MQP Packet-Master USB12

User Manual

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Contents

1 GETTING STARTED

1.1 Introduction

The Packet-Master USB12 is a non-intrusive Hardware USB Bus Analyser, intended for development of Low and Full Speed USB devices and hubs etc. It comes complete with our Windows application GraphicUSB for capturing and displaying every detail of the data interactions on a USB link.

1.2 Installing the Software and Driver

1.2.1 Install the Software from CD

- Insert the Installation disk into the CD drive.
- The disk should auto-start.
- Follow the on screen instructions.
- If the disk doesn't start then run the file Setup.exe in the root directory of the CD.
- If you should have problems with the install disk, you can run the installation file directly from its location on the CD. If the CD drive is drive "D:" the file is located in: "D:\website\" and is called "usb12_setup.exe".

1.2.2 Installing the Driver

- The first time you plug in the USB cable from your Packet-Master USB12, Windows will start the "Found new Hardware" wizard. If it asks to search "Windows Update", select "No, not this time".
- Ensure that you have the Installation CD in a CD drive. (*if the CD auto-runs and starts the GraphicUSB installation screen, then click "Exit" to leave it before continuing with the driver installation.)*
- For your information: If the CD drive is drive "D:", the driver files are located in "D:\Drivers\" and the installation file is called "mqpuba.inf".

1.2.3 Updating the Driver

- If there is a requirement to update the USB Driver for the Packet-Master USB12, you will be informed when you run a new version of GraphicUSB.
- Should you need to update the USB Driver at any time, full instructions are given in the file:
  "C:\Program Files\MQP Electronics\GraphicUSB\usb drivers\updating.txt"
  (Assuming a default location for the GraphicUSB installation)
- The driver itself is located in:
  "C:\Program Files\MQP Electronics\GraphicUSB\usb drivers\"
  (Assuming a default location for the GraphicUSB installation)

1.2.4 Update the Software

If at a later date you wish to make use of an update from our website. Please follow the instructions below:

- Download the file.
- Run the down-loaded .exe file straight from your hard disk and follow the on screen instructions.
- The latest version of the software is available at http://www.mqp.com/

1.3 Sample Capture Files

During installation of the software a number of sample capture files will be placed in the folder "Samples" in the application's installation directory. If you have accepted the defaults during installation, this will be called:
C:\Program Files\MQP Electronics\GraphicUSB\Samples
The sample files have the extension *.mqu
You may find it helpful to open one of these sample files to become familiar with the capabilities of GraphicUSB.

1.4 Front and Back Panels

- The Power Indicator illuminates when the Packet-Master is powered and connected to the Host computer.
- The Activity indicator shows the presence of data exchanges. The indicator flashes once for each DATA0, DATA1 or SETUP packet.
- Capture Start and Capture Stop buttons control the capturing of USB data, and the Capture Indicator shows when capturing is in progress.
- The USB through-connectors are used for connection to the Host and device under test.

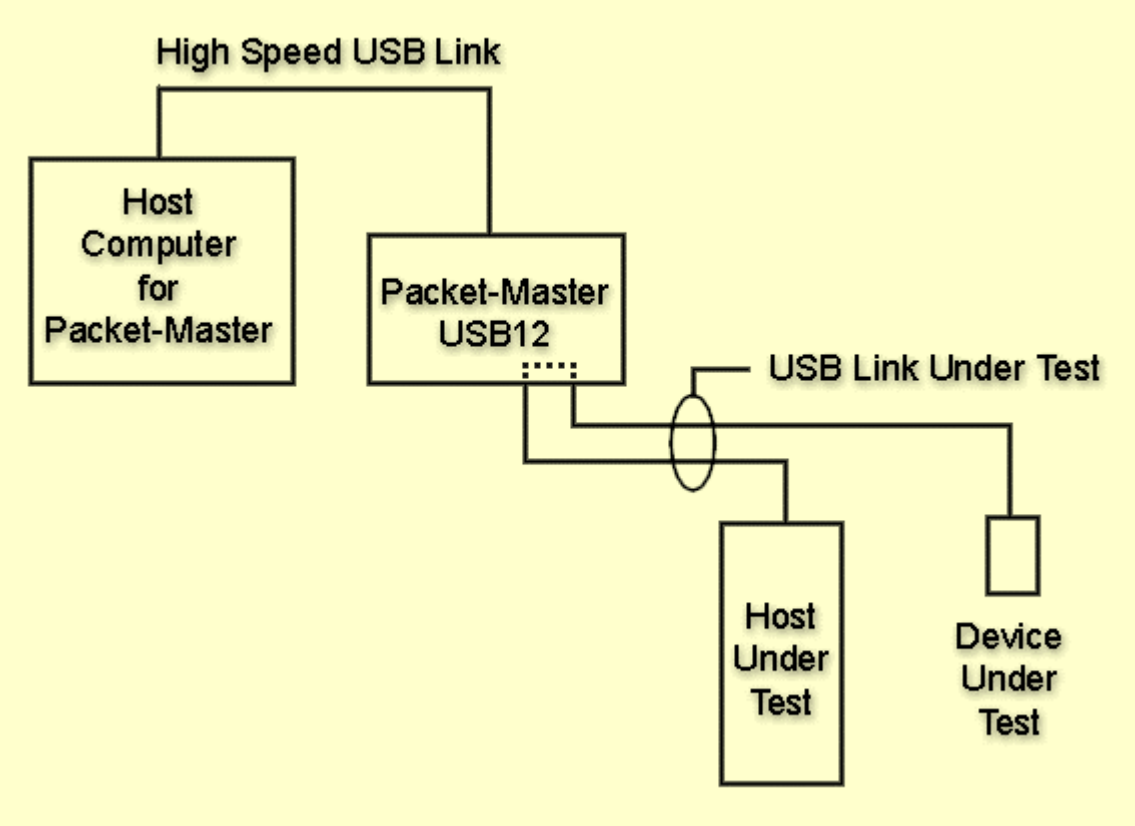
- The Packet-Master is normally USB Bus Powered for convenience of use.
- An optional external power input is provided (this is not normally required, but useful if the host won't configure a high-power device)
- A High Speed USB (480 Mbit/s) provides the connection to the Host PC.
- A 10 pin Feature connector provides signals for an oscilloscope or logic analyser.

1.5 Test Set Up

To achieve a good capture rate it is important to provide a suitable test environment. The Packet-Master USB12 should preferably be hosted by a good performance PC with a high speed USB connection. The USB host controller should not be shared by any other USB device while doing the testing.

The Packet-Master USB12 will function correctly when connected to a Full Speed link but the capacity will be severely reduced and only low rates of USB traffic may be captured from the device under test.

In a similar fashion it is theoretically possible to use the same host computer for the Packet-Master USB12 and for the Host under Test. We do not recommend this, but if it is absolutely unavoidable, then you must at least use a separate USB host controller for the device under test. If your computer does not have two host controllers then you will need to buy a plug-in USB host controller card.



It is possible to have more than one device under test. In this case the devices must first be connected to a Hub and the Hub plugged into the Packet-Master. Both devices and the Hub are downstream of the Packet-Master.

It is not recommended that a Hub is connected upstream of the analyser as traffic from the Host to Hub may be recorded but not the traffic from the Hub to the Host.

This test equipment, by its very nature, has to connect to a junction of two USB cables in order to probe the data on the link. It is important to keep the cables between the ‘device under test’ and the ‘host under test’ as short as possible (for example 1m), and to use good quality cables.

1.6 Data Capture

- Connect the Packet-Master to the Host computer as shown in the Test Set Up section**.** You must first have installed the GraphicUSB software and Driver**.**
- Connect the Device under Test and the Host under Test as shown in the Test Set UP section. It may be preferable to use a simple working commercial device such as a low speed mouse for your first data capture.
- Run the GraphicUSB software.
- Start capturing by either momentarily pressing the Start button on the Packet-Master front panel or clicking Capture on the tool bar.
- A capture window will open and you should see the capture statistics incrementing.
- After a few moments stop capturing by either momentarily pressing the Stop Button on the Packet-Master front panel or clicking the Save button in the Capture window.
- A full analysis of the data captured will be displayed.
- Each new capture will create a new capture window. To select the capture you wish to view click on “Window” on the menu bar.

1.7 Saving the Capture

If you wish to keep the capture for future reference, click on “File…Save” on the menu bar or on the “Save” icon on the Tool Bar. By default, files will be saved in the folder specified in the Options Settings Window. GraphicUSB files have the extension .mqu

2 TECHNICAL DATA

2.1 Requirements

The minimum requirements for the Packet-Master Host are as follows:

- Pentium 3 - 600MHz
- PC with High Speed USB port should be dedicated to the capturing. (Actual target device should be connected to a different Host Computer to ensure reliable capture bandwidth)
- Windows XP (Service Pack 1 or better) preferred. Also Windows 2000 / ME / 98SE.
- CD ROM / DVD Drive
- 128MB RAM
- 100MB space on Hard Disk

Note: A good performance machine is recommended for good capture rate.

2.2 Specifications

Weight:	165 g
Dimensions:	129 x 100 x 31 mm
Temperature:	0°C - 40°C
Humidity:	20% - 80% non condensing
Power:	150mA from USB host Optionally zero mA from USB if powered externally

2.3 Maximum Capture File Size

The maximum size of the Capture file is limited by the available RAM in the Host computer.

2.4 Safety

CE compliant.

2.5 Feature Connector

The signals available on the back panel connector are:

Pin	Signal	Notes
1	D+	De-glitched and synchronised with the 48 or 6MHz clock
2	GND	
3	D-	De-glitched and synchronised with the 48 or 6MHz clock
4	GND	
5	DECODED DATA	Decoded NRZI data
6	GND	
7	DATA CLOCK ENABLE	Data sampling signal phase-locked to the incoming signal transitions
8	GND	
9	PACKET SYNC PULSE	A pulse one clock period wide indicating that the sync pattern has been detected
10	GND	

2.6 External Power Supply

The Packet-Master USB12 normally derives its power from the Host computer's USB connection, but may be powered externally. This is not normally required, but useful if the host won't configure a high-power device. The external supply must meet the following requirements:

Output Voltage	9V Regulated
Output Current	300mA
Polarity	Centre Pin Positive

-

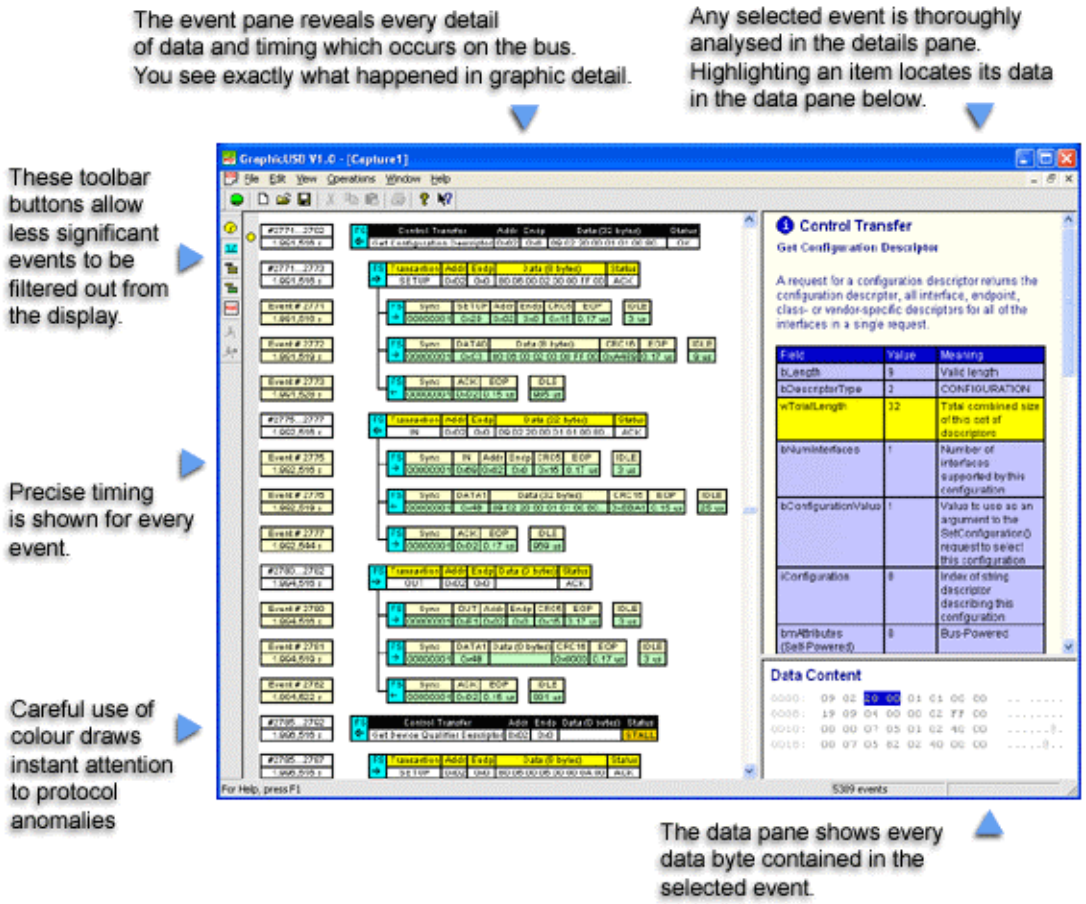
A suitable Power Supply is available from MQP Electronics Ltd. The use of any other supply is not recommended and is at the users own risk.

3 GraphicUSB SOFTWARE

3.1 Overview

The Packet-Master USB12 owes a large part of its functionality to the GraphicUSB application, which is supplied with the Analyser. A simple, yet information-rich display allows you to view every detail of a capture.

This shows the organization of the screen after a typical capture:

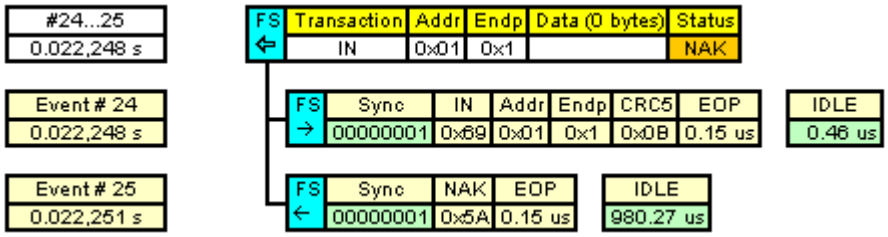


3.2 Panes

3.2.1 Event Pane

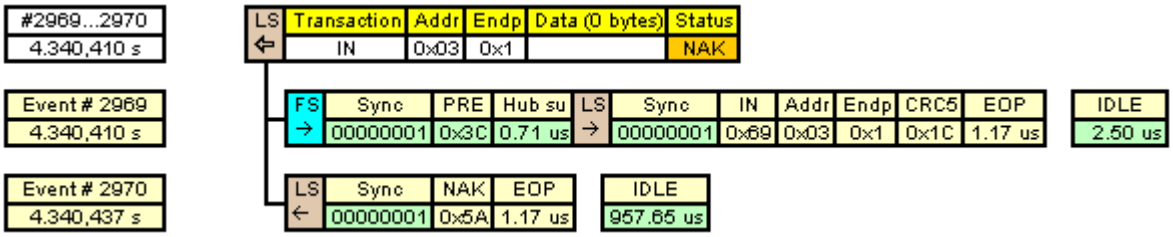
The Event Pane graphically shows every detail of data and timing on the bus. The example shown below is an IN transaction made up of two packets. The left hand column contains an event number and a time stamp. The time stamp has a resolution of 20.83ns. A vertical line associates the packets within the transaction. Looking in detail at the display for event #24 below, the following information is displayed:

- The speed of the transmission. FS is full speed, 12MHz and LS is low speed, 1.5MHz.
- The direction of the packet. A right pointing arrow is for host to device and a left pointing arrow for device to host.
- The Synchronisation field. The bit pattern received is shown.
- The Packet ID (PID). In this case it is an IN token.
- The Address field.
- The Endpoint field.
- The CRC field. Token packets have a five bit CRC while data packets have a sixteen bit CRC.
- End of Packet (EOP). An EOP is made up of a single ended zero for approximately two bit times followed by a J state. The time shown is the length of the single ended zero.
- Finally the idle time before the next event.



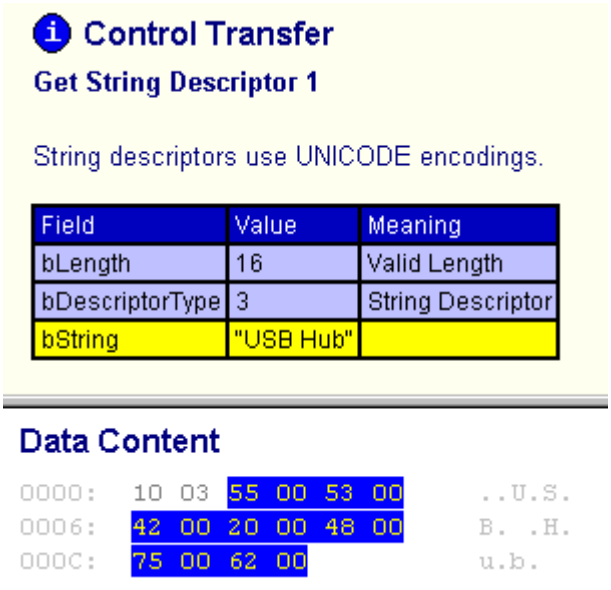
An error e.g. an incorrect CRC is indicated by the appropriate field being highlighted in red. A field highlighted in orange indicates a potential problem or warning.

This view of a GraphicUSB capture shows data being transferred at two different speeds on the same link. Each packet is preceded by a coloured marker indicating Full Speed or Low Speed. This makes the function of the PREAMBLE packet very clear. Notice also the detailed timing information for Hub Setup time, End of Packet duration, and IDLE state time.



3.2.2 Analysis and Data Panes

By clicking on an event row in the event pane, a complete analysis of the event is displayed in the analysis pane, and the data content is shown in its entirety in the data pane. Where appropriate, any information selected in the analysis pane is highlighted in the data pane for easy identification. All standard requests and descriptors are analysed in detail. Any discrepancies are described.



3.3 Toolbars

3.3.1 File Functions Toolbar

 Start Capture

 Open an existing Capture file

 Save the currently active Capture document

 Print the current Events Pane (If icon is grayed out, click in the Events Pane)

 About GraphicUSB

 Help on GraphicUSB

 Search Settings

 Find First

 Find Previous

 Find Next

 Find Last

3.3.2 View Filter Toolbar

 Show Start of Frame events

 Show bus events

 Show Transactions in Control Transfer

 Show Packets

Show NAKed Transactions

 Go to Event number

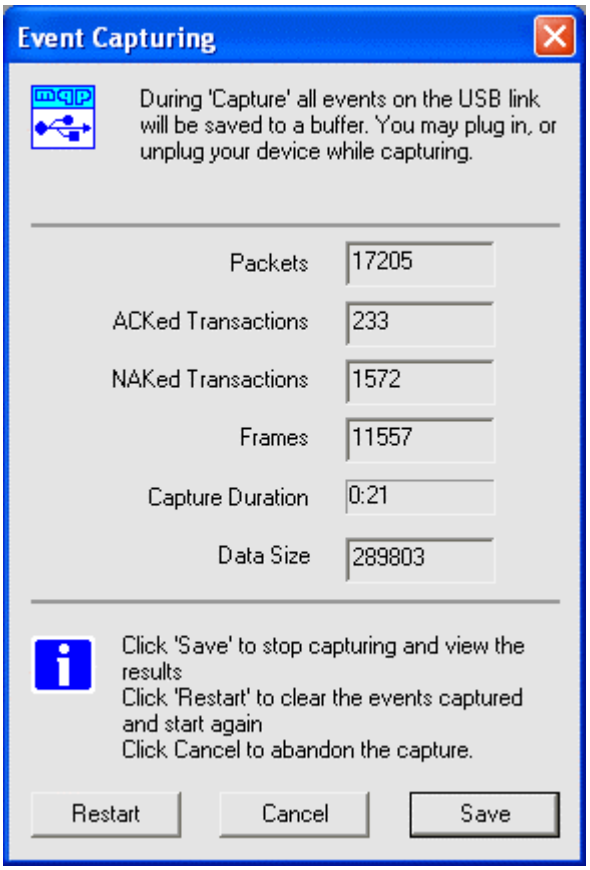
 Go to selected Event

3.4 Capturing

Capturing may be started by either clicking on the Capture button situated on the tool bar of GraphicUSB or by momentarily pressing the Start button on the front panel. During capturing an Event Capturing Window opens. This window contains the following information:

- The number of packets received
- The number of ACKed transactions
- The number of NAKed transactions
- The number of frames received
- The duration of the current capture
- The size of the captured data in bytes

At any time during the capture, devices may be plugged in or out.



To end capturing and display the data, either click on SAVE in the Capture window or momentarily press the STOP button on the front panel. Clicking RESTART will clear all the events so far and start again. Clicking CANCEL will abandon the capture.

3.5 Display Filters

Toolbar buttons allow the filtering out of events that you do not wish to display. The following filters are available:

Show SOF

Start of Frame packets on full speed devices and Keep Alive events on low speed devices come at approximately one millisecond intervals. Clicking this tool bar button removes/shows these events.

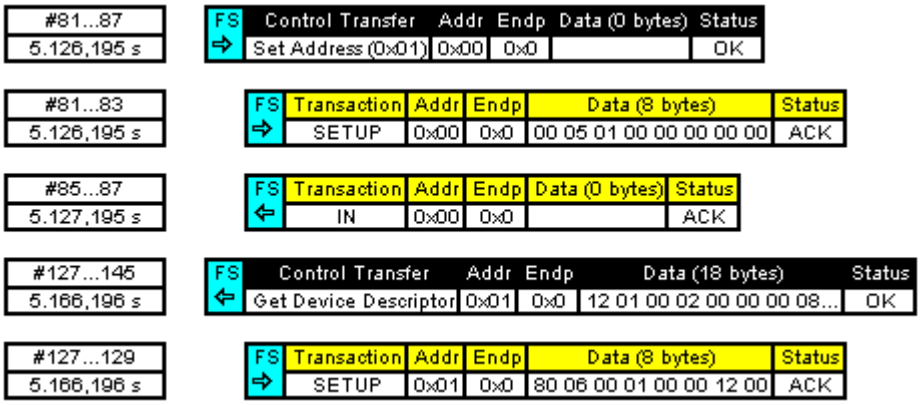
Show Bus States

Clicking the Bus States button removes/shows the following events:

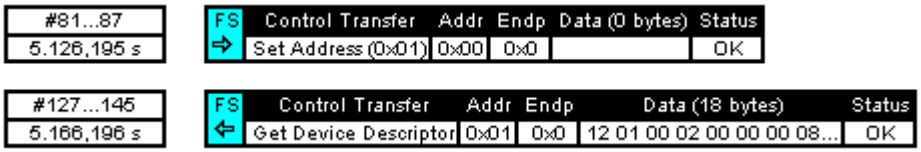
- Plugged in
- Unplugged
- Reset
- Suspend
- Resume

Show Transactions

A Control Transfer contains a number of transactions starting with a SETUP. Clicking this button removes/shows the transactions within a Control Transfer. The example below shows the effect of filtering out the transactions.

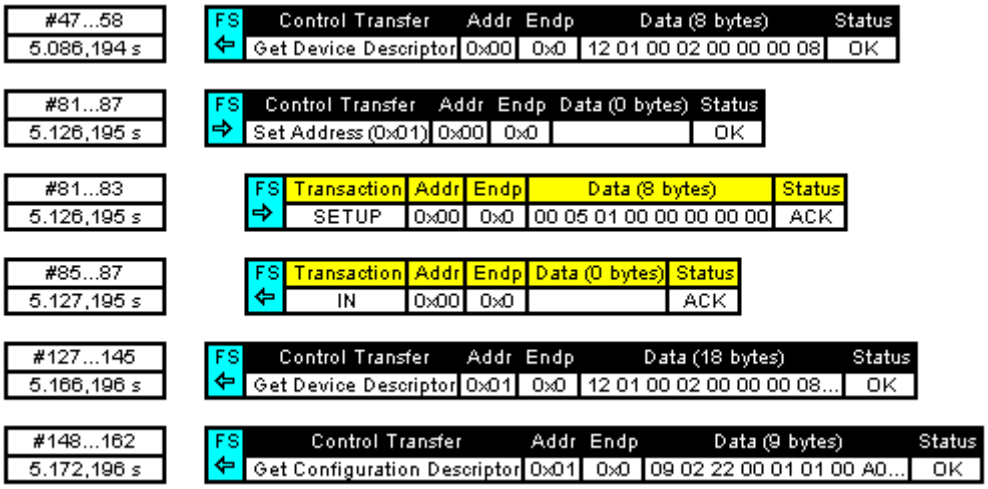


Show Transactions



Hide Transactions

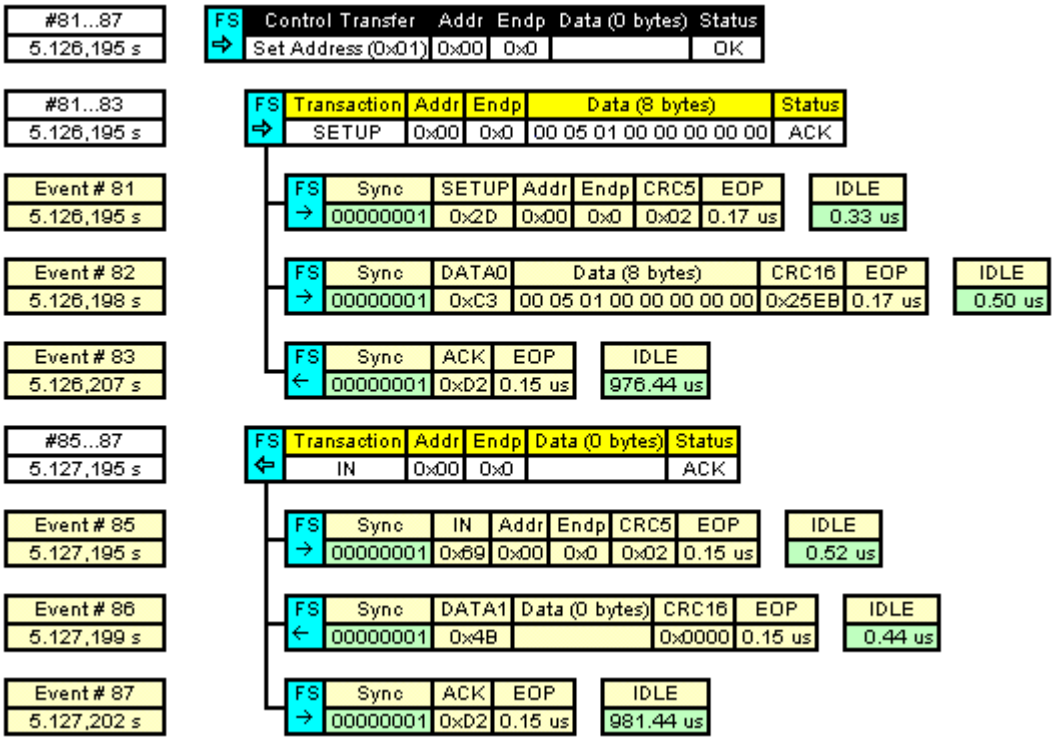
If transactions within control transfers have been filtered out, then double clicking on a particular control transfer will reveal the transactions within it, as shown below.



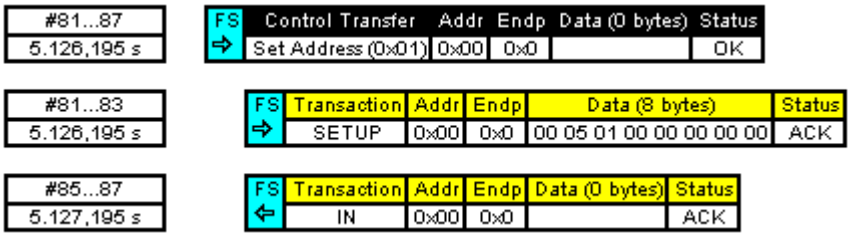
Show Selected Transactions

Show Packets

A transaction contains a number of packets. Clicking this button removes/shows the packets within the transactions.

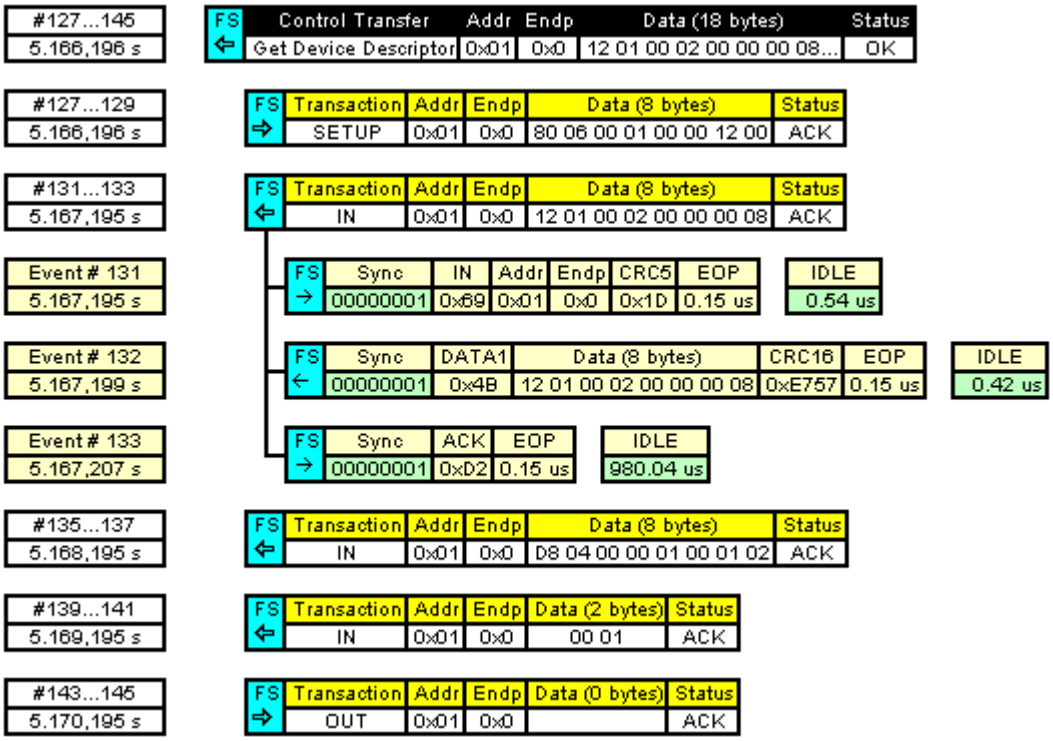


Show Packets



Hide Packets

If packets have been filtered out, then double clicking on a particular transaction will reveal the packets within it, as shown below.

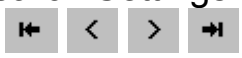


Show Selected Packets

Show NAKs

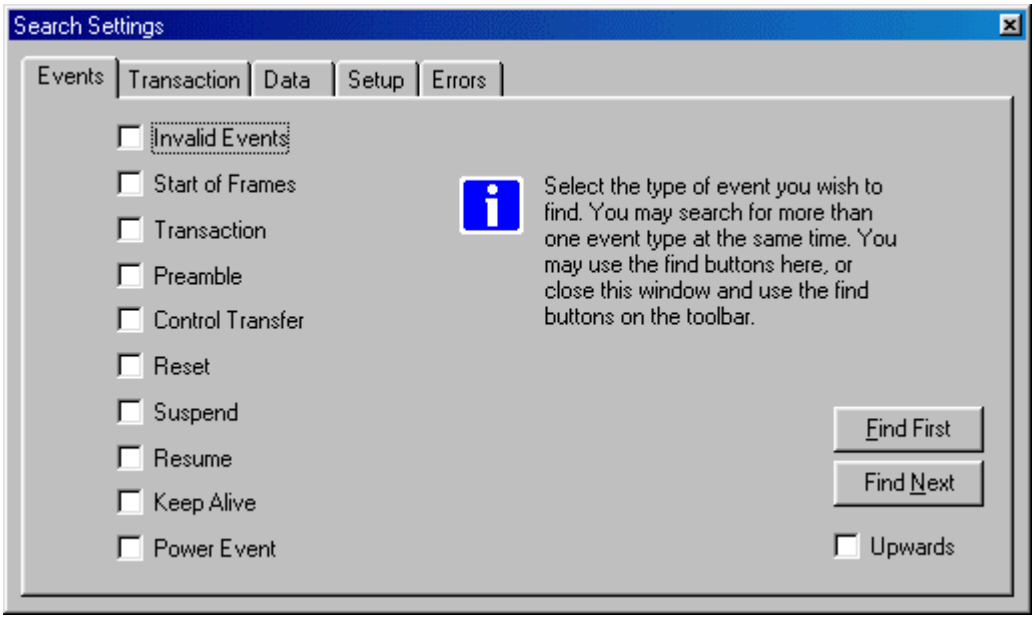
Clicking this button removes/shows any NAKed transactions. This differs from filtering NAKs during capture where NAKed control transactions will always be included.

3.6 Search

The Search function is used to locate particular events within the captured data. Events which are not currently being displayed will still be found by the search function and the display filter settings will be adjusted accordingly. Select the Search Settings by either clicking the Tool Button  or selecting the item on the Edit menu. Items may be searched for by Event, Transaction, Data, Setup or Error.
Once a search has been defined the Search Settings Window may be closed and the Toolbar Search buttons  used instead. This provides a clearer view of the data.

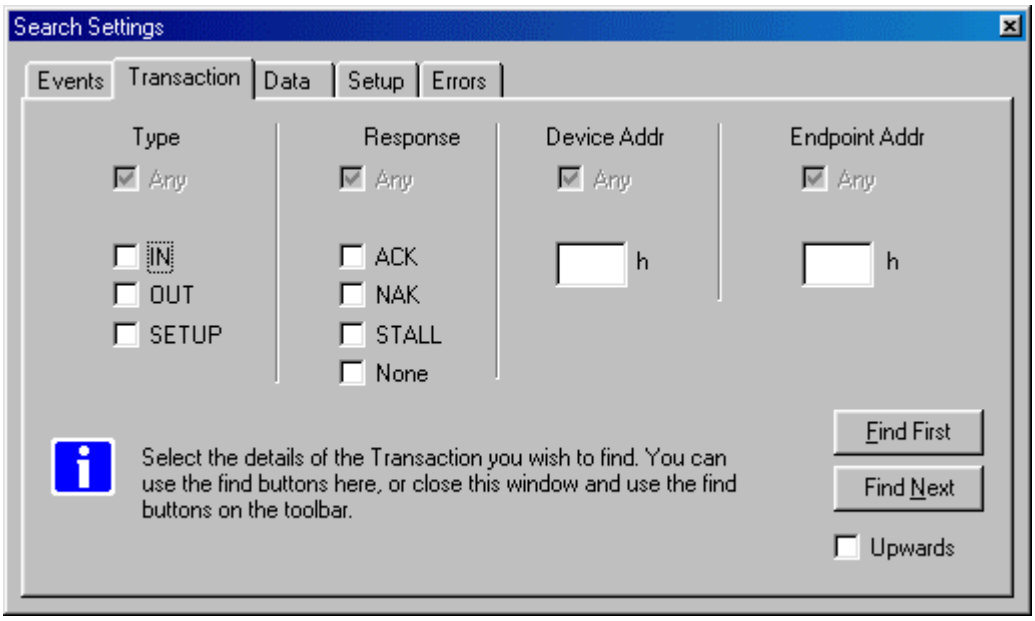
3.6.1 Event Search

The events search allows you to find such items as Reset, Preamble etc.



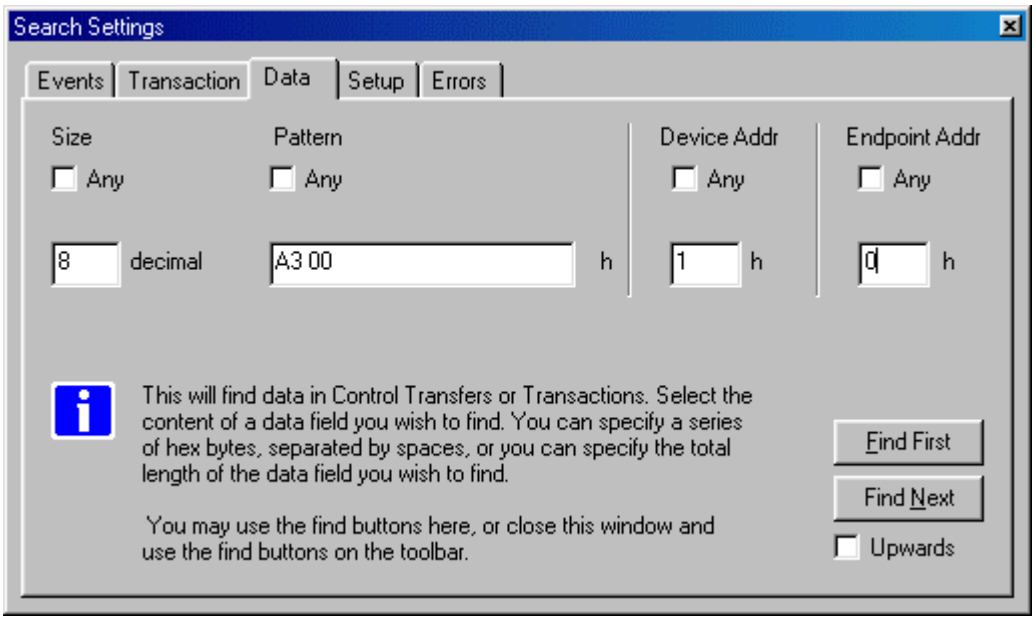
3.6.2 Transaction Search

Transactions may be searched for according to their Type (IN, OUT, or SETUP), the Response (ACK, NAK, STALL or NONE), the Device Address and/or Endpoint. If no selection is made in any particular column then any transaction meeting the requirements of the other columns will be found.



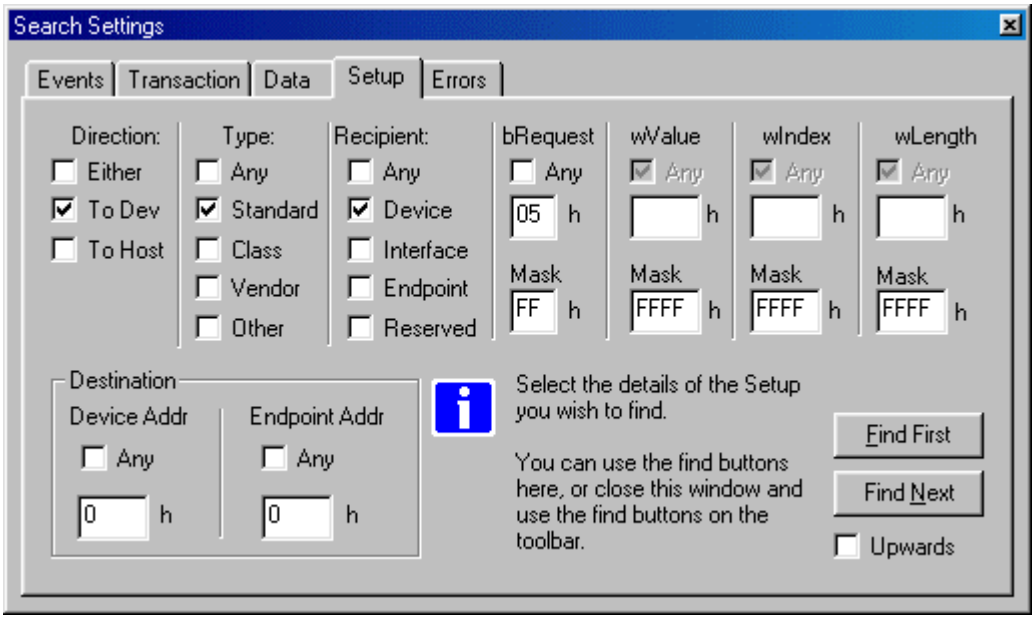
3.6.3 Data Search

The data to be searched for is entered as a sequence of Hex bytes separated by spaces. The size of the data field, the Device Address and Endpoint Address can also be specified. The example below shows a search for Hex bytes ‘A3 00’ in an 8 byte Data field with Device Address 1 and Endpoint 0. If no selection is made in any particular column then any transaction meeting the requirements of the other columns will be found.



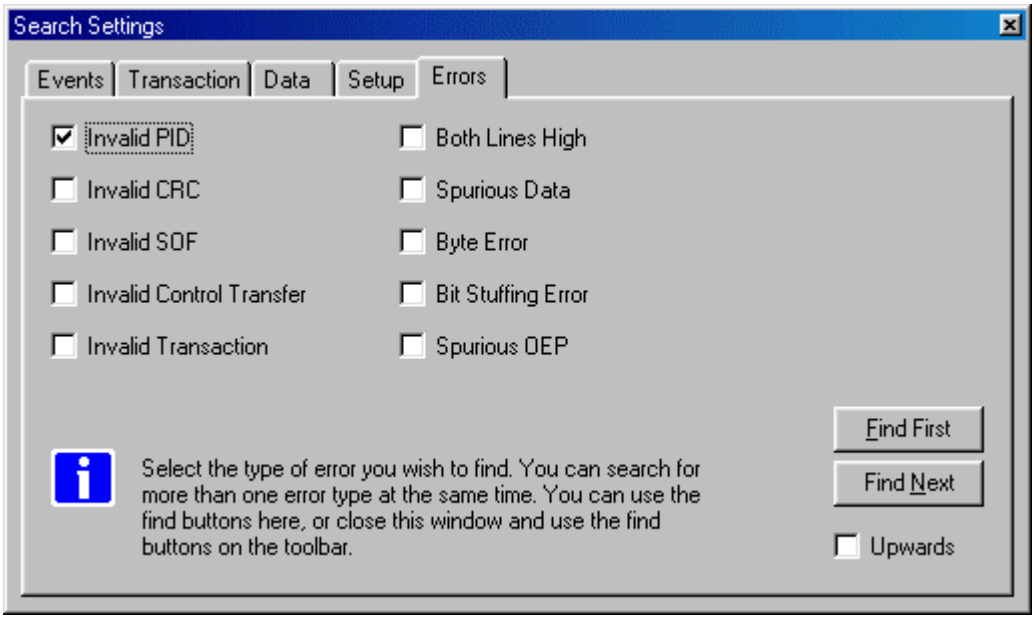
3.6.4 Setup Search

The example below demonstrates a search for a bRequest of 05h in a standard Setup to a device having Address 0 and Endpoint 0. Masks are available if you wish to test for only a part of a field. If no selection is made in any particular column then any transaction meeting the requirements of the other columns will be found.



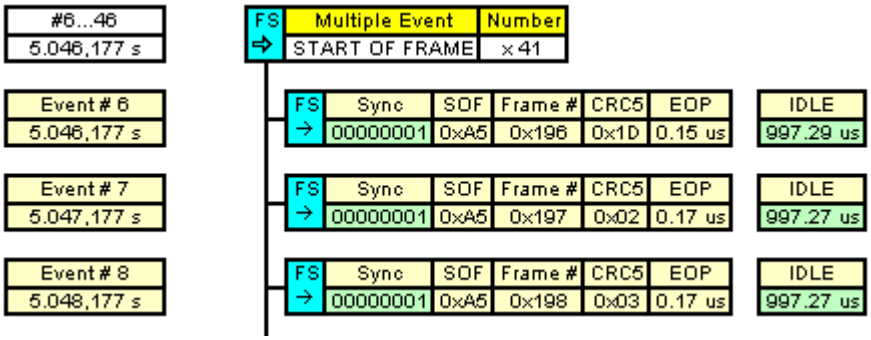
3.6.5 Error Search

Errors such as Invalid PID, Invalid CRC etc may be found by selecting the appropriate boxes. A more detailed explanation of these errors is given in the Errors Chapter.



3.7 Multiple Event Headers

Numerous consecutive Start of Frame packets or Keep Alive events make the display difficult to read. GraphicUSB inserts multiple Event Headers before such sequences. The packets can be hidden by clicking on the “Show Packets” button with the multiple Events Header still being visible. The multiple Events Headers can be hidden by clicking on the “Show SOFs” button. The example below shows 41 SOF’s grouped together.



Show SOF Packets

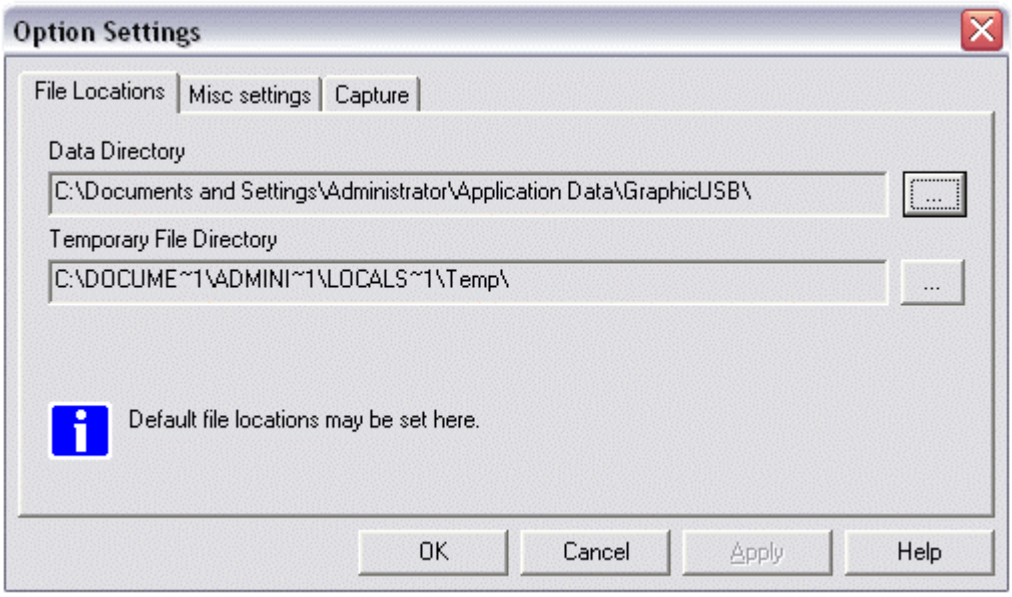
Hide SOF Packets

4 OPTION SETTINGS

Select Options in the Edit menu to open the Option Settings Window.

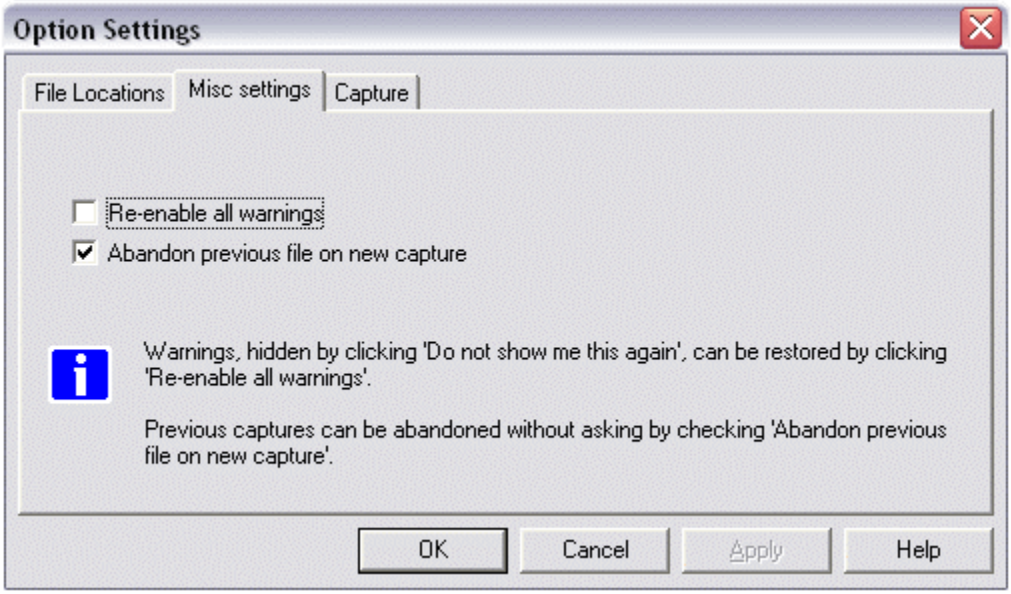
4.1 File Locations

Use this to specify the locations of the Capture and temporary files.



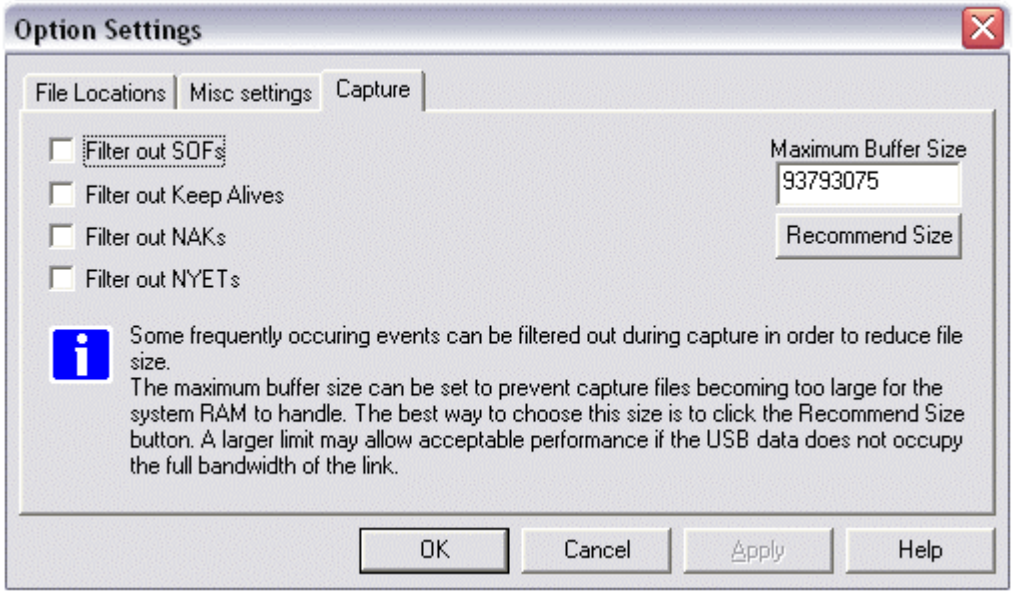
4.2 Miscellaneous Settings

- User warnings e.g. concerning the test set-up, may be re-enabled.
- If several captures are to be done in a row without the need to save each capture, then it can be beneficial to check the box 'Abandon previous file on new capture'. This will save RAM and make shutting down GraphicUSB quicker.



4.3 Capture

The size of the Capture file may be minimized by filtering Start of Frame or Keep Alive events or NAKed transactions. Please note that NAKed control transactions will always be included in the capture.



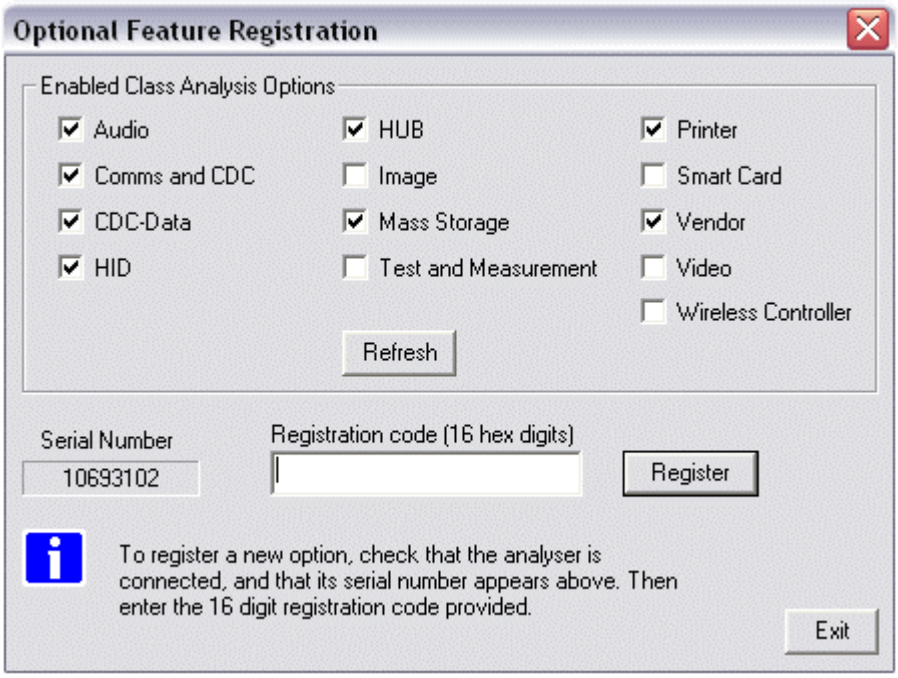
The size of the capture buffer defaults to a safe value which should guarantee a reliable capture under most circumstances. You may increase this size as required, but you should be prepared to decrease it again if you start to have poor response caused by the system using virtual memory to satisfy your requirement. The ‘Recommend Size’ button returns the buffer size to the default value for your system. An option well worth considering is to increase the size of the RAM in your PC.

5 CLASS ANALYSIS OPTIONS

5.1 Registration

The Class Analysis Options are supplied as software add-ons for GraphicUSB. The options are available for individual classes, so you only need to purchase the functionality you actually require. The options are provided in the form of 16 digit hexadecimal registration codes.

To enable a particular option, first ensure the analyser is connected to the host, and then click in the menu bar on Edit…Registration… and the following dialog will appear.



Enter the registration code provided and the corresponding option should become checked. Please store the registration code carefully in case you need to install the option on another host computer.

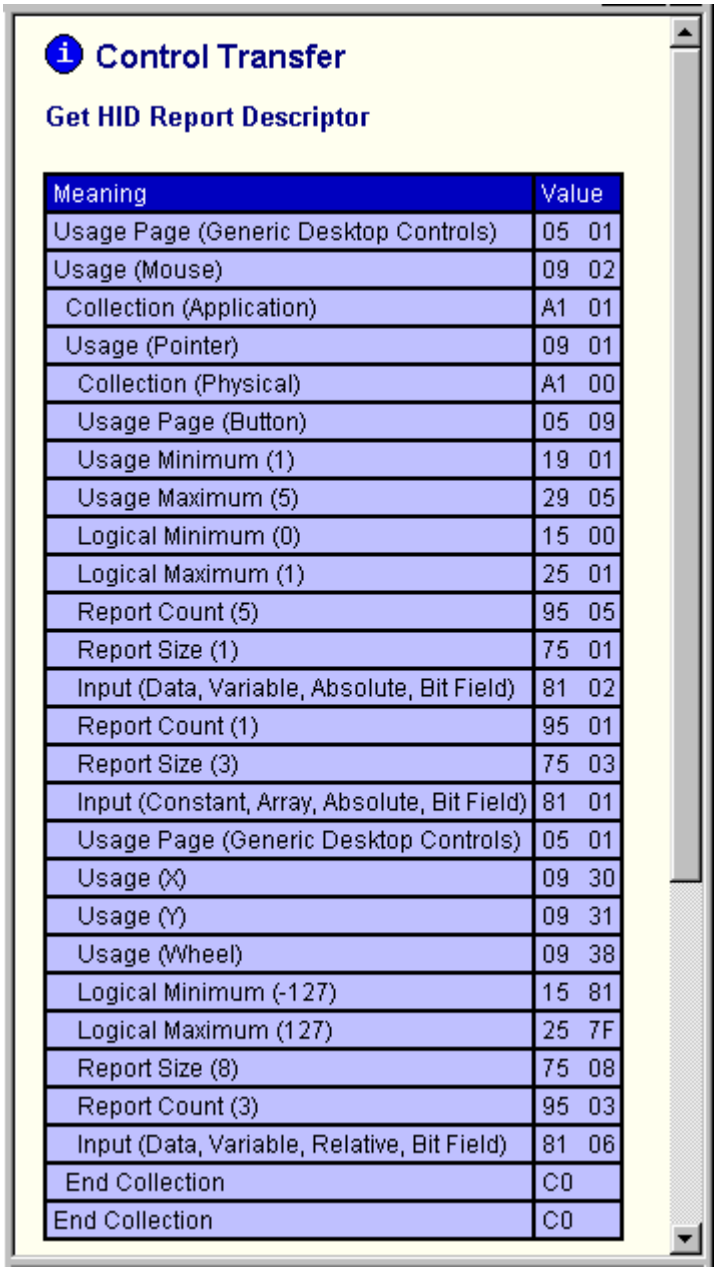
5.2 Analysis Overview

The Class Analysis option you have enabled will enhance all captures performed on the analyser in question. If you use the

analyser on a different host, remember to register the option on that computer as well.

The option will not allow the analysis of classes on captures performed with the analyser before the option was registered. However the captured files can later be viewed in their analysed form on any computer with or without the analyser present.

A typical class analysis example is shown below.

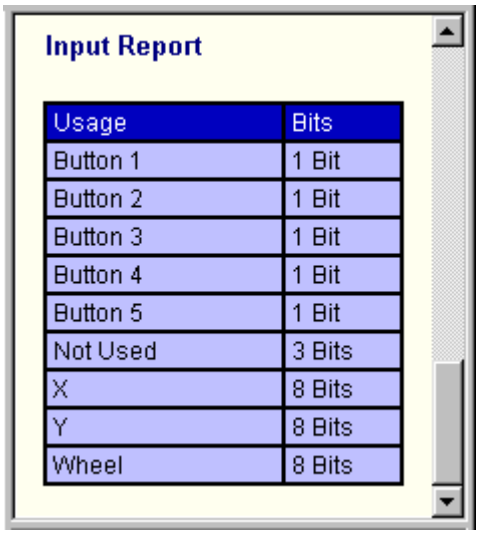


Control Transfer

Get HID Report Descriptor

Meaning	Value
Usage Page (Generic Desktop Controls)	05 01
Usage (Mouse)	09 02
Collection (Application)	A1 01
Usage (Pointer)	09 01
Collection (Physical)	A1 00
Usage Page (Button)	05 09
Usage Minimum (1)	19 01
Usage Maximum (5)	29 05
Logical Minimum (0)	15 00
Logical Maximum (1)	25 01
Report Count (5)	95 05
Report Size (1)	75 01
Input (Data, Variable, Absolute, Bit Field)	81 02
Report Count (1)	95 01
Report Size (3)	75 03
Input (Constant, Array, Absolute, Bit Field)	81 01
Usage Page (Generic Desktop Controls)	05 01
Usage (X)	09 30
Usage (Y)	09 31
Usage (Wheel)	09 38
Logical Minimum (-127)	15 81
Logical Maximum (127)	25 7F
Report Size (8)	75 08
Report Count (3)	95 03
Input (Data, Variable, Relative, Bit Field)	81 06
End Collection	C0
End Collection	C0

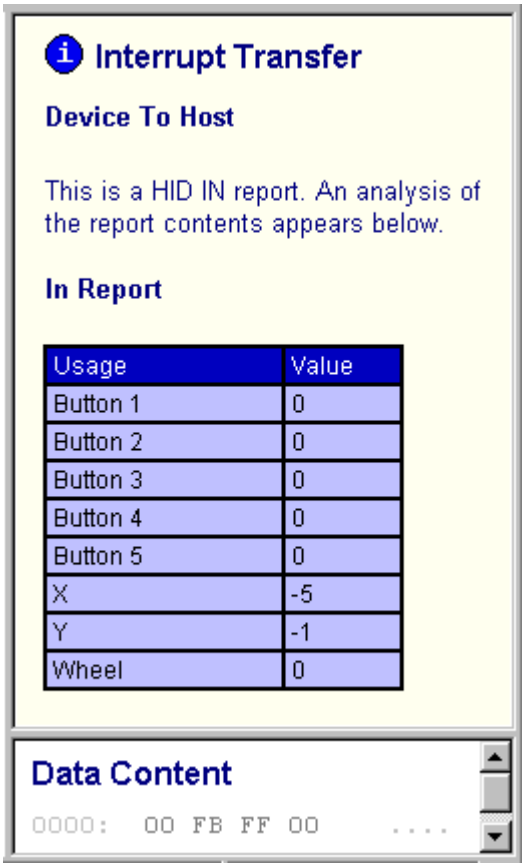
This shows a HID Report Descriptor, and below is the result of parsing it.



Input Report

Usage	Bits
Button 1	1 Bit
Button 2	1 Bit
Button 3	1 Bit
Button 4	1 Bit
Button 5	1 Bit
Not Used	3 Bits
X	8 Bits
Y	8 Bits
Wheel	8 Bits

Each transfer of a HID report is also analysed, as follows.



Interrupt Transfer

Device To Host

This is a HID IN report. An analysis of the report contents appears below.

In Report

Usage	Value
Button 1	0
Button 2	0
Button 3	0
Button 4	0
Button 5	0
X	-5
Y	-1
Wheel	0

Data Content

```
0000:  00 FB FF 00     ....
```

5.3 Vendor Class Analysis

5.3.1 Introduction

Unlike other USB classes, Vendor Class does not have a predetermined specification. The class is made up of whatever control requests and data transfer types a vendor finds useful. For this reason, it is normally difficult to provide a useful analysis. MQP's vendor class analysis option attempts to overcome this problem, by allowing the user to specify characteristics of the vendor class which can usefully be displayed on the capture document screens. To do this, the vendor class analysis option must be registered.

To do this the user should provide a specification file for their device. The file will have a predetermined file name as follows:

vendVVVVPPPP.txt

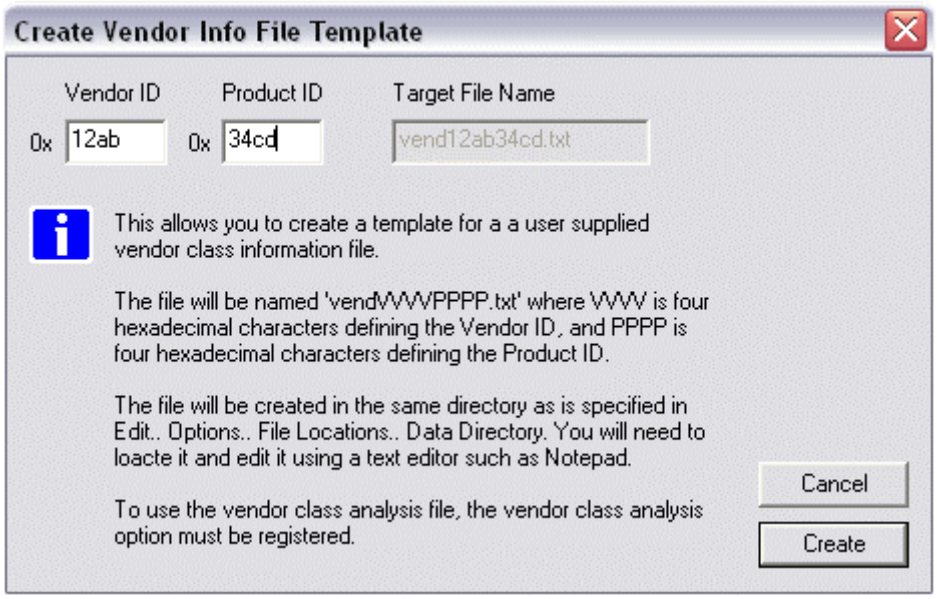
where VVVV is four hexadecimal characters defining the Vendor ID, and PPPP is four hexadecimal characters defining the Product ID.

So for example the file defining the vendor characteristics of a device with Vendor ID 0x12ab and Product ID 0x34cd would be called:

vend12ac34cd.txt

The file must be located in the same directory as is specified in:
Edit.. Options.. File Locations.. Data Directory..
(by default this is the standard location for application data defined by the operationg system).

A template for this file can be quickly created (with the correct filename, in the correct folder), by:
Operations.. Create Vendor File Template..



To work with this file, open it in a text editor such as Notepad or Wordpad, taking care when saving to keep the file in a plain text format.

The template file will have this typical appearance:


```
// in this example we define 2 control requests and 1 endpoint
// for our vendor device 'Widget'

<Device>
    VID=0x12AB    // the Vendor ID
    PID=0x34CD    // the Product ID

    <Control Request>
        bmRequestType=0x40
        bRequest=0x01
        bRequest.desc="Widget - Set Parameter"
        bRequest.text="This requests the device to accept a specified \
parameter.\nThe parameter value is included in the setup bytes."
        wIndex.desc="Parameter Number"
        wValue.desc="Parameter Value"
        wLength.Min=0
        wLength.Max=0
    </Control Request>

    <Control Request>
        bmRequestType=0xC0
        bRequest=0x01
        bRequest.desc="Widget - Get Parameter"
        bRequest.text="This requests the device to return a specified parameter.\n\
The value is 2 bytes sent in a data packet."
        wIndex.desc="Parameter Number"
        wValue.desc="Parameter Value"
        wLength.Min=0
        wLength.Max=0
    </Control Request>

    <Endpoint>
        ep.code=0x82
        ep.desc="Data Stream from Widget"
        ep.text="Responses in the 'Widget Protocol' are sent by the programmer. \
Typically each response is terminated with a 0x0d 0x0a character pair. Most commands \
are made up of ASCII characters."
    </Endpoint>

</Device>
```

5.3.2 File Syntax

5.3.2.1 Comments

A comment is introduced by the pair of characters '//'. Everything to the right on the same line is part of the comment and ignored.

5.3.2.2 Indentation

The example file uses (tabbed) indentation to emphasise the structure of the syntax, but it is not necessary to do this.

5.3.2.3 Numbers

Numerical values may be expressed in decimal, or in hexadecimal introduced by the prefix 0x. So 10 and 0x0a represent the same value.

5.3.2.4 Strings

String values must be enclosed in double quote marks, e.g. "this is a string".

A long string may span several lines of text as long as:

- each line which is not the end of the string is terminated as the last character with a '\'.
- each subsequent line in the string cannot have any white space at the start of the string which is not part of that string
- a line which is part of a string cannot have a comment
- a line which is part of a string cannot be blank

A string may include a line break by including the symbol '\n' at the required point. To have the symbol '\' in the string you must include '\\' at the point required.

See the template file above for examples of long strings.

5.3.2.5 <Device> </Device>

The whole file is the description of a device, and so must start with the '<Device>' tag, and end with '</Device>'.

5.3.2.6 VID= PID=

Following the '<Device>' tag, the next two lines must define the Vendor ID and the Product ID of the device.

5.3.2.7 <Control Request> </Control Request>

Each defined control request must be introduced by the '<Control Request>' tag, and ended with '</Control Request>'. Between the tags you should define the parameters of the request by specifying the following:

Parameter	Status	Value type	Purpose
bmRequestType=	Mandatory	Number from 0x00 - 0xff	Specifies the Setup packet field which identifies this request
bRequest=	Mandatory	Number from 0x00 - 0xff	Specifies the Setup packet field which identifies this request
bRequest.desc=	Mandatory	String to use as the name of this request. Must be single line and preferably kept short.	Appears in the Control transfer header of the event pane to name this request. Also appears in the Setup transaction header table, in the detail pane, and used as a sub-title in the detail pane for the Control transfer header.
bRequest.text=	Desirable	String to use as the explanation of this request. May be several lines of text.	Appears in the detail pane for the Control transfer header.
wIndex.desc= wIndexH.desc= wIndexL.desc= wValue.desc= wValueH.desc= wValueL.desc=	As required	String to use to name the purpose for this setup packet parameter field. Preferably kept short. Note that e.g. wIndexH is the high byte of wIndex to be used instead of it when the parameter only occupies a single byte.	Appears in the detail pane table when a Setup transaction header is selected in the event pane.
wLength.Min=	Optional	Minimum number of bytes which may be transferred in the Data Stage of the control	Used to validate the number of bytes transferred in the Data Stage.

		transfer. Defauts to 0.	
wLength.Max=	Optional	Minimum number of bytes which may be transferred in the Data Stage of the control transfer. Defauts to 65535.	Used to validate the number of bytes transferred in the Data Stage.

5.3.2.8 <Endpoint> </Endpoint>

Each defined endpoint must be introduced by the '<Endpoint>' tag, and ended with '</Endpoint>'. Between the tags you should define the parameters of the endpoint by specifying the following:

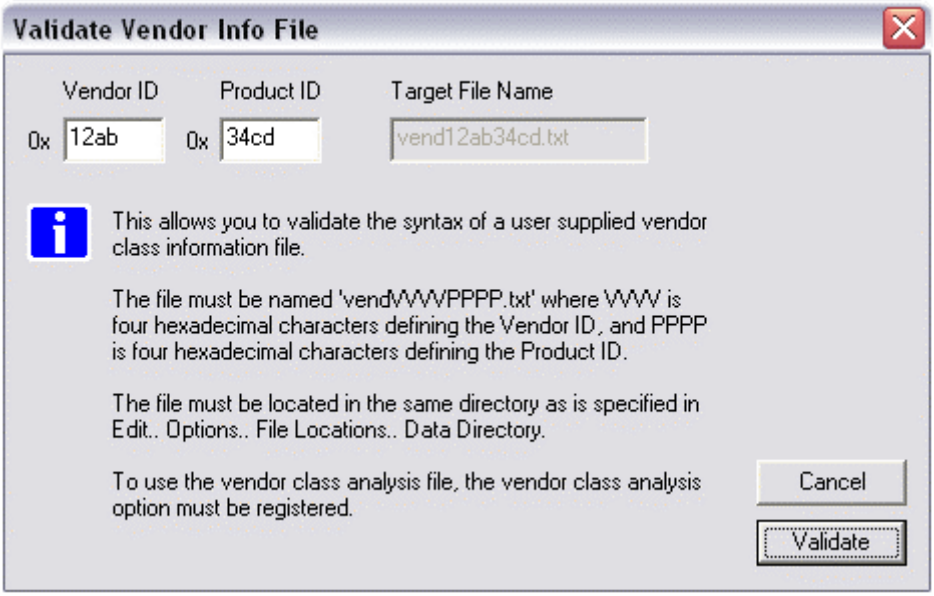
Parameter	Status	Value type	Purpose
ep.code=	Mandatory	Number from 0x01 - 0x0f for OUT endpoints, or from 0x81 - 0x8f for IN endpoints	Specifies the endpoint being described
ep.desc=	Mandatory	String to use as the name of this data transfer. Must be single line and preferably kept short.	Appears in the Data transfer header of the event pane to name this request. Also used as a sub-title in the detail pane for the Control transfer header.
ep.text=	Desirable	String to use as the explanation of this request. May be several lines of text.	Appears in the detail pane for the Data transfer header.

5.3.2.9 Syntax Checking

It would be irritating to have syntax error messages popping up whenever a syntax error in the user file is encountered, so during display of a capture file the parsing will fail silently, putting up the best

interpretation it can. We have provided a separate function to check the legality of the file before attempting to use it.

The syntax of the file can be validated by:
Operations.. Validate Vendor File..



Only the first syntax error found will be shown each time, so run the checker until no errors are flagged.

6 TROUBLESHOOTING

During capture a Data Overrun message appears.

This happens when the device under test generates more traffic than the Host computer can handle. Check that the Host computer has a High Speed USB connection and is sufficiently powerful. A test set up using two computers is preferable.

The data captured contains a large number of CRC or other errors.

Check the cabling between the Packet-Master and the device under test and to the Host under test. The cabling should be kept as short as possible with the total length of cable not exceeding 4 metres.

The data captured just contains a Plugged In message and a Start of Reset message.

This may happen if, after starting capture, a high speed device is plugged into the Packet-Master.

The data captured contains a large number of “Spurious Data” or “Both Lines High” errors.

This may be the result of using excessively long cables in the test setup or perhaps trying to analyse a high speed device.

An alternative possibility, which we have seen on some (non-approved) devices, is that the designer has incorporated reactive elements into the data lines such that on the bus itself the voltage waveform is not readable. A quick check with an oscilloscope will confirm this situation as the data lines will not show a clean square appearance, but rather mostly ringing shapes. One solution to devices of this type is to view their data upstream of a Full Speed Hub

My capture buffer fills up too quickly to collect any useful events.

Some devices can continuously NAK transfers, which leads to a very high bandwidth of not-very-useful data. We suggest that you disable the capture of NAKs in the Edit…Options…Capture dialog, which will reduce the amount of data captured, limiting it to transfers which are not NAKed.

If necessary, a further reduction in captured data can be achieved by disabling the capture of SOFs or Keep Alive events.

You can also increase the buffer size in the same dialog. If doing this causes system slowdown problems (caused by the system using virtual memory), then consider adding RAM to your computer.

7 WARRANTY

7.1 Warranty

MQP Electronics guarantees that its products are free from defects in materials and workmanship for the warranty period, subject to the limitations below. MQP Electronics will at its discretion either repair or replace any part that proves defective because of faulty materials or workmanship.

7.2 Limitations

This warranty does not cover any damage that results from any accident, misuse or unauthorized disassembly or repair. This product is not authorized for use as a critical component in life support equipment or any application where failure would result in any loss, injury or damage to persons or property.

7.3 Warranty Period

The warranty starts on the day of purchase and covers a period of one year.

7.4 Obtaining Service

Defective product may be returned to the authorized distributor from whom you purchased the product.
Defective product may be returned direct to MQP Electronics. Please call +44 (0)1666 825 666 and request a Return Material Authorization (RMA) number from customer services.

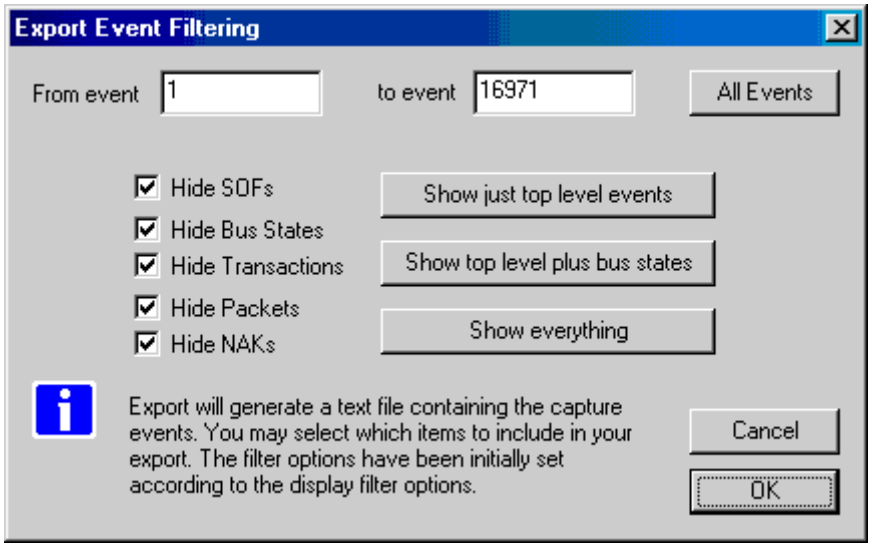
8 Export Functions

GraphicUSB allows various types of information to be exported to text based formats for further analysis or processing by the user. The following types of export are currently provided:

- Capture Event Information
- Data from a specific event
- Descriptors

8.1 Exporting Capture Events

With a capture document open, select the item 'Export Events...' from the File menu. The 'Export' dialog will be displayed:



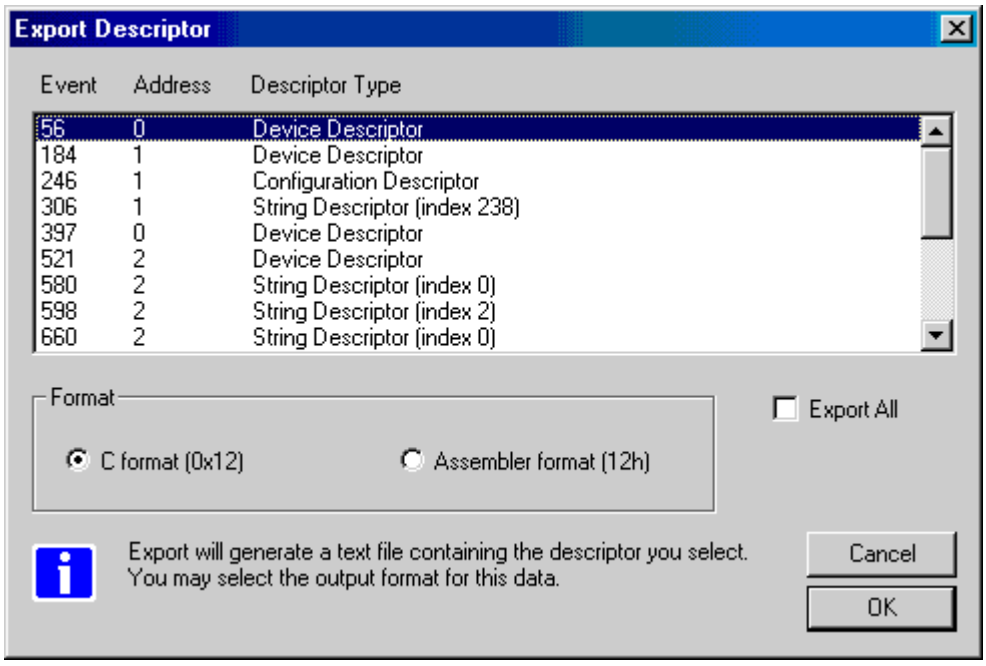
Select the event range, and the level of detail you wish to export, then click on OK. A typical output text file (showing just top level events) is shown below:


```
[3.742,754] LS: Control Transfer Addr:00 Endp:0 - Get Device Descriptor
            12 01 10 01 00 00 00 08 62 0F 01 10 01 00 01 02
            00 01
[3.773,991] LS: Control Transfer Addr:00 Endp:0 - Set Address (0x01)
            [Zero Data Bytes]
[3.836,513] LS: Control Transfer Addr:01 Endp:0 - Get Device Descriptor
            12 01 10 01 00 00 00 08 62 0F 01 10 01 00 01 02
            00 01
[3.838,518] LS: Control Transfer Addr:01 Endp:0 - Get Configuration Descriptor
            09 02 22 00 01 01 00 A0 32
[3.839,614] LS: Control Transfer Addr:01 Endp:0 - Get Configuration Descriptor
            09 02 22 00 01 01 00 A0 32 09 04 00 00 01 03 01
            02 00 09 21 10 01 00 01 22 34 00 07 05 81 03 04
            00 0A
[3.842,658] LS: Control Transfer Addr:01 Endp:0 - Get String Descriptor 238
            0C 03 41 00 42 00 43 00 44 00 41 00
```

8.2 Exporting Descriptors

8.2.1 Standard Descriptors

With a capture document open, select the item 'Export Descriptor...' from the File menu. The 'Export Descriptor' dialog will be displayed:



Select the descriptor you wish to export (or click on Export All). To assist you in deciding which is the appropriate descriptor, the event number and the device address are displayed. If you had previously selected a valid descriptor in the capture pane, then this descriptor will be pre-selected when you open this dialog.

You should now choose the format in which you wish to export the descriptor. By default it will be output as a (commented) 'c' code structure.

When you have made your selection, click on OK and you will be invited to choose the name and location of the exported file. An example file is shown below:

```
// Device Descriptor (event number 56)
static const unsigned char descriptor56[] =
{
      0x12,       // bLength
      0x01,       // bDescriptorType (DEVICE)
      0x10,       // bcdUSB (ls byte)
      0x01,       // bcdUSB (ms byte)
      0x00,       // bDeviceClass (Defined in Interface)
      0x00,       // bDeviceSubClass
      0x00,       // bDeviceProtocol
      0x08,       // bMaxPacketSize0
      0x62,       // idVendor (ls byte)
      0x0F,       // idVendor (ms byte)
      0x01,       // idProduct (ls byte)
      0x10,       // idProduct (ms byte)
      0x01,       // bcdDevice (ls byte)
      0x00,       // bcdDevice (ms byte)
      0x01,       // iManufacturer
      0x02,       // iProduct
      0x00,       // iSerialNumber
      0x01,       // bNumConfiguration
};
```


8.2.2 Class Specific Descriptors

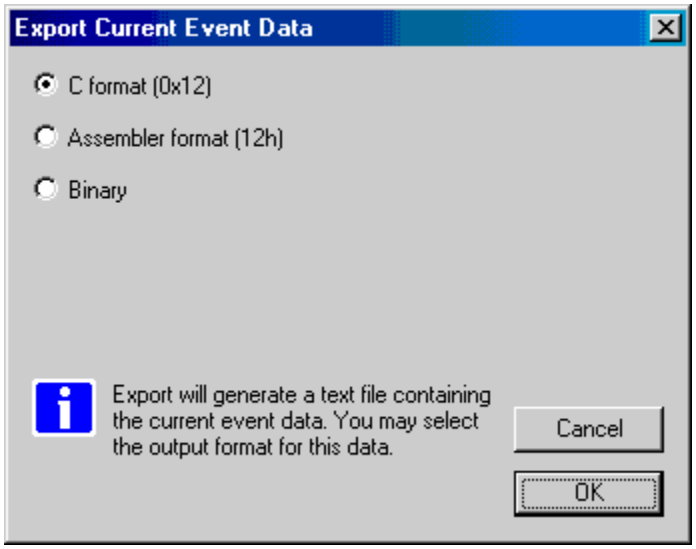
In some cases, where class analysis options have been installed, specific class descriptors are annotated, e.g.:

```
// HID Report Descriptor (event number 6185)
static const unsigned char descriptor6185[] =
{
    0x05,       // Usage Page (Generic Desktop Controls)
    0x01,       //
    0x09,       // Usage (Mouse)
    0x02,       //
    0xA1,       //   Collection (Application)
    0x01,       //
    0x09,       //   Usage (Pointer)
    0x01,       //
    0xA1,       //     Collection (Physical)
    0x00,       //
    0x05,       //     Usage Page (Button)
    0x09,       //
    0x19,       //     Usage Minimum (1)
    0x01,       //
    0x29,       //     Usage Maximum (5)
    0x05,       //
    0x15,       //     Logical Minimum (0)
    0x00,       //
    0x25,       //     Logical Maximum (1)
    0x01,       //
    0x95,       //     Report Count (5)
    0x05,       //
    0x75,       //     Report Size (1)
    0x01,       //
    0x81,       //     Input (Data, Variable, Absolute, Bit Field)
    0x02,       //
    0x95,       //     Report Count (1)
    0x01,       //
    0x75,       //     Report Size (3)
    0x03,       //
```

Other class descriptors can still be exported, but without the comment annotation.

8.3 Exporting Data from a Specific Event

With a capture document open, select the event from which you wish to export the data, by clicking on the event in the event pane (making it the 'Current Event'). Then select the item 'Export Current Event Data…' from the File menu. The 'Export Current Event Data' dialog will be displayed:



Select the format in which you wish to export the data. When you have made your selection, click on OK and you will be invited to choose the name and location of the exported file. An example file is shown below:

```
0xE2, 0x00, 0xE2, 0x00, 0xEA, 0x00, 0xEA, 0x00
0xED, 0x00, 0xED, 0x00, 0xEA, 0x00, 0xEA, 0x00
0xDC, 0x00, 0xDC, 0x00, 0xC2, 0x00, 0xC2, 0x00
0x9C, 0x00, 0x9C, 0x00, 0x6C, 0x00, 0x6C, 0x00
0x34, 0x00, 0x34, 0x00, 0xF6, 0xFF, 0xF6, 0xFF
0xB2, 0xFF, 0xB2, 0xFF, 0x6D, 0xFF, 0x6D, 0xFF
0x2C, 0xFF, 0x2C, 0xFF, 0xF0, 0xFE, 0xF0, 0xFE
0xBA, 0xFE, 0xBA, 0xFE, 0x89, 0xFE, 0x89, 0xFE
0x60, 0xFE, 0x60, 0xFE, 0x41, 0xFE, 0x41, 0xFE
0x2D, 0xFE, 0x2D,
```


9 ERRORS

9.1 Invalid PID

A Packet Identifier, PID, is a 4 bit code. The 4 bits of the PID are complemented and repeated making an 8 bit PID in total. An error in the transmission of the PID will result in an Invalid PID being reported.

9.2 Invalid CRC

A Cyclic Redundancy Check is performed on the data transmitted in a packet. Token packets have a 5 bit CRC while Data packets have a 16 bit CRC. The CRC is checked by the Packet-Master and, if incorrect, an error is reported.

9.3 Invalid SOF

A Start of Frame packet contains a frame number. If a frame number is out of sequence then an Invalid SOF error is reported. It's likely that frame numbers will be out of sequence after a Reset or Suspend; in these cases the error can be ignored.

9.4 Invalid Control Transfer

A Control transfer consists of a SETUP packet (which defines a from-host or to-host direction), followed by an optional set of 'Data Stage' DATA0/DATA1 packets in that direction, completed by a 'Status Stage' zero-length DATA1 packet, in the other direction. If this sequence is not correct then an Invalid Control Transfer error is reported.

The correct sequence for the data toggle in a Control Transfer is that the SETUP should contain a DATA0 packet, the Data Stage should start with a DATA1 packet and then alternate, and finally the Status Stage should be a zero-length DATA1 packet. If these polarities are not correct then an Invalid Control Transfer error is reported.

9.5 Invalid Transaction

A transaction consists of a token packet (SETUP/IN/OUT), followed by a DATA0 or DATA1 packet (in the appropriate direction), and completed by an ACK, NAK or STALL. Either the last or the last two packets may be missing. If this sequence is not correct then an Invalid Transaction error is reported.

A SETUP transaction must contain a DATA0 packet. If this polarity is not correct then an Invalid Transaction error is reported.

9.6 Bit Stuffing Error

In order to ensure adequate signal transitions, bit stuffing is employed by the transmitting device when sending a USB packet. A zero is inserted after every six consecutive ones in the data stream before the data is NRZI encoded. If more than six consecutive ones are detected a Bit Stuffing Error is reported.

9.7 Byte Error

All packets must have an integral number of bytes. If this is not the case a Byte Error is reported.

9.8 Spurious Data

If data is detected but doesn't begin with a synchronization pattern then the display will report Spurious Data.

9.9 Both Lines High

The data encoding scheme is such that the D+ and D- lines should never both be high at the same time. If this condition is encountered an error is reported.

9.10 Spurious End of Packet

An End of Packet condition should only appear at the end of a data packet. If the condition appears at any other time it will be reported as an error.

