If the function is successful, the return value is nonzero.
If the function is unsuccessful, the return value is zero.

Example

This example shows how to use this function.

```
FT_HANDLE ftHandle; // setup by FT_W32_CreateFile

FT_W32_EscapeCommFunction(ftHandle,CLRDTS);
FT_W32_EscapeCommFunction(ftHandle,SETRTS);
```

5.10 FT_W32_GetCommModemStatus

This function gets the current modem control value.

BOOL **FT_W32_GetCommModemStatus** (FT_HANDLE *ftHandle*, LPDWORD *lpdwStat*)

Parameters

ftHandle	Handle of the device.
lpdwStat	Pointer to a variable to contain modem control value. The modem control value can be a combination of the following:
MS_CTS_ON	Clear to Send (CTS) is on
MS_DSR_ON	Data Set Ready (DSR) is on
MS_RING_ON	Ring Indicator (RI) is on
MS_RLSD_ON	Receive Line Signal Detect (RLSD) is on

Return Value

If the function is successful, the return value is nonzero.
If the function is unsuccessful, the return value is zero.

Example

This example shows how to use this function.

```
FT_HANDLE ftHandle; // setup by FT_W32_CreateFile
DWORD dwStatus;

if (FT_W32_GetCommModemStatus(ftHandle,&dwStatus)) {
  // FT_W32_GetCommModemStatus ok
  if (dwStatus & MS_CTS_ON)
    ; // CTS is on
  if (dwStatus & MS_DSR_ON)
    ; // DSR is on
  if (dwStatus & MS_RI_ON)
    ; // RI is on
  if (dwStatus & MS_RLSD_ON)
    ; // RLSD is on
}
else
  ; // FT_W32_GetCommModemStatus failed
```

5.11 FT_W32_GetCommState

This function gets the current device state.

BOOL **FT_W32_GetCommState** (FT_HANDLE *ftHandle*, LPFTDCB *lpftDcb*)

Parameters

ftHandle	Handle of the device.
lpftDcb	Pointer to an FTDCB structure.

Return Value

If the function is successful, the return value is nonzero.
If the function is unsuccessful, the return value is zero.

Remarks

The current state of the device is returned in a device control block.

Example

This example shows how to use this function.

```
FT_HANDLE ftHandle; // setup by FT_W32_CreateFile
FTDCB ftDCB;

if (FT_W32_GetCommState(ftHandle,&ftDCB))
  ; // FT_W32_GetCommState ok, device state is in ftDCB
else
  ; // FT_W32_GetCommState failed
```

5.12 FT_W32_GetCommTimeouts

This function gets the current read and write request timeout parameters for the specified device.

BOOL **FT_W32_GetCommTimeouts** (FT_HANDLE *ftHandle*, LPFTTIMEOUTS *lpftTimeouts*)

Parameters

ftHandle	Handle of the device.
lpftTimeouts	Pointer to an FTTIMEOUTS structure to store timeout information.

Return Value

If the function is successful, the return value is nonzero.
If the function is unsuccessful, the return value is zero.

Remarks

For an explanation of how timeouts are used, see **FT_W32_SetCommTimeouts**.

Example

This example shows how to retrieve the current timeout values.

```
FT_HANDLE ftHandle; // setup by FT_W32_CreateFile
FTTIMEOUTS ftTS;

if (FT_W32_GetCommTimeouts(ftHandle,&ftTS))
  ; // FT_W32_GetCommTimeouts OK
else
  ; // FT_W32_GetCommTimeouts failed
```

5.13 FT_W32_PurgeComm

This function purges the device.

BOOL **FT_W32_PurgeComm** (FT_HANDLE *ftHandle*, DWORD *dwFlags*)

Parameters

ftHandle		Handle of the device.
dwFlags		Specifies the action to take. The action can be a combination of the following:
	PURGE_TXABORT	Terminate outstanding overlapped writes
	PURGE_RXABORT	Terminate outstanding overlapped reads
	PURGE_TXCLEAR	Clear the transmit buffer
	PURGE_RXCLEAR	Clear the receive buffer

Return Value

If the function is successful, the return value is nonzero.
If the function is unsuccessful, the return value is zero.

Example

This example shows how to purge the receive and transmit queues.

```
FT_HANDLE ftHandle; // setup by FT_W32_CreateFile

if (FT_W32_PurgeComm(ftHandle,PURGE_TXCLEAR|PURGE_RXCLEAR))
  ; // FT_W32_PurgeComm OK
else
  ; // FT_W32_PurgeComm failed
```

5.14 FT_W32_SetCommBreak

Puts the communications line in the BREAK state.

BOOL **FT_W32_SetCommBreak** (FT_HANDLE *ftHandle*)

Parameters

ftHandle	Handle of the device.

Return Value

If the function is successful, the return value is nonzero.
If the function is unsuccessful, the return value is zero.

Example

This example shows how put the line in the BREAK state.

```
FT_HANDLE ftHandle; // setup by FT_W32_CreateFile

if (!FT_W32_SetCommBreak(ftHandle))
  ; // FT_W32_SetCommBreak failed
else
  ; // FT_W32_SetCommBreak OK
```

5.15 FT_W32_SetCommMask

This function specifies events that the device has to monitor.

BOOL **FT_W32_SetCommMask** (FT_HANDLE *ftHandle*, DWORD *dwMask*)

Parameters

ftHandle	Handle of the device.
dwMask	Mask containing aevents that the device has to monitor. This can be a combination of the following:
EV_BREAK	BREAK condition detected
EV_CTS	Change in Clear to Send (CTS)
EV_DSR	Change in Data Set Ready (DSR)
EV_ERR	Error in line status
EV_RING	Ring Indicator (RI) detected
EV_RLSD	Change in Receive Line Signal Detect (RLSD)
EV_RXCHAR	Character received
EV_RXFLAG	Event character received
EV_TXEMPTY	Transmitter empty

Return Value

If the function is successful, the return value is nonzero.
If the function is unsuccessful, the return value is zero.

Remarks

This function specifies the events that the device should monitor. An application can call the function **FT_W32_WaitCommEvent** to wait for an event to occur.

Example

This example shows how to monitor changes in the modem status lines DSR and CTS.

```
FT_HANDLE ftHandle; // setup by FT_W32_CreateFile
DWORD dwMask = EV_CTS | EV_DSR;

if (!FT_W32_SetCommMAsk(ftHandle,dwMask))
  ; // FT_W32_SetCommMask failed
else
  ; // FT_W32_SetCommMask OK
```

5.16 FT_W32_SetCommState

This function sets the state of the device according to the contents of a device control block (DCB).

BOOL **FT_W32_SetCommState** (FT_HANDLE *ftHandle*, LPFTDCB *lpftDcb*)

Parameters

ftHandle	Handle of the device.
lpftDcb	Pointer to an FTDCB structure.

Return Value

If the function is successful, the return value is nonzero.
If the function is unsuccessful, the return value is zero.

Example

This example shows how to use this function to change the baud rate.

```
FT_HANDLE ftHandle; // setup by FT_W32_CreateFile
FTDCB ftDCB;

if (FT_W32_GetCommState(ftHandle,&ftDCB)) {
  // FT_W32_GetCommState ok, device state is in ftDCB
  ftDCB.BaudRate = 921600;
  if (FT_W32_SetCommState(ftHandle,&ftDCB))
    ; // FT_W32_SetCommState ok
  else
    ; // FT_W32_SetCommState failed
}
else
  ; // FT_W32_GetCommState failed
```

5.17 FT_W32_SetCommTimeouts

This function sets the timeout parameters for I/O requests.

BOOL **FT_W32_SetCommTimeouts** (FT_HANDLE *ftHandle*, LPFTTIMEOUTS *lpftTimeouts*)

Parameters

ftHandle	Handle of the device.
lpftTimeouts	Pointer to an FTTIMEOUTS structure to store timeout information.

Return Value

If the function is successful, the return value is nonzero.
If the function is unsuccessful, the return value is zero.

Remarks

Timeouts are calculated using the information in the FTTIMEOUTS structure.

For read requests, the number of bytes to be read is multiplied by the total timeout multiplier, and added to the total timeout constant. So, if TS is an FTTIMEOUTS structure and the number of bytes to read is dwToRead, the read timeout, rdTO, is calculated as follows.

rdTO = (dwToRead * TS.ReadTotalTimeoutMultiplier) + TS.ReadTotalTimeoutConstant

For write requests, the number of bytes to be written is multiplied by the total timeout multiplier, and added to the total timeout constant. So, if TS is an FTTIMEOUTS structure and the number of bytes to write is dwToWrite, the write timeout, wrTO, is calculated as follows.

wrTO = (dwToWrite * TS.WriteTotalTimeoutMultiplier) + TS.WriteTotalTimeoutConstant

Linux ignores the ReadIntervalTimeout, ReadTotalTimeoutMultiplier and WriteTotalTimeoutMultiplier currently.

Example

This example shows how to setup a read timeout of 100 milliseconds and a write timeout of 200 milliseconds.

```
FT_HANDLE ftHandle; // setup by FT_W32_CreateFile
FTTIMEOUTS ftTS;

ftTS.ReadIntervalTimeout = 0;
ftTS.ReadTotalTimeoutMultiplier = 0;
ftTS.ReadTotalTimeoutConstant = 100;
ftTS.WriteTotalTimeoutMultiplier = 0;
ftTS.WriteTotalTimeoutConstant = 200;

if (FT_W32_SetCommTimeouts(ftHandle,&ftTS))
  ; // FT_W32_SetCommTimeouts OK
else
  ; // FT_W32_SetCommTimeouts failed
```

5.18 FT_W32_SetupComm

This function sets the read and write buffers.

BOOL **FT_W32_SetupComm** (FT_HANDLE *ftHandle*, DWORD *dwReadBufferSize*, DWORD *dwWriteBufferSize*)

Parameters

ftHandle	Handle of the device.
dwReadBufferSize	Length, in bytes, of the read buffer.
dwWriteBufferSize	Length, in bytes, of the write buffer.

Return Value

If the function is successful, the return value is nonzero.
If the function is unsuccessful, the return value is zero.

Remarks

This function has no effect. It is the responsibility of the driver to allocate sufficient storage for I/O requests.

5.19 FT_W32_WaitCommEvent

This function waits for an event to occur.

BOOL **FT_W32_WaitCommEvent** (FT_HANDLE *ftHandle*, LPDWORD *lpdwEvent*, LPOVERLAPPED *lpOverlapped*)

Parameters

ftHandle	Handle of the device.
lpdwEvent	Pointer to a location that receives a mask that contains the events that occurred.
lpOverlapped	Pointer to an overlapped structure.

Return Value

If the function is successful, the return value is nonzero.
If the function is unsuccessful, the return value is zero.

Remarks

This function supports both non-overlapped and overlapped I/O, **except under Windows CE and Linux where only non-overlapped IO is supported**.

Non-overlapped I/O

The parameter, *lpOverlapped,* must be NULL for non-overlapped I/O.

This function does not return until an event that has been specified in a call to FT_W32_SetCommMask 95 has occurred. The events that occurred and resulted in this function returning are stored in *lpdwEvent*.

Overlapped I/O

When the device has been opened for overlapped I/O, an application can issue a request and perform some additional work while the request is pending. This contrasts with the case of non-overlapped I/O in which the application issues a request and receives control again only after the request has been completed.

The parameter, *lpOverlapped,* must point to an initialized OVERLAPPED structure.

This function does not return until an event that has been specified in a call to FT_W32_SetCommMask 95 has occurred.

If an event has already occurred, the request completes immediately, and the return code is non-zero. The events that occurred are stored in *lpdwEvent*.

If an event has not yet occurred, the request completes immediately, and the return code is zero, signifying an error. An application should call FT_W32_GetLastError 84 to get the cause of the error. If the error code is ERROR_IO_PENDING, the overlapped operation is still in progress, and the application can perform other processing. Eventually, the application checks the result of the

overlapped request by calling FT_W32_GetOverlappedResult 85. The events that occurred and resulted in this function returning are stored in *lpdwEvent*.

Example

This example shows how to write 128 bytes to the device using non-overlapped I/O.

```
FT_HANDLE ftHandle; // setup by FT_W32_CreateFile for non-overlapped i/o
DWORD dwEvents;

if (FT_W32_WaitCommEvent(ftHandle, &dwEvents, NULL))
  ; // FT_W32_WaitCommEvents OK
else
  ; // FT_W32_WaitCommEvents failed
```

This example shows how to write 128 bytes to the device using overlapped I/O.

```
FT_HANDLE ftHandle; // setup by FT_W32_CreateFile for overlapped i/o
DWORD dwEvents;
DWORD dwRes;
OVERLAPPED osWait = { 0 };

if (!FT_W32_WaitCommEvent(ftHandle, &dwEvents, &osWait)) {
  if (FT_W32_GetLastError(ftHandle == ERROR_IO_PENDING) {
    // wait is delayed so do some other stuff until ...
    if (!FT_W32_GetOverlappedResult(ftHandle, &osWait, &dwRes, FALSE))
      ; // error
    else
      ; // FT_W32_WaitCommEvent OK
        // Events that occurred are stored in dwEvents
  }
}
else {
  // FT_W32_WaitCommEvent OK
  // Events that occurred are stored in dwEvents
}
```

6 Appendix

This section contains type definitions 102 of the functional parameters and return codes used in the D2XX programming interface. It also contains a copy of the current FTD2XX.H file 108.

6.1 Type Definitions

Excerpts from the header file FTD2XX.H 108 are included in this appendix to explain any references in the descriptions of the functions in this document.
For Visual C++ applications, these values are pre-declared in the header file (FTD2XX.H 108), which is included in the driver release. For other languages, these definitions will have to be converted to use equivalent types, and may have to be defined in an include file or within the body of the code. For non-Visual C++ applications, check the application code examples on the FTDI website as a translation of these may already exist.

UCHAR	Unsigned char (1 byte)
PUCHAR	Pointer to unsigned char (4 bytes)
PCHAR	Pointer to char (4 bytes)
DWORD	Unsigned long (4 bytes)
LPDWORD	Pointer to unsigned long (4 bytes)
FT_HANDLE	DWORD

FT_STATUS (DWORD)

FT_OK = 0
FT_INVALID_HANDLE = 1
FT_DEVICE_NOT_FOUND = 2
FT_DEVICE_NOT_OPENED = 3
FT_IO_ERROR = 4
FT_INSUFFICIENT_RESOURCES = 5
FT_INVALID_PARAMETER = 6
FT_INVALID_BAUD_RATE = 7
FT_DEVICE_NOT_OPENED_FOR_ERASE = 8
FT_DEVICE_NOT_OPENED_FOR_WRITE = 9
FT_FAILED_TO_WRITE_DEVICE = 10
FT_EEPROM_READ_FAILED = 11
FT_EEPROM_WRITE_FAILED = 12
FT_EEPROM_ERASE_FAILED = 13
FT_EEPROM_NOT_PRESENT = 14
FT_EEPROM_NOT_PROGRAMMED = 15
FT_INVALID_ARGS = 16
FT_NOT_SUPPORTED = 17
FT_OTHER_ERROR = 18

Flags (see FT_OpenEx 12)

FT_OPEN_BY_SERIAL_NUMBER = 1
FT_OPEN_BY_DESCRIPTION = 2
FT_OPEN_BY_LOCATION = 4

Flags (see FT_ListDevices 8)

FT_LIST_NUMBER_ONLY = 0x80000000
FT_LIST_BY_INDEX = 0x40000000
FT_LIST_ALL = 0x20000000

FT_DEVICE (DWORD)

FT_DEVICE_232BM = 0
FT_DEVICE_232AM = 1
FT_DEVICE_100AX = 2

FT_DEVICE_UNKNOWN = 3
FT_DEVICE_2232C = 4
FT_DEVICE_232R = 5

Word Length (see FT_SetDataCharacteristics 21)
FT_BITS_8 = 8
FT_BITS_7 = 7

Stop Bits (see FT_SetDataCharacteristics 21)
FT_STOP_BITS_1 = 0
FT_STOP_BITS_2 = 2

Parity (see FT_SetDataCharacteristics 21)
FT_PARITY_NONE = 0
FT_PARITY_ODD = 1
FT_PARITY_EVEN = 2
FT_PARITY_MARK = 3
FT_PARITY_SPACE = 4

Flow Control (see FT_SetFlowControl 22)
FT_FLOW_NONE = 0x0000
FT_FLOW_RTS_CTS = 0x0100
FT_FLOW_DTR_DSR = 0x0200
FT_FLOW_XON_XOFF = 0x0400

Purge RX and TX Buffers (see FT_Purge 29)
FT_PURGE_RX = 1
FT_PURGE_TX = 2

Notification Events (see FT_SetEventNotification 35)
FT_EVENT_RXCHAR = 1
FT_EVENT_MODEM_STATUS = 2

Modem Status (see FT_GetModemStatus 27)
CTS = 0x10
DSR = 0x20
RI = 0x40
DCD = 0x80

FT232R CBUS EEPROM OPTIONS - Ignored for FT245R (see FT_EE_Program 62 and FT_EE_Read 59)
CBUS_TXDEN = 0x00
CBUS_PWRON = 0x01
CBUS_TXLED = 0x02
CBUS_RXLED = 0x03
CBUS_TXRXLED = 0x04
CBUS_SLEEP = 0x05
CBUS_CLK48 = 0x06
CBUS_CLK24 = 0x07

```
        CBUS_CLK12 = 0x08
        CBUS_CLK6 = 0x09
        CBUS_IOMODE = 0x0A
        CBUS_BITBANG_WR = 0x0B
        CBUS_BITBANG_RD = 0x0C
```

FT_DEVICE_LIST_INFO_NODE (see FT_GetDeviceInfoList 49)

```
typedef struct _ft_device_list_info_node {
        DWORD Flags;
        DWORD Type;
        DWORD ID;
        DWORD LocId;
        char SerialNumber[16];
        char Description[64];
        FT_HANDLE ftHandle;
} FT_DEVICE_LIST_INFO_NODE;
```

FT_PROGRAM_DATA (EEPROM Programming Interface)

```
typedef struct ft_program_data {
        WORD VendorId;                  // 0x0403
        WORD ProductId;                 // 0x6001
        char *Manufacturer;             // "FTDI"
        char *ManufacturerId;           // "FT"
        char *Description;              // "USB HS Serial Converter"
        char *SerialNumber;             // "FT000001" if fixed, or NULL
        WORD MaxPower;                  // 0 < MaxPower <= 500
        WORD PnP;                       // 0 = disabled, 1 = enabled
        WORD SelfPowered;               // 0 = bus powered, 1 = self powered
        WORD RemoteWakeup;              // 0 = not capable, 1 = capable
        //
        // Rev4 extensions
        //
        UCHAR Rev4;                     // true if Rev4 chip, false otherwise
        UCHAR IsoIn;                    // true if in endpoint is isochronous
        UCHAR IsoOut;                   // true if out endpoint is isochronous
        UCHAR PullDownEnable;           // true if pull down enabled
        UCHAR SerNumEnable;             // true if serial number to be used
        UCHAR USBVersionEnable;         // true if chip uses USBVersion
        WORD USBVersion;                // BCD (0x0200 => USB2)
} FT_PROGRAM_DATA, *PFT_PROGRAM_DATA;
```

FT_PROGRAM_DATA (EEPROM Programming Interface - compatible with DLL version 2.1.4.1 or later)

```
typedef struct ft_program_data {
        DWORD Signature1;               // Header - must be 0x00000000
        DWORD Signature2;               // Header - must be 0xffffffff
        DWORD Version;                  // Header - FT_PROGRAM_DATA version
                                        //          0 = original
                                        //          1 = FT2232C extensions
        WORD VendorId;                  // 0x0403
        WORD ProductId;                 // 0x6001
        char *Manufacturer;             // "FTDI"
        char *ManufacturerId;           // "FT"
        char *Description;              // "USB HS Serial Converter"
```

```
        char *SerialNumber;             // "FT000001" if fixed, or NULL
        WORD MaxPower;                  // 0 < MaxPower <= 500
        WORD PnP;                       // 0 = disabled, 1 = enabled
        WORD SelfPowered;               // 0 = bus powered, 1 = self powered
        WORD  RemoteWakeup;                     // 0 = not capable, 1 = capable
        //
        // Rev4 extensions
        //
        UCHAR Rev4;                     // non-zero if Rev4 chip, zero otherwise
        UCHAR IsoIn;                    // non-zero if in endpoint is isochronous
        UCHAR IsoOut;                   // non-zero if out endpoint is isochronous
        UCHAR PullDownEnable;           // non-zero if pull down enabled
        UCHAR SerNumEnable;                     // non-zero if serial number to be used
        UCHAR USBVersionEnable;         // non-zero if chip uses USBVersion
        WORD USBVersion;                // BCD (0x0200 => USB2)
        //
        // FT2232C extensions
        //
        UCHAR Rev5;                     // non-zero if Rev5 chip, zero otherwise
        UCHAR IsoInA;                   // non-zero if in endpoint is isochronous
        UCHAR IsoInB;                   // non-zero if in endpoint is isochronous
        UCHAR IsoOutA;                  // non-zero if out endpoint is isochronous
        UCHAR IsoOutB;                  // non-zero if out endpoint is isochronous
        UCHAR PullDownEnable5;          // non-zero if pull down enabled
        UCHAR SerNumEnable5;            // non-zero if serial number to be used
        UCHAR USBVersionEnable5;        // non-zero if chip uses USBVersion
        WORD USBVersion5;               // BCD (0x0200 => USB2)
        UCHAR AIsHighCurrent;                   // non-zero if interface is high current
        UCHAR BIsHighCurrent;                   // non-zero if interface is high current
        UCHAR IFAIsFifo;                // non-zero if interface is 245 FIFO
        UCHAR IFAIsFifoTar;             // non-zero if interface is 245 FIFO CPU target
        UCHAR IFAIsFastSer;             // non-zero if interface is Fast serial
        UCHAR AIsVCP;                   // non-zero if interface is to use VCP drivers
        UCHAR IFBIsFifo;                // non-zero if interface is 245 FIFO
        UCHAR IFBIsFifoTar;             // non-zero if interface is 245 FIFO CPU target
        UCHAR IFBIsFastSer;             // non-zero if interface is Fast serial
        UCHAR BIsVCP;                   // non-zero if interface is to use VCP drivers
} FT_PROGRAM_DATA, *PFT_PROGRAM_DATA;
```

FT_PROGRAM_DATA (EEPROM Programming Interface - compatible with DLL version 3.1.6.1 or later)

```
typedef struct ft_program_data {
        DWORD Signature1;               // Header - must be 0x00000000
        DWORD Signature2;               // Header - must be 0xffffffff
        DWORD Version;                  // Header - FT_PROGRAM_DATA version
                                        //          0 = original
                                        //          1 = FT2232C extensions
                                        //          2 = FT232R extensions
        WORD VendorId;                  // 0x0403
        WORD ProductId;                 // 0x6001
        char *Manufacturer;             // "FTDI"
        char *ManufacturerId;           // "FT"
        char *Description;              // "USB HS Serial Converter"
        char *SerialNumber;             // "FT000001" if fixed, or NULL
        WORD MaxPower;                  // 0 < MaxPower <= 500
        WORD PnP;                       // 0 = disabled, 1 = enabled
        WORD SelfPowered;               // 0 = bus powered, 1 = self powered
```

```
    WORD RemoteWakeup;                  // 0 = not capable, 1 = capable
    //
    // Rev4 extensions
    //
    UCHAR Rev4;                         // non-zero if Rev4 chip, zero otherwise
    UCHAR IsoIn;                        // non-zero if in endpoint is isochronous
    UCHAR IsoOut;                       // non-zero if out endpoint is isochronous
    UCHAR PullDownEnable;               // non-zero if pull down enabled
    UCHAR SerNumEnable;                 // non-zero if serial number to be used
    UCHAR USBVersionEnable;             // non-zero if chip uses USBVersion
    WORD USBVersion;                    // BCD (0x0200 => USB2)
    //
    // FT2232C extensions
    //
    UCHAR Rev5;                         // non-zero if Rev5 chip, zero otherwise
    UCHAR IsoInA;                       // non-zero if in endpoint is isochronous
    UCHAR IsoInB;                       // non-zero if in endpoint is isochronous
    UCHAR IsoOutA;                      // non-zero if out endpoint is isochronous
    UCHAR IsoOutB;                      // non-zero if out endpoint is isochronous
    UCHAR PullDownEnable5;              // non-zero if pull down enabled
    UCHAR SerNumEnable5;                // non-zero if serial number to be used
    UCHAR USBVersionEnable5;            // non-zero if chip uses USBVersion
    WORD USBVersion5;                   // BCD (0x0200 => USB2)
    UCHAR AIsHighCurrent;               // non-zero if interface is high current
    UCHAR BIsHighCurrent;               // non-zero if interface is high current
    UCHAR IFAIsFifo;                    // non-zero if interface is 245 FIFO
    UCHAR IFAIsFifoTar;                 // non-zero if interface is 245 FIFO CPU target
    UCHAR IFAIsFastSer;                 // non-zero if interface is Fast serial
    UCHAR AIsVCP;                       // non-zero if interface is to use VCP drivers
    UCHAR IFBIsFifo;                    // non-zero if interface is 245 FIFO
    UCHAR IFBIsFifoTar;                 // non-zero if interface is 245 FIFO CPU target
    UCHAR IFBIsFastSer;                 // non-zero if interface is Fast serial
    UCHAR BIsVCP;                       // non-zero if interface is to use VCP drivers
    //
    // FT232R extensions
    //
    UCHAR UseExtOsc;                    // Use External Oscillator
    UCHAR HighDriveIOs;                 // High Drive I/Os
    UCHAR EndpointSize;                 // Endpoint size
    UCHAR PullDownEnableR;              // non-zero if pull down enabled
    UCHAR SerNumEnableR;                // non-zero if serial number to be used
    UCHAR InvertTXD;                    // non-zero if invert TXD
    UCHAR InvertRXD;                    // non-zero if invert RXD
    UCHAR InvertRTS;                    // non-zero if invert RTS
    UCHAR InvertCTS;                    // non-zero if invert CTS
    UCHAR InvertDTR;                    // non-zero if invert DTR
    UCHAR InvertDSR;                    // non-zero if invert DSR
    UCHAR InvertDCD;                    // non-zero if invert DCD
    UCHAR InvertRI;                     // non-zero if invert RI
    UCHAR Cbus0;                        // Cbus Mux control - Ignored for FT245R
    UCHAR Cbus1;                        // Cbus Mux control - Ignored for FT245R
    UCHAR Cbus2;                        // Cbus Mux control - Ignored for FT245R
    UCHAR Cbus3;                        // Cbus Mux control - Ignored for FT245R
    UCHAR Cbus4;                        // Cbus Mux control - Ignored for FT245R
    UCHAR RIsVCP;                       // non-zero if using VCP drivers
} FT_PROGRAM_DATA, *PFT_PROGRAM_DATA;
```

FTCOMSTAT (FT-Win32 Programming Interface)

```
typedef struct _FTCOMSTAT {
        DWORD fCtsHold : 1;
        DWORD fDsrHold : 1;
        DWORD fRlsdHold : 1;
        DWORD fXoffHold : 1;
        DWORD fXoffSent : 1;
        DWORD fEof : 1;
        DWORD fTxim : 1;
        DWORD fReserved : 25;
        DWORD cbInQue;
        DWORD cbOutQue;
} FTCOMSTAT, *LPFTCOMSTAT;
```

FTDCB (FT-Win32 Programming Interface)

```
typedef struct _FTDCB {
        DWORD DCBlength;                    // sizeof(FTDCB)
        DWORD BaudRate;                     // Baudrate at which running
        DWORD fBinary: 1;                   // Binary Mode (skip EOF check)
        DWORD fParity: 1;                   // Enable parity checking
        DWORD fOutxCtsFlow:1;               // CTS handshaking on output
        DWORD fOutxDsrFlow:1;               // DSR handshaking on output
        DWORD fDtrControl:2;                // DTR Flow control
        DWORD fDsrSensitivity:1;            // DSR Sensitivity
        DWORD fTXContinueOnXoff: 1;                 // Continue TX when Xoff sent
        DWORD fOutX: 1;                     // Enable output X-ON/X-OFF
        DWORD fInX: 1;                      // Enable input X-ON/X-OFF
        DWORD fErrorChar: 1;                // Enable Err Replacement
        DWORD fNull: 1;                     // Enable Null stripping
        DWORD fRtsControl:2;                // Rts Flow control
        DWORD fAbortOnError:1;              // Abort all reads and writes on Error
        DWORD fDummy2:17;                   // Reserved
        WORD wReserved;                     // Not currently used
        WORD XonLim;                        // Transmit X-ON threshold
        WORD XoffLim;                       // Transmit X-OFF threshold
        BYTE ByteSize;                      // Number of bits/byte, 7-8
        BYTE Parity;                    // 0-4=None,Odd,Even,Mark,Space
        BYTE StopBits;                      // 0,2 = 1, 2
        char XonChar;                       // Tx and Rx X-ON character
        char XoffChar;                      // Tx and Rx X-OFF character
        char ErrorChar;                 // Error replacement char
        char EofChar;                       // End of Input character
        char EvtChar;                       // Received Event character
        WORD wReserved1;                    // Fill
} FTDCB, *LPFTDCB;
```

FTTIMEOUTS (FT-Win32 Programming Interface)

```
typedef struct _FTTIMEOUTS {
        DWORD ReadIntervalTimeout;          // Maximum time between read chars
        DWORD ReadTotalTimeoutMultiplier;   // Multiplier of characters
        DWORD ReadTotalTimeoutConstant;     // Constant in milliseconds
        DWORD WriteTotalTimeoutMultiplier;  // Multiplier of characters
        DWORD WriteTotalTimeoutConstant;    // Constant in milliseconds
} FTTIMEOUTS, *LPFTTIMEOUTS;
```

6.2 FTD2XX.H

```
/*++

Copyright (c) 2001-2005  Future Technology Devices International Ltd.

Module Name:

   ftd2xx.h

Abstract:

   Native USB device driver for FTDI FT8U232/245
   FTD2XX library definitions

Environment:

   kernel & user mode

Revision History:

   13/03/01    awm     Created.
        13/01/03        awm             Added device information support.
        19/03/03        awm             Added FT_W32_CancelIo.
        12/06/03        awm             Added FT_StopInTask and FT_RestartInTask.
        18/09/03        awm             Added FT_SetResetPipeRetryCount.
        10/10/03        awm             Added FT_ResetPort.
        23/01/04        awm             Added support for open-by-location.
        16/03/04        awm             Added support for FT2232C.
        23/09/04        awm             Added support for FT232R.
        20/10/04        awm             Added FT_CyclePort.
        18/01/05        awm             Added FT_DEVICE_LIST_INFO_NODE type.
        11/02/05        awm             Added LocId to FT_DEVICE_LIST_INFO_NODE.
        25/08/05        awm             Added FT_SetDeadmanTimeout.
        02/12/05        awm             Removed obsolete references.
        05/12/05        awm             Added FT_GetVersion, FT_GetVersionEx.


--*/


#ifndef FTD2XX_H
#define FTD2XX_H

// The following ifdef block is the standard way of creating macros
// which make exporting from a DLL simpler.  All files within this DLL
// are compiled with the FTD2XX_EXPORTS symbol defined on the command line.
// This symbol should not be defined on any project that uses this DLL.
// This way any other project whose source files include this file see
// FTD2XX_API functions as being imported from a DLL, whereas this DLL
// sees symbols defined with this macro as being exported.

#ifdef FTD2XX_EXPORTS
#define FTD2XX_API __declspec(dllexport)
#else
#define FTD2XX_API __declspec(dllimport)
#endif
```

```
typedef PVOID  FT_HANDLE;
typedef ULONG FT_STATUS;

//
// Device status
//
enum {
    FT_OK,
    FT_INVALID_HANDLE,
    FT_DEVICE_NOT_FOUND,
    FT_DEVICE_NOT_OPENED,
    FT_IO_ERROR,
    FT_INSUFFICIENT_RESOURCES,
    FT_INVALID_PARAMETER,
    FT_INVALID_BAUD_RATE,

    FT_DEVICE_NOT_OPENED_FOR_ERASE,
    FT_DEVICE_NOT_OPENED_FOR_WRITE,
    FT_FAILED_TO_WRITE_DEVICE,
    FT_EEPROM_READ_FAILED,
    FT_EEPROM_WRITE_FAILED,
    FT_EEPROM_ERASE_FAILED,
        FT_EEPROM_NOT_PRESENT,
        FT_EEPROM_NOT_PROGRAMMED,
        FT_INVALID_ARGS,
        FT_NOT_SUPPORTED,
        FT_OTHER_ERROR
};


#define FT_SUCCESS(status) ((status) == FT_OK)

//
// FT_OpenEx Flags
//

#define FT_OPEN_BY_SERIAL_NUMBER    1
#define FT_OPEN_BY_DESCRIPTION      2
#define FT_OPEN_BY_LOCATION                 4

//
// FT_ListDevices Flags (used in conjunction with FT_OpenEx Flags
//

#define FT_LIST_NUMBER_ONLY                 0x80000000
#define FT_LIST_BY_INDEX            0x40000000
#define FT_LIST_ALL                         0x20000000

#define FT_LIST_MASK (FT_LIST_NUMBER_ONLY|FT_LIST_BY_INDEX|FT_LIST_ALL)

//
// Baud Rates
//

#define FT_BAUD_300             300
#define FT_BAUD_600             600
#define FT_BAUD_1200            1200
#define FT_BAUD_2400            2400
```

```
#define FT_BAUD_4800                4800
#define FT_BAUD_9600                9600
#define FT_BAUD_14400               14400
#define FT_BAUD_19200               19200
#define FT_BAUD_38400               38400
#define FT_BAUD_57600               57600
#define FT_BAUD_115200              115200
#define FT_BAUD_230400              230400
#define FT_BAUD_460800              460800
#define FT_BAUD_921600              921600

//
// Word Lengths
//

#define FT_BITS_8                   (UCHAR) 8
#define FT_BITS_7                   (UCHAR) 7
#define FT_BITS_6                   (UCHAR) 6
#define FT_BITS_5                   (UCHAR) 5

//
// Stop Bits
//

#define FT_STOP_BITS_1              (UCHAR) 0
#define FT_STOP_BITS_1_5    (UCHAR) 1
#define FT_STOP_BITS_2              (UCHAR) 2

//
// Parity
//

#define FT_PARITY_NONE              (UCHAR) 0
#define FT_PARITY_ODD               (UCHAR) 1
#define FT_PARITY_EVEN              (UCHAR) 2
#define FT_PARITY_MARK              (UCHAR) 3
#define FT_PARITY_SPACE             (UCHAR) 4

//
// Flow Control
//

#define FT_FLOW_NONE        0x0000
#define FT_FLOW_RTS_CTS     0x0100
#define FT_FLOW_DTR_DSR     0x0200
#define FT_FLOW_XON_XOFF    0x0400

//
// Purge rx and tx buffers
//
#define FT_PURGE_RX         1
#define FT_PURGE_TX         2

//
// Events
//

typedef void (*PFT_EVENT_HANDLER)(DWORD,DWORD);
```

```
#define FT_EVENT_RXCHAR                 1
#define FT_EVENT_MODEM_STATUS   2

//
// Timeouts
//

#define FT_DEFAULT_RX_TIMEOUT   300


#define FT_DEFAULT_TX_TIMEOUT   300

//
// Device types
//

typedef ULONG FT_DEVICE;

enum {
    FT_DEVICE_BM,
    FT_DEVICE_AM,
    FT_DEVICE_100AX,
    FT_DEVICE_UNKNOWN,
    FT_DEVICE_2232C,
    FT_DEVICE_232R
};


#ifdef __cplusplus
extern "C" {
#endif


FTD2XX_API
FT_STATUS WINAPI FT_Open(
            int deviceNumber,
            FT_HANDLE *pHandle
            );

FTD2XX_API
FT_STATUS WINAPI FT_OpenEx(
    PVOID pArg1,
    DWORD Flags,
    FT_HANDLE *pHandle
    );

FTD2XX_API
FT_STATUS WINAPI FT_ListDevices(
            PVOID pArg1,
            PVOID pArg2,
            DWORD Flags
            );

FTD2XX_API
FT_STATUS WINAPI FT_Close(
    FT_HANDLE ftHandle
    );
```

```
FTD2XX_API
FT_STATUS WINAPI FT_Read(
    FT_HANDLE ftHandle,
    LPVOID lpBuffer,
    DWORD nBufferSize,
    LPDWORD lpBytesReturned
    );

FTD2XX_API
FT_STATUS WINAPI FT_Write(
    FT_HANDLE ftHandle,
    LPVOID lpBuffer,
    DWORD nBufferSize,
    LPDWORD lpBytesWritten
    );

FTD2XX_API
FT_STATUS WINAPI FT_IoCtl(
    FT_HANDLE ftHandle,
    DWORD dwIoControlCode,
    LPVOID lpInBuf,
    DWORD nInBufSize,
    LPVOID lpOutBuf,
    DWORD nOutBufSize,
    LPDWORD lpBytesReturned,
    LPOVERLAPPED lpOverlapped
    );

FTD2XX_API
FT_STATUS WINAPI FT_SetBaudRate(
    FT_HANDLE ftHandle,
        ULONG BaudRate
        );

FTD2XX_API
FT_STATUS WINAPI FT_SetDivisor(
    FT_HANDLE ftHandle,
        USHORT Divisor
        );

FTD2XX_API
FT_STATUS WINAPI FT_SetDataCharacteristics(
    FT_HANDLE ftHandle,
        UCHAR WordLength,
        UCHAR StopBits,
        UCHAR Parity
        );

FTD2XX_API
FT_STATUS WINAPI FT_SetFlowControl(
    FT_HANDLE ftHandle,
    USHORT FlowControl,
    UCHAR XonChar,
    UCHAR XoffChar
        );

FTD2XX_API
FT_STATUS WINAPI FT_ResetDevice(
```

```
    FT_HANDLE ftHandle
        );

FTD2XX_API
FT_STATUS WINAPI FT_SetDtr(
    FT_HANDLE ftHandle
        );

FTD2XX_API
FT_STATUS WINAPI FT_ClrDtr(
    FT_HANDLE ftHandle
        );

FTD2XX_API
FT_STATUS WINAPI FT_SetRts(
    FT_HANDLE ftHandle
        );

FTD2XX_API
FT_STATUS WINAPI FT_ClrRts(
    FT_HANDLE ftHandle
        );

FTD2XX_API
FT_STATUS WINAPI FT_GetModemStatus(
    FT_HANDLE ftHandle,
        ULONG *pModemStatus
        );

FTD2XX_API
FT_STATUS WINAPI FT_SetChars(
    FT_HANDLE ftHandle,
        UCHAR EventChar,
        UCHAR EventCharEnabled,
        UCHAR ErrorChar,
        UCHAR ErrorCharEnabled
    );

FTD2XX_API
FT_STATUS WINAPI FT_Purge(
    FT_HANDLE ftHandle,
        ULONG Mask
        );

FTD2XX_API
FT_STATUS WINAPI FT_SetTimeouts(
    FT_HANDLE ftHandle,
        ULONG ReadTimeout,
        ULONG WriteTimeout
        );

FTD2XX_API
FT_STATUS WINAPI FT_GetQueueStatus(
    FT_HANDLE ftHandle,
        DWORD *dwRxBytes
        );

FTD2XX_API
```

```
FT_STATUS WINAPI FT_SetEventNotification(
   FT_HANDLE ftHandle,
         DWORD Mask,
         PVOID Param
         );

FTD2XX_API
FT_STATUS WINAPI FT_GetStatus(
   FT_HANDLE ftHandle,
   DWORD *dwRxBytes,
   DWORD *dwTxBytes,
   DWORD *dwEventDWord
         );

FTD2XX_API
FT_STATUS WINAPI FT_SetBreakOn(
   FT_HANDLE ftHandle
   );

FTD2XX_API
FT_STATUS WINAPI FT_SetBreakOff(
   FT_HANDLE ftHandle
   );

FTD2XX_API
FT_STATUS WINAPI FT_SetWaitMask(
   FT_HANDLE ftHandle,
   DWORD Mask
   );

FTD2XX_API
FT_STATUS WINAPI FT_WaitOnMask(
   FT_HANDLE ftHandle,
   DWORD *Mask
   );

FTD2XX_API
FT_STATUS WINAPI FT_GetEventStatus(
   FT_HANDLE ftHandle,
   DWORD *dwEventDWord
   );

FTD2XX_API
FT_STATUS WINAPI FT_ReadEE(
   FT_HANDLE ftHandle,
         DWORD dwWordOffset,
   LPWORD lpwValue
         );

FTD2XX_API
FT_STATUS WINAPI FT_WriteEE(
   FT_HANDLE ftHandle,
         DWORD dwWordOffset,
   WORD wValue
         );

FTD2XX_API
FT_STATUS WINAPI FT_EraseEE(
```

```
    FT_HANDLE ftHandle
        );

//
// structure to hold program data for FT_Program function
//
typedef struct ft_program_data {

        DWORD Signature1;               // Header - must be 0x00000000
        DWORD Signature2;               // Header - must be 0xffffffff
        DWORD Version;                  // Header - FT_PROGRAM_DATA version
                                        //      0 = original
                                        //      1 = FT2232C extensions
                                        //      2 = FT232R extensions

        WORD VendorId;                  // 0x0403
        WORD ProductId;                 // 0x6001
        char *Manufacturer;             // "FTDI"
        char *ManufacturerId;           // "FT"
        char *Description;              // "USB HS Serial Converter"
        char *SerialNumber;             // "FT000001" if fixed, or NULL
        WORD MaxPower;                  // 0 < MaxPower <= 500
        WORD PnP;                       // 0 = disabled, 1 = enabled
        WORD SelfPowered;               // 0 = bus powered, 1 = self powered
        WORD  RemoteWakeup;                     // 0 = not capable, 1 = capable
        //
        // Rev4 extensions
        //
        UCHAR Rev4;                     // non-zero if Rev4 chip, zero otherwise
        UCHAR IsoIn;                    // non-zero if in endpoint is isochronous
        UCHAR IsoOut;                   // non-zero if out endpoint is isochronous
        UCHAR PullDownEnable;           // non-zero if pull down enabled
        UCHAR SerNumEnable;                     // non-zero if serial number to be used
        UCHAR USBVersionEnable;         // non-zero if chip uses USBVersion
        WORD USBVersion;                // BCD (0x0200 => USB2)
        //
        // FT2232C extensions
        //
        UCHAR Rev5;                     // non-zero if Rev5 chip, zero otherwise
        UCHAR IsoInA;                   // non-zero if in endpoint is isochronous
        UCHAR IsoInB;                   // non-zero if in endpoint is isochronous
        UCHAR IsoOutA;                  // non-zero if out endpoint is isochronous
        UCHAR IsoOutB;                  // non-zero if out endpoint is isochronous
        UCHAR PullDownEnable5;          // non-zero if pull down enabled
        UCHAR SerNumEnable5;            // non-zero if serial number to be used
        UCHAR USBVersionEnable5;        // non-zero if chip uses USBVersion
        WORD USBVersion5;               // BCD (0x0200 => USB2)
        UCHAR AIsHighCurrent;                   // non-zero if interface is high current
        UCHAR BIsHighCurrent;                   // non-zero if interface is high current
        UCHAR IFAIsFifo;                // non-zero if interface is 245 FIFO
        UCHAR IFAIsFifoTar;             // non-zero if interface is 245 FIFO CPU target
        UCHAR IFAIsFastSer;             // non-zero if interface is Fast serial
        UCHAR AIsVCP;                   // non-zero if interface is to use VCP drivers
        UCHAR IFBIsFifo;                // non-zero if interface is 245 FIFO
        UCHAR IFBIsFifoTar;             // non-zero if interface is 245 FIFO CPU target
        UCHAR IFBIsFastSer;             // non-zero if interface is Fast serial
        UCHAR BIsVCP;                   // non-zero if interface is to use VCP drivers
        //
```

```
        // FT232R extensions
        //
        UCHAR UseExtOsc;                // Use External Oscillator
        UCHAR HighDriveIOs;             // High Drive I/Os
        UCHAR EndpointSize;             // Endpoint size

        UCHAR PullDownEnableR;          // non-zero if pull down enabled
        UCHAR SerNumEnableR;            // non-zero if serial number to be used

        UCHAR InvertTXD;                // non-zero if invert TXD
        UCHAR InvertRXD;                // non-zero if invert RXD
        UCHAR InvertRTS;                // non-zero if invert RTS
        UCHAR InvertCTS;                // non-zero if invert CTS
        UCHAR InvertDTR;                // non-zero if invert DTR
        UCHAR InvertDSR;                // non-zero if invert DSR
        UCHAR InvertDCD;                // non-zero if invert DCD
        UCHAR InvertRI;                         // non-zero if invert RI

        UCHAR Cbus0;                    // Cbus Mux control
        UCHAR Cbus1;                    // Cbus Mux control
        UCHAR Cbus2;                    // Cbus Mux control
        UCHAR Cbus3;                    // Cbus Mux control
        UCHAR Cbus4;                    // Cbus Mux control

        UCHAR RIsVCP;                   // non-zero if using D2XX drivers

} FT_PROGRAM_DATA, *PFT_PROGRAM_DATA;

FTD2XX_API
FT_STATUS WINAPI FT_EE_Program(
   FT_HANDLE ftHandle,
        PFT_PROGRAM_DATA pData
        );

FTD2XX_API
FT_STATUS WINAPI FT_EE_ProgramEx(
   FT_HANDLE ftHandle,
        PFT_PROGRAM_DATA pData,
        char *Manufacturer,
        char *ManufacturerId,
        char *Description,
        char *SerialNumber
        );

FTD2XX_API
FT_STATUS WINAPI FT_EE_Read(
   FT_HANDLE ftHandle,
        PFT_PROGRAM_DATA pData
        );

FTD2XX_API
FT_STATUS WINAPI FT_EE_ReadEx(
   FT_HANDLE ftHandle,
        PFT_PROGRAM_DATA pData,
        char *Manufacturer,
        char *ManufacturerId,
        char *Description,
        char *SerialNumber
```

```
        );

FTD2XX_API
FT_STATUS WINAPI FT_EE_UASize(
    FT_HANDLE ftHandle,
        LPDWORD lpdwSize
        );

FTD2XX_API
FT_STATUS WINAPI FT_EE_UAWrite(
    FT_HANDLE ftHandle,
        PUCHAR pucData,
        DWORD dwDataLen
        );

FTD2XX_API
FT_STATUS WINAPI FT_EE_UARead(
    FT_HANDLE ftHandle,
        PUCHAR pucData,
        DWORD dwDataLen,
        LPDWORD lpdwBytesRead
        );

FTD2XX_API
FT_STATUS WINAPI FT_SetLatencyTimer(
    FT_HANDLE ftHandle,
    UCHAR ucLatency
    );

FTD2XX_API
FT_STATUS WINAPI FT_GetLatencyTimer(
    FT_HANDLE ftHandle,
    PUCHAR pucLatency
    );

FTD2XX_API
FT_STATUS WINAPI FT_SetBitMode(
    FT_HANDLE ftHandle,
    UCHAR ucMask,
        UCHAR ucEnable
    );

FTD2XX_API
FT_STATUS WINAPI FT_GetBitMode(
    FT_HANDLE ftHandle,
    PUCHAR pucMode
    );

FTD2XX_API
FT_STATUS WINAPI FT_SetUSBParameters(
    FT_HANDLE ftHandle,
    ULONG ulInTransferSize,
    ULONG ulOutTransferSize
        );

FTD2XX_API
FT_STATUS WINAPI FT_SetDeadmanTimeout(
    FT_HANDLE ftHandle,
```

```
        ULONG ulDeadmanTimeout
    );

FTD2XX_API
FT_STATUS WINAPI FT_GetDeviceInfo(
    FT_HANDLE ftHandle,
    FT_DEVICE *lpftDevice,
        LPDWORD lpdwID,
        PCHAR SerialNumber,
        PCHAR Description,
        LPVOID Dummy
    );

FTD2XX_API
FT_STATUS WINAPI FT_StopInTask(
    FT_HANDLE ftHandle
    );

FTD2XX_API
FT_STATUS WINAPI FT_RestartInTask(
    FT_HANDLE ftHandle
    );

FTD2XX_API
FT_STATUS WINAPI FT_SetResetPipeRetryCount(
    FT_HANDLE ftHandle,
        DWORD dwCount
    );

FTD2XX_API
FT_STATUS WINAPI FT_ResetPort(
    FT_HANDLE ftHandle
    );

FTD2XX_API
FT_STATUS WINAPI FT_CyclePort(
    FT_HANDLE ftHandle
    );


//
// Win32-type functions
//

FTD2XX_API
FT_HANDLE WINAPI FT_W32_CreateFile(
        LPCSTR                          lpszName,
        DWORD                           dwAccess,
        DWORD                           dwShareMode,
        LPSECURITY_ATTRIBUTES   lpSecurityAttributes,
        DWORD                           dwCreate,
        DWORD                           dwAttrsAndFlags,
        HANDLE                          hTemplate
        );

FTD2XX_API
BOOL WINAPI FT_W32_CloseHandle(
    FT_HANDLE ftHandle
```

```
        );

FTD2XX_API
BOOL WINAPI FT_W32_ReadFile(
    FT_HANDLE ftHandle,
    LPVOID lpBuffer,
    DWORD nBufferSize,
    LPDWORD lpBytesReturned,
        LPOVERLAPPED lpOverlapped
    );

FTD2XX_API
BOOL WINAPI FT_W32_WriteFile(
    FT_HANDLE ftHandle,
    LPVOID lpBuffer,
    DWORD nBufferSize,
    LPDWORD lpBytesWritten,
        LPOVERLAPPED lpOverlapped
    );

FTD2XX_API
DWORD WINAPI FT_W32_GetLastError(
    FT_HANDLE ftHandle
    );

FTD2XX_API
BOOL WINAPI FT_W32_GetOverlappedResult(
    FT_HANDLE ftHandle,
        LPOVERLAPPED lpOverlapped,
    LPDWORD lpdwBytesTransferred,
        BOOL bWait
    );

FTD2XX_API
BOOL WINAPI FT_W32_CancelIo(
    FT_HANDLE ftHandle
    );


//
// Win32 COMM API type functions
//
typedef struct _FTCOMSTAT {
    DWORD fCtsHold : 1;
    DWORD fDsrHold : 1;
    DWORD fRlsdHold : 1;
    DWORD fXoffHold : 1;
    DWORD fXoffSent : 1;
    DWORD fEof : 1;
    DWORD fTxim : 1;
    DWORD fReserved : 25;
    DWORD cbInQue;
    DWORD cbOutQue;
} FTCOMSTAT, *LPFTCOMSTAT;

typedef struct _FTDCB {
    DWORD DCBlength;      /* sizeof(FTDCB)                */
    DWORD BaudRate;       /* Baudrate at which running    */
```

```
    DWORD fBinary: 1;     /* Binary Mode (skip EOF check)    */
    DWORD fParity: 1;     /* Enable parity checking          */
    DWORD fOutxCtsFlow:1; /* CTS handshaking on output       */
    DWORD fOutxDsrFlow:1; /* DSR handshaking on output       */
    DWORD fDtrControl:2;  /* DTR Flow control                */
    DWORD fDsrSensitivity:1; /* DSR Sensitivity              */
    DWORD fTXContinueOnXoff: 1; /* Continue TX when Xoff sent */
    DWORD fOutX: 1;       /* Enable output X-ON/X-OFF        */
    DWORD fInX: 1;        /* Enable input X-ON/X-OFF         */
    DWORD fErrorChar: 1;  /* Enable Err Replacement          */
    DWORD fNull: 1;       /* Enable Null stripping           */
    DWORD fRtsControl:2;  /* Rts Flow control                */
    DWORD fAbortOnError:1; /* Abort all reads and writes on Error */
    DWORD fDummy2:17;     /* Reserved                        */
    WORD wReserved;       /* Not currently used              */
    WORD XonLim;          /* Transmit X-ON threshold         */
    WORD XoffLim;         /* Transmit X-OFF threshold        */
    BYTE ByteSize;        /* Number of bits/byte, 4-8        */
    BYTE Parity;          /* 0-4=None,Odd,Even,Mark,Space    */
    BYTE StopBits;        /* 0,1,2 = 1, 1.5, 2               */
    char XonChar;         /* Tx and Rx X-ON character        */
    char XoffChar;        /* Tx and Rx X-OFF character       */
    char ErrorChar;       /* Error replacement char          */
    char EofChar;         /* End of Input character          */
    char EvtChar;         /* Received Event character        */
    WORD wReserved1;      /* Fill for now.                   */
} FTDCB, *LPFTDCB;

typedef struct _FTTIMEOUTS {
    DWORD ReadIntervalTimeout;          /* Maximum time between read chars. */
    DWORD ReadTotalTimeoutMultiplier;   /* Multiplier of characters.        */
    DWORD ReadTotalTimeoutConstant;     /* Constant in milliseconds.        */
    DWORD WriteTotalTimeoutMultiplier;  /* Multiplier of characters.        */
    DWORD WriteTotalTimeoutConstant;    /* Constant in milliseconds.        */
} FTTIMEOUTS,*LPFTTIMEOUTS;


FTD2XX_API
BOOL WINAPI FT_W32_ClearCommBreak(
    FT_HANDLE ftHandle
        );

FTD2XX_API
BOOL WINAPI FT_W32_ClearCommError(
    FT_HANDLE ftHandle,
        LPDWORD lpdwErrors,
    LPFTCOMSTAT lpftComstat
        );

FTD2XX_API
BOOL WINAPI FT_W32_EscapeCommFunction(
    FT_HANDLE ftHandle,
        DWORD dwFunc
        );

FTD2XX_API
BOOL WINAPI FT_W32_GetCommModemStatus(
    FT_HANDLE ftHandle,
```

```
        LPDWORD lpdwModemStatus
        );

FTD2XX_API
BOOL WINAPI FT_W32_GetCommState(
    FT_HANDLE ftHandle,
    LPFTDCB lpftDcb
        );

FTD2XX_API
BOOL WINAPI FT_W32_GetCommTimeouts(
    FT_HANDLE ftHandle,
    FTTIMEOUTS *pTimeouts
        );

FTD2XX_API
BOOL WINAPI FT_W32_PurgeComm(
    FT_HANDLE ftHandle,
        DWORD dwMask
        );

FTD2XX_API
BOOL WINAPI FT_W32_SetCommBreak(
    FT_HANDLE ftHandle
        );

FTD2XX_API
BOOL WINAPI FT_W32_SetCommMask(
    FT_HANDLE ftHandle,
    ULONG ulEventMask
    );

FTD2XX_API
BOOL WINAPI FT_W32_SetCommState(
    FT_HANDLE ftHandle,
    LPFTDCB lpftDcb
        );

FTD2XX_API
BOOL WINAPI FT_W32_SetCommTimeouts(
    FT_HANDLE ftHandle,
    FTTIMEOUTS *pTimeouts
        );

FTD2XX_API
BOOL WINAPI FT_W32_SetupComm(
    FT_HANDLE ftHandle,
        DWORD dwReadBufferSize,
        DWORD dwWriteBufferSize
        );

FTD2XX_API
BOOL WINAPI FT_W32_WaitCommEvent(
    FT_HANDLE ftHandle,
    PULONG pulEvent,
        LPOVERLAPPED lpOverlapped
    );
```

```
//
// Device information
//

typedef struct _ft_device_list_info_node {
        ULONG Flags;
    ULONG Type;
        ULONG ID;
        DWORD LocId;
        char SerialNumber[16];
        char Description[64];
        FT_HANDLE ftHandle;
} FT_DEVICE_LIST_INFO_NODE;


FTD2XX_API
FT_STATUS WINAPI FT_CreateDeviceInfoList(
        LPDWORD lpdwNumDevs
        );

FTD2XX_API
FT_STATUS WINAPI FT_GetDeviceInfoList(
        FT_DEVICE_LIST_INFO_NODE *pDest,
        LPDWORD lpdwNumDevs
        );

FTD2XX_API
FT_STATUS WINAPI FT_GetDeviceInfoDetail(
        DWORD dwIndex,
        LPDWORD lpdwFlags,
        LPDWORD lpdwType,
        LPDWORD lpdwID,
        LPDWORD lpdwLocId,
        LPVOID lpSerialNumber,
        LPVOID lpDescription,
        FT_HANDLE *pftHandle
        );


//
// Version information
//

FTD2XX_API
FT_STATUS WINAPI FT_GetDriverVersion(
    FT_HANDLE ftHandle,
        LPDWORD lpdwVersion
        );

FTD2XX_API
FT_STATUS WINAPI FT_GetLibraryVersion(
        LPDWORD lpdwVersion
        );



#ifdef __cplusplus
```

```
}
#endif


#endif  /* FTD2XX_H */
```

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