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## ***USB2224 Software Release Notes*** ***v0.438***

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## ***Software Compliance***

The software in this release conforms to the following industry flash card specifications. SMSC has tested to the best of its ability to ensure that this software conforms to these specifications. However, no other warranty is assured, express or implied, other than provided by SMSC's standard terms and conditions.

1. SmartMedia™ Electrical Specification Version 1.40
2. SmartMedia™ Physical Format Specifications Version 1.40
3. SmartMedia™ Logical Format Specifications Version 1.30
4. MultiMediaCard System Specification Version 3.31
5. SD Memory Card Specifications Version 1.1
6. Memory Stick Standard Format Specification Version 1.40-00
7. Memory Stick Pro Standard Format Specifications Version 1.01-01
8. Memory Stick Duo Standard Format Specifications Version 1.10-00
9. CompactFlash Specification Rev 2.0
10. xD Picture Card Specification Version 1.2
11. Universal Serial Bus Specification Rev 2.0
12. USB Mass Storage Class, Bulk Only Transport Version 1.0

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## **Revision History**

0.0.0.212:      - **ROM Mask 01.**

### **Firmware:**

- Modified the firmware to improve the transfer speeds of certain high-end Lexar Compact Flash cards.
- Fixed a bug in the Compact Flash media identification code, related to identifying the media supported PIO mode of operation and setting the right mode on the host.
- Modified the code such that when Vbus is removed, the device can be put into suspend if the UDC and PHY are held in reset. Operation of the 2224 is changed so that if Vbus is removed it will suspend and wakeup only when Vbus is reattached.
- Modified the code to reduce the suspend current to below 500uA when using DFU enabled firmware (both.bin) running externally.
- Fixed a bug with Memory Stick media surprise removal during a read or write.
- Fixed a bug with Secure Digital media surprise removal during a read or write.
- Added Memory Stick 2 bit ECC error checking.
- Added support for Sony High Speed Memory Stick.
- Added support for xD Picture Cards.
- Added support for the Sony Memory Stick Format Application.

### **Applications:**

- Modified the SetIcon utility (v1.2.0.6) to fix a bug which caused a "No disk in drive" error message to appear in Windows XP SP1 under certain conditions.
- Modified the Windows 98 Safe Removal Utility (v1.0.0.4) to display more descriptive error messages when an error occurs while stopping the device.
- Modified the Attributes Calculator Utility (v.08) to allow both encoding and decoding of attribute values. Please note that you must have the Microsoft Dot Net framework installed on your PC in order to run the Attributes Calculator utility.
- Added a Japanese version of the SMSC FormatPro utility to the application software distribution package.

0.0.0.304:      -**External Evaluation Build**

### **Firmware:**

- Added support for the ST 93C66-W EEPROM.
- Added xD compliance specific changes (xD card identification, xD mapper changes, and support for an xD media door).
- Added firmware extensions for the new USBDM utility which is used for DFU firmware upload and descriptor updates.
- Added a new attribute bit to enable support for using an xD media door.

### **Applications:**

- Initial release of the Dos Production Line Utility (DosPLTU) (v1.4).
- Released the initial version of the USBDM application (v1.0) which is used for DFU uploads and descriptor updates, as well as for creating consumer DFU updates in a single distributable exe. See the section of this document entitled "Using the USB Drive Manager Application" for more details.
- Updated the Attributes Calculator (v.14) to add an attribute bit definition for Byte 3, bit 1 (xD Door Support).
- Modified SetIcon.exe to enable dynamic icon support. Dynamic icon support allows the OEM to display a different icon for each media type (CF, SM, xD, SD, MMC, MS, MSPRO) and for each media state (either media inserted, or no media present.) This version of SetIcon is fully backwards compatible with previous versions and their associated ini files. See the section of this document entitled "Using the USB97C223 Custom Icon Package" for more details.
- Modified the 98SafeRemovalUtility (v1.0.0.5) to prevent the app window from popping up during initialization.
- Updated the USB2224 Software Installer to add dynamic icon functionality and the updated 98SafeRemoval utility.

## 0.0.0.322: - External Evaluation Build

**Firmware:**

- Fixed a logic error in code that checks for MS protected blocks.
- Removed firmware support for the SMSC MS Pro format utility.
- Added a new attribute bit, "Attach on card insertion / Detach on card removal" which forces the device to either attach or detach depending upon the presence or absence of media.
- Made several code space optimizations to reduce overall code size.
- Removed the SD polling functionality. In order to use SD with the 2224, you must use GPIO5 as an SD card detect.
- Added support for 256MB Smart Media.
- Implement Mode Sense Page 5 and Vendor Page Support to comply with USB Boot Device specification (as yet unpublished.)
- Made several firmware changes to fully comply with the Memory Stick specification.
- Made several firmware changes to fully comply with the xD Picture Card specification.
- Fixed a bug with MS surprise removal in Linux.
- Fixed some issues with the CE pull-up resistor on CF and SM and corrected the sequence of events in the power-up/down macros for all media.
- Changed the read\_format\_capacity function to support the SCSI-mmc2 specification. This implementation is applicable to all media types.
- Fixed a bug in end user DFU code. When reading the NVStore using the new dfu commands, the residue was not being decremented. Since the SMSC drvlib.dll ignores the residue mismatch, this had no noticeable effect, however to be fully compliant with the specification, the change was made.
- Changed Byte 2, bit 7 (Skip SM and xD Status Byte Check) to a reserved bit. In the 2224, the status byte check is taken care of in hardware. Setting or clearing this bit has no effect on the operation of the 2224.
- Changed Byte 1, bit 2 (Use GPIO5 as an SD Card Insert Indicator) to a reserved bit. In the 2224, GPIO5 must be used as an SD card insert indicator if an SD interface has been implemented, so this bit is set automatically by the 2224.

**Applications:**

- Modified the DosPLTU utility (v1.5) to add support for EHCI and OHCI host controllers.
- Modified the USBDM application (v1.004) to include support for creating end-user DFU executables (OEM.exe) that will upgrade firmware versions prior to 300. Please note use must be using external flash in order to upload new firmware with DFU.
- Modified the USBDM application (v1.004) and the Attribute Calculator (v.15) to include support for the new attribute bit, "Attach on card insertion / Detach on card removal" which forces the device to either attach or detach depending upon the presence or absence of a flash card.
- Updated the Cardreader Software Installer (v2.5) to include the Microsoft Hotfix for Windows XP (SP1). This hotfix corrects the SetIcon issue where icons would not be properly updated until a card was either inserted or removed. Note that this hotfix will be included in Microsoft's upcoming Windows XP (SP2) update. It can also be downloaded from Microsoft's website via Windows Update (KB 833998).
- Modified SetIcon (v1.2.1.1) so that it no longer auto arranges the icons on the user's desktop.

## 0.0.0.323: - ROM Mask 02

**Firmware:**

- Fixed a bug that prevented some MMC cards from being accessed.

**Applications:**

- Changed the Card Reader Software installer (v2.6) included in the DFU and Driver Package to remove the MS Hotfix 833998 for Windows XP. This hotfix is now available from the Microsoft Windows Update site. SMSC will continue to provide an installer that includes the hotfix as a separate download (~25 MB).

0.0.0.337: **-External Evaluation Build****Firmware:**

- Fixed a bug with the firmware not responding on an embedded host during a media surprise removal
- Added a new attribute bit for LUN Power Configuration feature and new EEPROM byte for LUN Power GPIO to allow customers to update which GPIOs control power to which LUN. This implementation is for customers who wish to control which GPIOs control power to the FETs to deliver power to a multi-card socket, instead of requiring 4 GPIOs to power 4 FETs independently (default)
- Fixed a bug with SM\_CE pull-up being enabled after power up and resume from suspend. To meet xD specification this internal pull-up should be disable, so removed enabling of this pull-up from firmware
- Fixed an issue with BIOS booting from Memory Stick Pro by changing the media identification process for MS Pro
- Fixed a bug with MS Pro failing to enumerate rarely after a surprise removal of the USB cable during a format.

**Applications:**

- Modified SetIcon (v1.2.1.2) to first determine the drive where Windows is installed and form the total path before updating the registry.
- Modified the CheckROM (v1.3) and EpruUpdt (v1.7) applications to add support for EHCI and OHCI host controllers.
- Modified the USBDM application (v1.302), DFUTest Application (v2.3.0.4), and DescUpdt application (v1.0.0.9) to include support for new chip design attribute bits, these changes are not applicable to 2224.
- Modified Attribute Calculator (v.15) to grey out attribute bit options that are not available for the device that is selected in the "Filter by Chip" option
- Modified the USBDM application (v1.302), DFUTest Application (v2.3.0.4), and DescUpdt application (v1.0.0.9) to include support for "Use LUN Pwr Config" attribute bit and LUN Pwr Cfg byte.
- Removed support for obsolete application Susb and Writeee
- Modified USBDM (v1.302) to allow for editing a .dat file without a device attached. A virtual device is seen if there is no valid device attached.
- Added functionality to automatically detach and reattach device after firmware upload is completed using USBDM (v 1.302). User is no longer prompted to complete this action since it is done for them.
- Added support to CheckROM, EpruUpdt, and DosPLTU to specify host controller number. In order to use this option the end user has to know how many host controllers of the given type are present in the system and also the enumeration order of the host controller to which the device is attached. If these details are not known, this information can be found by trial and error methods.
- Added "-d" option in DosPLTU (v1.8) to prompt for media during R/W tests.

0.0.0.361: **-ROM Mask 04****Firmware:**

- Time-out values for Smart Media have been adjusted to comply with version 1.20 of xD specification.
- Improved the detection of MS-Pro cards. This solved an issue with MacOS 9.X where the MS Pro was not being correctly identified on the first insertion
- Added check for Vbus at the end of k\_msg\_initialize in dev\_mgr so we can force a suspend if Vbus is absent.
- Fixed a bug where self powered 2224 board occasionally fails device surprise removal on large sizes of xD
- Added "generic" default configuration to be displayed when there is no valid eeprom available.
- Added reporting of unique MCU types for 2224. When you use the USBDM application, the Info tab will now tell you if the firmware being used is built for 2224.
- Added code to turn off the CF interface when powering down.
- Added Card Power Down on Idle feature to 2224 build. Idle Time Limit byte needs to be set to a value between 0x1 and 0xA to use this feature. Setting this byte will set the idle time limit to between 1 and 10 minutes depending on the value entered. Any card not acted upon for the idle time limit will be powered down until accessed again.
- Added a fix to properly identify the capacity for SD cards with > 512 byte block length (2GB SD card).
- Initialized lun data medium\_type\_code to 0 (default medium type/currently mounted medium type) in initialize controller function for SD, SM, CF, and Nand. Some BIOSs don't like uninitialized random data for medium type.

- Initialized `rslt` to `k_success` in `dfa_lun_mode_sense()` before use. `rslt` was checked w/o being set to a value when `k_mode_page_flexible_disk` (page 5) is requested. `rslt` was being initialized only for vendor page and all page requests. This caused SM LUN to stall mode sense 10 page 5 request.
- Fixed Memory Stick response to Mode Sense 6 and 10. Sony specific codes for MS, MSPro, and MS-ROM should be returned only for Vendor Page 20 only.
- Fixed Memory Stick's response to Mode Sense 6/10 with page code 3Fh (or 05h)

**Applications:**

- Added a check to properly update the serial number string upon overflow from "FFFFFFFFFFFF" to "000000000000" for DosPLTU (v1.9)
- Changed attribute bits for FET power and HS SD mode USBDM (v1.407) (Does not apply to 2224)
- Added Hub tab to USBDM (v1.407) (Does not apply to 2224)
- Added FF and 00 padding to short MFG and PRODUCT strings for USBDM (v1.403)

0.0.0.391

**-External Evaluation Build****Firmware:**

- Fixed a bug that occurred only for the configuration where the SD LUN and SM/XD Lun shared the same power GPIO. Under this configuration, SM or XD would not be recognized when the 2224 device was powered on with the media already inserted in the device.
- Added MSC Compliance fixes
- Fixed a bug where the 2224 would fail to enumerate if the C3 feature was enabled and SD/MMC cards were inserted before the 2224 was powered up.
- Fixed an issue with Xdigital adapters not enumerating when inserted into a 2224 with the C3 feature set.
- Fixed an issue where the 2224 failed to write to a Delkin 640MB CF card after the card powered down using the card power down on idle feature. This issue was not seen for any other media cards.
- Fix for self-powered C3 issue involving the following sequence of events: remove the USB cable from a properly enumerated self-powered 2224 with xD/SM inserted, remove the xD/SM card, and reattach the USB cable. After this sequence the card reader will not attach when the xD/SM card is reinserted. When this condition is met, MS and CF will no longer work and only SD will function correctly.
- Fixed a bug with a memory stick that contained a 2-bit ECC file on it. The MS could not be accessed again after the 2-bit ECC file was encountered until the card was removed and reinserted.
- Altered SM detection so that a SM card can now be recognized even if it is inserted slowly.
- Fixed a CF bug that only occurred with one 64MB PNY card that was used during testing where the card would not be recognized approximately 1 out of every 10 insertions during media insertion/removal testing. Other CF card tested did not show this failure.
- Fix for lock-up in ATA poller. Added a 1 second timer to bail out of the ATA poller if media not found ready after the set time. This prevents device from locking up under certain error conditions.

**Applications:**

- Removed the attribute bit check boxes for "Ignore HS SD Max Current" (Byte 3, bit 4) and "Switch to HS SD mode" (Byte 3, bit 5) USBDM (v1.510). (Does not apply to 2224)
- Removed support for DFUTest from Release Notes and Release Packages. All functionality of the DFUTest application is done with the USBDM application. Removed the attributes calculator since this tool is not needed with the USBDM.
- Upgraded CardReader Software Installer to now be a universal installer for all SMSC products. This resulted in new ini files that included all PID's that use this installer instead of only 2224's PID.
- Created a second card reader installer. There are now two options for the card reader installer. Cardreader Software Installer v 3.2.0.0.exe is the traditional installer. Cardreader Software Installer Safe Removal v3.2.0.0.exe is a new installer that does not allow the 2224 to be removed via the safe removal icon. Both installers are universal for all SMSC products. The only difference is the safe removal option.
- Added LUN Power Mask 1 and LUN Power Mask 2 bytes to PLDU (v1.0.1.0). (Does not apply to 2224)
- Fixed issue with `-t` option for `EprmUpdt(v1.8)`
- Removed support for `CheckRom.exe`



**0.0.0.395 -External Evaluation Build.**

**Firmware:**

- Fix a bug where occasionally the system would fail to read SM after SM surprise removal during a write if the C3 feature is enabled.
- Enabled firmware to detect a multiple-emulation error when the media reports a write failure in order to pass xD compliancy testing.
- Fixed an issue with code corruption after descriptor update to a no-EEPROM version of firmware.

**Applications:**

- EprMUpdt (v1.9) Added support for SCSI Pass Through calls in MscBot layer. EprMUpdt makes SPT calls to update EEPROM data.

**0.0.0.438 -External Evaluation Build.**

**Firmware:**

- Fix for USB2224 failing to detach when media is ejected during suspend with C3 enabled
- Removed Variable PID and Card Power Down on Idle features

**Applications:**

- USBDM (v2.0.0.4) Added dropdown option for MMC-4 attribute bits (does not apply to the 2224)
- USBDM (v2.0.0.4) Added Infra-Red dropdown option (does not apply to the 2224)
- USBDM (v2.0.0.4) Added capability to manually change attribute bits
- USBDM (v2.0.0.4) Reorganized Configuration tab for attribute bits to be separated by media type
- USBDM (v2.0.0.4) Removed Variable PID checkbox and Idle Time Limit field
- PLDU (v2.0.0.7) Updated PLDU to be based on the USBDM application
- PLDU (v2.0.0.7) Removed Variable PID checkbox and Idle Time Limit field

## **The Non-Volatile Store Data**

The NVStore is user modifiable data that is stored in either serial EEPROM or external program flash ROM and used by the device during operation. Some of the values that can be modified in the NVStore data include the serial number, VID/PID, Manufacturers ID String, Product ID String, LUN ID Strings, the modifiable device descriptors such as bmAttributes and MaxPower, number of LUNs, LUN order, and other modifiable bytes which customize the operation of the USB2224.

The NVStore data is programmed into the device using a text file “EEPROM.DAT”, which contains the bytes of data that are written to the EEPROM.

SMSC provides a utility to program the NVStore data called “USBDM.exe”. The procedure for using the USBDM Utility to write the NVStore data is described in the following paragraphs.

## **Using Flash ROM to Store the NVStore Data**

If you are using external program flash you can, as a cost reduction measure, eliminate the need for a serial eeprom in your device by using the SST39VF010 Flash ROM, and the “NO EEPROM” version of the USB2224 firmware. The NO EEPROM firmware uses a portion of the memory storage area in the SST39VF010 Flash to hold all of the NVStore data. Currently, the SST39VF010 is the only chip supported by the NO EEPROM firmware. If you have a requirement to use another flash, please contact SMSC Sales to inquire about adding support for your chip.

Note: The USB2224 contains internal masked ROM program code. If you are running the 2224 from internal ROM code, you must use an external eeprom to store the NVStore data (VID/PID/Manufacturer and Product ID Strings, Attribute Bytes, etc.)

## **Creating the EEPROM.DAT File**

An eeprom.dat file can be created using the USBDM application by altering all fields in the Configuration and Branding tab as desired for the new file and saving the file using the “Save” button. This can be done with or without a device attached to the host computer. The following section describes these tabs and the USBDM application in detail.

## **Using the USB Drive Manager Application (for Windows XP only)**

The USB Drive Manager (USBDM) application can be used to create the eeprom.dat file and program the USB2224 device via USB, plus some additional functions such as creating end-user firmware updates contained within a single, easily distributable exe, and having the ability to instantly read the NVStore data from the device without the need for a driver swap.

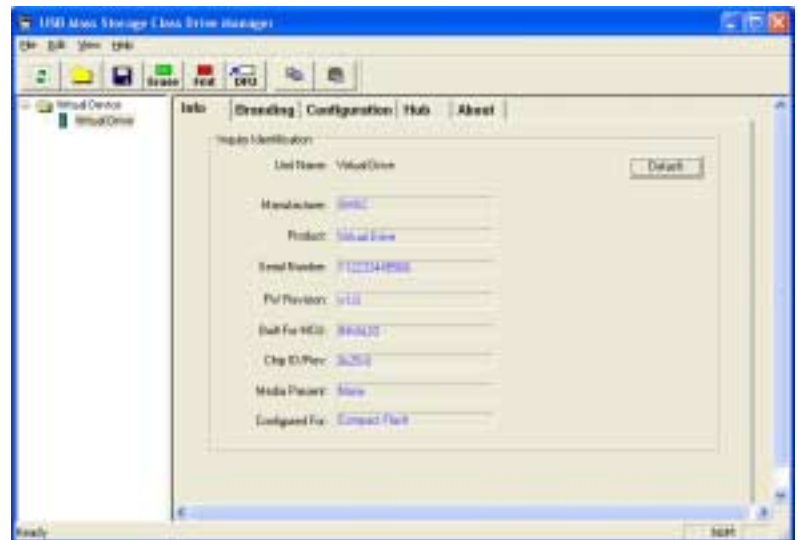
**Note: Only USBDM version 2.0.0.4 or newer will work properly for updating 2224**

**Note: USBDM will not work for updating a SMSC standalone hub.**

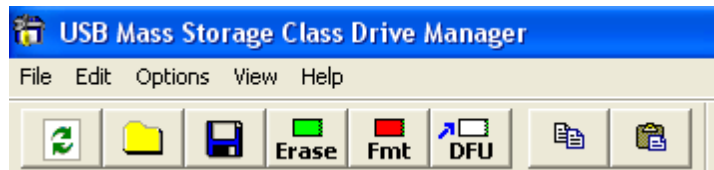
**Note: The USBDM Application is supported in Windows XP only.**

### **Getting Started:**

To start the USB Drive Manager application, simply double click on the “USBDM.exe” executable. Once the application opens you will see the screen shown to the right if there is a device attached to the host computer. If there is no device present, a virtual device will be listed instead of the USB MSC Device information shown in this example. This virtual device allows a .dat file to be edited without the need for a device to be attached to the host computer.



### **The USBDM Toolbar**



The toolbar buttons shown above are displayed at the top left hand side of the application. Starting from left to right, they perform the following functions:

Button 1: Refresh Drive List

Button 2: Load .dat file

Button 3: Save .dat file

Button 4: Erase Media (Not Used With 2224)

Button 5: Format Drive (Not Used With 2224)

Button 6: Upload Firmware

Button 7: Copy

Button 8: Paste

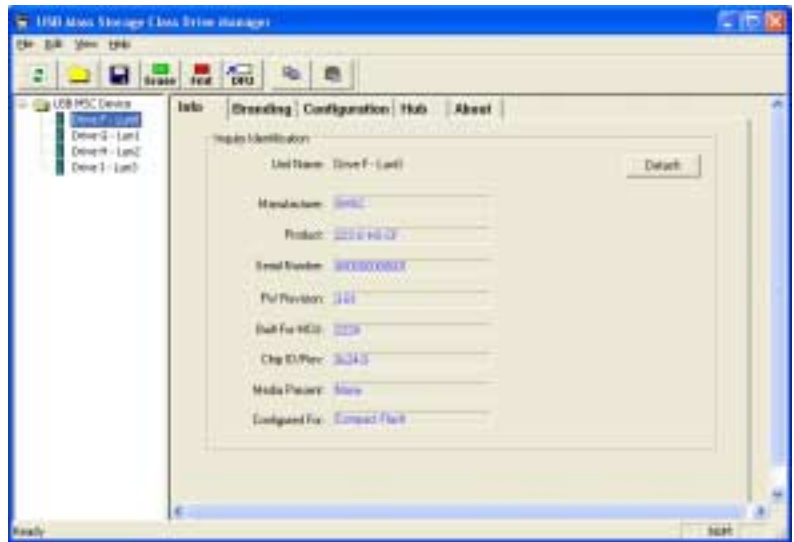
\*If you do not see these buttons displayed, go to “View” in menu bar and make sure there is a check next to the “Toolbar” option.

\*Clicking on the “Help” option above the toolbar and selecting “About Drive Manager” will display the version of the USBDM application.

### The Info Tab

The info tab is displayed whenever a USB mass storage class device is attached to the host while USBDM is running. This tab displays the key fields in the NVStore data for the device. Note: Unless the device contains the SMSC USBDM firmware extensions which are found in firmware versions 300 and higher, most of the data fields will display INVALID.

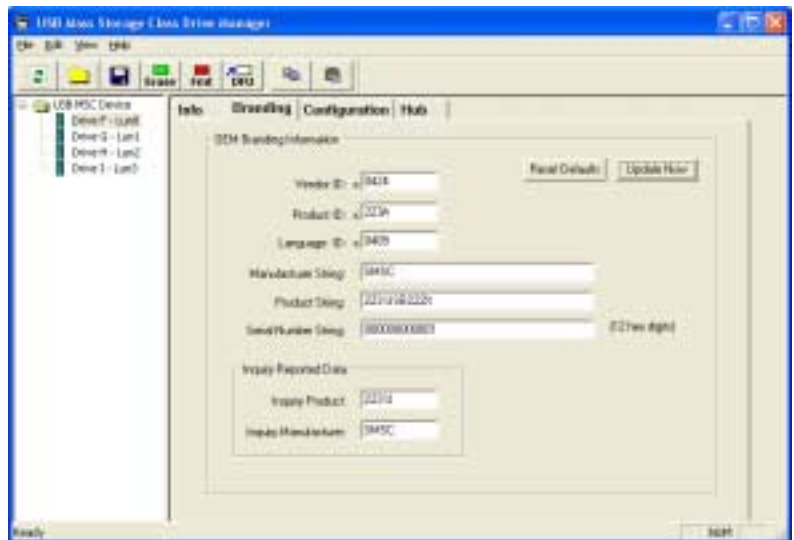
Attach a device containing the USBDM firmware extensions (firmware versions 300 or higher) to the PC via a USB cable. The USB Drive Manager application will read the NVStore data for this device if there exists valid data. It will display information for each drive that is available on the device. The example to the right has information for Drive F, Drive G, Drive H, and Drive I. You can toggle between the information for each of these drives by single clicking on the Drive entry under the "USB MSC Device" folder on the left side of the application.



Note: The detach button seen on this tab will momentarily detach the target device from the system.

### The Branding Tab

The Branding tab is used to write vendor specific data to the NVStore. Programmable fields include: Vendor ID, Product ID, Language ID, Product String, Manufacturing String, and Serial Number String. Any of this information can be changed on the device. Once you have entered the information for your device, click on the "Update Now" button to program the NVStore. After updating your device, power cycle the device to ensure that the updated information is being used.



**Vendor ID:** Unique for every vendor. Assigned by the USB Implementers Forum.

**Product ID:** Unique to product. Assigned by vendor.

**Language ID:** 0409 is the Language Code for English. Other Language Codes may be found in the USB specification.

**Product String:** 28 characters max. Used to identify the product. This string will be used during the USB enumeration process in Windows.

**Manufacturing String:** 28 characters max. Used to identify the manufacturer.

**Serial Number:** 12 hex digits max. Must be unique to each device.

**Inquiry Manufacturer (8 Bytes) and Product (5 Bytes) ID Strings:** If bit 4 of the 1<sup>st</sup> attribute byte is set, the device will use these strings in response to a USB inquiry command, instead of the USB Descriptor Manufacturer and Product ID Strings.

### Using .dat files with USBDM

The Load .dat file button can be used to populate these fields from a valid .dat file. After clicking the Load .dat file button, you will be prompted to specify a .dat file. Once the .dat file has loaded, the text fields will be updated to reflect the data in the .dat file. Any changes made to the text fields can also be saved into a .dat format using the Save .dat file button at the top of the application.

## The Configuration Tab

The Configuration tab contains all of the other NVStore programmable fields not found in the Branding Tab.

The Configuration Tab is where you set:

- 1) The NVStore signature which is always “ATA1” for the USB2224
- 2) The attribute bits
- 3) The LUN assignments
- 4) The LUN IDs
- 5) NAND Profile (Not Used for USB2224)
- 6) Miscellaneous settings such as the USB descriptors bMaxPower and bmAttribute

These user programmable fields are described in detail in the following paragraphs.

**Signature:** The signature should remain set to ATA1 for USB2224.



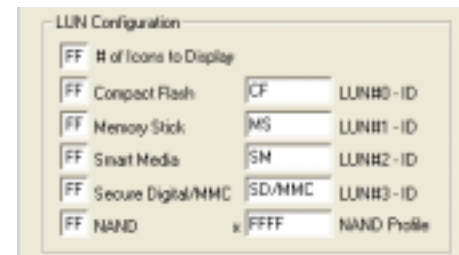
**Attribute Bits:** The attribute bits are used to customize the functionality of the USB2224 firmware. A complete list of all programmable attribute bits and their function is listed in the section of this document entitled “Attribute Bit Definitions and NVStore Editable Values.” In the image shown above “Reverse Card Write Protect Sense” in the SD section is the only option selected. Placing a check to the left of an option sets an attribute bit. If the box is unchecked, the attribute bit will be cleared. Any of these options may be checked or unchecked depending on the various needs for the product being programmed. There are also dropdown options in the “IrDA”, “CIR”, and “MMC-4” sections. None of these dropdowns apply to the 2224 and should not be used.

### **LUN Configuration:**

**LUN ID Strings (7 bytes each)-** There are four LUN ID strings corresponding to LUN# 0,1,2 and 3.

**Number of Icons to Display, CF Lun #, MS Lun #, NAND Lun #, SD/MMC Lun #, SM Lun #-** These bytes are used to specify the number of LUNs the device exposes to the host. These bytes are also used for icon sharing- Assigning more than one LUN to a single icon. This is used in applications where the device utilizes a combo socket and the OEM wishes to have only a single icon displayed for one or more interfaces. For more information, see the section of this document entitled “LUN Configuration and Icon Sharing.” If this field is set to “FF”, the program assumes that you are using the default value of “04” and will display icons for CF, MS, SM, and SD. If this field is any other value besides “FF”, you must specify the LUN# assignments in the boxes below starting with LUN 00 and going to (# of Icons to Display -1)

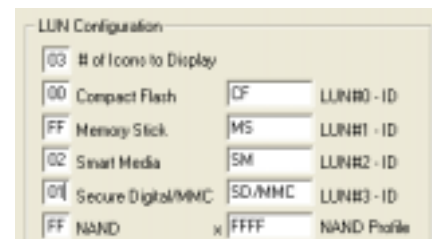
**NAND Profile (2 Bytes): (Not used for the USB2228)** This is where the NAND performance profile is specified for controllers that use it.



Note that more than one interface (CF, MS, SM, or SD) can share a LUN. Remember **LUN numbering always starts at 00**.

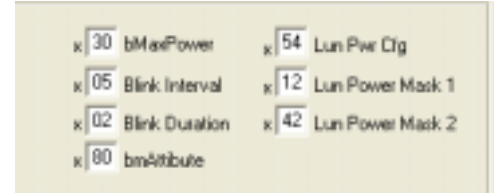
The configuration to the right directs the firmware to show three LUN's in the order of CF, SD/MMC, and SM. Note that Memory Stick is not enabled in this configuration.

# Of Icons to Display: 03  
 Compact Flash (1<sup>st</sup> LUN): 00  
 Memory Stick (will not display): FF  
 Smart Media (2<sup>nd</sup> LUN): 02  
 Secure Digital/MMC (3<sup>rd</sup> LUN): 01



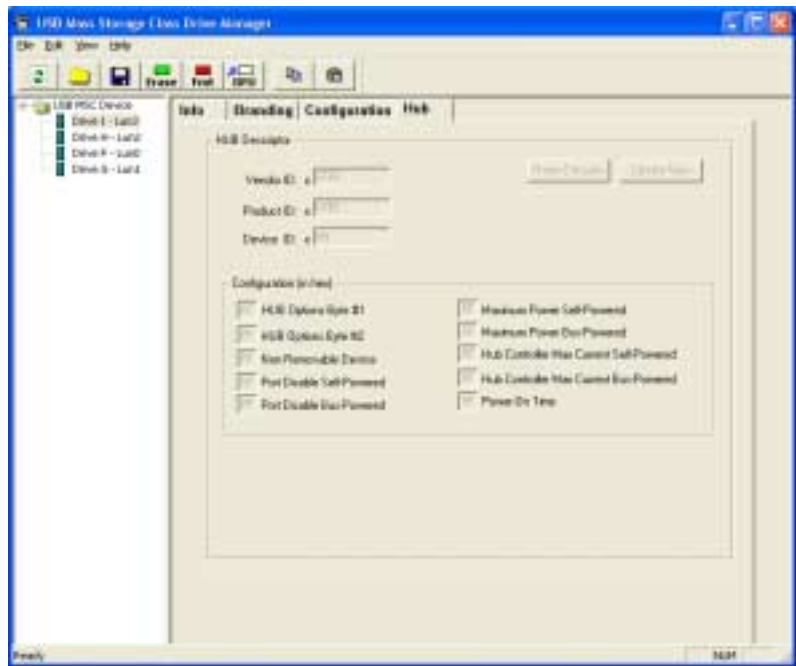
**Misc. Settings:** The Misc. Settings section is used to program the other miscellaneous NVStore editable values. They are:

- 1) **bMaxPower** (1 byte): Per USB specification. Do not set this value greater than 100mA
- 2) **Blink Interval** (1 byte): Programmable in 10ms intervals. Hi bit indicates idle state: 0–Off, 1-On. The remaining bits are used to determine the blink interval up to a max of 128 x 10 ms.
- 3) **Blink Duration** (1 byte): This byte is used to designate the number of seconds that the GPIO 0 LED will continue to blink after a drive access. Setting this byte to “05” will cause the GPIO 0 LED to blink for 5 seconds after a drive access.
- 4) **bmAttribute** (1 byte): Per USB Specification.  
80 - Device is Bus Powered  
C0 – Device is Self Powered
- 5) **Lun Pwr Cfg** (1 byte): – Should be a valid hexadecimal number. Default = E1. Refer to the “Lun Power Configuration” section for additional information on how to calculate this byte.
- 6) **Lun Power Mask1 (Not used for the 2224)** (1 byte): - Defines which GPIO or FET is used for MS and CF
- 7) **Lun Power Mask2 (Not used for the 2224)** (1 byte): - Defines which GPIO or FET is used for SD and SM



## The Hub Tab

The Hub tab is non-functional for the 2224 product. If a 2224 (or any USB mass storage class device that does not support this tab’s functions) is connected to the host when USBDM is running, the entries will be grayed out and inactive. Attempting to modify the contents of the Hub tab will have no effect on the operation of the device. Changing any values on the Hub tab will have no effect, as these entries will be grayed out and inactive.



## **Attribute Bit Definitions**

**Attributes (4 bytes):** The attribute value for your device is determined by the options selecting in the USBDM utility provided by SMSC. Changing the checkboxes and dropdown boxes and updating the device can update this information. These bits are defined below and organized by the Byte/Bit order. In the USBDM GUI, these bits are organized by which media type/feature they affect. The majority of these bits are displayed as checkboxes in the USBDM GUI. A few of them are displayed in dropdown options. The “Infra-Red” and “MMC-4” dropdown options are not used with the 2224 and changing these settings will have no effect on the device. The bit definitions are as follows:

**Note:** The bit names are shown in bold below and correlate to how the attribute checkbox is labeled in USBDM. Not all checkboxes apply to the USB2224. Those bits that do not apply will specify, “Reserved – always set to 0” in the definitions below.

**Byte 1, bit 0:** Reserved – always set to 0. **Use Slow NAND FLASH Media Timing**

**Byte 1, bit 1:** Reserved – always set to 0. **Enumerate NAND Device as Removable**

**Byte 1, bit 2:** Reserved – always set to 0. **Use GPIO5 as an SD Card Insert Indicator**

**Byte 1, bit 3: Behavior of iSerial byte in device descriptor**

1 - Always report iSerial as zero in the device descriptor.

0(default) - Report non-zero iSerial in device descriptor if serial number is valid.

**Byte 1, bit 4: Use the Inquiry Manufacturer and Product ID Strings**

1 – Use the Inquiry Manufacturer and Product ID Strings.

0 (default) - Use the USB Descriptor Manufacturer and Product ID Strings.

**Byte 1, bit 5: Set Activity GPIO High when Suspended.**

1 – The activity LED GPIO is set to High when suspended.

0(default) - The activity LED GPIO is set to Low when suspended.

**Byte 1, bit 6: Reverse SD Card Write Protect Sense**

1 - SD cards will be write protected when SW\_nWP is high, and writable when SW\_nWP is low

0 (default) - SD cards will be write protected when SW\_nWP is low, and writable when SW\_nWP is high

**Byte 1, bit 7: Make SD Cards Write Protected (Read Only) Always**

1 – SD cards will always be write protected, regardless of the state of the card's write protect switch

0 (default) - SD cards will only be write protected when the write protect switch on the SD card is engaged

**Byte 2, bit 0: Don't Perform Smart Media CIS Checking**

1 – Ignore CIS check for Smart Media to allow the USB2224 to work with non-compliant cards.

0(default) – Enforce Strict CIS checking for Smart Media cards.

**Byte 2, bit 1** Reserved – always set to 0. **Perform NAND Media Idle processing**

**Byte 2, bit 2: Use Slow Compact Flash Compatibility Mode**

1 – Compact Flash will operate in slow PIO-0 mode only regardless of CF card's actual capability.

0(default) – Compact Flash will operate at the fastest mode the card reports it can support.

**Byte 2, bit 3: Device Responds To Get Status(1)**

1 – Device will report itself as SELF POWERED in response to a GET STATUS from the host.

0(default) – Device will report itself as BUS POWERED in response to a GET STATUS from the host.



**Attribute Bit Definitions (cont.)**

**Byte 2, bit 4:** Change the USB Version the Device Reports to the Host (Warning: Setting this bit will result in the device being non-compliant with the USB 2.0 specification.)

1 – Device will report itself as USB version 1.1 in the bcdUSB device descriptor.

0(default) – Device will report itself as USB version 2.0 in the bcdUSB device descriptor.

**Byte 2, bit 5:** Use a Common Media Insert / Media Activity LED.

1 – The activity LED will function as a common media inserted/media access LED.

0(default) – The activity LED will remain in its idle state until media is accessed.

**Byte 2, bit 6:** Reserved – always set to 0. **Perform Software 1-bit ECC Error Correction on Smart Media.**

**Byte 2, bit 7:** Reserved – always set to 0. **Skip Page Status Byte Check on SM and xD.**

**Byte 3, bit 0:** Attach on Card Insert / Detach on Card Removal.

1 – The device will attach to the host when media is inserted and detach from the host when media is removed.

0(default) – The device will always remain attached while powered, regardless of the presence or absence of media.

**Byte 3, bit 1:** Enable xD Door Support

1 – Adds support for using an xD door by moving the activity LED to GPIO 12, using GPIO 1 as an xD door input ( See hardware schematic)

0(default) – All GPIOs retain their normal function.

**Byte 3, bit 2:** Use Lun Power Configuration.

1 – Custom LUN Power Configuration stored in the NVSTORE is used. Refer to section “LUN Power Configuration” section for additional information about this feature.

0(default) – Default LUN Power Configuration is used.

**Byte 3, bit 3:** Reserved – always set to 0.

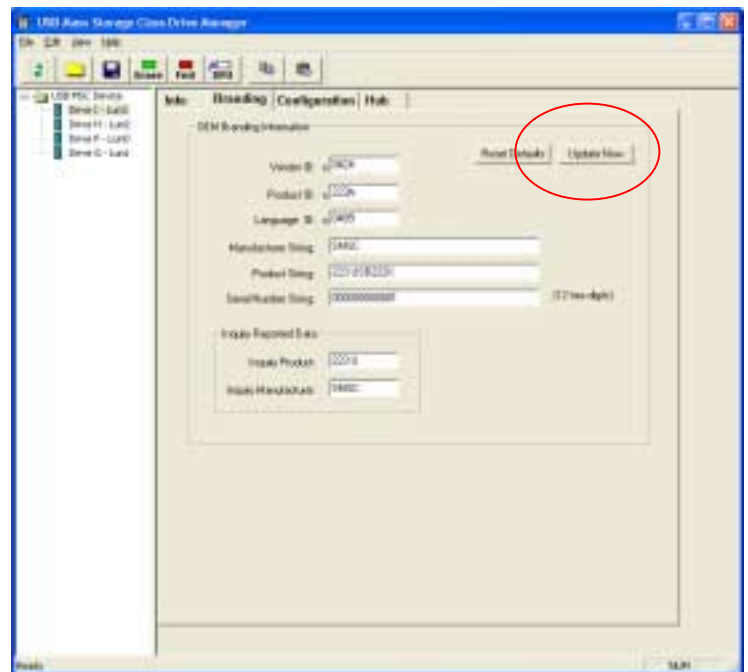
**Note:** Bits that are used for the dropdown options in the “IrDA”, “MMC-4”, and “CIR” sections of the Configuration tab are not used with the 2224 and changing these settings will have no effect on the device.

All other bits in the Attribute fields are reserved and should be set to 0.

**Programming the NVStore Data**

Once the eeprom.dat file has been created and loaded into USBDM, you are ready to program the NVStore data into your device.

Press the “Update Now” button on either the Branding or Configuration Tab of the USBDM application. Both buttons will update all of the information displayed on any tab in USBDM. The operation will report that the Update completed Successfully once the data has been programmed.





## LUN Configuration and Icon Sharing

### LUN Configuration

LUN (Logical Unit Number) is the term given to each available media type in the USB2224. The USB2224 has a total of 4 LUNs available for use: Compact Flash, Memory Stick, Smart Media, and Secure Digital/Multimedia Card. OEMs can specify the number and order of LUNs exposed to the user by setting the LUN Configuration section of the Configuration tab in USBDM and updating the NVSTORE with these new settings.

**Example:** The example on the right shows the correct settings for a 2224 device that exposes icons for MS, SM and CF in that order. Note the following bytes:

**Number of Icons to Display: “03”** (The user will see 3 icons)  
**MS LUN #: “00”** (Memory Stick will be the 1<sup>st</sup> icon displayed)  
**SM LUN #: “01”** (Smart Media will be the 2<sup>nd</sup> icon displayed)  
**CF LUN #: “02”** (Compact Flash will be the 3<sup>rd</sup> icon displayed)  
**SD/MMC LUN #: “FF”** (An icon for SD/MMC will not be displayed)

**Note:** LUN numbering always starts at “00”.

LUN Configuration			
03	# of Icons to Display		
02	Compact Flash	CF	LUN#0 - ID
00	Memory Stick	MS	LUN#1 - ID
01	Smart Media	SM	LUN#2 - ID
FF	Secure Digital/MMC	SD/MMC	LUN#3 - ID
FF	NAND	x FFFF	NAND Profile

### Icon Sharing

In addition to LUN configuration, the USB2224 can be further customized to allow more than one LUN to share an icon. This functionality would most likely be used for devices that contain multi-card adapters (adapters that can read more than one type of card.) So if you wanted to use a “5-in-1” or a “6-in-1” adapter, the USB2224 could be configured to only display a single icon to the user, rather than an icon for each individual media type. Alternatively, if you wanted to use a “4-in-1” adapter for Memory Stick, Smart Media, Secure Digital and Multimedia Card, but have a separate adapter for Compact Flash, you could configure the USB2224 to display 2 icons to the user (one for the 4-in-1 adapter and one for the Compact Flash) as shown in the example on the right.

**Example:** The example on the right shows the correct settings for a 2224 device that exposes 2 icons: 1 for (CF) and 1 for (MS, SM and SD/MMC) in that order. Note the following bytes:

**Number of Icons to Display: “02”** (The user will see 2 icons)  
**CF LUN #: “00”** (Compact Flash will be the 1<sup>st</sup> icon displayed)  
**MS LUN #: “01”**  
**SM LUN #: “01”**  
**SD/MMC LUN #: “01”** } (These media will all share a single icon)

LUN Configuration			
02	# of Icons to Display		
00	Compact Flash	CF	LUN#0 - ID
01	Memory Stick	MS	LUN#1 - ID
01	Smart Media	SM	LUN#2 - ID
01	Secure Digital/MMC	SD/MMC	LUN#3 - ID
FF	NAND	x FFFF	NAND Profile

The LUN Power Configuration allows the user to customize which GPIOs control power to which LUNs. Without this feature, users designing card readers that utilize multi-card sockets (sockets which can accept different flash card types) must include one FET for each card that the socket supports. Therefore, if a socket can accept any card type, the board design must include 4 FETs even though only 1 FET is active at a time. In order to reduce cost, only one FET is needed per socket. Users can set the LUN Power Configuration to have a single GPIO control power to the FET to deliver power to the multi-card socket, instead of requiring 4 GPIOs to power 4 FETs independently.

The format of the NVStore LUN Pwr Cfg byte is as follows:

The Power GPIO field for each of the sockets shall be defined as follows:

By default the LUN Power Configuration byte will be as follows:

The above chart shows SD being powered by GPIO 11, SM powered by GPIO 10, MS powered by GPIO 8, and CF powered by GPIO 9.

### 0xA9 Example:

Bit							
7	6	5	4	3	2	1	0
SD Power GPIO		SM Power GPIO		MS Power GPIO		CF Power GPIO	
1	0	1	0	1	0	0	1
0xA9							

## **Using Device Firmware Upgrade (DFU)**

**Important Note:** The version 212 release of the USB2224 firmware includes the final version of the DFU loader “DFU.hex”. This DFU loader is incompatible with previously released versions of the USB2224 firmware, but will be forward compatible with all future releases. In order to have DFU firmware upgradeability for any 2224 device going forward, you must use the version 212 DFU loader.

### **Overview**

Device Firmware Upgrade (DFU) is the process by which device firmware is updated through a standard USB cable, eliminating the need to remove, reprogram and replace flash memory. This operation is accomplished by placing special code into an external flash memory chip at the time it is initially programmed. This code can then later be called upon to essentially change the USB device into a flash programmable device. Then new firmware can then be uploaded to the device and reprogrammed into the flash. Once the operation is complete, the device configures itself back to a normal USB device and begins utilizing the new firmware. **Please note that you can not perform a device firmware upgrade if you are running from the internal USB2224 ROM code. You must use an external flash if you want to have device firmware upgrade capability.**

SMSC’s Device Firmware Upgrade (DFU) package gives manufacturers the ability to easily utilize DFU to dynamically update the firmware and descriptor information in their devices. This allows for in circuit programming of new device firmware both on the assembly line, and by the end user in the field. This affords both the manufacturer and the end user a great opportunity to utilize the feature enhancements and bug fixes of new code immediately once it becomes available.

In order to help customers evaluate the DFU technology, SMSC provides a DFU package that consists of the DFU driver, device firmware, sample DFU applications and source code, and a DFU driver API which customers can use to quickly develop custom DFU applications. SMSC also provides a DFU package for Mac 10.X and 9.X systems. This document serves to describe the use of these tools, and the implementation of Device Firmware Upgrade in a typical device application.

### **Files Required for DFU for Windows**

**USBDM.exe** –A sample DFU application which demonstrates the use of the API and the procedure for updating the firmware and NVStore data.

**eeprom.dat** –A text file containing the changeable descriptor information used to update the NVStore. This file can be created and edited using the branding and configuration tabs in the USBDM application.

**hex2bin.exe** -A batch capable utility that converts INTEL HEX, MOTOROLA 'S', or TEKTRONIX HEX files to Binary Format.

**dfu.exe** -A utility used to add, remove, or check for the presence of a DFU file suffix. Any firmware image that is to be uploaded to a device via DFU, should contain a valid DFU file suffix.

**dfu.hex** -The DFU execution code that is inserted into the lower 64kb of a 128kb flash when it is initially programmed. This hex file is converted to a 64kb binary file with the “hex2bin.exe” utility, and then appended to the 64kb “fmc.bin” file to create the 128kb flash image. (Included with the USB2224 firmware).

**fmc.hex** -The USB2224 device firmware that is inserted into the upper 64kb of a 128kb flash when it is initially programmed. This hex file is converted to a 64kb binary file with the “hex2bin.exe” utility, and then appended to the 64kb “dfu.bin” file to create the 128kb flash image. (Included with the USB2224 firmware).

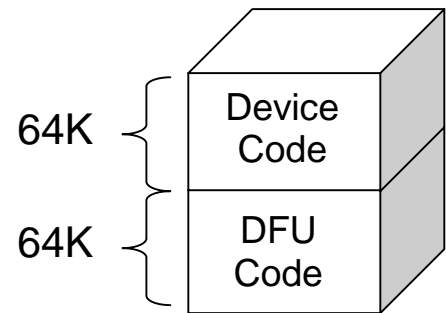
**fmc.dfu** -A firmware image that can be uploaded to the device. This file is created by the user. This document explains in detail how to make downloadable DFU images through the use of the “DFU.exe” utility, which appends a DFU file suffix to the firmware file to be uploaded to the device. (This file is created by the user).

**Application Source Code** - All of the source code for the USBDM sample application.

**Creating the 128KB DFU Capable Flash Binary “both.bin”**

In order to prepare a device for DFU operation, the flash must be programmed with both the DFU code, and the normal USB2224 device code. The device code is converted to a 64KB binary file, and appended to the DFU code, which has also been converted to a 64KB binary file. Together they form the 128KB binary file which is uploaded to the flash eeprom. When this file is uploaded to the flash, the DFU code occupies the lower 64KB block, and the device code occupies the upper 64KB block.

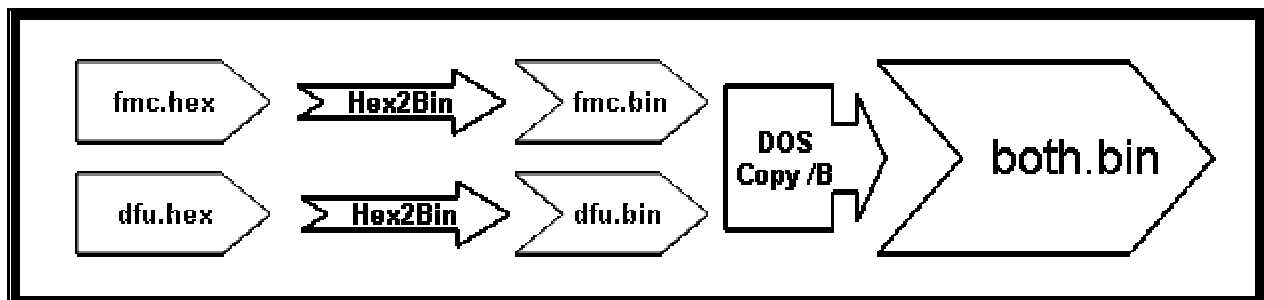
In normal operation, a DFU capable USB2224 device executes only the device code in the upper 64KB block of memory. This code allows it to function as a normal USB 2.0 flash media controller. However, when the device is switched to DFU mode, the DFU code in the lower 64KB block begins executing and the device ceases to be a flash media device. Essentially, it changes to become an eeprom programming device. In this mode it is capable of reprogramming the USB2224 device code in the upper 64KB block of flash memory. Once the operation is complete, the device switches code execution back to the upper bank and begins operating with the newly updated code. At this point it ceases to be an eeprom programming device, and returns to being a flash media device.

**128KB Flash EEPROM**

To create the 128KB DFU capable flash binary file that will initially be programmed into the flash eeprom, you will need two files:

- 1) `fmc.hex` (The device code)
- 2) `dfu.hex` (The DFU code)

The “dfu.hex” file is provided by SMSC, and provides programming support for a limited number of eeproms. The “fmc.hex” file is the standard USB2224 device firmware. These two files, “dfu.hex” and “fmc.hex,” are both converted to 64KB binary files with the “hex2bin.exe” utility, and then appended to each other with a DOS copy command. Together they become the 128KB binary file “both.bin”. The procedure for creating “both.bin” is outlined below.



Note that this entire procedure can be accomplished easily using a simple DOS batch file:

```
hex2bin -L65536 dfu.hex dfu.bin
hex2bin -L65534 fmc.hex fmc.bin
copy /Y /B dfu.bin /B + fmc.bin /B both.bin /B
```

### **Preparing a Device for DFU Operation**

In order to prepare a device for DFU operation, the flash must initially be programmed with the “both.bin” code. The “both.bin” file contains both the device code as well as the DFU code. The DFU code must preexist on the flash in order for it to be capable of receiving a DFU upload. The DFU code remains dormant in the lower 64KB of memory until it is called upon to perform a device firmware upgrade operation.

Once the flash has been programmed with the “both.bin” file, it may be inserted into the 2224’s flash socket in preparation for DFU operation.

### **Choosing a Flash Eeprom for Your Device**

SMSC provides customers the “dfu.hex” file which supports only the **SST39VF010**, **AM29LV010B**, **AM29LV040B**, **STM29W010B**, **MBM29LV400TC**, and the **MBM29LV200TC** flash eeproms. While all of these flash support DFU firmware uploads, only the SST39VF010 supports NO EEPROM operation.

If you wish to use another flash in your device, it would most likely require some modification to the existing DFU code by SMSC to support the electrical characteristics of the new chip. If this is the case, please contact SMSC sales to have the project scheduled.

If you do decide to use another flash eeprom, there are a few requirements to look for to make sure it will work with DFU. First of all it should be 128KB and byte writable. Also, it should have equivalent programming characteristics as the three supported chips, i.e. block size, erase size, read/write/erase speed, command set, and command address. Provided the chip meets all of the above requirements, there is a good chance that it will support DFU.

### **Setting up the Hardware**

Either a USB 1.1 or 2.0 controller may be used for the DFU operation, however some USB 2.0 host controller drivers such as OMI’s have been found to have defects which prevent DFU from performing normally. If you are going to use a USB 2.0 host controller, it is recommended that you use Microsoft’s host controller drivers in order to achieve the best results. Once the board is attached and powered up, it should enumerate as a normal USB flash media controller. When you see the drive icon(s) appear, the device is ready. Currently only USB 2.0 may be used for the DFU operation when using Macintosh operating systems. The following section describes the next step in the process, which is setting up the software application to perform the DFU.

## Performing a Firmware Update Using the USB Drive Manager Application

The following files are needed to perform a device firmware upgrade with the USBDM application:

1. The USBDM application executable (USBDM.exe)
2. The device code (both.bin) **\*Must be preprogrammed in the device flash in order to accept DFU**
3. A HEX to BIN converter (hex2bin.exe)
4. Utility to add the .dfu suffix (dfu.exe)
5. The updated firmware image. Steps to create this file are explained below (fmc.dfu)

\* Note that if you also want to perform an update of the serial eeprom, you will need a 6th file, "eeprom.dat" which contains the descriptor information for the serial eeprom.

A firmware update can only be done using this application if a valid both.bin file is already programmed onto the device. See the section of this document entitled "Creating the 128KB DFU Capable Flash Binary 'both.bin'" for steps on how to create the both.bin file.

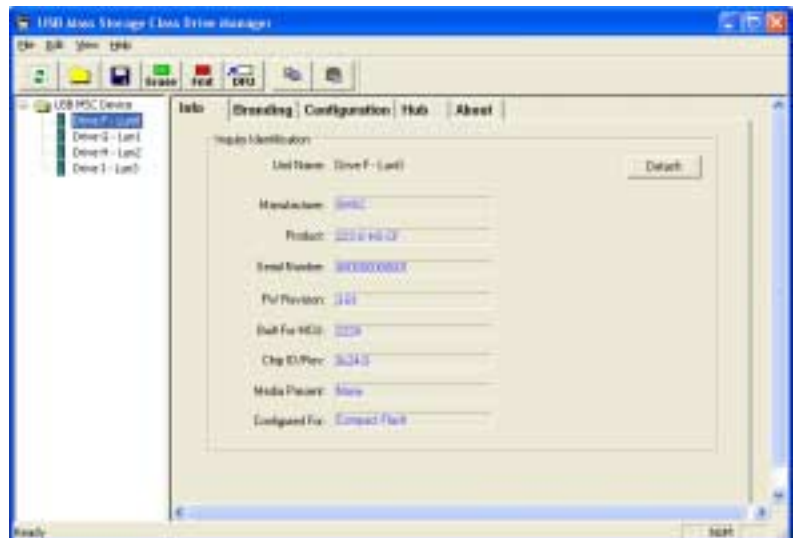
### Creating the .dfu File:

The .dfu file is a DFU uploadable firmware image. It is essentially USB2224 firmware converted to binary format using the hex2bin.exe utility, with a DFU suffix appended to it. For information on creating the .dfu file, please see the section of this document entitled "Creating a DFU Uploadable File". Please note that the USBDM application uses the device ID field (DID) to check firmware version information. The DID field should be filled with the major and minor firmware version (for this example, v3.00, the DID would be 0x0300).

This procedure can be completed using a simple DOS batch file:

```
hex2bin -l65534 fmc.hex fmc.bin
dfu fmc.bin -did 0x0300 -pid 0x223A -vid 0x0424
ren fmc.bin fmc.dfu
```

USBDM is used for the firmware update. To begin the firmware update, start USBDM by double clicking on the icon.

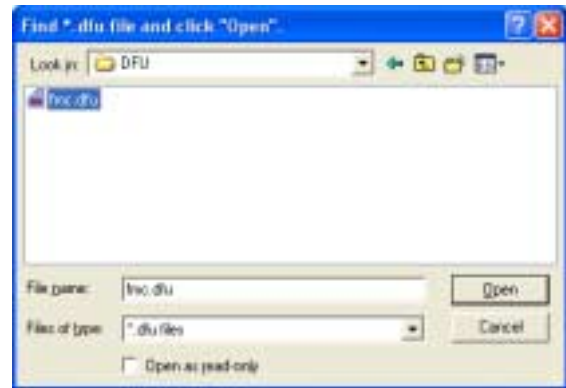


### Updating the Firmware:

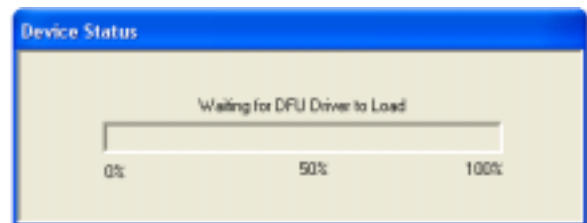
To perform a firmware update, click on the “Upload Firmware” button at the top of the application.



You will then be prompted to select the .dfu file that you wish to upload to your device. Navigate to the .dfu file (if it is not already listed in the current folder) and click open.



You will see a pop up box on your screen that displays the status of the firmware upload. This status will cycle through “Waiting for DFU Driver to Load”, “Switching to DFU Mode”, “Uploading New Firmware”, “Validating New Firmware”, and “Firmware Upload Successful”. Once the loading is complete you will be prompted to unplug the device and reattach it to continue (or to restart the host if the device is internally mounted). Once the device is reattached, the device will enumerate and the information for the updated firmware will be loaded into the USB Drive Manager application.



Note: The first time USBDM is used for DFU on a Windows XP host, the found new hardware wizard will be seen when the dfu driver is used during the firmware update process. This will only happen the first time a DFU is performed on a host. When this comes up, choose to have windows automatically install the driver. Choose to continue loading the SMSC DFU driver even though it is unsigned. While this is occurring, you may receive a message from USBDM asking you if you wish to continue waiting for the device to respond. Select yes to continue waiting.

### Using USB Drive Manager to Create a Consumer Firmware Update Executable

USBDM can be used to create a very simple, easy to use, easy to distribute firmware update that OEMs can give to their customers to allow firmware upgrades. To create the executable, you only need two files:

1. The Drive Manager application (USBDM.exe)
2. The updated firmware image. (fmc.dfu)

**Note: Ensure that the DID set in the DFU file matches the Major and Minor firmware revision.**

Simply drag and drop the .dfu file on the USBDM.exe icon in Windows. You will see a popup box asking if you would like to create an OEM consumer version of the DFU application. Click yes and the application will build the consumer firmware update executable. The executable will be given the default name of “OEM.exe”. You can rename this file to whatever you like. This is the file that is distributed to the customer to allow firmware upgrades.



**Note: The target device must be preprogrammed with a valid “both.bin” file to allow firmware upgrades.**

### Using the OEM.exe to Update Firmware

The OEM executable icon is shown to the right.



1) Double click on this executable to begin updating the firmware in your target device.

2) You will be prompted to attach a supported USB device.

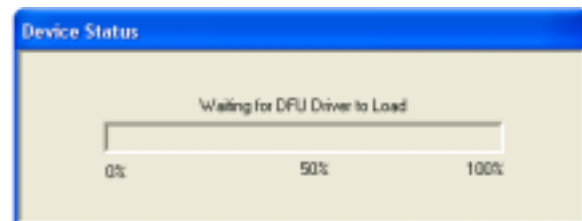
This prompt also displays which firmware version the executable will use to update your device. For this example, Firmware Version 3.00 is used.

3) Connect your device(if not connected already) and click “Continue”.



Note: This application allows consumers to make firmware updates to their device provided that 1) a valid both.bin file is already programmed on the target device and 2) the firmware that they are attempting to upgrade to is equal to or newer than the firmware version already on the device. This application will not allow an update to a version of firmware that is older than what is currently on the device. You will be asked if you would like to update your device firmware, click “yes” to verify the update and the application will begin to update your device.

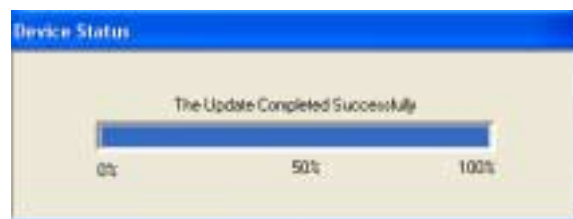
The application will show the status of the update. It will cycle through “Waiting for DFU Driver to Load”, “Switching to DFU Mode”, “Uploading New Firmware”, “Validating New Firmware”, and “Firmware Upload Successful”.



4) The USB Drive Manager application will prompt you to either reboot your computer (if an internal USB device was updated) or unplug the device and plug it back in (if an external device was updated).



After this is completed, you will see the device status pop up return with the message “The Update Completed Successfully”. The firmware is now updated on your device.



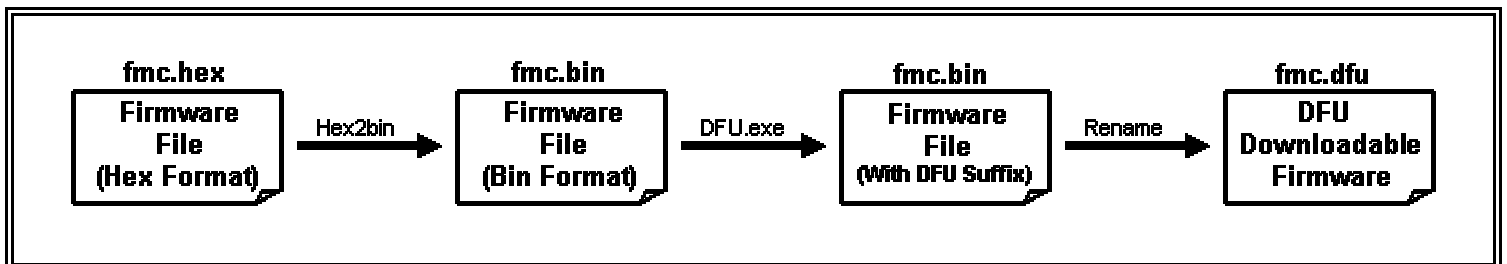


### Creating a DFU Uploadable File

In order for a file to be uploadable via a DFU operation, it must contain a valid DFU file suffix. The DFU file suffix contains a CRC of the entire file, a DFU signature, and the VID, PID, and DID for the device to be upgraded. The following table was extracted from the USB Device Firmware Upgrade Specification (Rev 1.0), and shows the composition of the DFU file suffix.

Offset	Field	Size	Value	Description
-0	<i>dwCRC</i>	4	Number	The CRC of the entire file, excluding <i>dwCRC</i> . (Calculation specified in the following section).
-4	<i>bLength</i>	1	16	The length of this DFU suffix including <i>dwCRC</i> .
-5	<i>ucDfuSignature</i>	3	uc	The unique DFU signature field.
-8	<i>bcdDFU</i>	2	BCD	DFU specification number.
-10	<i>idVendor</i>	2	ID	The vendor ID associated with this file. Either FFFFh or must match device's vendor ID.
-12	<i>idProduct</i>	2	ID	The product ID associated with this file. Either FFFFh or must match device's product ID.
-14	<i>bcdDevice</i>	2	BCD	The release number of the device associated with this file. Either FFFFh or a BCD firmware release or version number.

In the SMSC DFU application, DFU downloadable files are given the extension “.dfu”. This is strictly arbitrary; the files can be of any extension as long as the application is designed to handle them. In order to create your own DFU downloadable file, you begin with the firmware file that is going to be used to upgrade the device. If the new firmware file is not already in binary format, it should be converted to binary using the Hex2Bin utility provided. Once in binary format, the “dfu.exe” utility is used to append a valid DFU file suffix to the firmware file (See the next section titled “Using the DFU.exe Utility”). Once the DFU file suffix has been added, you may rename the file with a .dfu extension to indicate that it is DFU downloadable. The entire procedure for creating the DFU downloadable file is summarized below.



### Using the DFU.exe Utility

The “DFU.exe” utility can be used to add a DFU suffix to a file, or to check for the presence of a valid DFU suffix on an existing file. If required, the “DFU.exe” utility can also be used to remove a DFU suffix from a file. The “DFU.exe” utility is run from a command box in Windows.

The usage of DFU.exe is:

**DFU.exe <filename> [options]**

To check for the presence of a DFU file suffix:

**DFU.exe <filename>**

To remove a DFU suffix from a file:

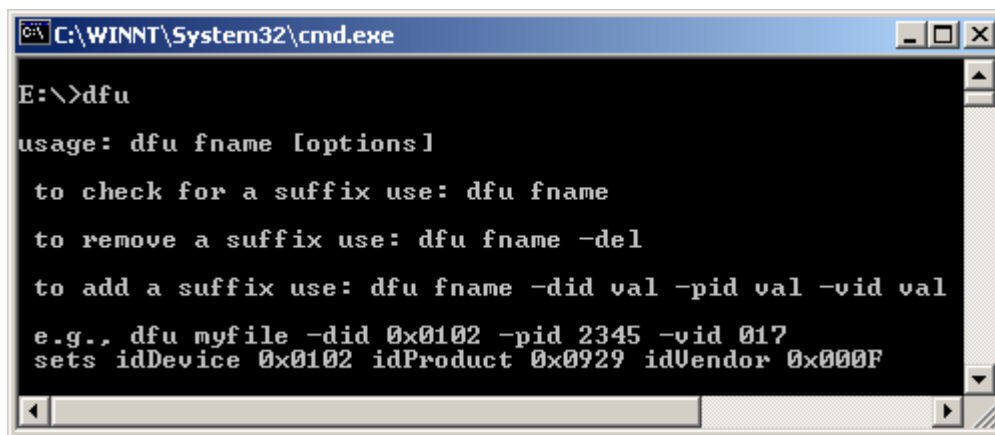
**DFU.exe <filename> -del**

To add a DFU suffix to a file:

**DFU.exe <filename> -did <val> -pid <val> -vid <val>**

Example of adding a DFU suffix to “fmc.bin”:

**DFU.exe fmc.bin -did 0xFFFF -pid 0x223A -vid 0x0424**



```
C:\WINNT\System32\cmd.exe

E:\>dfu

usage: dfu fname [options]

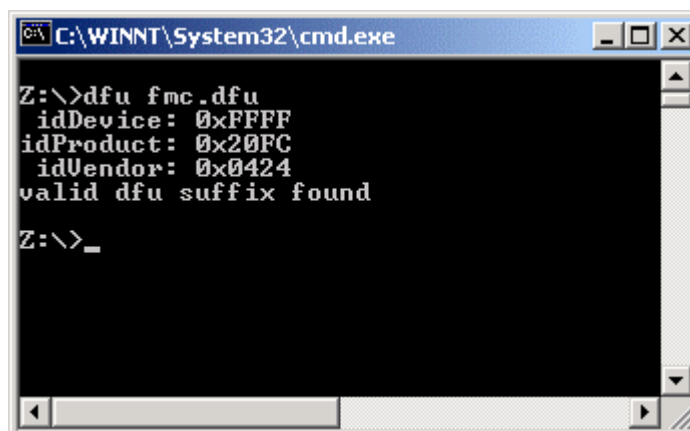
to check for a suffix use: dfu fname

to remove a suffix use: dfu fname -del

to add a suffix use: dfu fname -did val -pid val -vid val

e.g., dfu myfile -did 0x0102 -pid 2345 -vid 017
sets idDevice 0x0102 idProduct 0x0929 idVendor 0x000F
```

Once the DFU suffix has been added to the file, the last step is to give it a file extension that matches the type expected by your application. The dfuTest sample application is programmed to accept DFU uploadable files that have the “.dfu” extension. Finally, to check and make sure that the file has a valid suffix:



```
C:\WINNT\System32\cmd.exe

Z:\>dfu fmc.dfu
idDevice: 0xFFFF
idProduct: 0x20FC
idVendor: 0x0424
valid dfu suffix found

Z:\>_
```

### **Performing a Firmware Upgrade with the DFU App Application(Mac 10.X Only)**

\*Note: Before attempting to use this DFU application, ensure that your device is set up properly for DFU by reviewing the section “Using Device Firmware Upgrade (DFU)”

The following files are required in order to perform a device firmware upgrade using Mac 10.X:

1. The DFU application- (DFU\_App)
2. The updated firmware image- (fmc.dfu)
3. smsckext.kext
4. DFU\_Drvr.framework
5. smsctoolslib.framework

### **Where to find DFU\_App**

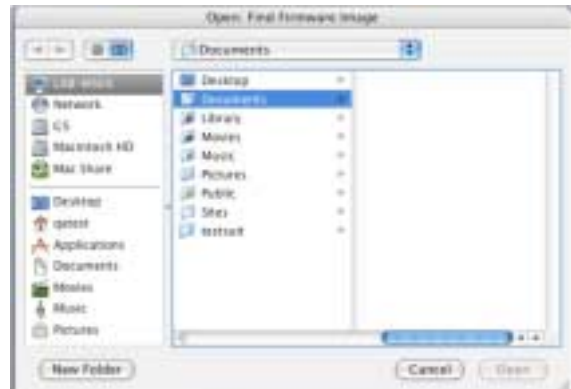
The 223-installer package will automatically load the DFU application in the hard drive that was selected during the installation process. Open the Applications folder in this hard drive. Once in the Applications folder open the folder created during installation called “USB Mass Storage Software”. In this folder you will find a ReadME.txt and a DFU\_App icon. (Note: if your installer package does not include the DFU feature then you will only find a ReadME.txt). The DFU\_App.app may be copied to the desktop if desired for ease of use.

### **Using an engineering version of DFU\_App application**



To start the DFU\_App application, simply double click the DFU\_App icon.

The application will open a dialog box, which allows you to browse to the desired firmware image. The file you select must have a .dfu suffix. Refer to the previous section “Creating a DFU Uploadable File” for instructions on how to create this file. Once you have navigated to the .dfu file that contains the version of firmware you wish to upgrade to, click open. You must have a valid USB device attached to a 2.0 host controller in order for the firmware upload to complete properly. DFU for Mac 10.X is currently only supported for use with a 2.0 host controller.



After opening the file, the firmware upload will begin. The first screen you will see will verify that you wish to upgrade the firmware of the USB device detected. (You may upgrade to a version of firmware that is newer than the current firmware on the device, the same as the version currently on the device, or older than the version currently on the device.) Click yes if this is the upgrade that you want. The application will then detach and reattach the device. You may get a pop up message warning you of a removal of the device. This message can be ignored.



After the device reattaches, the device will switch to DFU mode and begin downloading the new firmware. The progress of this upgrade will be shown on the message box. After the download is complete, the new firmware will be verified and the message box will display either a successful firmware update or a failure message.



A typical firmware update takes about 1 minute to complete. Once the success message is displayed you must unplug and replug the device in order to complete the DFU process.



## Creating a customer version of DFU

The engineering version of DFU\_App can be used to upgrade firmware or to create a customer version of the DFU\_App application. In order to prepare the DFU\_App application for customer use a file named "fmc.dfu" that contains the firmware required by the customer to be placed in the resource folder of the application. The file must be named "fmc.dfu" in order for the application to properly recognize it as a customer version.

To navigate to the resource folder, right click on the DFU\_App icon. Select "Show Package Contents" from the drop down menu. There will be only one folder icon displayed in the DFU\_App contents. It is titled "Contents". Double click on the "Contents" folder.



The contents folder contains the items shown to the right. Drop a file named `fmc.dfu` (that has the firmware you would like the customer version of DFU\_App to contain) into the “Resources” folder. The next time the DFU\_App is started it will now recognize the `fmc.dfu` file in the resources folder and act as a customer version instead of an engineering version. Refer to the previous section “Creating a DFU Uploadable File” for instructions on how to create `fmc.dfu`.

At any time the `fmc.dfu` file can be moved from the resources folder and the DFU\_App will act as an engineering version again, or it can be replaced with a file that is loaded with a different version of firmware.



### Using a customer version of DFU\_App

The process for uploading firmware using the customer version of DFU\_App is extremely similar to the way the firmware is uploaded using the engineering version of this application. The icon for the customer version of DFU\_App is identical to the engineering DFU\_App icon. The only difference between the engineering version and the customer version is that when the customer icon is double clicked instead of being prompted to navigate to the `dfu` file to upgrade to, the first screen the user will see is the prompt verifying that they wish to upgrade. The customer option does not give the option to choose different versions of firmware to upgrade to; whichever version was loaded into the `fmc.dfu` file contained in the resource folder is the only upgrade that can be done on the device.



The only option the customer version gives the user is whether or not they want to update to the version of firmware stored in the application. The steps to upload the firmware are identical to the steps in the previous section “Using the engineering version of DFU\_App” beginning with the screen shown to the right.

### **Known Issues with DFU App Application(Mac 10.X Only)**

1. Must use a USB 2.0 port to perform firmware update
2. If user is unable to select a `fmc.dfu` file when using the engineering version, a customer version must be created and used as a work around.
3. If an error occurs during creating the customer version, check to see if the user has write access to the DFU\_App, if not, create a copy that is writable and try to create the customer version from this copy.
4. Not supported for Mac OS versions newer than 10.3.4

### **Performing a Firmware Upgrade with the DFU Application(Mac 9.X Only)**

\*Note: Before attempting to use this DFU application, ensure that your device is set up properly for DFU by reviewing the section “Using Device Firmware Upgrade (DFU)”

The following files are required in order to perform a device firmware upgrade using Mac 9.X:

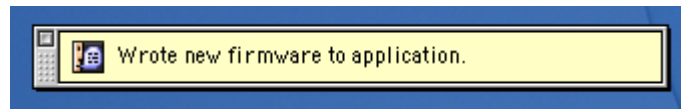
1. The DFU application- (DFU)
2. The updated firmware image- (fmc.dfu)
3. Resource file with standard hard drive icons for four lun device (mscicons)
4. Resource file with dynamic icons (msciconsx)
5. Manufacturer specific driver(s) (Manufacturer String\_PID i.e SMSC\_223a)
6. Manufacturer String\_Shim i.e. SMSC\_Shim

### **Using DFU application(Mac 9.X)**

Before using the DFU application the firmware must be loaded into the application itself. Create a valid .dfu file with the desired firmware and drag and drop it onto the DFU icon. (For specific instructions on how to create the .dfu file refer to section “Creating a DFU Uploadable File”) You may upgrade to a newer version of firmware, the same version of firmware, or an older version of firmware



When a valid .dfu file is loaded in the DFU application a message box will display that the firmware write was a success. At this point the firmware is only loaded into the application, it has not yet upgraded the device. After this message box is seen you may begin to use the DFU application for upgrading the firmware for your device.



To start the DFU process, ensure that you device you wish to upgrade the firmware on is attached to the host computer and double click the DFU icon.



The application will open a dialog box, displays the firmware version that the DFU application was loaded with. This is the version that will be programmed into your USB device once you click continue.



After opening the file, the firmware upload will begin. During this process there will be a status dialog box titled “Device Firmware Upgrade”. This box will display the steps that are occurring during the upgrade. The final step has the message “Please Unplug and replug device”. After the device is replugged the firmware upgrade is complete. A typical firmware update takes about 1 minute to complete.

## **Using the USB2224 Custom Icons Package**

The USB2224 custom icons package allows OEMs to assign custom icons to the drives associated with the USB2224 flash media controller. This allows the end user to easily distinguish between the different media types in Windows Explorer. The application works with Windows 98 SE, Windows Me, Windows 2000 and Windows XP. A new feature available in SetIcon versions 1.2.0.7 and later is the ability to dynamically change icons based on media state. In other words, you can specify that one icon appear if there is media in the reader slot, and another icon appear when there is no media in the reader slot. Also, the dynamic icon functionality enables the detection of MMC, MS Pro, and xD, allowing the user to display custom icons for those media types as well.

## **Contents of the USB2224 Custom Icons Package**

The USB2224 Custom Icons Package consists of the following:

**SetIcon.exe**- The custom icon application.

**Oem\_0424.ini**- A sample Windows 98 ini file.

**Smsc.ini**- A sample Windows Me/2000 ini file.

**Sample Icons**- The sample icons distributed with this package are for evaluation use only.

**Eeprom.dat**- A text file containing the changeable descriptor information used to update the serial eeprom with the DFUTest utility.

## **Creating the Required SetIcon Ini Files**

In order for the SetIcon application to work properly, an ini file with a specific file name and format must be installed on the host computer. The ini file tells the SetIcon application which icons are associated with which drives, and provides a full path to each icon. The following four paragraphs describe the procedure for creating, naming, formatting and installing the ini file on the host PC.

### **1) Setting the Ini File Name:**

**Windows 98 SE** - The name of the ini file should be of the type "Oem\_xxxx.ini" where xxxx is the VID as a hexadecimal number.

Example: If VID is 0x0424, the ini filename should be "Oem\_0424.ini"

**Windows Me, 2000 and XP**- The name of the ini file should be the same as the device's Manufacturer string, but be no longer than 8 characters. If the Manufacturer string is greater than 8 characters, then only the first 8 characters of the string should be used. If the Manufacturer string is less than 8 characters, then the ini file should use the entire Manufacturer's string.

Example: If MFG string is "Standard Microsystems Corp", the ini filename should be "Standard.ini"

Example: If MFG string is "SMSC", the ini filename should be "SMSC.ini"

(**Note:** The Manufacturer's string may be set or viewed using the Write223 utility 'Option 1'. See the "Programming the Serial EEPROM" section of this document for more details.)

(**Note:** For Windows Me alone, all blank spaces (" ") in the Manufacturer's string should be replaced with under scores (" \_ ") in the ini file name.)

Example: If MFG string is "S M S C", the ini filename for Windows Me should be "S\_M\_S\_C.ini" and for Windows 2000, it should be "S M S C.ini"

### Creating the Required SetIcon Ini Files (Cont.)

#### 2) Setting the Ini Section Name:

**Windows 98 SE** - The name of the section should be of the type [xxxx] where xxxx is the PID as hexadecimal number.

Example: If the PID is 0x223A, the ini section name should be [223A]

**Windows Me, 2000 and XP**- The name of the section should be same as the first 5 characters of the Device's Product ID string enclosed in square brackets, including any spaces if present.

Example: If the Product ID string is "223 USB Controller", the section name should be "[223 U]"

Example: If the Product ID string is "223US", the section name should be "[223US]"

Example: If the Product ID string is "223", the section name should be "[223]"

Example: If the Product ID string is "", the section name should be "[]"

(**Note:** The Manufacturer's string may be set or viewed using the DFUTest utility 'Read Device'.)

#### 3) Creating the Ini Section Content:

Under the Ini Section name should be a two line entry for each media type. The format for the two line entry is "Prod=Path\IconName.ico", where "Prod" is the string following the dash (-) in the Disk Drives section of the Device Manager for that drive (as seen in the screenshot to the right). Path\IconName.ico is the full path and icon name for the icon to be used for that drive. "ProdLABEL=Label Name" – (A declaration used to display a descriptive label in Windows Explorer for disk volumes with no names) where "ProdLABEL" is the same as "Prod" as explained above appended with the word "LABEL" and "Label Name" is the label that is to be displayed for the corresponding drive.

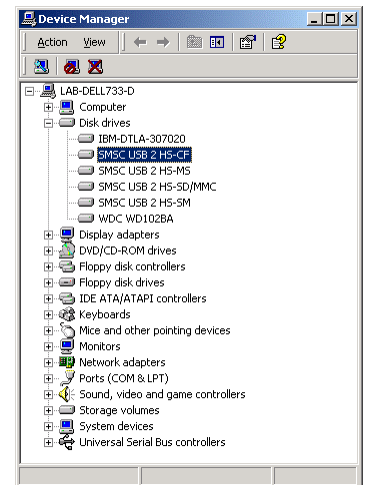
Note: The string length of "Label Name" should be less than 32 characters and should only contain alpha-numerical characters and special characters 'space' (' ') and 'under score' ('\_').

Example: CF=\Program Files\Icons\CF.ico

Example: CFLABEL=Compact Flash Drive

Example: SD/MMC=\Program Files\Icons\SDMMC.ico

Example: SD/MMCLABEL=SDMMC Drive (**Note there is no slash "/"**)



#### *Important Notes:*

- 1) The full path to the icon should be less than 64 characters.
- 2) The file containing the icon should only be an .ico, .dll or .exe file.
- 3) There should not be any extra spaces before and after the '=' sign

To use the dynamic icon functionality, you also need to add lines for each LUN number and interface type (i.e. CF, SM, XD, etc.) for both the media present "L#\_" and media not present "L#\_NM" states. Please see the sample ini file that follows for clarification.



#### 4) Placing the Ini File in the Correct Location on the Target PC:

In order for the custom icon application to work correctly, the ini file must be placed in one of the Windows System directories, depending on which operating system is being used. Those directories are:

[Windows 98 SE](#) - "Windows\System"

[Windows Me](#) - "Windows\System"

[Windows 2000](#) - "Windows\System32"

[Windows XP](#) - "Windows\System32"

### **Manually Installing the Custom Icons Application Files**

In order to perform a manual installation of the custom icons application files, the following steps should be performed:

1. Copy the SetIcon.exe file to a location on the target computer's hard drive. (i.e. "C:\Program Files\Icons\SetIcon.exe")
2. Copy the icon files to a location on the target computer's hard drive. (i.e. "C:\Program Files\Icons\").
3. Add a String entry to the Windows registry key "HKEY\_LOCAL\_MACHINE\Software\Microsoft\Windows\CurrentVersion\Run" that will automatically start the SetIcon application each time the host computer is booted.

**String:** SetIcon   **Value:** C:\Program Files\Icons\SetIcon.exe

4. Copy the ini file to the appropriate Windows System directory on the host PC. (See the previous section "Creating the Ini Files" for details.)
5. Manually start the SetIcon.exe application by double clicking it, or simply reboot the host PC. The entry placed in the registry during Step 3 will automatically start the application after the PC is rebooted.

A Sample Ini File

```
[223 U]
CF=C:\Program Files\Icons\CF.ico
CFLABEL=Compact Flash Drive
MS=C:\Program Files\Icons\MS.ico
MSLABEL=Memory Stick Drive
SM=C:\Program Files\Icons\SM.ico
SMLABEL=Smart Media Drive
SD/MMC=C:\Program Files\Icons\SDMMC.ico
SD/MMCLABEL=SDMMC Drive

L0_CF=\Program Files\SMSC\Cf.ico
L0_CFLABEL=Compact Flash Drive
L0_NM=\Program Files\SMSC\cf-gray.ico
L0_NMLABEL=Compact Flash Drive

L1_MS=\Program Files\SMSC\Ms.ico
L1_MSLABEL=Memory Stick Drive
L1_MSPR=\Program Files\SMSC\MsPro.ico
L1_MSPRLABEL=Memory Stick Pro Drive
L1_NM=\Program Files\SMSC\ms-gray.ico
L1_NMLABEL=Memory Stick Drive

L2_SM=\Program Files\SMSC\Sm.ico
L2_SMLABEL=Smart Media Drive
L2_XD=\Program Files\SMSC\Xd.ico
L2_XDLABEL=xD Media Drive
L2_NM=\Program Files\SMSC\sm-gray.ico
L2_NMLABEL=Smart Media Drive

L3_SD=\Program Files\SMSC\Sd.ico
L3_SDLABEL=SD Media Drive
L3_MMC=\Program Files\SMSC\Mmc.ico
L3_MMCLABEL=MMC Media Drive
L3_NM=\Program Files\SMSC\sdmmc-gray.ico
L3_NMLABEL=SDMMC Media Drive
```

## Creating a Windows Installer for the Custom Icons Application Files

Using an automated installer is the preferred method for installing and setting up the Custom Icons application to run on an end user's PC. As part of the USB2224 Custom Icons Application Package, a sample Windows installer is included which demonstrates a practical example of using a Windows installer to install, setup and run the Custom Icons application. To use the installer, simply run it and then reboot the host PC once the installation is complete. When the reboot is complete, the custom icons for the 2224 should appear in Windows Explorer.

**Important Note:** The ini files that are installed by the SMSC provided installer are hard coded to match SMSC's VID/PID, Manufacturer String, and Product ID String. The EEPROM.DAT file that is included with the software distribution contains the required data, and should be used to program evaluation boards to be used with the installer. Otherwise the ini files will not match the data in your board, and the icons will not appear. In general, to create a Windows Installer you should configure it to do the following:

1. Copy the SetIcon.exe file to a location on the target computer's hard drive. (i.e. "C:\Program Files\Icons\SetIcon.exe")
2. Copy the icon files to a location on the target computer's hard drive. (i.e. "C:\Program Files\Icons\").
3. Add a String entry to the Windows registry key "HKEY\_LOCAL\_MACHINE\Software\Microsoft\Windows\CurrentVersion\Run" that will automatically start the SetIcon application each time the host computer is booted.

**String:** SetIcon **Value:** C:\Program Files\Icons\SetIcon.exe

4. Configure the installer to do a conditional installation depending on the operating system, to copy the ini files to the appropriate Windows System directory. (See the section "Creating the Ini Files" for details.)
5. Configure the installer to run the "SetIcon.exe" application once the install is complete. Alternatively, you could force the user to reboot the PC.

## Troubleshooting the Custom Icons Application

Issue:

Cause:

After installing the Custom Icons application and rebooting, the custom icons do not appear.	<ol style="list-style-type: none"> <li>1) If you used the custom installer it is likely that the contents of your serial eeprom do not match the ini files that are installed with the installer. Read the section "Programming the Serial EEPROM" and program the eeprom to match SMSC's VID/PID, Manufacturers String, and Product ID String for the 2224. An EEPROM.DAT file with this data is included in the SetIcon software release for your convenience.</li> <li>2) If you created your own ini files and installed the application files manually, the cause is most likely an incorrectly named or formatted ini file. Refer to the section "Creating the Ini Files" and double check to make sure that the ini files are correctly named, formatted, and placed in the proper location.</li> <li>3) Check to see that the "SetIcon.exe" application is running by checking the Processes tab in the Task Manager.</li> </ol>
After installing the Custom Icons application the drives still show the original icon.	Unplug the USB cable and then reattach it. Icons are only displayed when the device is attached with the SetIcon application running. If this does not correct the problem, try the troubleshooting steps above.
In Windows XP (SP1) the custom icons do not appear after a reboot of the host. However if the USB cable is detached and reattached, or media is either inserted or ejected, the icon(s) appear.	This is a bug in Windows XP. Microsoft has developed a fix (KB823293).
In Windows XP, the drive media label is not updated when a card is inserted.	This is a known issue in Windows XP. As a workaround, you can either hit F5 to refresh the label, or remove and reinsert the media.
Card Reader Software Safe Removal Installer does not install properly when attempting to run the installer after removing a previous version of the installer	When the Card Reader Software Installer is removed, the uninstall stops the device and removes all registry entries associated with the device. The device must be unplugged and reattached before it will enumerate.

## **Windows Installer Packages**

There are two sample installers included in the USB2224 DFU and Driver Package. Both of these installers demonstrate a practical example of using a Windows installer to install, setup and run the Custom Icons application as mentioned in the previous section. In addition, one of these installers “Cardreader Software Installer Safe Removal vXXX.exe” has the added feature of not allowing a SMSC device to be removed by the safe removal icon available in Windows 2000 and Windows XP. The Safe Removal program will still function properly for other non-SMSC vid/pids, it will just not list any SMSC VID/PIDs as options to remove. The other installer “Cardreader Software Installer vXXX.exe” will allow a SMSC VID/PID to be removed via the safe removal program. The safe removal functionality is the only difference between these two installers.

**Important Note:** The SMSCMSC.ini file that is installed by the SMSC provided installer is hard coded to match SMSC’s VID/PID, Manufacturer String, and Product ID String. In order to enable this feature for end products with different VID/PIDs this file should be renamed and all SMSC VID/PIDs should be removed and replaced with the end product VID/PID. A sample SMSCMSC.ini is included below. This file is installed by the SMSC provided installer at C:\Windows\inf.

```
[Version]
Signature="$WINDOWS NT$"
Class=USB
ClassGuid={36FC9E60-C465-11CF-8056-444553540000}
Provider=%SMSC%
DriverVer=11/14/1999,5.00.2183.1

[Manufacturer]
%SMSC%=SMSC

[SMSC]
%USB\VID_0424&PID_223A.DeviceDesc%= SMSC_BULK, USB\VID_0424&PID_223A

[SMSC_BULK]
Include = usbstor.inf
Needs = USBSTOR_BULK
Addreg = SMSC_BULK.AddReg,SMSC_BULK_NR.AddReg

[SMSC_BULK.HW]
Include = usbstor.inf
Needs = USBSTOR_BULK.HW

[SMSC_BULK.NT]
Include = usbstor.inf
Needs = USBSTOR_BULK.NT
Addreg = SMSC_BULK.AddReg,SMSC_BULK_NR.AddReg

[SMSC_BULK.NT.HW]
;

[SMSC_BULK.NT.Services]
Include = usbstor.inf
Needs = USBSTOR_BULK.NT.Services

;Registry Sections
[SMSC_BULK.AddReg]
HKR,,DriverFlags,0x00010001,0x00000001

[SMSC_BULK_NR.AddReg]
HKR,,NonRemovable,0x00010001,0x00000001

[SourceDisksNames]
1= %InstallDisk%,,,""

[SourceDisksFiles]
SmscMsc.INF = 1

[Strings]
SMSC = "Standard Microsystems Corporation"
USB\VID_0424&PID_223A.DeviceDesc = "USB Mass Storage Device"
InstallDisk = ""
```

## **Using the Production Line Descriptor Update Utility (PLDU)**

**Purpose:** The PLDU is used to update device firmware and/or device descriptors such as the VID/PID, Manufacturer and Product ID strings in a production line environment using Windows 2000 SP3 and SP4. Under Windows XP, this can be used to update device descriptors or firmware if all the devices have same descriptor data. Otherwise, each device will enumerate as a MSC device and the utility needs to keep swapping drivers which is a time consuming operation and not really effective under a production line environment. This application is intended to be used by OEMs in their production line environment and is not intended for other users. The utility features a simple interface that displays success or failure of the programming operation in graphical form using either a green box with a checkmark (PASS), or a red box with an "X" (FAIL). The PLDU is capable of programming one device at a time and takes approximately 12 seconds to complete.

### **Features:**

1. Firmware update.
2. Descriptor (NVRAM) update.
3. Read descriptor (NVRAM) data from device.
4. GUI editor to edit and create DAT files.
5. Graphical and Text status display.
6. Automatic serial number increment after every descriptor update.
7. Break up of serial number to YY-MM-DD-S-SN format where
  - YY - Year (2 digits)
  - MM - Month (2 digits)
  - DD - Day (2 digits)
  - S - Station number (1 digit)
  - SN - Serial number (5 digits)

### **Application Behavior:**

1. When the application is run with no SMSC devices plugged in, all controls should be disabled.
2. While the application is running, the controls should be dynamically enabled and disabled as the device is plugged and unplugged.
3. The button controls on all tabs except the "Production" tab will always be disabled.
4. The "Update Device" button will be enabled only after loading a DAT file.
5. If the "Update Firmware" button is clicked, the utility removes reference to a previously loaded DAT file and disables the "Update Device" button.
6. Any changes made to the YY-MM-DD-S-Sno controls will be lost if user switches to a different tab and returns to the "Production" tab. The changes should be saved immediately to a DAT file before switching tabs. If the user needs to switch tabs to make changes in those tabs, then those changes should be made first and lastly switch to the "Production" tab. Now the user can make necessary changes to the formatted serial number controls and can be saved to a DAT file that will include all the changes done on the other tabs as well. However, NOTE THAT THIS IS THE BEHAVIOR ONLY WHEN A DAT FILE HAS NOT BEEN LOADED ALREADY AND THE BUTTON "Update Device" IS DISABLED.
7. When a DAT file is loaded and the "Update Device" button is enabled, following behavior is to be expected;
  - a. Changes made to serial number controls in "Production" tab will be lost if user changes tabs. However, these changes will be active for the user to save to a DAT file or update to the device immediately after the changes are made and before switching tabs.
  - b. Changes made to controls on other tabs will be lost and can never be saved to a DAT file or updated to a device.
  - c. Changes made to serial number controls, though available for an immediate update to a device, will be lost after the update completes if those changes don't reflect the current date (YY-MM-DD).

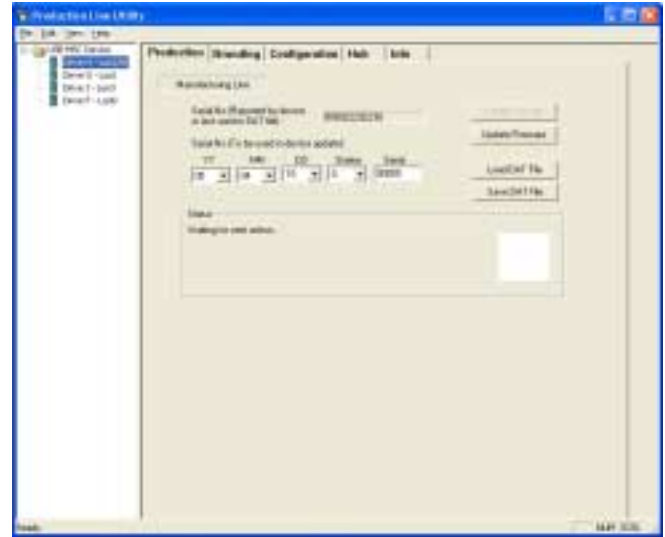
**Button Behaviour:**

-----

1. Update Device
  - a. Enabled only after a DAT file is loaded
  - b. Disabled whenever a firmware update is done
  - c. When clicked, app reads the serial number from the YY-MM-DD-S-Sno controls and embeds this serial number into the DAT file that is loaded in memory to write to the device.
  - d. After every update, the DAT file is updated to reflect the last serial number used to write to the device and also automatically increments the serial number.
2. Update Firmware
  - a. Prompts for a DFU file (only the first time) and uses this file to update the device's firmware.
  - b. Always ignores any changes done to the controls in all tabs. The utility always reads the descriptor data from the device and embeds this into the DFU file image before writing the DFU file image to the device. Thus, after a firmware update, the device's descriptor data should be the same as it was before the update.
  - c. If a DAT file was previously loaded, clicking this button would unload the DAT file and disable the "Update Device" button.
3. Load DAT File
  - a. Loads a DAT file into memory.
  - b. Enables the "Update Device" button
  - c. Any changes done to controls on all tabs are lost while switching tabs.
  - d. Changes done to YY-MM-DD-S-Sno controls are available for saving to a DAT file or writing to device only immediately after the changes are made.
  - e. When a DAT file is loaded, the YY-MM-DD-S-Sno controls are set to reflect current date, same station number digit as in the DAT file and either a default value of "00000" or DAT file's last 5 digits of serial number value incremented by one. The default value of "00000" is used whenever the DAT file's YY-MM-DD digits do not match the current date.
4. Save DAT File
  - a. Saves the values from the controls to a DAT file.
  - b. Refer to earlier sections to find out when changes to controls are lost.
  - c. After saving to DAT file, this DOES NOT automatically load that DAT file into memory.

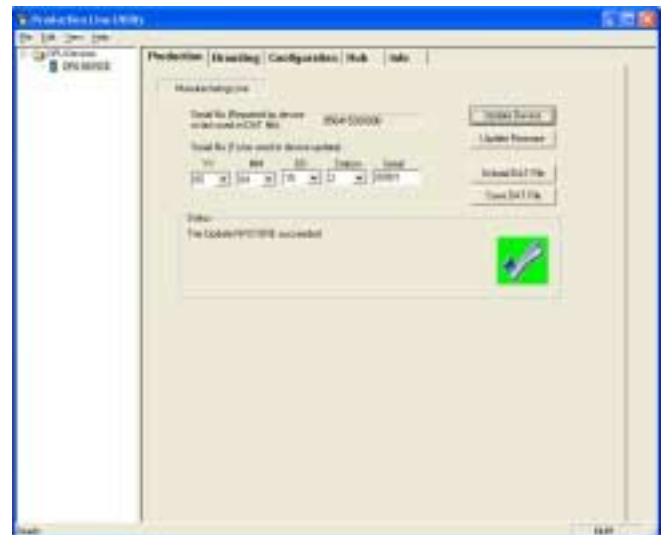
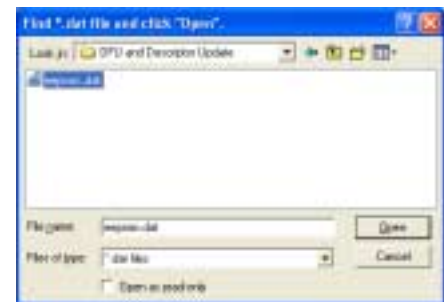
### Setting Up the PLDU Application

1. First attach a USB2224 device to the host. To start the PLDU application, simply double click “PLDU.exe” executable.
2. After the main program dialog opens the production tab displays four options:
  - a. Update Device- Updates NVStore descriptor data such as VID/PID, Manufacturer and Product ID strings from the “EEPROM.DAT” file. Note – this option is not available until a DAT file is loaded.
  - b. Update Firmware- Updates the device firmware using a DFU update file with the .dfu extension.
  - c. Load DAT file – Loads a DAT file into memory
  - d. Save DAT file - Saves the values from the controls to a DAT file



### Using the PLDU to Update Device Descriptors

1. The first operation that should be performed on a USB2224 device coming off the production line is to update its descriptors. To do this, first press “Load DAT file”. The application will prompt you to select the EEPROM.dat file that will be used to program the descriptors. Once the EEPROM.DAT file has been selected the option to Update Device will now be available.
2. Click the “Update Device” button. The PLDU application will swap the mass storage class driver for the SMSC DFU driver.
3. Once the DFU driver swap has completed, the data from the eeprom.dat file that is loaded is programmed into the device. The operation takes about 12 seconds to complete. Provided the programming was successful, the Status box displays a green box with a checkmark and reports success. At this point the user simply detaches the device and reattaches the next device to be programmed. The PLDU automatically updates the EEPROM.DAT file to the next unique serial number.



## **Using the Production Line Test Utility (PLTU)**

**Purpose:** The PLTU application is used to test the basic functionality of USB2224 devices in a production line environment using Windows 2000 (SP3) only. The application creates a subdirectory on the media for each LUN, copies a 'Test File' to the subdirectory, deletes the 'Test File', and then deletes the subdirectory.

### **Features:**

1. Capable of testing 5 devices with 4 LUNs each simultaneously.
2. After testing, the application cleans up the registry entries involving the OEM's VID, PID, Inquiry MFG and Product strings.
3. Graphical and Text status display of test results.
4. GUI editor to edit and create ini files.

## **Creating the PLTU ini File**

Before using the PLTU you must create or edit an ini file. A sample ini file is shipped with the PLTU application which can be modified for your setup. The ini file should contain the following lines:

OEMVID = **VID**

This is the original equipment manufacturer's VID (Vendor ID) of the device whose descriptor has already been updated. The 'VID' is specified as a four digit hexadecimal number.

OEMPID = **PID**

This is the original equipment manufacturer's PID (Product ID) of the device whose descriptor has already been updated. The 'PID' is specified as a four digit hexadecimal number.

INQUIRY\_MFG = **Inquiry MFG String**

This is the string returned by the device as part of the Vendor information in the Inquiry data. This can be of maximum 8 characters.

INQUIRY\_PRODUCT = **Inquiry Product String**

This is part of the string returned by the device Product information Inquiry data. This can be of maximum 5 characters.

TEST\_FILE = **path to Test file**

Specifies the full path to the file that is to be used during file copy tests.

DEV1\_LUN0 = **Drive Letter**

DEV1\_LUN1 = **Drive Letter**

DEV1\_LUN2 = **Drive Letter**

DEV1\_LUN3 = **Drive Letter**

DEV2\_LUN0 = **Drive Letter**

DEV2\_LUN1 = **Drive Letter**

DEV2\_LUN2 = **Drive Letter**

DEV2\_LUN3 = **Drive Letter**

DEV3\_LUN0 = **Drive Letter**

DEV3\_LUN1 = **Drive Letter**

DEV3\_LUN2 = **Drive Letter**

DEV3\_LUN3 = **Drive Letter**

DEV4\_LUN0 = **Drive Letter**

DEV4\_LUN1 = **Drive Letter**

DEV4\_LUN2 = **Drive Letter**

DEV4\_LUN3 = **Drive Letter**



### Creating the PLTU ini File (Cont.)

DEV5\_LUN0 = *Drive Letter*

DEV5\_LUN1 = *Drive Letter*

DEV5\_LUN2 = *Drive Letter*

DEV5\_LUN3 = *Drive Letter*

These lines specify the Drives that are associated with the multiple LUNs of the respective devices to be tested. If the 'Drive Letter' is not specified for a particular LUN, then it means that the corresponding LUN of that device is NOT to be tested. If the 'Drive Letter' is not specified for all LUNs for a particular device, then it means that the entire device is either NOT present or NOT to be tested.

### A Sample PLTU ini File

```
OEMVID      = 0424
OEMPID      = 223A
INQUIRY_MFG  = SMSC
INQUIRY_PRODUCT = 223
TEST_FILE    = C:\TEST\1MEG.R01
```

```
DEV1_LUN0 = F
DEV1_LUN1 = G
DEV1_LUN2 = H
DEV1_LUN3 = I
```

```
DEV2_LUN0 = J
DEV2_LUN1 = K
DEV2_LUN2 = L
DEV2_LUN3 = M
```

```
DEV3_LUN0 = N
DEV3_LUN1 = O
DEV3_LUN2 = P
DEV3_LUN3 = Q
```

```
DEV4_LUN0 = R
DEV4_LUN1 = S
DEV4_LUN2 = T
DEV4_LUN3 = U
```

```
DEV5_LUN0 =
DEV5_LUN1 =
DEV5_LUN2 =
DEV5_LUN3 =
```

#### **NOTE:**

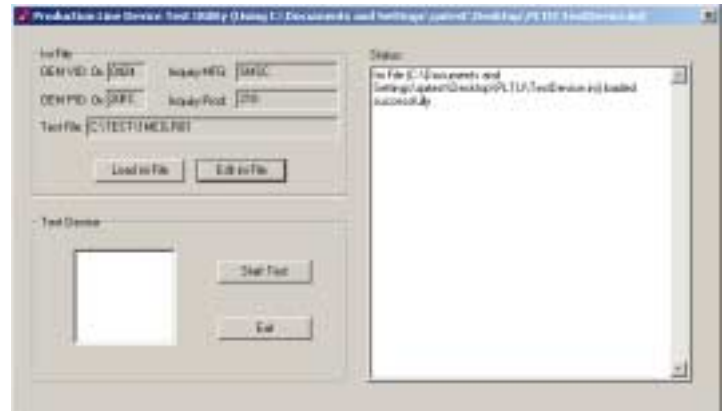
There can be spaces before and after the '=' sign, but the total number of characters for an entire line (including spaces) should be less than 255.

### Setting Up the PLTU Application

1. First attach a USB2224 device to the host. To start the PLTU application, simply double click “TestDevice.exe” executable. The application will prompt you to select the location of the ini file when it is first started.

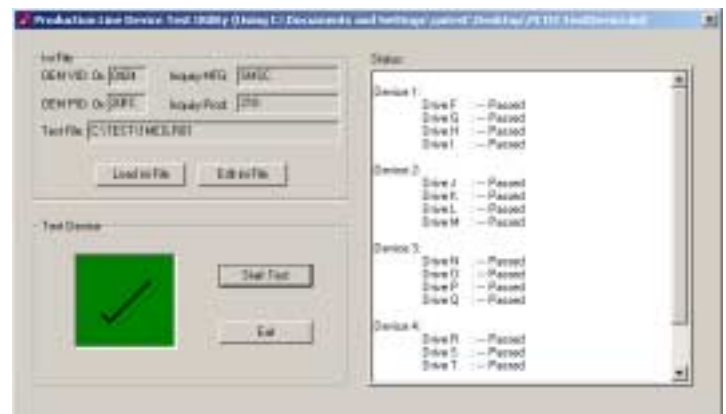


2. Provided the ini file contains the correct path to the key files on the local machine, the main program dialog opens. The station is now ready to begin testing devices. At this point you should attach the devices to be tested and ensure that they have good media with sufficient free space to hold the file being used for testing.



### Using the PLTU to Test Multiple Devices

1. Once all of the devices have been attached, the user simply presses the “Start Test” button to begin testing devices in accordance with the contents of the ini file being used. After the testing has completed, the user receives a graphical representation of the test results in the form of a green box with a black checkmark to indicate “PASS”, or a red box with a black “X” to indicate “FAIL”.



2. Once the test has completed, the user should remove all of the tested devices and then attach the next set of devices to be tested. Once all of the devices are attached and enumerated (as indicated by the presence of drive icons in Windows Explorer), the user repeats step 1 to test the next set of devices.

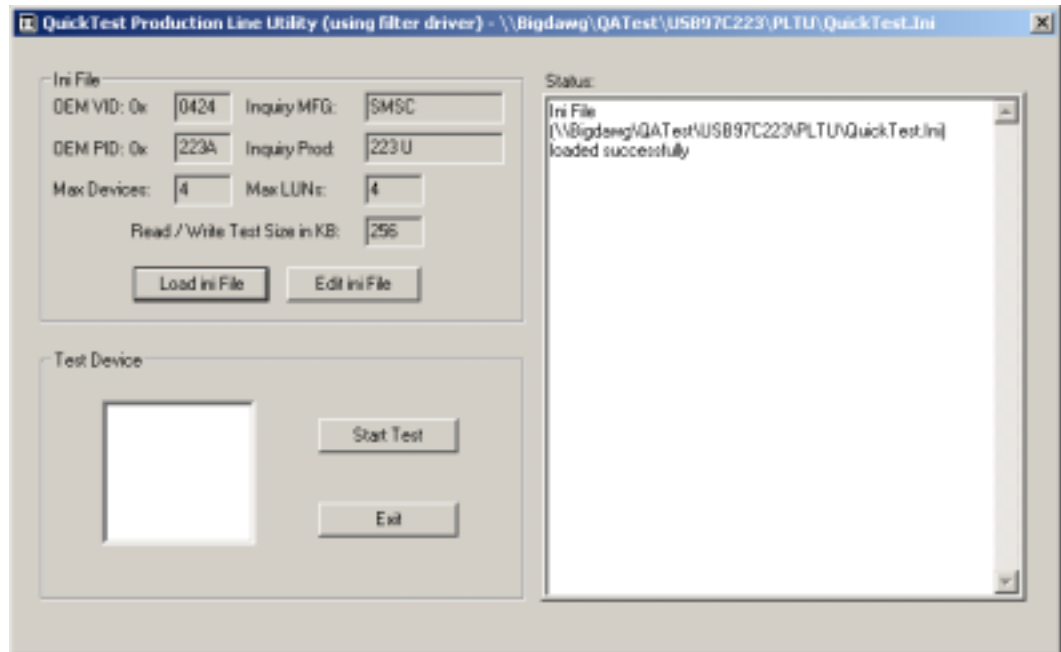
**Known Issues with the USB2224 Production Line Utilities**

Issue:	Workaround:	Status:
The PLDU and PLTU applications are designed to be used with Windows 2000 (SP3) host systems using the Microsoft mass storage class driver. While the applications may work with other operating systems, only Windows 2000 (SP3) is supported.	N/A	N/A
Some EHCI host controller drivers such as Orange Micro's do not work properly with the DFU driver swapping performed by the PLDU and PLTU applications.	We highly recommend that you use the Microsoft supplied EHCI drivers for the test systems running the PLDU and PLTU applications.	N/A
The PLTU does not distinguish between general device write failures and media specific write failures. This means that the test will fail if no media present in the drive, media is full, media is unformatted, media is corrupt, media is write protected, etc.. Under such circumstances, the test results do not reflect the status of the device, but rather the failure of the media. Hence, it is recommended that the test is performed again on the device with known good media.	Only use known good media to perform the PLTU testing.	N/A
Due to caching by the OS, the IO transfer may not be fully completed before the test results are displayed by the application. It is recommended that the user wait for 5 to 10 seconds before disconnecting the devices.	Wait 5-10 seconds after completion of the PLTU tests before removing the devices from the host.	N/A
User may experience errors when running applications if certain files used by applications are marked read only.	Make sure that all files used with these utilities are not marked read only	N/A

## **Using the QuickTest Production Line Read/Write Test Utility**

The QuickTest utility is a streamlined version of the full Production Line Test Utility discussed previously. QuickTest can test a maximum of (4) USB2224 devices at a time, with a maximum of 4 LUNs each. The testing procedure is very simple involving these only 4 steps:

1. Writes to media on each LUN starting from LBA 1024
2. Reads from media on each LUN starting from LBA 1024
3. Compares the data read against the data written to the media
4. Updates the status for each LUN in the application



The testing is performed on all the LUNs of the device serially. However, tests on multiple devices are performed simultaneously using multiple threads. The QuickTest utility requires the presence of the SMSC password filter driver to send BULK-ONLY commands, totally by-passing the native file system. On windows 2000 systems, Service Pack 3 should be installed.

QuickTest.exe requires the SMSC password filter driver (Smscpwd.inf) to be installed in order to function properly. This driver is no longer installed by the card reader installer and must be installed manually before running QuickTest. In order to install the password filter drivers, copy Smscpwd.inf and Smscpwd.sys to your system. Open the device manager and double click on the USB Mass Storage Device entry in the Universal Serial Bus Controllers section. In the driver tab, select update driver. The wizard will assist in installing this driver. When given the choice, specify to have the wizard display a list of known drivers for this device. Choose "Have Disk" and browse to where you copied the smscpwd.inf file and select it. This should give you the option to install "USB Mass Storage Device with Password Protection (WinMe)".

### **Limitations of the QuickTest Utility:**

1. Does not distinguish between general device write failures and media specific write failures. This means that the test will fail if no media is present in the drive, the media is full, unformatted, corrupt, write protected, etc.. Under such circumstances, the test results do not reflect the status of the device. Hence, it is recommended that the test is performed again on the device with known good media.
2. The time taken to complete the tests depend on the following:
  - Test size - This can be from 64KB to 5000KB. The bigger the size, the more time it will take to complete the tests.
  - Number of devices connected- The field "Max Devices" specifies how many devices to test at once (should be  $1 \leq N \leq 4$ ). However, it is not necessary that the actual number of devices connected be equal to the number specified in the "Max Devices" field. For example, the "Max Devices" field can specify 4 but the actual number of devices connected may be  $<4$  or  $>4$ . However, the utility will either test only the actual number of devices connected or the "Max Devices", whichever is less. Though tests on multiple devices are performed simultaneously, the time taken for the tests to complete on multiple devices will be a little more than that for a single device.

## **Using the EPRMUPDT.exe Utility**

EPRMUPDT.exe is a DOS based utility used to write and / or read EEPROM data to / from the USB2224 device. This utility is designed to be used by OEMs in a production line environment with as little human intervention as possible.

### **EprMUpdt Usage:**

```
EprMUpdt [-h|-u] [-v] [-c] [-w"oFileName"] [-r"iFileName"] [-t"HostController"]
-h|-u .....print help/usage
-v .....verbose, optional, default is off
-c .....confirm scanned serial number (last 3 digits) before
           updating EEPROM
-w"oFileName" .....name of DAT file (with full path) that is to be written
           to device EEPROM
-r"iFileName" .....name of formatted text file (with full path) that is to
           be created by reading device EEPROM
-l"LogFileName" .....log the serial number to the specified log file
-t"HostController"....specifies the host controller type to which the device is
           attached. This should be "UHCIn", "OHCIIn" or "EHCIIn",
           where 'n' is a number (0 to 9) specifying the host
           controller in the enumeration order. This is an optional
           parameter and if not specified, a default value of "UHCI"
           will be used. Similarly 'n' is also optional and if it is
           not specified, a default value of '0' will be used.
-i .....infinite loop, till user presses 'CTRL C' to quit
```

### **Note:**

-----

1. All options can be specified using both UPPERCASE or lowercase letters.
2. The double quotes (") around file names for -w, -r and -l options is optional. If the path names does not contain blank spaces, then the double quotes are not necessary. If the path names contain blank spaces, then the double quotes are mandatory.
3. The file names for the -w, -r and -l options are to be specified with full path information. If the files are in the current directory, then the path information is not necessary.
4. The double quotes around the 'HostController' in -t option is optional.

### **Features:**

1. Uses a template EEPROM.DAT file, modifying the serial number alone by scanning it off the keyboard buffer, to update the device EEPROM.
2. Reads the contents of the device EEPROM and generates a formatted text file that vividly describes all the fields of EEPROM structure.
3. The options for writing and reading EEPROM data can be specified together or alone.
4. Provides an option (-c) to confirm the scanned serial number (last 3 digits) with the user before updating the EEPROM data.
5. Provides an option (-v) to turn on or off the additional debug / status comments.
6. Provides an option (-l"LogFileName") to log the serial number to the user specified log file.
7. Allows processing devices one after another in a loop till user wants to exit (by pressing 'Ctrl C') by specifying the -i option in the command line. Otherwise, the utility will exit back to the command prompt after it is done with a single device.

### **Using the EPRMUPDT.exe Utility (cont.)**

8. Displays the status by showing a big "ERR", "FAIL" or "PASS" along with other relevant information.

"ERR" - Means an error occurred outside of the main process of updating or reading to / from the device. This can happen if there are any errors while parsing the input arguments, or invalid usage, or invalid file paths, or any errors while starting the host controller and root hub. The application will exit with code 2 during such circumstances.

"FAIL" - Means an error occurred during the process of updating or reading to / from the device. This can happen if no matching devices are found, or verification of last 3 digits of serial number fails, or error while writing data to device, or error while reading data from device, or verification of read and write data fails. The actual reason for the failure is given below the "FAIL" status and the application exits with code 1 during such circumstances. If the -i option is specified, then the application proceeds to prompt for scanning the serial number again. At this point, it is left to the user discretion, whether to connect a new device or proceed with the existing device. For example, if the failure is due to last 3 digits serial number mismatch, it could be due to human error rather than a device error and so the user may want to proceed with the same device again.

"PASS" - Means no error occurred and the process of updating or reading to / from the device completed successfully, including all necessary verifications and the application exits with code 0. If the -i option is specified, then the application proceeds to prompt for scanning the serial number again. At this stage, the user can safely remove the existing device and connect a new device and enter the serial number again.

9. The utility will return with one of the following exit codes.

0 - Indicates "PASS"  
1 - Indicates "FAIL"  
2 - Indicates "ERR"

10. The utility will work with all types of host controllers (UHCI, OHCI & EHCI) and the host controller to which the device is connected is specified by the -t option. The -t option specifies the type of the host controller as well as the number in the PCI enumeration order of the host controllers. These two together identify a unique host controller which the application enumerates to detect the test device. Note that this is optional and that the default values will be used if it is not specified.

examples:

-t"UHCI"	- Test on the 1st UHCI host controller
-t"EHCI0"	- Test on the 1st EHCI host controller
-t"OHCI2"	- Test on the 3rd OHCI host controller

#### **Limitations of the EPRMUPDT.exe Utility:**

1. Supports devices connected only at the root hub level.
2. In order to properly specify the number in the PCI enumeration order of the host controllers the end user has to know how many host controllers of the given type are present in the system and also the enumeration order of the host controller to which the device is attached. If these details are not known, this information can be found by trial and error methods.
3. There is no bus traffic after SPT EEPROM write call. Still, the EEPROM write call should pass and the application will report the status of the write. Use only one of the -w or -r options and don't combine both the options. If both the options are used, then the write should pass but the read should fail because of a known issue.

### **Using the Windows XP Special Memory Stick Format Registry Key**

Windows XP has the capability to apply a Sony factory format on Memory Stick cards by adding a special key to the registry:

```
[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows NT\CurrentVersion\PerHwIdStorage\
USBSTOR#DiskSMSC____2224_U_HS-MS____] "DeviceGroup"="MemoryStick"
```

This key has to be customized to match the inquiry data returned from the device. The inquiry data is made up of the first 8 characters of the Manufacturer String, followed by the first 5 characters on the Product String. In the example registry key above, the strings are:

Manufacturer String = "SMSC" (Note that SMSC is followed by four spaces denoted by underscores to make up the 8 characters.)

Product String = "2224 USB2224" (Note that only the first 5 characters, including the space, are used.)

This registry key works for Windows XP only. It will not work for Windows 2000 or any other operating system. Once the registry key has been added, when a user formats a Memory Stick card from using Windows, the Sony factory FAT format will be applied, including the creation of the "MEMSTICK.IND" hidden file.

## **Using the KillReg Utility**

KillReg is a DOS based application to stop a device and clean its related registry entries during an automated uninstallation process. KillReg is designed to be called from a Windows Installer script. It is used during installation and uninstallation of USB97C210/223/2224 devices under all Windows operating systems to remove the device entries from the registry. This allows the SMSC Win2K or Windows native driver to be loaded if the device has previously been installed without a driver, or with an incorrect driver. KillReg is also used during the uninstallation process to completely remove the registry entries for a particular device.

### **Requirements:**

KillReg requires an ini file to be present in the Windows directory. The name of this ini file should be passed as command line argument to the application from the installer script.

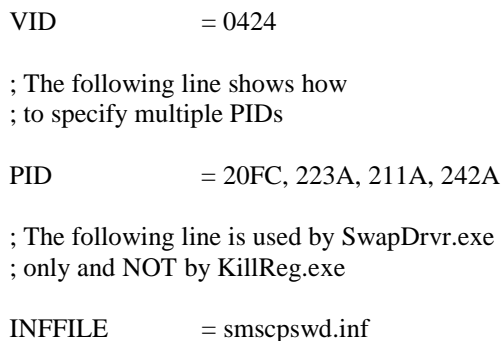
### **INI File Requirements:**

1. The ini file should be in the Windows directory.
2. The ini file should contain the following lines;

```
VID = VID  
PID = PID1[,PID2,PID3,...,PID30]
```

where VID and PID are represented as 4 digit hexadecimal numbers.

### **A Sample ini File:**



```
VID          = 0424  
  
; The following line shows how  
; to specify multiple PIDs  
  
PID          = 20FC, 223A, 211A, 242A  
  
; The following line is used by SwapDrvr.exe  
; only and NOT by KillReg.exe  
  
INFFILE      = smscpswd.inf
```

### **NOTE:**

1. The ini file is also used by the application "SwapDrvr.exe", which will expect the line specifying the INFFILE. KillReg ignores this line.
2. Multiple PIDs separated by a comma can be specified to uninstall all the PIDs associated with a single VID.



## **Using the Swapdrv Utility**

Swapdrv is a DOS based application used by a Windows installer to load the password filter driver in Windows XP. Unfortunately, SwapDrv does not work with Windows 98 and Me. The only USB2224 application that requires the password filter driver be loaded when running XP is the QuickTest production line test utility. If you are not using that utility or do not want to include it in your installer, you can skip this section.

### **Requirements:**

1. The device should be connected while this application is invoked from a Windows installer. The application will prompt the user to connect the device during run time.
2. Swapdrv needs an ini file to be present in the Windows directory. The name of this ini file should be passed as command line argument to the application from the installer script.
3. The installer application should have already placed the required INF and SYS files in their correct locations.

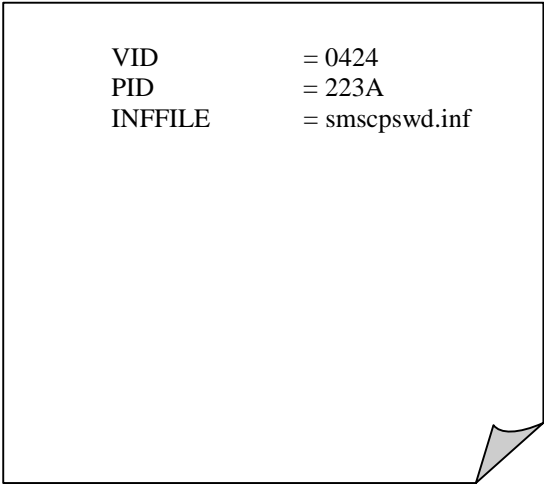
### **INI File Requirements:**

1. The ini file should be in the Windows directory.
2. The ini file should contain the following lines;

```
VID = VID  
PID = PID  
INFFILE = Inf file name
```

where VID and PID are represented as 4 digit hexadecimal numbers.

### **A Sample ini File:**



```
VID          = 0424  
PID          = 223A  
INFFILE      = smscpswd.inf
```

## **Using the Dos Production Line Utility (DosPLTU)**

DosPLTU is a DOS based utility intended to be used by OEMs to streamline their production testing, requiring as little human intervention as possible. This utility supports checking the device firmware version, checking and / or updating the device EEPROM with a template DAT file, and performing R/W tests on all the logical units (LUNs) supported by the device.

### **DosPLTU Usage:**

```

DosPLTU [-h|-u] [-v] [-f"version"] [-t -n"loopcount" -s"testsize"]
        [-e"DATFileName" | -w"DATFileName" | -x"DATFileName"]
        [-l"LogFileName"] [-c"HostController"]
-h|-u .....print help/usage
-v .....verbose, optional, default is off
-f"version".....version number that is to be checked against the firmware version of the device
-t .....perform R/W tests
-n"loopcount".....specifies the number of times the R/W tests are to be
                    performed. This is optional and a default value of 10
                    will be used if this is not specified
-s"testsize".....specifies the test transfer size in KB for the R/W tests.
                    This is optional and a default value of 64KB will be used
                    if this is not specified
-d"CfgFileName".....name of the configuration file (with full path) that
                    specifies the media types for each supported LUN. This is
                    optional and if not specified, then testing would be done
                    on all LUNs for one media type, with out prompting the
                    user to insert other types of media
-e"DATFileName".....name of DAT file (with full path) that is to be checked
                    against the device EEPROM. This option cannot be specified
                    with -w or -x options
-w"DATFileName".....name of DAT file (with full path) that is to be written
                    to device EEPROM This option cannot be specified with -e
                    or -x options
-x"DATFileName".....name of DAT file (with full path) that is to be checked
                    against the device EEPROM and if necessary that is to be
                    written to the device EEPROM. This option cannot be
                    specified with the -e or -w options
-l"LogFileName".....name of the log file (with full path) to which the test
                    status messages are logged
-c"HostController"....specifies the host controller to which the device is
                    attached. This should be "UHCI", "OHCI" or "EHCI",
                                where 'n' is a number (0 to 9) specifying the host
                                controller in the enumeration order. This is an optional
                                parameter and if not specified, a default value of "UHCI"
                                will be used. Similarly 'n' is also optional and if it is
                                not specified, a default value of '0' will be used.
-i .....infinite loop, till user wants to quit

```

### **Note:**

1. All options can be specified using both UPPERCASE or lowercase letters.
2. The double quotes (") around file names is optional. If the path names does not contain blank spaces, then the double quotes are not necessary. If the path names contain blank spaces, then the double quotes are mandatory.
3. The file names are to be specified with full path information. If the files are in the current directory, then the path information is not necessary.
4. The double quotes around the 'version' in -f option is optional.
5. The value of 'version' is specified as a max 4-digit decimal integer number.
6. The double quotes around the 'HostController' in -t option is optional.
7. The double quotes for -n and -s options are optional.

**Option Groups and Priority Levels:**

1. The options are classified into 5 groups as described below.
 

a. Usage	- "-h" or "-u"
b. Firmware check	- "-f"
c. EEPROM check / update	- "-e", "-w" and "-x"
d. R/W tests	- "-t", ["-n", "-s" and "-d"]
e. Miscellaneous	- "-v", "-c", "-l" and "-i"
2. The utility has a priority level for each group of options. The priority level and processing details are described below.
  - a. Usage group - Has the highest priority (level 0). If this is specified, then the utility would just display the program usage and exit. All other options are ignored and are not processed.
  - b. Firmware check group - Has the next highest priority (level 1). The utility processes this option before EEPROM check and R/W test options. If the device firmware does not match the version specified with this option, then the utility would display an error message and exit without processing any other option.
  - c. EEPROM check / update group - Has a priority level of 2. If "-f" option is specified, the utility would process this option after successfully checking the device firmware version. Otherwise, this would be processed first. It is important to note that this group has 3 options ("-e", "-w" and "-x") which are mutually exclusive. That is, only one of the 3 options can be specified. If any error occurs while processing this group, the utility ignores the R/W test option and exits after displaying the corresponding error message.
  - d. R/W test group - This has the lowest priority (level 3) and is processed last after successfully processing other specified options. This group has three additional options ("-n", "-s" and "-d") that may or may not be specified. Refer to the usage for more details about these options.
  - e. Miscellaneous group - Has no priority level at all. The options under this group are very general and only help the user to control how the tests are done and how the results are displayed. These options, by themselves, do not affect the types of tests or their order in any way.

**DosPLTU Features:**

1. Checks the firmware version of the device.
2. Checks the device EEPROM against a template DAT file and returns an error if any mismatch is found. This is achieved by using the "-e" option and is useful in testing devices whose EEPROM has already been updated.
3. Updates the device EEPROM always with a template DAT file with out checking for any mismatch. After every update, the serial number is automatically incremented and the DAT file is updated. This is achieved by using the "-w" option and is useful in updating the device EEPROM for the first time.
4. Checks the device EEPROM against a template DAT file and updates the device EEPROM if any mismatch is found. If the EEPROM is updated, the serial number is automatically incremented and the DAT file is updated. This is achieved by using the "-x" option and is useful in testing devices whose EEPROM may or may not have been already updated.
5. Performs R/W tests on all LUNs supported by the device. The tests are performed using the loop count and test size values specified with "-n" and "-s" options. The R/W test option also takes in an optional -d option that specifies the device configuration. When this option is specified, the tests are performed on each LUN prompting the user to insert the supported media types for the LUN. This option is useful in cases, where LUN sharing is done in devices by having a combo socket and it is necessary to test all the media types supported by the socket. For a sample device configuration file, please look in to "Device.cfg" file.
6. Provides an option (-v) to turn on or off the additional debug / status comments.

7. Provides an option (-l"LogFileName") to log all messages to the user specified log file.
8. Allows processing devices one after another in a loop till user wants to exit by specifying the "-i" option in the command line. Otherwise, the utility will exit after it is done with a single device.
9. Displays the status by showing a big "ERR", "FAIL" or "PASS" along with other relevant information.

"ERR" - Means an error occurred outside of the test process. This can happen if there are any errors while parsing the input arguments, or invalid usage, or invalid file paths, or any errors while starting the host controller and root hub.

The application will exit with error code 1 during such circumstances.

"FAIL" - Means an error occurred during the process of testing. This can happen if no matching devices are found or any of the test fails. The actual reason for the failure is given below the "FAIL" status.

The application will exit with error code > 1 during such circumstances.

"PASS" - Means no error occurred and the process of testing completed successfully.

The application will exit with error code 0 during such circumstances.

10. The utility will work with all types of host controllers (UHCI, OHCI & EHCI) and the host controller to which the device is connected is specified by the -c option. The -c option specifies the type of the host controller as well as the number in the PCI enumeration order of the host controllers. These two together identify a unique host controller which the application enumerates to detect the test device. Note that this is optional and that the default values will be used if it is not specified.

examples:

-c"UHCI"	- Test on the 1st UHCI host controller
-c"EHCI0"	- Test on the 1st EHCI host controller
-c"OHCI2"	- Test on the 3rd OHCI host controller

Note: In order to properly specify the number in the PCI enumeration order of the host controllers the end user has to know how many host controllers of the given type are present in the system and also the enumeration order of the host controller to which the device is attached. If these details are not known, this information can be found by trial and error methods.

11. The utility will return with one of the following exit codes.

- 0 - Indicates "PASS"
- 1 - Indicates "ERR"
- 2 - Indicates "FAIL" (Device not found error)
- 3 - Indicates "FAIL" (Firmware mismatch error)
- 4 - Indicates "FAIL" (Error while reading device EEPROM)
- 5 - Indicates "FAIL" (Device EEPROM and template DAT file mismatch error)
- 6 - Indicates "FAIL" (Error while writing to the device EEPROM)
- 7 - Indicates "FAIL" (Error verifying updated EEPROM data)
- 8 - Indicates "FAIL" (Error while initializing disk(s) for R/W tests)
- 9 - Indicates "FAIL" (Error while writing to disk)
- 10 - Indicates "FAIL" (Error while reading from disk)
- 11 - Indicates "FAIL" (Error verifying read and write data)
- 12 - Indicates "FAIL" (Error creating the log file)

#### NOTE:

As mentioned above, when the device EEPROM is updated, the DAT file is updated with the serial number incremented by one. During such cases, there is a chance for the serial number to overflow from "FFFFFFFFFFFF" to "000000000000". When this overflow occurs, there will be a warning displayed to indicate the overflow. However, the testing on the current device continues normally as the overflow will matter only with the next device that is to be tested. Even if the tests on the current device pass successfully, the return value will be "ERR" to indicate the serial number overflow error.

**Limitations of the DosPLTU.exe Utility:**

1. Supports devices connected only at the root hub level.
2. In order to properly specify the number in the PCI enumeration order of the host controllers the end user has to know how many host controllers of the given type are present in the system and also the enumeration order of the host controller to which the device is attached. If these details are not known, this information can be found by trial and error methods.
3. The utility does not distinguish between actual device failures and media specific failures during R/W tests. Hence, it is recommended that the R/W tests are done on devices with known good media.
4. It is recommended that no other USB devices are connected to the system, specially when the system is booting.
5. It is recommended that the utility is used on systems having Pentium II or III processors (400 - 800 MHz processor speed). The utility seems to fail more as the processor speed increases. On systems having Pentium4 processors with speed as high as 1.4 to 2.4 GHz, the utility works reliably around 80% of the times and varies with different system configurations.

**Device Configuration File Structure:**

-----  
 The device configuration file is used with the "-d" option for performing R/W tests on all supported media types of each LUN of the device. The utility prompts the user to insert different media, one by one, in order to perform the tests. For this, the utility needs to know the device configuration, ie. how many LUNs the device supports and the different media types supported by each LUN. These are specified in the device configuration file.

The number of LUNs supported by the device is indicated by the following line;

MAX\_LUNS=n  
 where 'n' is a number (> 0 and <= 4) that specifies the number of LUNs

The media types supported by each LUN are indicated as shown below;

Lx=t1,t2,...,t6  
 where 'x' is a zero based LUN number, that should be < 'n' specified above  
 and 't1','t2',..., 't6' are media types that should be one of the valid media types.

The valid media types that are defined, for now (more could be added later), are given below;

1 = CF  
 2 = MS  
 3 = SM  
 4 = XD  
 5 = SD  
 6 = MMC

Note:

- 
1. There should be no spaces before and after the equals ('=') sign
  2. Number of LUNs specified is 1 based, ie. if the device supports 4 LUNs, specify

MAX\_LUNS=4

3. The LUN index ('x') is 0 based, ie. 1st LUN is indexed as L0.
4. Multiple media types are separated by commas(',') without any spaces in between as shown below

L0=1  
 L1=2  
 L2=3,4  
 L3=5,6

The utility parses this file to understand the device configuration. From the example file shown above, the utility understands that the device supports 4 LUNs and the 1st LUN supports only CF media, the 2nd LUN supports only MS media, the 3rd LUN supports SM and XD media and the 4th LUN supports SD and MMC media.

## **Using the USB2224 with Linux**

Versions 2.4.20 and greater of the Linux kernel provide native support for multi-LUN USB mass storage class devices like the USB2224. Some brands of Linux such as SuSe 8.2 require little or no user setup. Simply plug in your USB2224 device, and icons will appear, provided there is media in the card reader slots. Other brands of Linux such as Redhat require the user to configure the kernel in order to enable multi-LUN support in the mass storage class driver. The procedure for doing that is:

### **Requirement:**

RedHat Linux 9.0 with kernel 2.4.20 or greater

### **Steps:**

1. Install RedHat Linux 9.0 on the host system
2. Login to the system as 'root'.
3. Open a terminal window.
4. Plug the multi-LUN card reader into the host.
5. At the shell prompt, type 'cat /proc/scsi/scsi'.
6. If the screen shows only one LUN, type 'lsmod'.
7. If 'usb-storage' does not exist, type 'insmod usb-storage'.
8. If 'usb-storage' exists, type 'cdrecord -scanbus'. It will display  
scsibus0:  

```

0,0,00) 'SMSC          ' '223 U HS-CF' 'X.XX' Removable Disk
0,1,01) *
0,2,02) *
0,3,03) *
0,4,04) *
0,5,05) *
0,6,06) *
0,7,07) *
```
9. Create a batch file with the following calls:  

```

'echo "set-single-device 0 0 0 0">/proc/scsi/scsi
'echo "set-single-device 0 0 0 1">/proc/scsi/scsi
'echo "set-single-device 0 0 0 2">/proc/scsi/scsi
'echo "set-single-device 0 0 0 3">/proc/scsi/scsi
'cat /proc/scsi/scsi'
```
10. After running the batch file, the screen should display:

Attached devices:

Host: scsi0 Channel: 00 ID: 00 LUN: 00

Vendor: SMSC Model: 223 U HS-CF

Type: Direct-Access

Rev: X.XX

ANSI SCSI revision: 02

Attached devices:

Host: scsi0 Channel: 00 ID: 00 LUN: 01

Vendor: SMSC Model: 223 U HS-MS

Type: Direct-Access

Rev: X.XX

ANSI SCSI revision: 02

Attached devices:

Host: scsi0 Channel: 00 ID: 00 LUN: 02

Vendor: SMSC Model: 223 U HS-SM

Type: Direct-Access

Rev: X.XX

ANSI SCSI revision: 02

Attached devices:

Host: scsi0 Channel: 00 ID: 00 LUN: 03

Vendor: SMSC Model: 223 U HS-SD/MMC

Type: Direct-Access

Rev: X.XX

ANSI SCSI revision: 02

11. Now multi-LUN support is enabled and you should be able to mount and access all media normally.

**Media Tested with the USB2224**

The following flash media cards were used during the development and testing of the USB2224. All media listed has been determined to work properly and be compatible with the USB2224.

Compact Flash	Memory Stick	Secure Digital	Smart Media
CompUSA 16MB	Lexar 16MB	IO Data 64MB	Fuji Film 8MB
CompUSA 48MB	Lexar 32MB	Buffalo 256MB	Fuji Film 16MB
CompUSA 64MB	Lexar 64MB	Lexar 16MB	Kingston 64MB
Delkin Devices Pro 640MB	Lexar 128MB	Lexar 32MB	I-O Data 8MB
Hyperstone 8MB	Lexar 256MB	Lexar 64MB	I-O Data 16MB
IO Data 4MB	PQI 64MB	Lexar 128MB	I-O Data 32MB
IO Data 8MB	PQI 128MB	Lexar 256MB	I-O Data 64MB
IO Data 32MB	SanDisk 16MB	Lexar 512MB	I-O Data 128MB
King Max 8MB	SanDisk 64MB	Memorex 32MB	Lexar 16MB
King Stone 64MB	SanDisk 128MB	Memorex 128MB	Lexar 32MB
Lexar 16MB	Sony 8MB	Panasonic 512MB	Lexar 64MB
Lexar 32MB	Sony 16MB	PNY 64MB	Lexar 128MB
Lexar 48MB	Sony 32MB	PNY 128MB	Memorex 32MB
Lexar 64MB	Sony 64MB	PNY 512MB	Memorex 64MB
Lexar 128MB	Sony 128MB	PQI 64MB	Memorex 128MB
Lexar 256MB	Sony 256MB	PQI 128MB	Olympus 8MB
Lexar 512MB (24x)		PQI 256MB	PNY 128MB
Lexar 512MB (80x)	<b>High Speed Memory Stick</b>	SanDisk 32MB	Samsung 32MB
Lexar 1GB (4x)	Sony 16MB	SanDisk 64MB	SanDisk 32MB
Lexar 1GB (24x)	Sony 32MB	SanDisk 128MB	SanDisk 64MB
Lexar 2GB (40x)	Sony 128MB	SanDisk Extreme 256MB	SanDisk 128MB
Memorex 32MB		SanDisk 512MB	Viking 64MB
Memorex 64MB	<b>Memory Stick Pro</b>	SanDisk 2GB	
Memorex 128MB	Sony 256MB	SanDisk Ultra II 2GB	<b>xD Picture Card</b>
Memorex 256MB	Sony 512MB	SimpleTech 128MB	Fuji 32MB
PNY 64MB	Sony 1GB		Fuji 64MB
PNY 128MB	SanDisk 256MB	<b>MMC</b>	Fuji 128MB
PNY 256MB	SanDisk 512MB	Lexar 16MB	Fuji 256MB
PNY 512MB	SanDisk 1GB	Lexar 32MB	Fuji 512MB
PQI 16MB		Lexar 64MB	Olympus 16MB
PQI 64MB	<b>Memory Stick Duo</b>	PQI 32MB	Olympus 32MB
Samsung 128MB	Sony 16MB	PQI 64MB	Olympus 64MB
SanDisk 16MB	Sony 32MB	PQI 128MB	Olympus 128MB
SanDisk 32MB	Sony 64MB	PQI 256MB	Olympus 256MB
SanDisk 1GB	Sony 128MB	SanDisk 8MB	Olympus 512MB
SanDisk Extreme 1GB		SanDisk 16MB	PQI 64MB
SanDisk Ultra 128MB	<b>Mini Secure Digital</b>	SanDisk 32MB	
Viking 32MB	Panasonic 32MB	SanDisk 64MB	
	Panasonic 64MB	SimpleTech 64MB	
	Panasonic 128MB	SimpleTech 128MB	
<b>IBM MicroDrive</b>	SanDisk 32MB		
IBM Microdrive 340MB	SanDisk 64MB		
IBM Microdrive 1GB	Toshiba 32MB		
Hitachi 2GB			
MagicStor 2.2GB			

## **USB2224 Performance Benchmarks**

The measurements were performed using HDBench v3.30 on a Windows XP (SP1) system with an ICH4 south bridge. (Pentium 4, 1.8GHz, 512MB DDR). All benchmarks were measured on new (out of the box) media. Please note that the benchmark performance of flash cards varies widely from manufacturer to manufacturer, and the performance of all manufacturers' cards degrade with use. In order to duplicate the results below, you must use brand new media and test on a similarly configured host.

<b>Full Speed (USB1.1)</b>	<b>Reads</b>	<b>Writes</b>
<i>Compact Flash</i>	1043 KB/s	932 KB/s
<i>Memory Stick</i>	909 KB/s	550 KB/s
<i>High Speed Memory Stick</i>	811 KB/s	652 KB/s
<i>Memory Stick Pro</i>	1031 KB/s	902 KB/s
<i>Smart Media</i>	977 KB/s	537 KB/s
<i>XD Card</i>	818 KB/s	437 KB/s
<i>Secure Digital</i>	1039 KB/s	945 KB/s
<i>Multimedia Card</i>	996 KB/s	374 KB/s

### **Media Used for Testing:**

SanDisk Extreme 1GB  
 Lexar Media 128MB  
 Sony MagicGate 128MB  
 Sony 512MB  
 Memorex 128MB  
 Fuji xD-Picture Card 512MB  
 SanDisk Extreme 256MB  
 Lexar Media 64MB

<b>High Speed (USB2.0)</b>	<b>Reads</b>	<b>Writes</b>
<i>Compact Flash</i>	9682 KB/s	5953 KB/s
<i>Memory Stick</i>	1540 KB/s	833 KB/s
<i>High Speed Memory Stick</i>	4031 KB/s	897 KB/s
<i>Memory Stick Pro</i>	4027 KB/s	3157 KB/s
<i>Smart Media</i>	4762 KB/s	1746 KB/s
<i>XD Card</i>	3968 KB/s	669 KB/s
<i>Secure Digital</i>	7275 KB/s	5340 KB/s
<i>Multimedia Card</i>	1522 KB/s	486 KB/s

### **Media Used for Testing:**

SanDisk Extreme 1GB  
 Lexar Media 128MB  
 Sony MagicGate 128MB  
 Sony 512MB  
 Memorex 128MB  
 Fuji xD-Picture Card 512MB  
 SanDisk Extreme 256MB  
 Lexar Media 64MB



**GPIO Assignment Table**

The following is a table of GPIO assignments for the USB2224. Please note that multi-function GPIO operations are determined by attribute settings. Please refer to the software release notes for detail on configuration settings.

<b>Name</b>	<b>Description</b>	<b>Function</b>	
GPIO0	<i>Not available due to pin count</i>		
GPIO1	Flash Media Activity LED	Media Activity LED/xD Door detect	
GPIO2	EE_CS	EE_CS	
GPIO3	V_BUS	V_BUS	
GPIO4	EE_DIN/EE_DOUT	EE_DIN&DOUT/xD Card Identification	
GPIO5	SD Card Detect	SD Card Detect	
GPIO6	A16 ( external ROM only ) /ROMEN	ROMEN/A16	
GPIO7	EE_CLK/Unconfigured LED	EE_CLK/Uncfg LED	
GPIO8	MS Power Control	MS Power Control	
GPIO9	CF Power Control	CF Power Control	
GPIO10	SM Power Control	SM Power Control	
GPIO11	SD Power Control	SD Power Control	
GPIO12	MS Activity	MS Activity/Media Activity LED	
GPIO13	CF Activity	CF Activity	
GPIO14	SM Activity	SM Activity	
GPIO15	SD/MMC Activity	SD/MMC Activity	

**Known Firmware Related Issues****General:**

Issue:	Workaround:	Status:
No known issues		

**CF Devices:**

Issue:	Workaround:	Status:
No known issues.		

**MS Devices:**

Issue:	Workaround:	Status:
When High Speed Magic Gate Memory Stick media is formatted with a FAT file system on a MacOS 10.X host, the media becomes unreadable on machines with Windows operating systems, but will continue to work normally with Macs.	None.	We believe this is a Magic Gate security protocol issue. WE will continue to investigate and provide a fix in a future release of the USB2224 firmware if possible.

**SM Devices:**

Issue:	Workaround:	Status:
Writes to 2MB Smart Media cards are not supported.	None.	2MB Smart Media cards can be read by the USB2224, but writes are not supported. These cards are considered obsolete and there are no plans to implement support for them in the future.

**SD/MMC Devices:**

Issue:	Workaround:	Status:
Under certain conditions, the USB2224 device may fail to recognize an SD/MMC card inserted while writing to either CF or MS or SM cards.	Attempt to reinsert the card.	Currently under investigation. May be fixed in a future release of the USB2224 firmware.

**xD Devices:**

Issue:	Workaround:	Status:
No known issues.		

### **Issues Not Related to Firmware**

Issue:	Workaround:	Status:
Due to the write caching functionality of Windows, data corruption can sometimes occur if the media is removed improperly.	Before removing any piece of media, you should right click the drive icon in Windows Explorer and select "Eject" from the context menu. This will force the operating system to perform a write of any cached data.	Limitation of the OS.
Reading or writing multiple media types simultaneously will generally happen at the slowest media rate.	This is a limitation of the OS. If writes to a slow media type like MS are made while reading from a fast media type like CF or SM, then the read will slow to approximately the rate of the write. This is because the OS must process each command separately. It is not a limitation of the firmware.	Limitation of the OS.
If the USB2224 EVB does not have a properly programmed serial number, only one drive appears in Windows Explorer.	Program a unique serial number into the board using the "DFUTest" utility.	
Surprise removal of the USB cable during a write to any media type under Windows 98, Me, or MacOS sometimes causes the host to become unresponsive.	Reboot the host.	This appears to be a bug with the operating systems. All mass storage class devices tested have displayed this behavior.
Occasionally, surprise removal of the USB cable during writes to any media type under Windows XP, results in the failure of the device to re-enumerate after being reattached.	Reboot the host.	This is a Windows XP bug. No mass storage class USB devices will enumerate with host in this state.
Windows 2000 does not immediately report that media is write protected when attempting to perform a full format. The format will appear to progress to completion, but at the end of the operation reports that the media is write protected.	None.	This is normal behavior for Windows 2000. This occurs for all USB write protectable devices when performing a full format.
16MB MMC media reports an incorrect format capacity when you attempt to format it in Windows 98 or Me after having previously formatted a 64MB MMC.	Power cycle the board.	Appears to be a bug with the Windows Operating system.
Prematurely attempting to access a drive after resuming from suspend sometimes results in a device I/O error in Win2K. This is a known issue at Microsoft. (Reference Microsoft Knowledge Base article Q323754)	Obtain and install the updated Usbhub.sys file from the hotfix that is described in Microsoft Knowledge Base article Q306455.	N/A
Under Mac OS 9.x only one drive will appear on the desktop. This is normal as the Mac OS 9.x mass storage class driver does not support multiple LUN devices.	Use the MacOS 8.6-9.x driver provided by SMSC.	Use the MacOS 8.6-9.x driver provided by SMSC.
DFU for Mac 10.X does not work when the device is connected to a 1.1 USB host controller	Attach device to a 2.0 host controller when using DFU on Mac OS 10.X	Under investigation. May be fixed in a future release
When MSPro media is inserted and the device is enumerated drive icons won't come up until media is ready to be read. Per MSPro spec larger media could takes 10 seconds to be ready	None.	
Under Windows 2000 SP2 or below, only one drive icon appears.	Windows 2000 SP2 and below does not provide native support for multi LUN mass storage class devices like the USB2224. You can use the SMSC Windows 2000 driver, or upgrade your OS to Service Pack 3 or higher. (This is a free update).	Use the SMSC Windows 2000 driver, or upgrade to Windows 2000 SP3 or higher.
Some Memory Sticks can not be formatted with the Sony Format utility if "Physical Device Display" is not checked	Check the "Physical Device Display" if the MS does not have the option to format. After the first format, this box may not need to be checked for future formats.	This is a limitation of the Sony Format tool, listed in the applications help topics.