17 Data Storage & Downloading

The SFM does not store data on internal memory. Data is stored on Non-Volatile storage: MicroSD cards. Data can be downloaded via USB Cable, wireless Radio Frequency (RF), or through physical removal of the MicroSD card.

17.1 MicroSD Card Storage Capacity

The storage capacity of the supplied MicroSD card is 4GB. In practical terms, when the SFM1 is configured to record in Sap Flow mode, it has the memory capacity to log all raw parameters relevant to the calculation of Sap Velocity and Sap Flow and operational diagnostics of the instrument such as: battery voltage and charging current at a 10 minute logging interval for hundreds of years. Alternatively, if configured in "Raw Needle Temperature" mode, the SFM1 has the memory capacity to log data for 82 years at a raw temperature sampling frequency of 1Hz for 100 seconds per measurement.

17.2 Data Format

17.2.1 Windows FAT-32 Compatible

Data is written to and stored on the MicroSD card in fully compliant Windows File Allocation Table (FAT-32) format. What this means is that any MicroSD card can be used in the Instrument. There is no requirement that memory cards must be supplied by ICT. Any MicroSD card purchased anywhere in the world, or a MicroSD card from any digital camera or mobile phone can be inserted directly into the Instrument for immediate compatibility and use. Similarly, any MicroSD card used in the SFM1 can be removed and placed into a Camera, or phone and MOST importantly any computer and is automatically recognized and functional. If inserted into a computer the data can be copied across through Windows Explorer to any file location on the PC.

NOTE 85: MicroSD cards are "Hot Swappable" meaning they can be removed from the instrument and inserted into a USB port of a computer using a USB card adaptor and then reinserted to the instrument. No closing down, ejecting or formatting is required.

17.2.2 Data File Nomenclature

The data file is automatically generated by the SFM1 using the following nomenclature; instrument_serial_number.csv e.g., SFM1A813.csv. The serial number not only uniquely identifies each instrument it contains specific information about the date of manufacture and production run. Please provide the serial number to ICT International for all support inquiries.

NOTE 86: The Serial Number is automatically stored in the "Header Line" of the data file as well as being the data file name. A Serial Number is affixed to the back of the instrument for physical display. Finally, the Serial Number is displayed on screen in the SFM software upon connection to the instrument.

17.2.3 Data File Format

The SFM1 stores data, in one of two file formats, *.CSV or *.BIN, to the internal MicroSD memory card. The file structure of the SFM1, whether it uses a comma (,) or a point (.) for the separator, and a point (.) or a comma (,) for the decimal delimiter, is based upon the regional settings of the user's computer.

These regional settings are typically set the first time a user connects to the computer. If the computer's regional settings are different to the Sap Flow Meter a warning message is displayed on screen warning that the Regional settings of the computer do not match those of the instrument. If they are both set to the same regional settings no message will appear.

WARNING 17 - It is recommended that the regional settings of the Instrument are set to those of the computer that will be used to process the Sap Flow data. Failure to do this will result in a data file that is unreadable in both Excel and Sap Flow Tool Software because the file structure is the opposite of how the computer is configured.

17.2.3.1 Main Data File – Sap Flow Mode

Main data files have a *.CSV file extension and are a true Comma Separated Values (CSV) data file that can be easily opened in Excel or SFT software. They are used for logging Sap Flow measurements and associated raw data. These files are typically small, in the range of 10's to 100's of KB's in size. The file includes a detailed header line with all of the correction parameters relevant to any processed data contained in the data file. As well every column is preformatted with headings denoting the measurement parameter and the engineering units of the measurement.
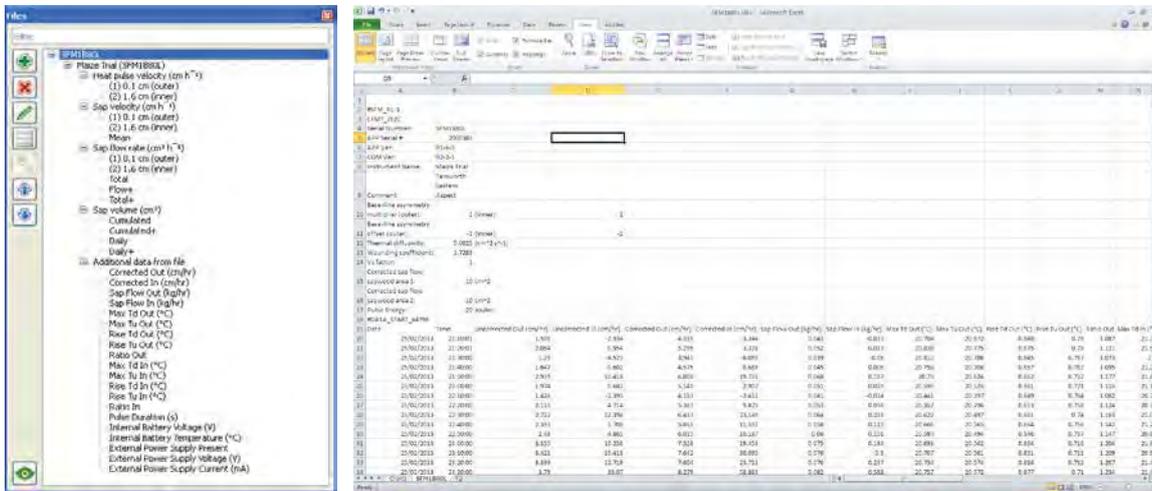

Figure 85: A summary of the parameters recorded and stored for each measurement when the SFM1 is configured in Sap Flow Mode as displayed in Sap Flow Tool Software (left) and Excel (right).

WARNING 18 – It is very important that the integrity of the original *.CSV data file be maintained. Opening this file in Excel will corrupt the native Comma Separated Values file format as Excel introduces hidden formatting markers. These hidden markers have the potential to make the file unreadable in Sap Flow Tool. It is recommended that if the CSV file is opened in Excel save file as an *.XLSX file format maintaining the original file name, but do not save any changes to the original *.CSV file.

17.2.3.2 Raw Temperature Data – Needle Temperature Mode

Raw Temperature Data files have the file extension *.BIN and are used for logging the high temporal frequency (up to 30Hz) needle temperatures that enable advanced data processing using any heat pulse algorithm. Because the Raw Temperature Mode records large volumes of data, potentially 30 readings per second for 300 seconds per measurement, the data is stored in a binary (*.BIN) format. This file can only be opened in SFT software for analysis. These files have the potential to be very large - in the range of GBs - depending upon the logging interval and longevity of the installation.

WARNING 19 – Do NOT attempt to download a *.BIN file via the USB cable or MCC1 wireless modem. It is too large. You must download this file type by removing the MicroSD card.

NOTE 87: When the SFM1 is configured in Needle Temperature mode logging Raw Temperature data, the data storage capacity will vary depending upon the sampling frequency and duration of each measurement after the heat pulse.

17.2.4 SD Card Logging Options

The measurement parameters to be logged to either the *.CSV or *.BIN data files can be set on the SD Card Logging Options Window. This Option is accessed via the Commands Menu along the top menu bar of the SFM1 software. Simply check the box against the data required to be logged.
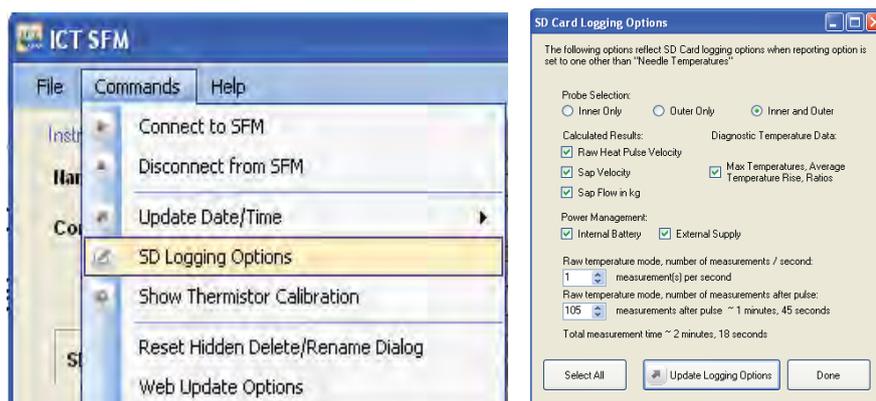

Figure 86: The SD Card Logging Options tab showing that the calculated parameters of Raw Heat Pulse Velocity, Sap Velocity and Sap Flow will be logged to the *.CSV data file along with the Diagnostic Temperature data Max Temperature, Average Temperature Rise, Ratios and Power management data; internal battery and External Supply.

17.3 Downloading Data

17.3.1 Download data Via USB Cable

A Mini USB cable is supplied for downloading and configuring the instrument. It is a "Standard" cable in most computer stores. The physical USB connection is the simplest method to download data from the SFM1 Sap Flow Meter.

17.3.2 Download Data Icon

Data can be downloaded in a number of ways. The simplest is to click the green Download Data icon on the main window under the Instrument Information section.
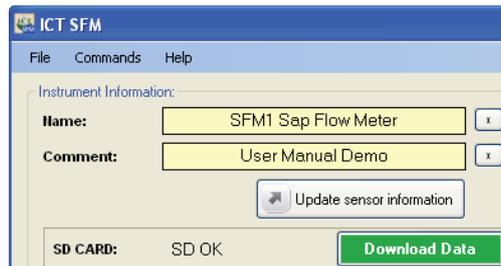

Figure 87: Download Data Icon.

If a data file exists on the MicroSD card then a MS Windows Explorer "Save As" window automatically loads providing a choice of directories to save the data file to. The Default location is C:\Program Files\ICT\ICT SFM\ This directory can be changed to a user defined storage location if preferred.

Figure 88: Microsoft Windows "Save As" Window.

Once the data file has been downloaded the "Save As" Window gives way to a subsequent pop-up box that confirms the file has been downloaded and prompts the user with options to "delete" or "rename" the data file. Both options can be declined by clicking "Cancel" and data will continue to be logged to the existing data file.
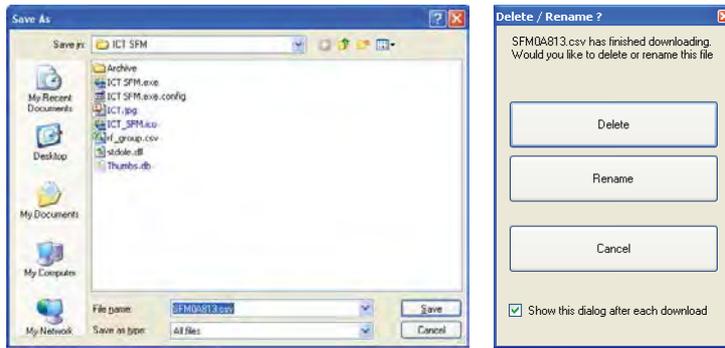
Figure 89: Data management Pop-up Option to Delete or Rename the data file.

NOTE 88: The automated Pop-up prompt to Delete/Rename the data file after download can be deactivated by deselecting the "Show this Dialog after each download" check box.

17.3.3 Delete or Rename a data file

It is not necessary to delete the data file from the SD card. Instead, it can be renamed to form an off-site backup of your data file should your computer hard drive fail. When renaming the data file it is recommended to rename the file extension using numbers e.g., *.001, *.002, *.003.
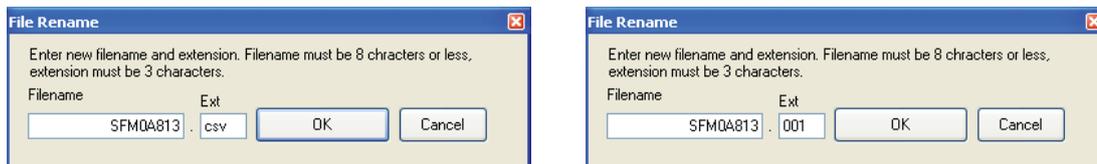

Figure 90: Clicking on the Rename option provides the facility to rename the file name and or the file extension.

Each numerical increment designates the chronological downloading of the instrument and should the downloaded copy of the data ever be lost these files can be reloaded into SFT software and easily stitched together to recover the lost data. A list of the data files stored on the MicroSD card can be viewed by toggling the Show List/Hide List icon on the SD Card tab.

17.3.4 Appending data to a file

The SFM1 can append data to an existing data file. When downloading data from the Sap Flow Meter select the same directory to save the data file to as the previous version of the data file of the same name. The Software will check the properties of the destination data file and compare them against the properties of the file about to be downloaded. If the properties are the same but the file to be downloaded the software prompts with the Resume File Dialog shown below.
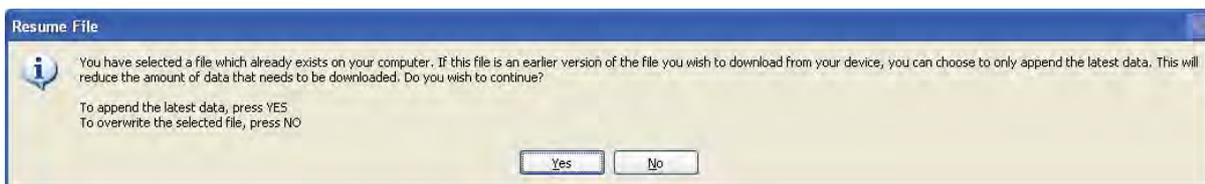

Figure 91: Resume File Dialog offers the option to "Append" data to an existing file or "Overwrite" the data of an existing file.

Choosing "YES" will append the data to the existing file eliminating the redundancy of download and reducing the volume of data that needs to be downloaded. This will significantly reduce the download time for large files. The option to download the whole data file is available by clicking "No". This will overwrite all data in the existing file maintaining a

"clean" chronological record of data. This avoids messy duplication of portions of data within the same file that can cause a confusing and time consuming post processing chore.

17.3.5 SD Card Data Management Options

The SD Card tab provides information on files written to the MicroSD card and any non-Sap Flow Meter files that may exist on the MicroSD card. Details including the file name and size including that of the current file where data are being recorded are displayed. Options to view the full list of data files stored on the MicroSD card, rename, delete and of course download the current data file or any historical data files are provided. The operation of each icon function is the same as those described in the preceding section. The current file status can be updated using the "Refresh" button and other files on the SD card can be displayed using the "Show List" function.

17.3.5.1 Refresh – SD Card tab

The "Refresh" icon is used to refresh the display of the SD Card tab. This function is necessary to display a new data file for the first time, or after a data file has been deleted. If no data file exists on the MicroSD card one is automatically created upon the Sap Flow Meter performing a measurement. The file name and size can be displayed by clicking "Refresh" Until the icon is clicked the current "Data File:" field will report "File Not Found".
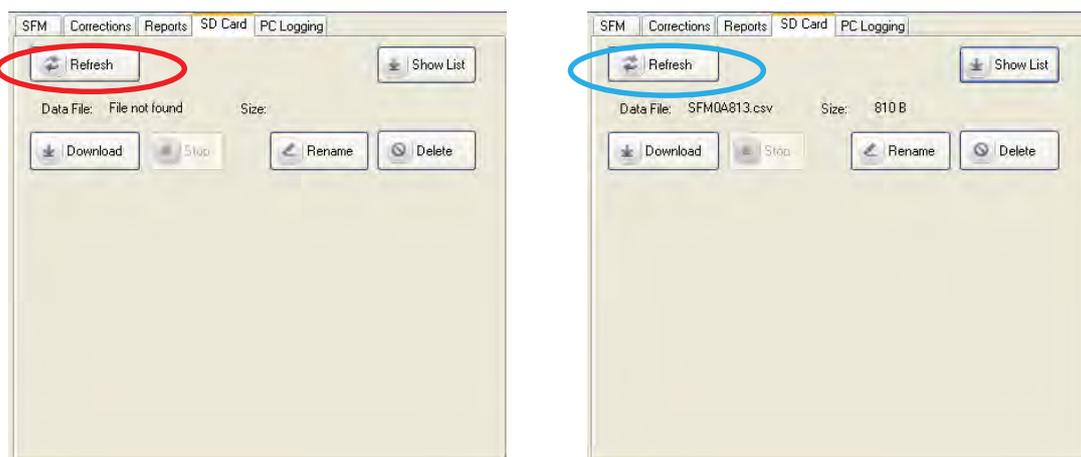

Figure 92: A newly written data file will not appear in the SD Card tab until the Refresh Icon is clicked.

17.3.5.2 Show List/Hide List

The Show List/Hide List icon allows the user to toggle the view of the SD Card tab between a single listing of the current data file name and size of the file, or a complete list of all data files stored on the MicroSD Card.
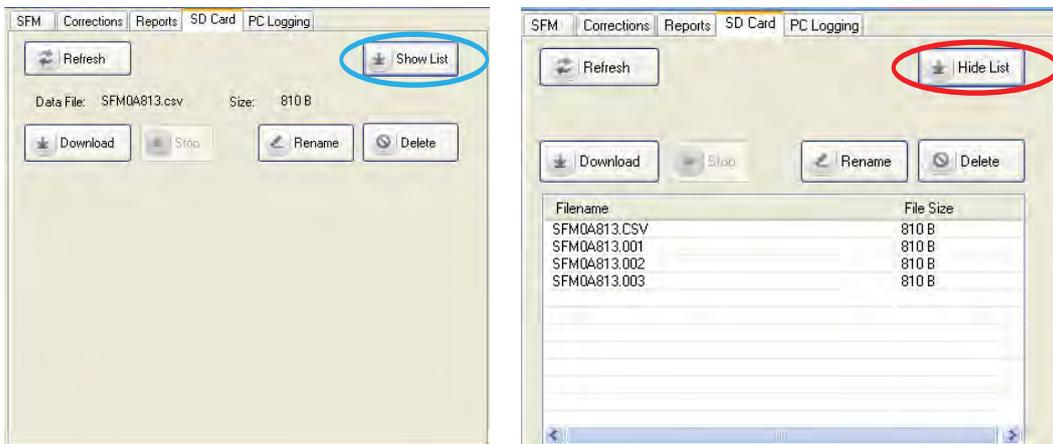

Figure 93: The alternate displays of the SD Card tab when using the "Show List"/"Hide List" toggle icon.

17.3.5.3 Download - file

On first inspection the "Download" icon would appear seemingly redundant. However, this icon provides access to all data files stored on the MicroSD card rather than the only active data file, also possible using the "Download Data" icon on the main "Instrument Information" panel of the software. In order to utilise the "Download" icon a file must first be selected from the list of files stored on the MicroSD card. Once selected click the "Download" icon and the download process is the same as described in the downloading data section.

NOTE 89: An error message is displayed in the dialogue box if no data file is selected before hitting download.
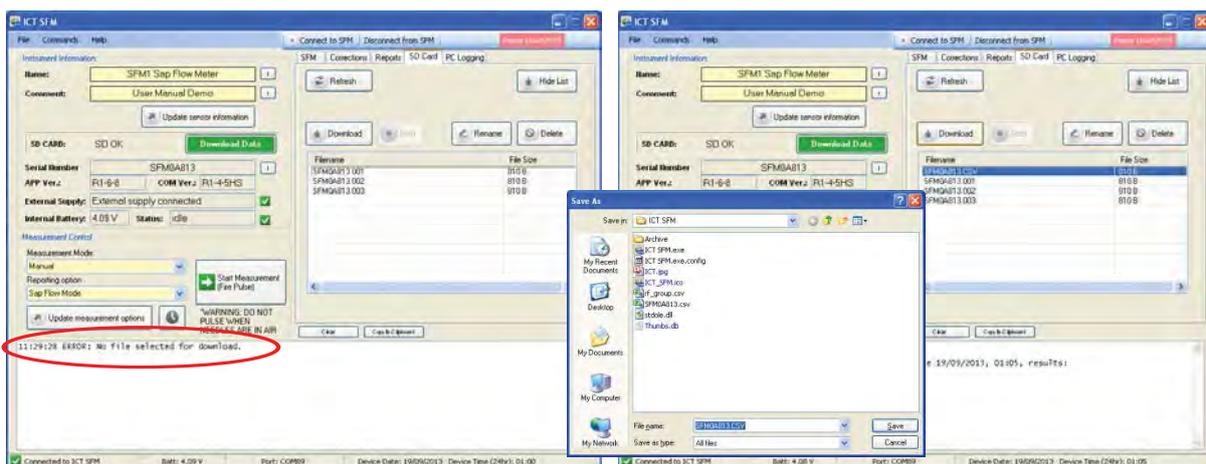

Figure 94: The error message displayed in the dialogue box when an incorrect download procedure is attempted (left) and a successful download when the correct procedure is followed (right).

17.3.5.4 Stop - Download

By default the "Stop" Icon is grayed out. It only becomes active when downloading a file to allow the user to stop the download if desired. In the screenshot below, captured during a download, the "Stop" icon is active to facilitate stopping the download should it be necessary. The download process provides user feedback that includes a green status bar, "Time remaining:" and % download complete.
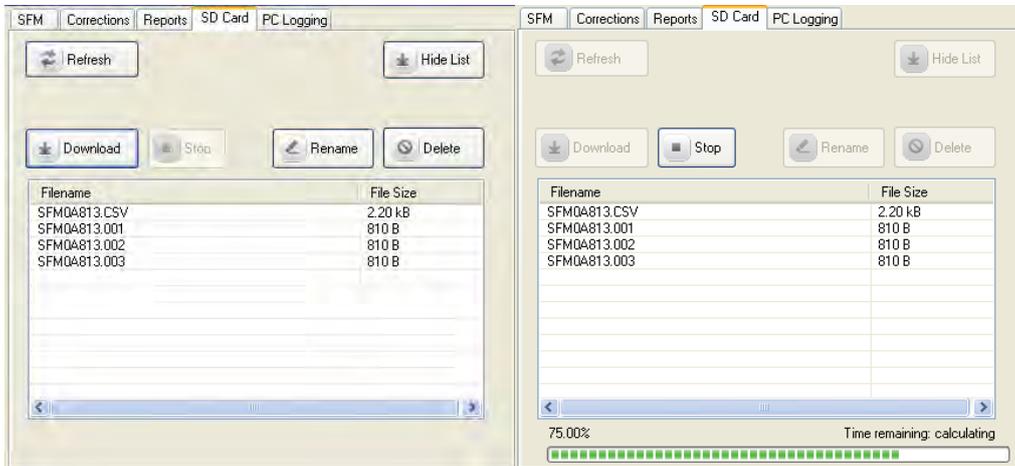

Figure 95: The "Stop" Download icon is inactive by default, only becoming active during a download.

17.3.5.5 Rename - file

When data is downloaded, the data file can be renamed by adding an incremental number to the file extension such as; filename.004 instead of filename.csv The data is then left on the MicroSD card as an "off-site" back up of the master data set stored in the office. This is an inherent data backup and redundancy function and operates in exactly the same way as previously described when renaming data files downloaded using the "Download Data" icon.
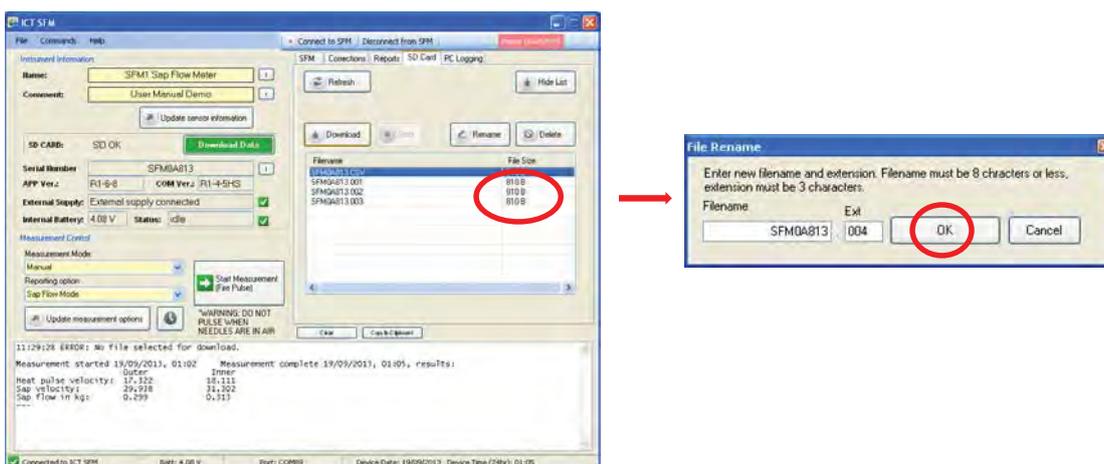

Figure 96: Clicking on the Rename option provides the facility to rename the file name and or the file extension.

17.3.5.6 Delete - file

Select a file for deletion by clicking on the corresponding file and the "File Erase" Pop-up message appears. This dialog simply warns that the file will be permanently deleted and requires user confirmation by clicking on "OK" before the file is deleted. Once deleted the file is immediately removed from the SD Card tab with the "Data File:" field reporting "File not Found"
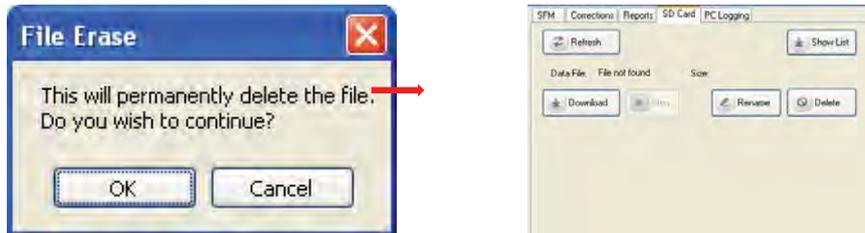

Figure 97: Clicking "OK" on the File Erase Pop-up dialog results in the immediate deletion of the data file on the SD Card tab.

17.3.6 Download MicroSD Card via USB Adaptor

The SFM1 data can be downloaded by removing the MicroSD card and putting it in a USB Adaptor (supplied by ICT or available from electronics and computer stores) and inserting the MicroSD card into a USB port of a computer. Open the communication port to access the MicroSD card. The MicroSD card is secured by a spring locking mechanism, press on the edge of the card to release the spring then remove the card. A pair of forceps or tweezers is very convenient for extracting and inserting the card.

Photo 45: Removing the MicroSD card using a pair of forceps (tweezers) via the communications port.

Photo 46: Place the MicroSD card inside the USB Adaptor and insert it directly into a USB port on a computer.

ICT use Microsoft FAT32 formatting so the card is immediately recognizable as a mass storage device when inserted to a computer running a Windows OS. A MS Windows® Explorer File Window will pop up, allowing files to be cut, copied, pasted or dragged as normal. Copy the file and paste it to the preferred directory location on the computer. The full USB2 data transfer speed (seconds for 2GBs of data) is then possible when downloading data. If a USB cable is used between the device and the PC then the speed is much slower (minutes per KB).

NOTE 90: The ability to remove the MicroSD card from the instrument means data can be manually downloaded from the instrument without the requirement of a laptop in the field. The MicroSD card can simply be removed from the Instrument and exchanged with a new MicroSD card inserted in its place. The SFM1 automatically generates a new data file and continues logging uninterrupted while the data is returned to the office for download from the original MicroSD card.

Figure 98: MicroSD Card Adaptor with the MicroSD card from the SFM1 inserted into the USB port of a computer.

Again, either manually delete or rename the file on the MicroSD card before reinserting it to the SFM1 to continue logging.

NOTE 91: Deleting a file from the MicroSD card will not cause any problems for the SFM1. If a MicroSD card is inserted into an instrument and a data file does not exist, the next time a reading is logged the instrument will automatically create a new data file on the SD card. A CSV data file will be prefixed with the serial number of the instrument e.g., SFM1B80L.csv