Mass DFU application user manual

Flash programming utility for the LPC2888

Rev. 01 — 26 July 2006

Document information	
Info	**Content**
Keywords	LPC2888, DFU, Flash Programming, USB
Abstract	This manual describes the Mass DFU Application that is used to program the on-chip 1MB Flash via USB

PHILIPS

Revision history

Rev	Date	Description
1.0	20060726	Initial Revision

Contact information

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1. Introduction

The purpose of the Mass DFU Application is to program firmware on a single LPC2888 device or multiple LPC2888 devices using the DFU USB interface. LPC2888 is provided with 1MB of on-chip Flash. This memory can be programmed either via USB or via JTAG/application by using the Flash-programming interface. For more details on the Flash programming please refer to the LPC2880/LPC2888 Users Manual.

This manual covers the following topics:

- System setup
- Installation of the Mass DFU Application
- Startup menu
- Setup mode submenu
- Program mode submenu
- Color legend submenu
- Statistics submenu

The first two sections deal with the setup and installation. The remaining sections deal with the different GUI features.

The protocol used to download the firmware to the LPC2888, is the Device Firmware Upgrade (DFU) interface of the Universal Serial Bus connection. This interface is available on the device side (in the Boot ROM).

2. System Setup

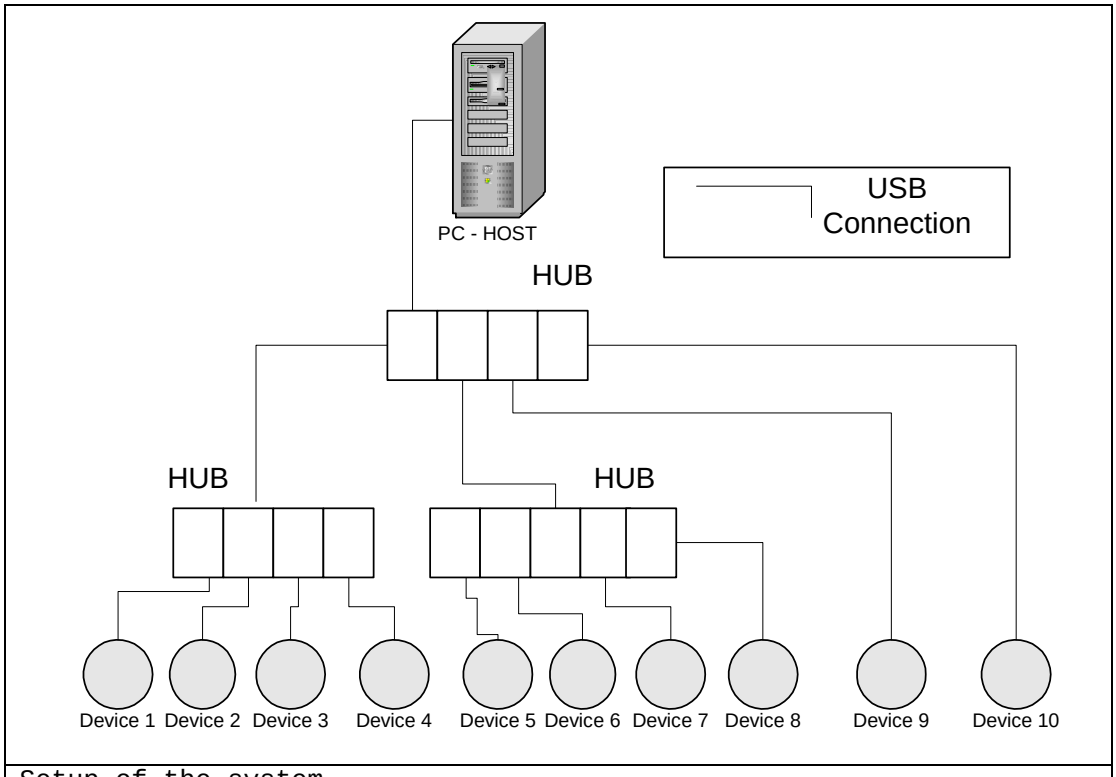
This application has the following hardware and software requirements.

2.1 Hardware

- Standard PC with USB host 1.1
- Multiple hubs (depending how many devices you want to program simultaneously)
- Multiple cables:
  - USB connector B – USB connector A: PC/hub to hub
  - USB connector B – USB mini connector B: PC/hub to device

Power to the devices: Batteries, power supply cables or USB powered depending of the implementation of the devices.

Setup Example:



Setup of the system

2.2 Software

- Windows OS
- Installation of the Mass DFU Application (section 3 below)

3. Installation

To install the program, please follow the instructions in the below table.

Step	Action
1	Unzip the MASS_DFU.zip file into a directory on your machine
2	Browse to the “Application” directory
3	Start the MassDFUApplication.exe file

Installation of the USB driver for the same is described in the Setup mode submenu section 5.

4. Starting The DFU Application

4.1 Start-up

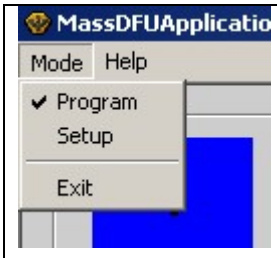
The application starts by default always in program mode (see Program Mode). The first time at start-up, no devices are visible. The application needs to be configured for your setup by using the Setup submenu.

4.2 Menu Structure

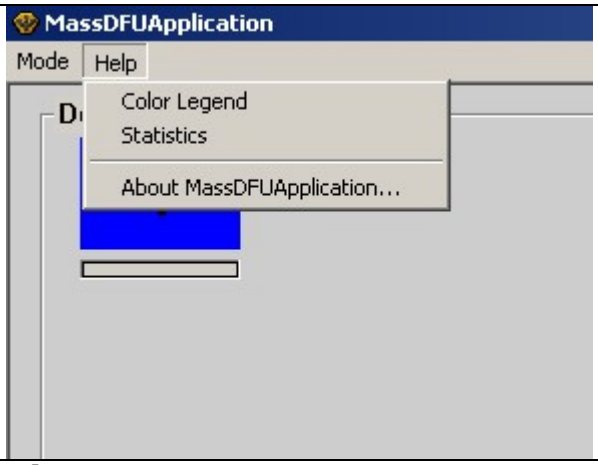
The menu structure is illustrated in the picture and table below.

Mode Menu contains	*Description*
Program submenu	Normal operation mode to program devices
Setup submenu	Special mode to configure the USB bus topology, firmware and options
The exit submenu	Exits the application (Same as the X in the right upper corner and the “Exit” button in Program Mode)

Help Menu contains	*Description*
Color Legend submenu	The different colors used in the Program Mode are explained.
Statistics submenu	The programming statistics of the devices in the Program Mode are given.
About MassDFUApplication…	Displays the version of the application



Mode Menu



Help Menu

If the application is used for the first time then the first step after starting the application would be to switch to Setup Mode.

5. Setup Mode Sub Menu

In the Setup Mode, the following needs to be configured:

- Bus topology
- Firmware file
- General settings (Optional step)

All settings are stored into a file, “storage.dfu” which is generated in the same directory as the application executable. The setup has to be done only once for a certain Bus Topology and firmware. At startup, the application will load at startup the stored settings from this file. The user enters the Setup mode by starting the Mass DFU Application and then selecting the Setup submenu.

5.1 Bus Topology

To allocate a number to a device port in a USB bus topology, the following procedure has to be followed.

The course of the Setup phase is as follows:

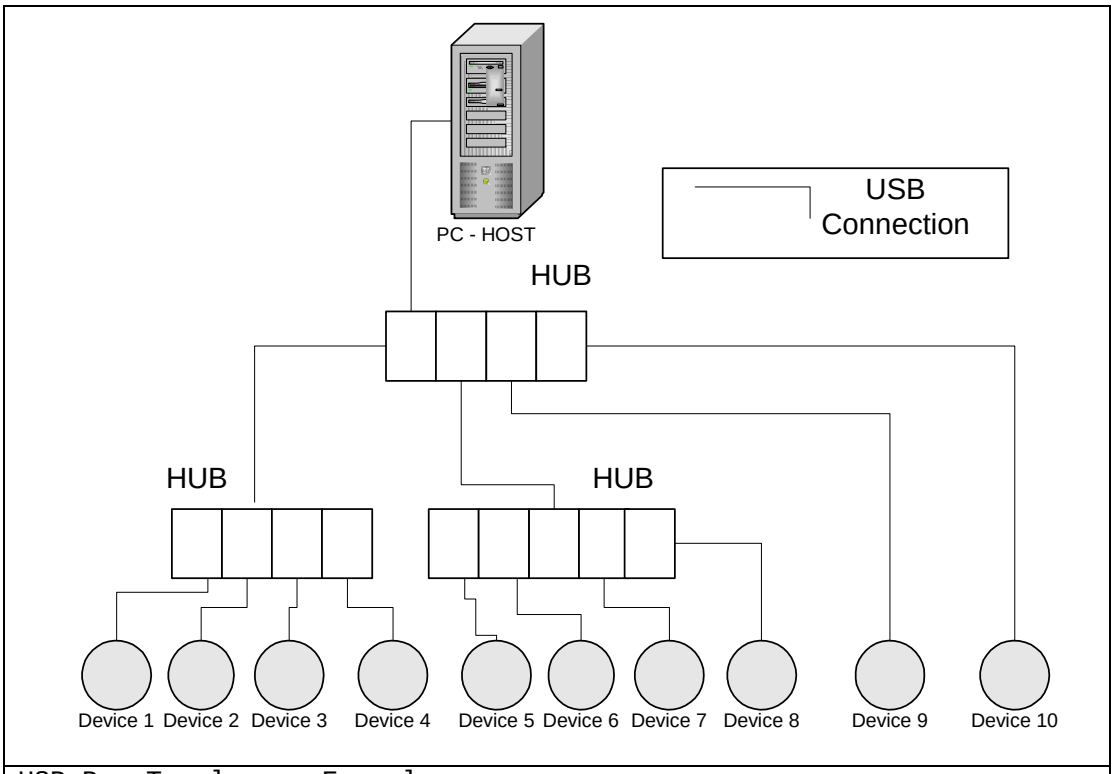
- Start the Mass DFU application and go into the Setup submenu. At this point, disregard the “New Topology” button. This is covered later in section 5.1.4).
- User connects an LPC2888 device to the USB port.
- When the device is set in USB download mode, a new device is found (on the PC side) and the driver will be asked to install (see Section 5.1.1). The LPC2888 can be taken into download mode (via USB) by configuring P2.2 and P2.3. For a complete description, please refer to Chapter 4 of the LPC288x Users Manual.
- Once the driver is installed, the device will show up in the message box and in the drop list (which reflects the number of devices that would be visible in program mode). The drop down list will be set to 1.
- User connects one more LPC2888 device to the USB port.
- New device is found (when LPC2888 enters USB download mode) and the driver will be asked to install (see Section 5.1.2).
- Once the driver is installed, the device will show up in the message box and in the drop list. The drop down list is now set to 2.
- …
- When all devices the user wants to connect are connected, the setup phase is completed.

This topology is stored into the storage.dfu file.

Note:

1. For fixed hubs and devices, you have to install the driver only once for all devices in this configuration.

The Setup phase has to be redone only if the USB Bus Topology is changed



USB Bus Topology – Example

5.1.1 USB Driver Installation (when the first device is connected)

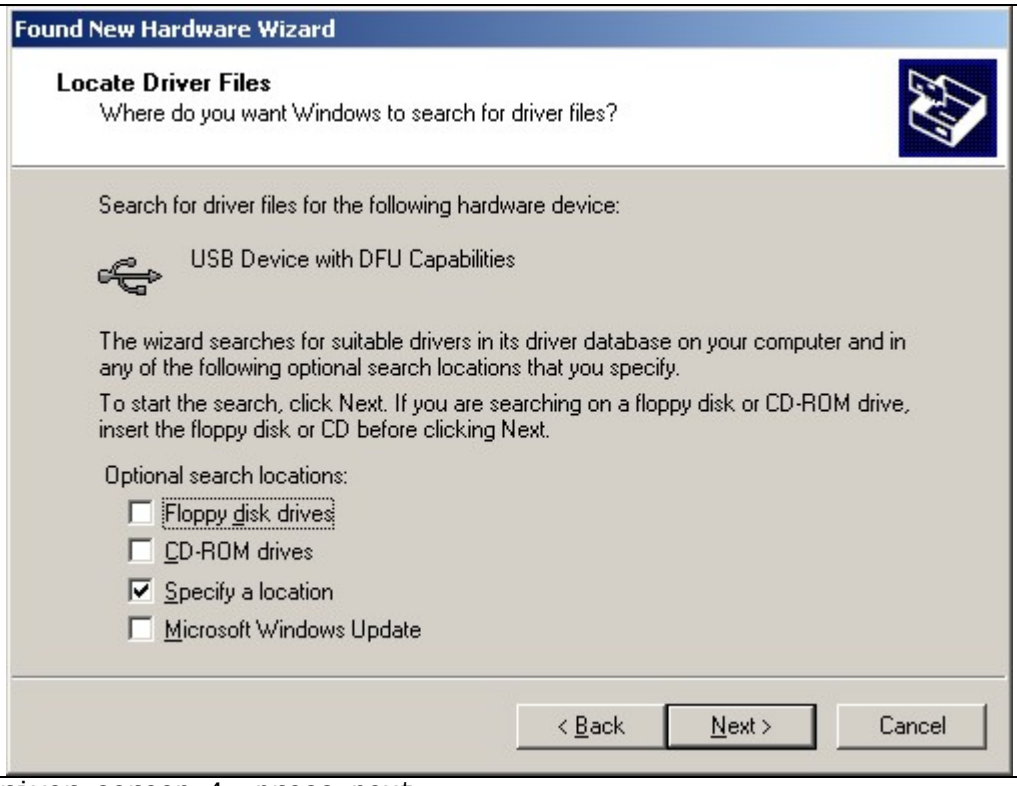
The following screen shots show the procedure to install the driver when an LPC2888 is connected for the first time (in USB download mode). When a device is connected to a new port in a USB Topology configuration, Windows will prompt for the driver. Connection of the same device to this port will use the installed driver. You have to set the driver only once for every USB port.

Once a device is connected (and it is set in the USB download mode) the following screen might appear on the PC screen (this would vary with Window OS variations)

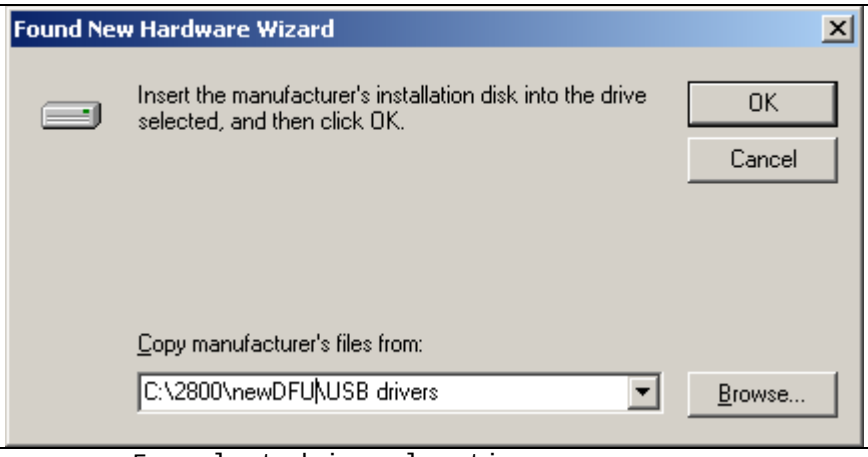
Driver screen 1

Driver screen 2, press next

Driver screen 3, press next

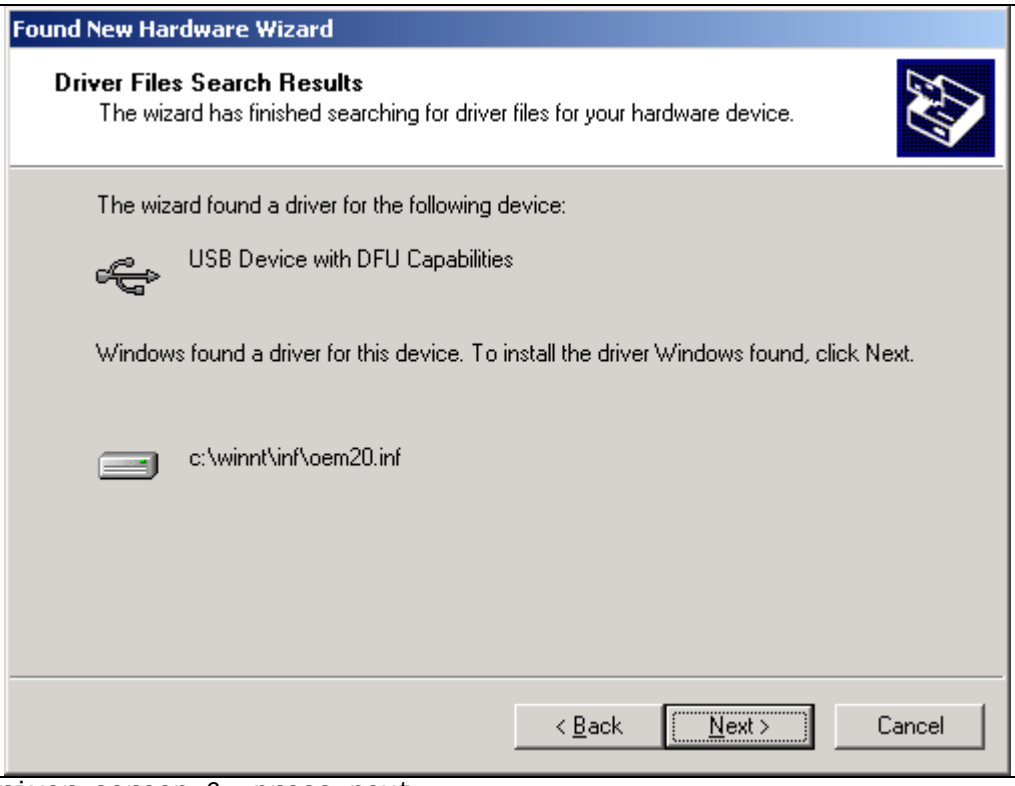


Driver screen 4, press next



Driver screen 5, select driver location

Above, we are assuming that the MASS_DFU zip file was unzipped to a folder named “newDFU”.

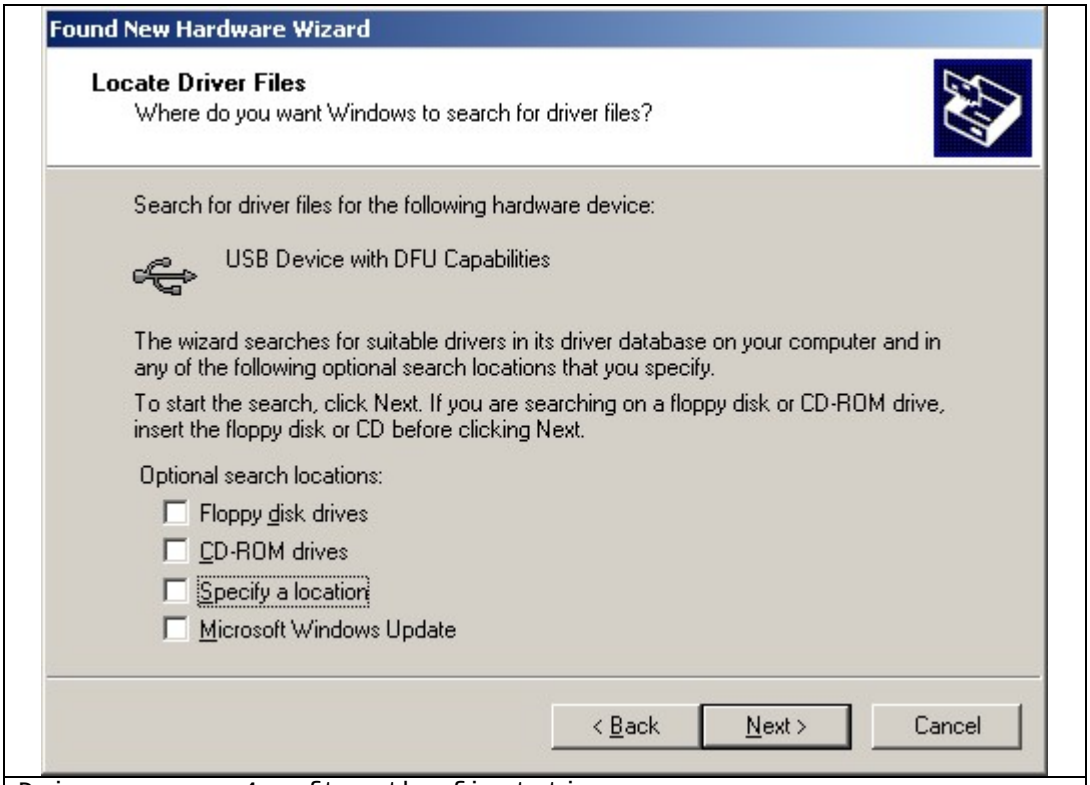


Driver screen 6, press next

Driver screen 7, press finish

5.1.2 USB Driver Installation (for other devices)

To increase speed for the other devices, unselect the checkbox “Specify a location” and press “Next”



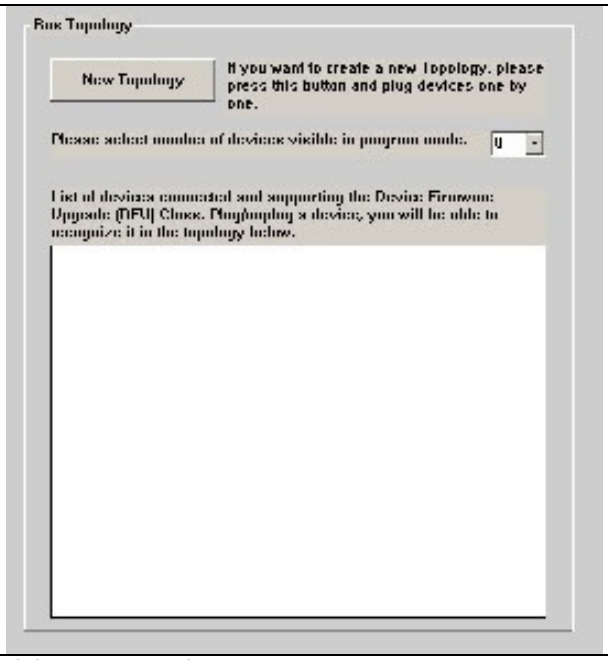
Driver screen 4, after the first time

Note:
This is only done once for one configuration of hubs and devices. The settings are stored and will be retrieved when the application is started.

5.1.3 GUI Objects Description

The Bus Topology has:

- A button to clear the current topology and start a new topology.
- A drop down box, which enables the number of devices visible in the Program Mode.
- A list box, that displays the devices set in the topology



Graphical Objects of the Bus Topology

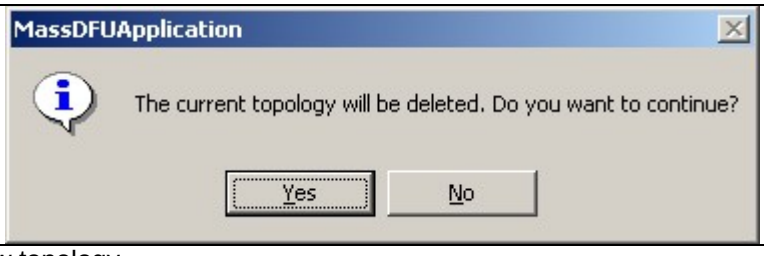
The above figure shows the state when the application is started for the first time on that location (so there is no storage present) or when the topology is cleared.

In this state, it is no longer possible to switch to Program Mode. A ***USB bus topology must be set*** to continue. If an attempt were made to switch to Program Mode the following warning appears.

Bus topology Warning

5.1.3.1 New Bus Topology

When a new bus topology has to be configured, the button with “New Topology” has to be pressed. A message box will warn that the old configuration will be deleted. (See figure).



Warning new topology

If you choose:

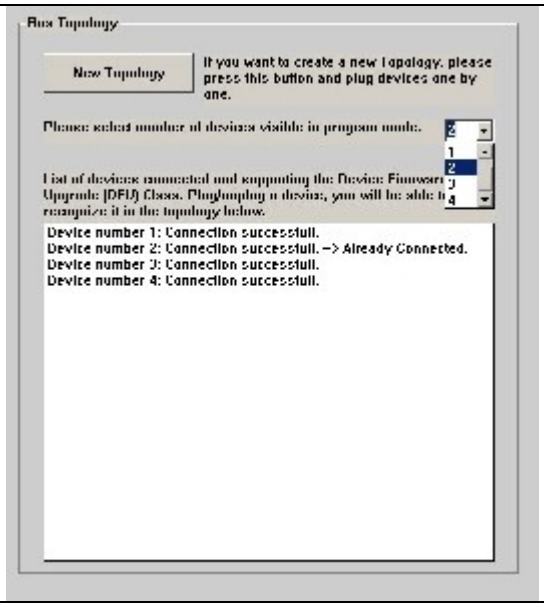
- No: The current topology will stay and nothing happens
- Yes: The current topology will be deleted and the list box will be empty. All devices that will be plugged from now on will be logged. The already plugged devices need to be unplugged and re-plugged. The number of devices visible would be equal to zero.

5.1.3.2 Number of devices visible in Program Mode (drop-down list)

The number of devices visible has 2 boundaries:

- Upper limit: the number of devices in the bus topology
- Lower limit: 0

Selecting a lower number from this list will affect the program mode. As shown below, 2 is selected out of 4 devices and hence in program mode only 2 devices will be available for programming.

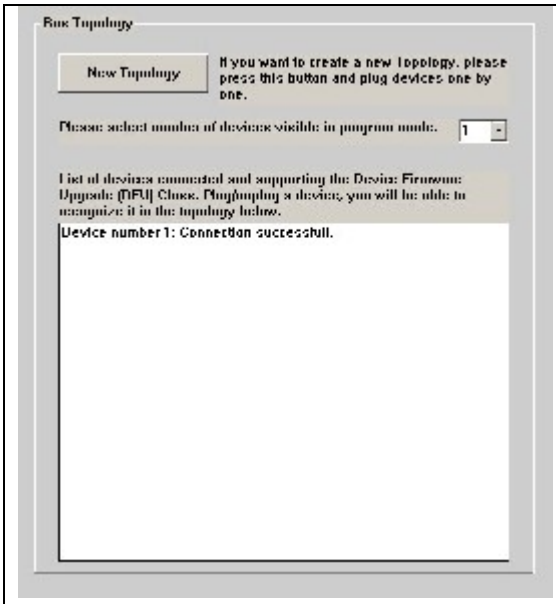


Select number of devices visible

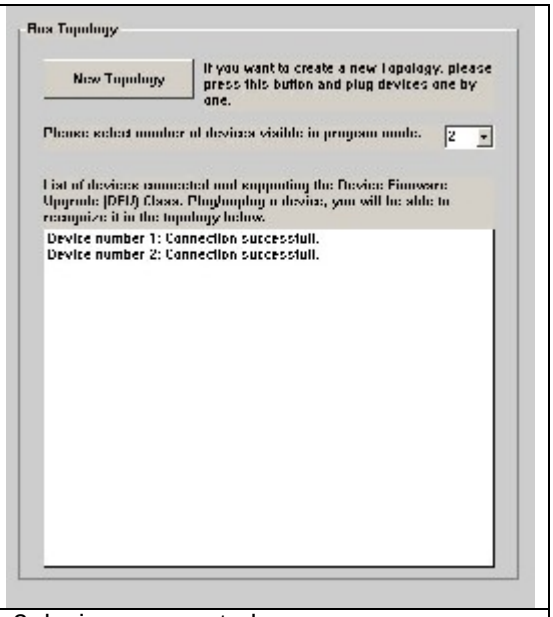
5.1.3.3 Device Listing box

To configure the bus topology, you have to do the following:

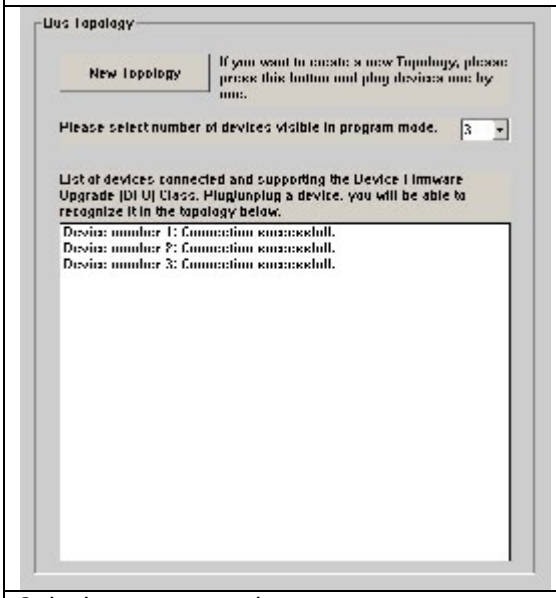
- User connects a device to the USB port with “user-number” 1. A message is displayed in the list box which says “***Device number 1: Connection Successful***”
- User connects a device to the USB port with “user-number” 2: A message is displayed in the list box which says “***Device number 2: Connection Successful***”



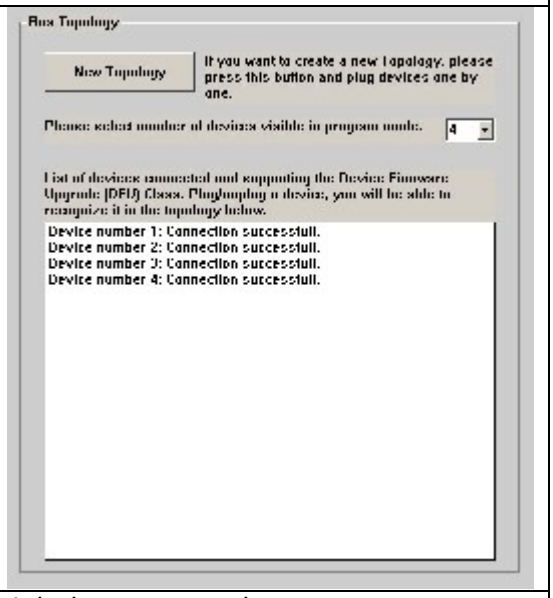
1 device connected



2 devices connected



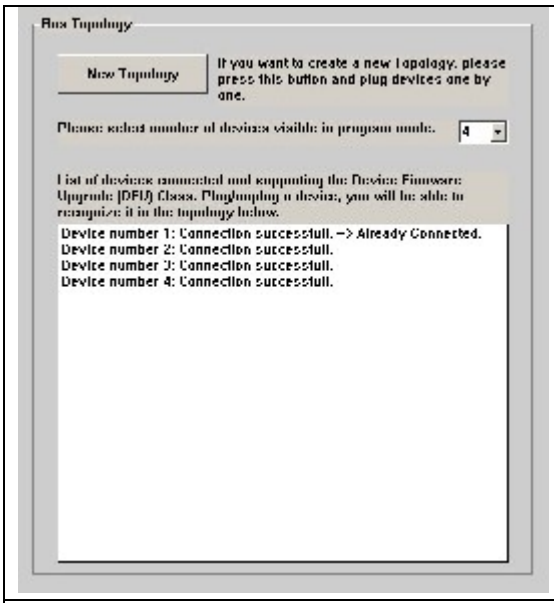
3 devices connected



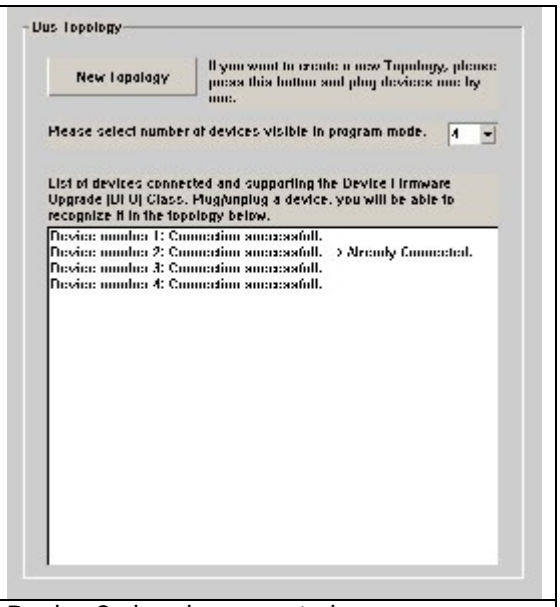
4 devices connected

- User is notified if a device is connected to a port that has already been used during the current set-up session. (See figure)

Note: The number of devices visible is also updated for each new device that is connected.



Device 1 already connected



Device 2 already connected

5.2 Firmware File Selection

The second part is the firmware selection. This is the file that will be programmed to the devices in the Program Mode.

5.2.1 GUI Object Description

The Firmware selection menu has the following items:

- A drop down box of previous selected files.
- A button to select a file from the hard drive.

Graphical Objects of the Firmware Selection

The above figure shows the state when the application is started for the first time on that location (so there is no storage present).

In this state it is impossible to switch to program mode. A **firmware file must be selected** to continue. A warning is given (see figure).

Firmware Selection Warning

5.2.2 HostCryptv2 Utility

The firmware file has to be in a specific *.ebn format. A DOS utility is provided (that runs from a Command prompt) which can convert binary files to *.ebn formats. Usually, ARM compilers would compile a project into an AXF file or an ELF file. ARM Compilers will always have an option of generating a Binary file for the project. Using this option, a binary file can be generated and then used with this utility.

The command for executing this utility is as follows:

hostcryptv2 <filename>.bin <filename>.ebn –K0 –F0

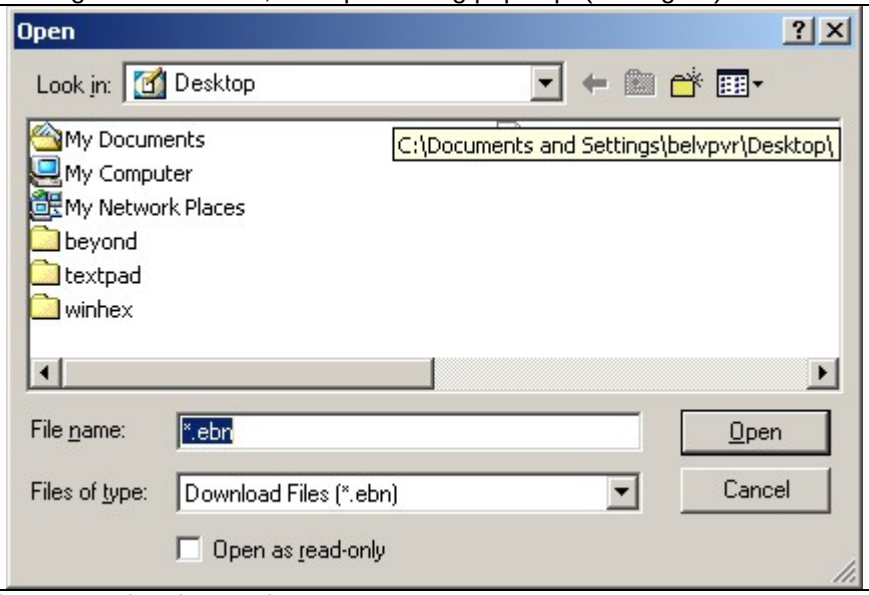
Here is a snapshot showing how this could be done (blinky.bin is the input file in this case):

```
C:\2800>hostcryptv2 blinky.bin test1.ebn -K0 -F0

HOSTCRYPT PS1.2

This version does not place a limitation on image size.

WARNING: Images created with this version are not compatible with
the ROM DFU.

Copyright (C) Philips Semiconductors 2002

Encrypted Image created from blinky.bin and written to test1.ebn

Key table index:        0

Flash sector offset:    0

Computed CRC:           a6e432d0

128 bit key:            91ec6c69 eacee0d0 6972503a f69228bf

C:\2800>
```

Please ignore the warning at this point. It will not affect the creation of the ebn file in any way.

5.2.3 File Selection (*.ebn) by using a button

When pressing the "…" button, the Open dialog pops up. (See figure).



Select firmware using the "…" button

Select the *.ebn file that you wish to load. Once selected, the following window appears. Please ignore this warning (press OK) and continue.

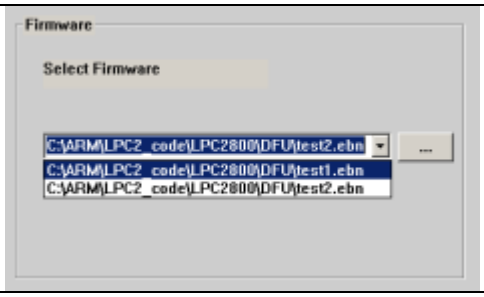
A sample file is shown in the dropdown box and the file is ready to be loaded into memory.

Firmware file is selected

5.2.4 File Selection by drop down box

If you press the down arrow at the right side of the dropdown box, the lists of previous selected firmware files are displayed.

When you click on an item in the list, the file will be loaded and the same warnings will be displayed as in the loading of the file during the press with the "…" button.



Firmware file selection by drop down box

5.2.5 File does not exist

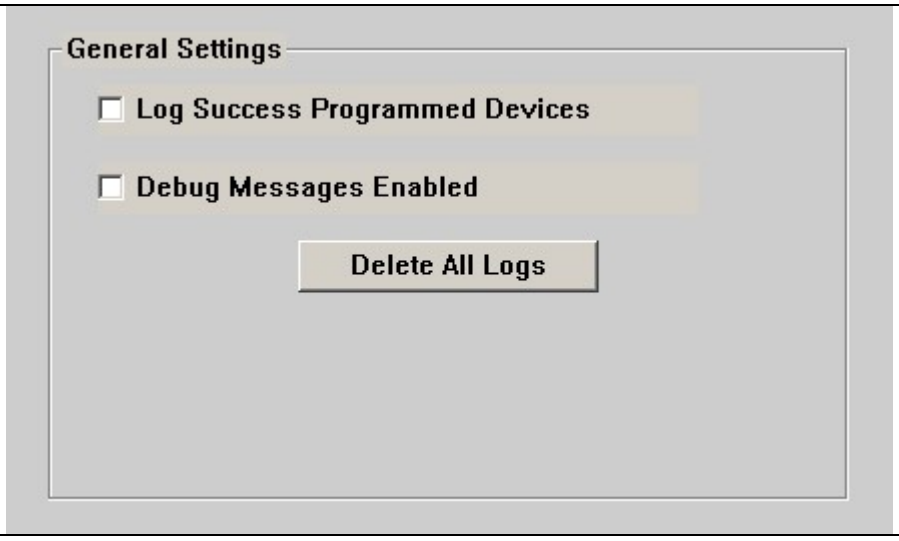
When a file that was selected in the drop down list of firmware files not exist anymore, another file in the list will be loaded. If none of the files exits, no file will be loaded and the "start automatic programming" will not start because of a valid firmware file does not exist.

5.3 General Settings

5.3.1 GUI Objects Description

The General Settings section has the following items:

- 2 check boxes to enable/disable
- 1 button

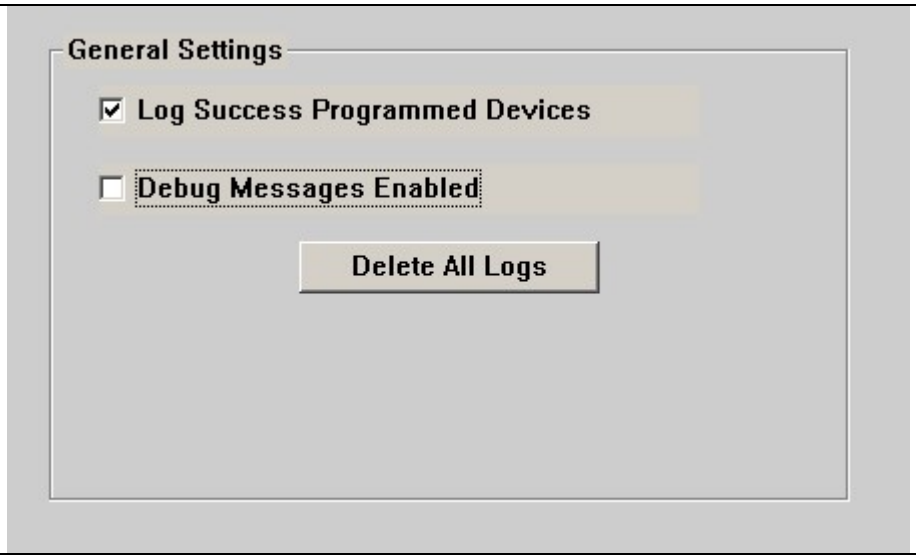


Options

The figure shows the state when the application is started for the first time on that location (so there is no storage present).

5.3.2 Log Success Programmed Devices

As described in the Program Mode, all connected devices that have errors will be written to disk in the “MassLog” directory structure. By checking this option all the successfully programmed devices will be logged.

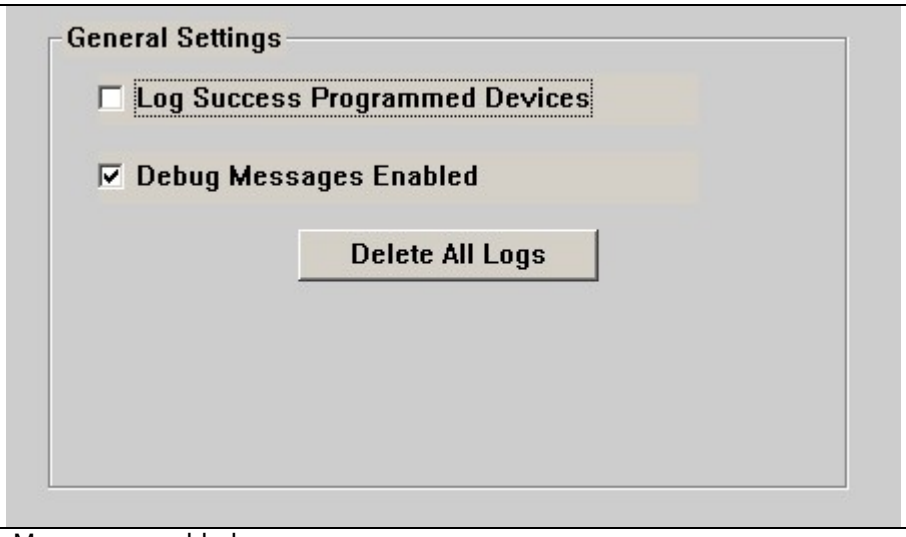


Log Success Programmed Devices enabled

5.3.3 Debug Messages Enabled

To get more information in the Program Mode regarding programming of the devices, this option will give all debug information messages that are received from the lower “DFU Protocol” library.

This is only used for debug purpose or information point of view.



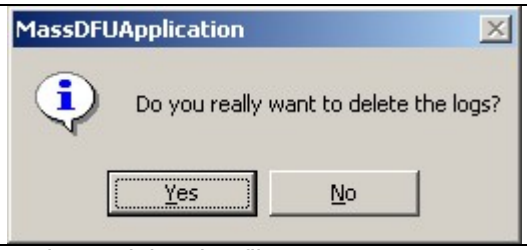
Debug Messages enabled

Note: Do not check this option when you want to program a lot of devices simultaneously. You will not be able to read anything anymore in the log box in the Program Mode.

5.3.4 Delete All Logs

This button will delete all log files in the “MassLog” structure, except the ones that are open at this moment. The device log files and the log files of the application will be deleted.

A Warning is given if you are sure to delete the log files (see figure). After the deletion a message is given that the deletion has been ended (see figure).



Warning to delete log files

Deletion is completed

5.4 Exiting from Setup Menu without correct setup

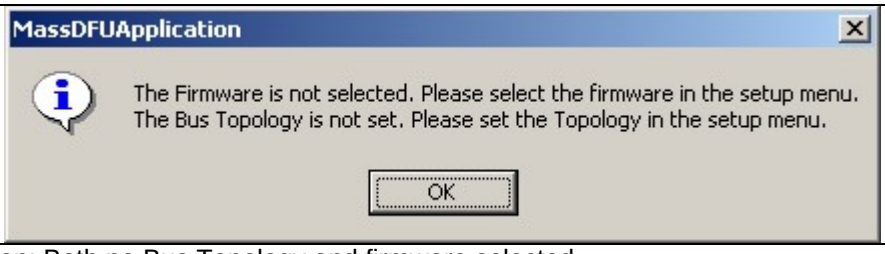
You can exit the Setup Mode at anytime. Some warnings are given but they will not block the user to exit the application. The current setup configuration will be stored in the persistent storage.

The following warnings are given under the following conditions:

Condition: No Bus Topology Selected

Condition: No Firmware Selected

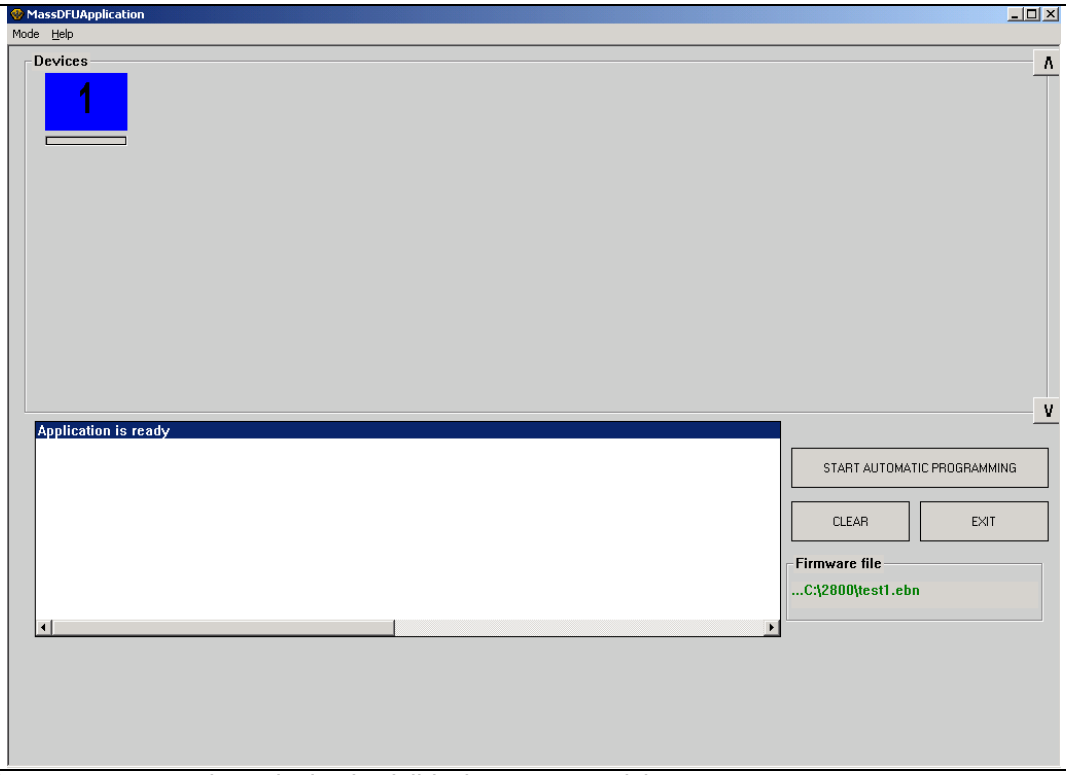
If both are not selected, the following message is given.



Condition: Both no Bus Topology and firmware selected

5.5 Switch to Program Menu

The Program mode will be displayed and it shows the number of devices that have been selected for programming (in blue).



Setup mode to Program Mode: 1 device is visible (Program Mode)

Message "***Application is ready***" is printed in the message box when the application is ready.

6. Program Mode Sub Menu

6.1 General Description

The Program Mode is the start-up mode of the application by default. In this mode devices are programmed in an automatic way. After configuring the Setup Mode settings (see Setup Mode), the devices are visible in the program mode.

By plugging in the devices, the devices are detected and the device number will change from white to blue. When the “Start Automatic Programming” button is pressed, all connected devices will start to be programmed. The progress is indicated and the color of the device number is yellow during programming. If the device is programmed successfully at the end, the device number will change to green, otherwise it would be red. When automatic programming is enabled, the user has only to unplug the finished devices and plug in a new device. The new device will be programmed immediately.
This is the general way of working. All the special cases will be taken in to account in the next paragraphs.

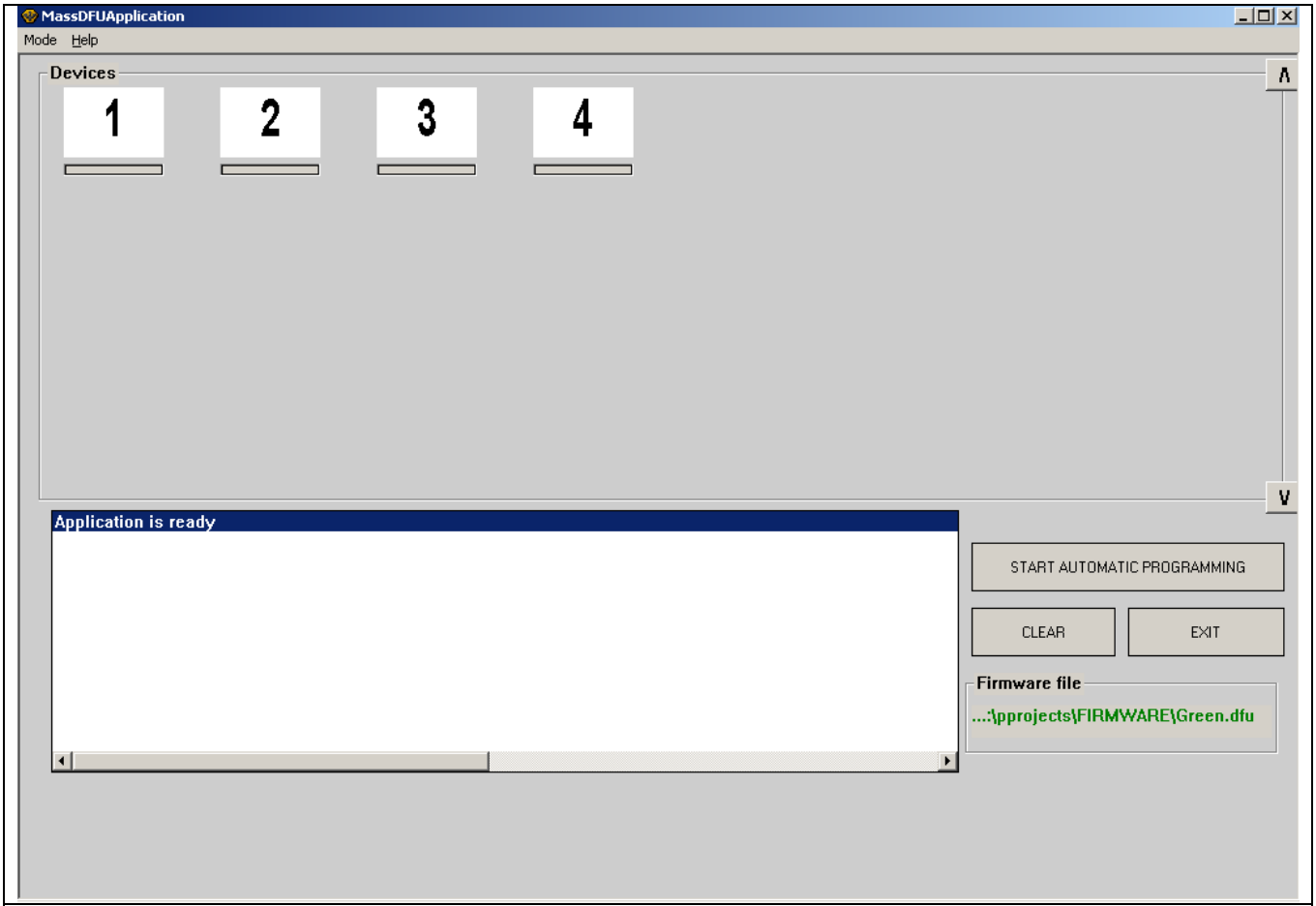
For color explanation, see the color legend.

6.2 GUI Object Description

The Program Mode consist of the following items:

- Message box
  - Contains user messages of the application and the devices.
- Start button
  - Button to start and stop automatic programming
- Exit button
  - Exit the application
- Device number and progress bar
  - This is available per device and there is a device number box with a colour and a progress bar. The colour indicates in what state the device is and the progress bar indicates during programming the progress of the firmware download.
- 2 small buttons at the right side of the devices screen
  - These buttons move up or down one row of devices if more devices in the topology are configured then there are possible to see on the screen (depends on the screen resolution). These buttons have no effect when all the devices are visible on screen.

For color explanation, see the color legend.



The Graphical Objects: when 4 devices are visible and unplugged

6.3 Start Automatic Programming

Precondition: A USB Bus topology (at least 1 device) and firmware must be selected before starting the programming (see Setup Mode). The warnings from Section 5.4 are given when either the topology, either the firmware or both are not selected.

When the button “Start Automatic Programming” button is pressed, the devices will do the following:

- Blue devices will be started programming and become yellow.
- Red and green devices will be stay in their mode
- White: no device is connected and nothing will happen.

Message: “***Start Automatic Programming***” is printed in the message box.

Remark: only the devices that are visible in the Program mode will be programmed. All other devices that are connected but not visible in the Program Mode will not be programmed.

At the end, a yellow device number becomes either:

- **Green:**

  Device has been programmed successfully.
  Message: "***Device Number <nb> has been programmed successfully. Please remove the device.***" Is printed in the message box, with <nb> is the device number.

- **Red:**

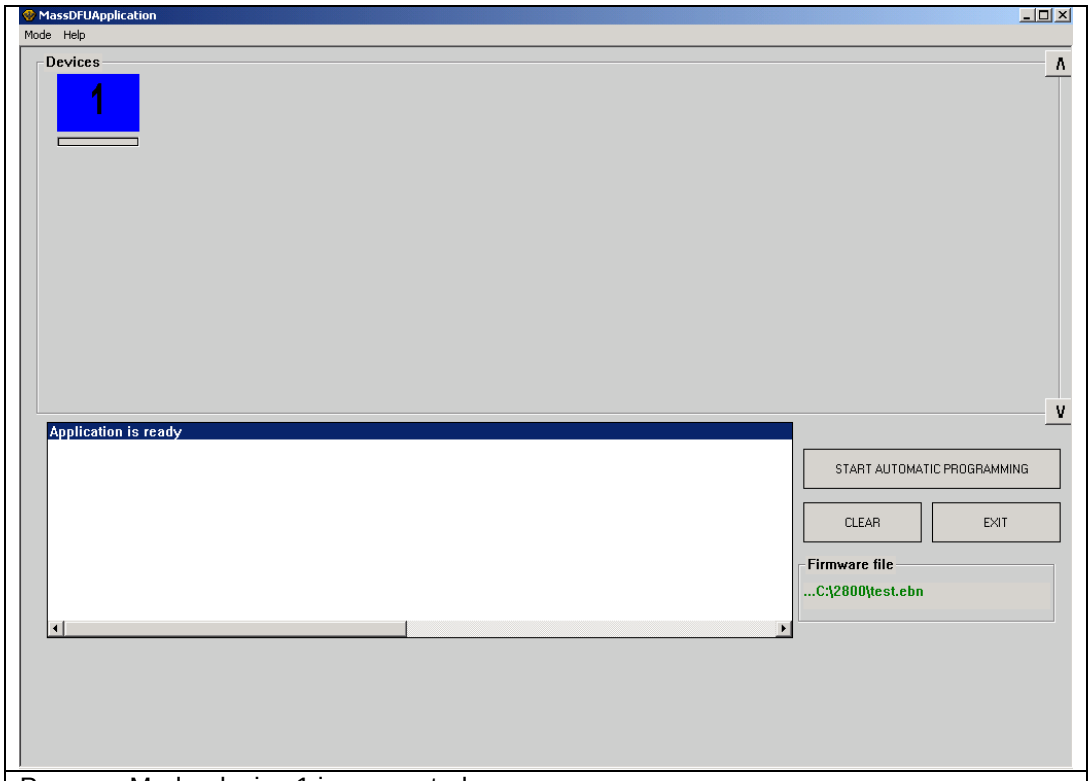
  Device has some errors.

  Message: "***Device Number <nb> has errors. Please disconnect the device. Look for information in <file>***" is printed in the message box, with <nb> is the device number and <file> is the file path + file name of the device log file.

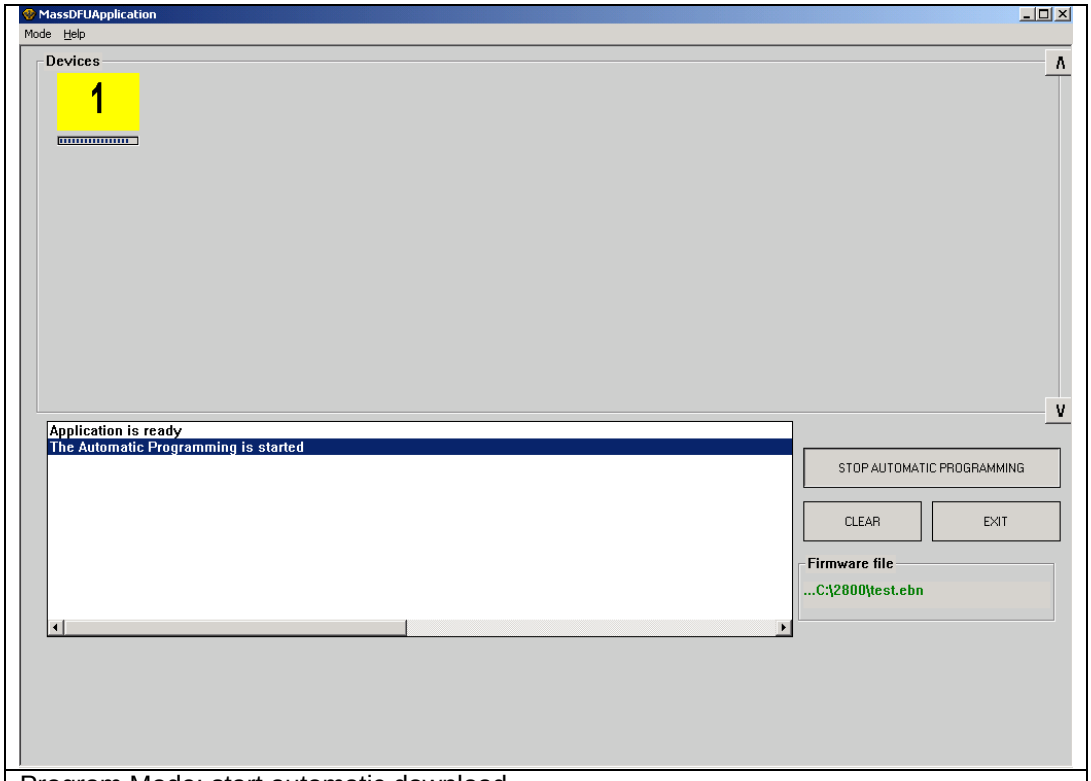
If during the programming the user unplugs the device, the device number will become white again (no device plugged).

Message: "***Device Number <nb> unplugged while downloading. Look for information in <file>.***" Is printed in the message box with <nb> is the number of the device and <file> is the file path + file name of the device log file.

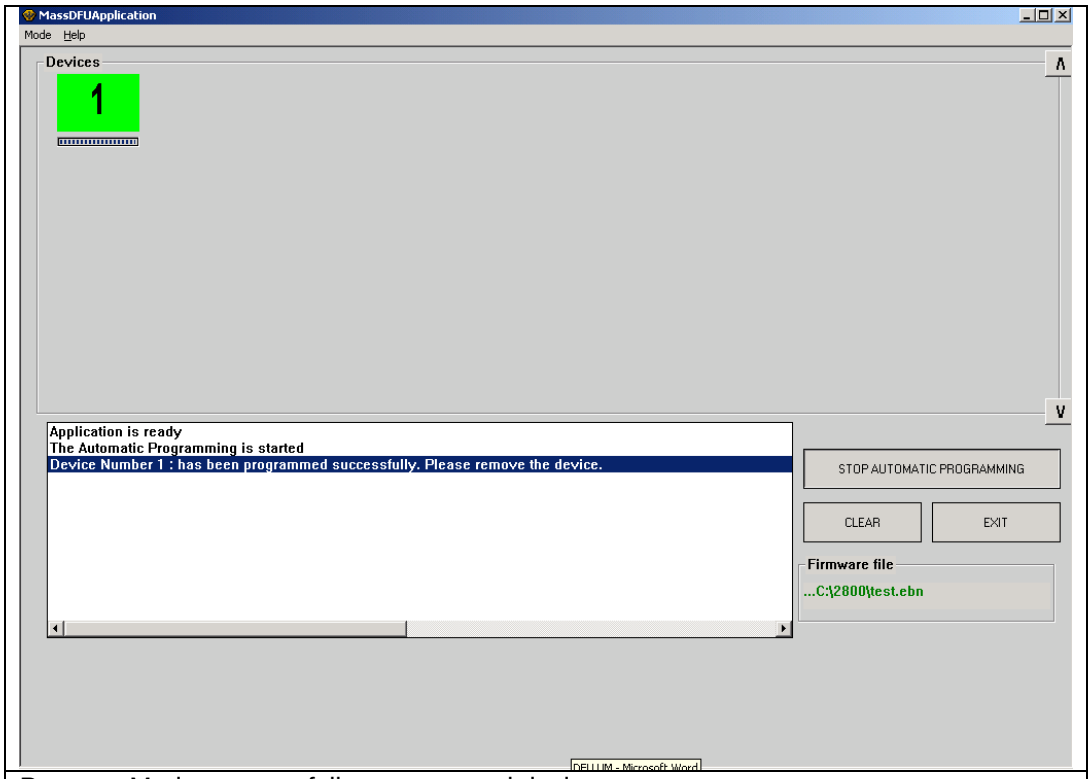
Automatic Programming Example:
The bus topology has only one device selected for programming in setup mode.



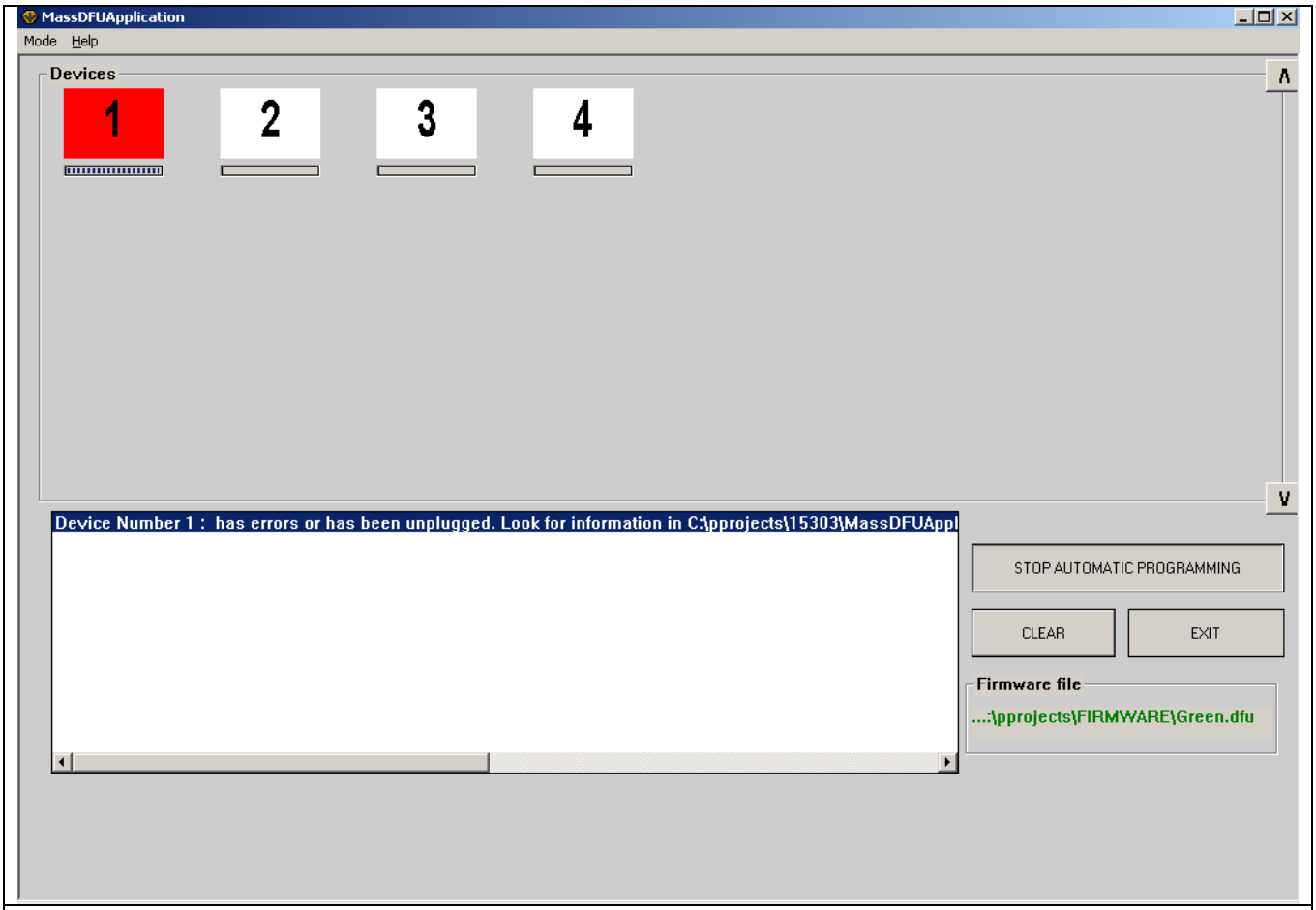
Program Mode: device 1 is connected



Program Mode: start automatic download



Program Mode: successfully programmed device



Program Mode: If the device has some errors

6.4 Stop Automatic Programming

At any moment, the user can stop the automatic programming by pressing the “Stop Automatic Programming” button. Result for the devices:

- Red devices: will stay red and stay in error.
- Green devices are programmed successfully and stay green
- Yellow devices will become blue, means that they wait to be programmed again.
- Blue devices will stay blue (this is a transient state because they will directly start programming).
- White devices (no device connected) will stay the same.

Message: “***Stop Automatic Programming***” is printed in the message box.

6.5 Other Commands

6.5.1 Clear Message Box

To clear the message box, press the “CLEAR” button.

6.5.2 Exit from Program Mode

When pressing the “Exit” button, the application will be closed.

6.6 Special Cases

6.6.1 Trying to stop Automatic Programming

When the automatic download is enabled, a warning is shown:

Figure 5: Warning to stop automatic programming

When “Cancel”, return without any actions.
When ”OK”, continue closing the application.

6.6.2 Trying to program wrong devices

Disconnect all devices software wise. The user does not have to do anything except when a device cannot be disconnected software wise. The user receives a message to manually disconnect the device with device number <nb> (<nb> is device number).

Figure 6: Warning to manually disconnect error devices

6.7 Log File Structure

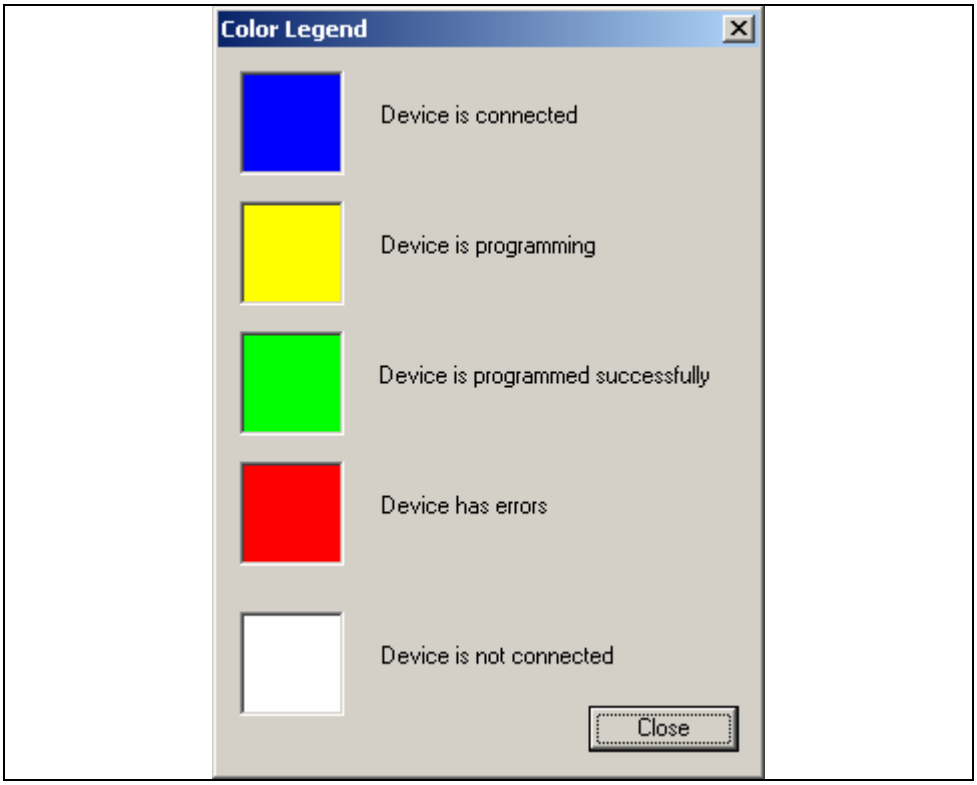
There are 2 kinds of log files:

- Device log file: Contains all the debug information about the programming of a specific device at a specific time (time stamp given is at the end of the programming)
- Application log file: Contains the general logging of the application as what is shown in the message box in the program mode (time stamp given is at the start of the application).

The log file structure is generated at the same location where the executable is located.

7. Color Legend Sub Menu

The different colors used in the Program Mode are explained briefly in this dialog box.



8. Statistics Sub Menu

Statistics about the program mode has been held per application session. Closing the application, re-opening the application will clear the statistic values.
The statistics are described in next table:

Statistic Value	Description
Number of currently connected devices	The devices that are connected at this moment
Total number of devices that has been programmed successfully	Number of all devices that had been programmed successfully from the start of the application.
Total number of devices that has been programmed with errors	Number of all devices that had been programmed with errors from the start of the application.

Statistics dialog

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10. Contents

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