

# AN10498

## LPC952 debugging/programming using the debug interface

Rev. 01 — 20 July 2006

Application note

### Document information

Info	Content
<b>Keywords</b>	P89LPC952, microcontrollers, Flash programming, debugging.
<b>Abstract</b>	This appnote describes how to use the 2-wire debug interface on the LPC952 for programming and emulation. The LPC952 is programmed on an MCB950 development board using the FS2 System Navigator debugger. The information that is needed to accomplish the programming and debugging are described step by step in detail in this appnote.

**Revision history**

Rev	Date	Description
01	20060720	Initial revision

**Contact information**

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## 1. Introduction

The P89LPC952 is a microcontroller with on-board flash and a 2-wire debugging interface. The 2-wire debug interface can both be used to program and debug the application that the microcontroller is used in. This application note will describe in detail how to use the development tools to program the internal program Flash memory, and how to debug the application using the same development tools.

## 2. Development tools for the LPC952

This section describes different tools that are available for the development for the LPC952.

These tools include:

1. MCB950 Development board; Hardware
2. FS2 System Navigator 2-wire debugger; Hardware
3. Keil  $\mu$ Vision 3 IDE (Integrated Development Environment); Software

### 2.1 MCB950 development board

The MCB950 is a low cost development board for the LPC952 microcontroller. The LPC952 can enter debug mode on this board using the FS2 System Navigator for emulation.

Either the FS2 System Navigator or the FlashMagic ISP software can program the LPC952 microcontroller on the MCB950 development board.

Fig 1 shows the MCB950 development board.



Fig 1. MCB950 development board

## 2.2 FS2 system navigator

The FS2 System Navigator is the 2 wire debugger that can be used for emulation on the LPC952. The FS2 System Navigator is also capable of programming the internal Flash memory of the LPC952.

The latest firmware for the FS2 System Navigator can be downloaded from:

[http://www.semiconductors.philips.com/fs2\\_sysnav\\_firmware](http://www.semiconductors.philips.com/fs2_sysnav_firmware)

Follow the software installation procedure provided by FS2.

Fig 2 shows the FS2 System Navigator.



Fig 2. FS2 System Navigator

## 2.3 Keil's $\mu$ Vision 3 IDE

The MCB950 comes with a CD that contains the LPC Development Studio version of the  $\mu$ Vision 3 IDE. The latest version of the LPC Development Studio can be downloaded from: [http://www.semiconductors.philips.com/keil\\_LPCdevstudio](http://www.semiconductors.philips.com/keil_LPCdevstudio)

$\mu$ Vision 3 will be the IDE used for both the programming and the debugging of the LPC952.

# 3. Programming the LPC952 using the FS2 system navigator

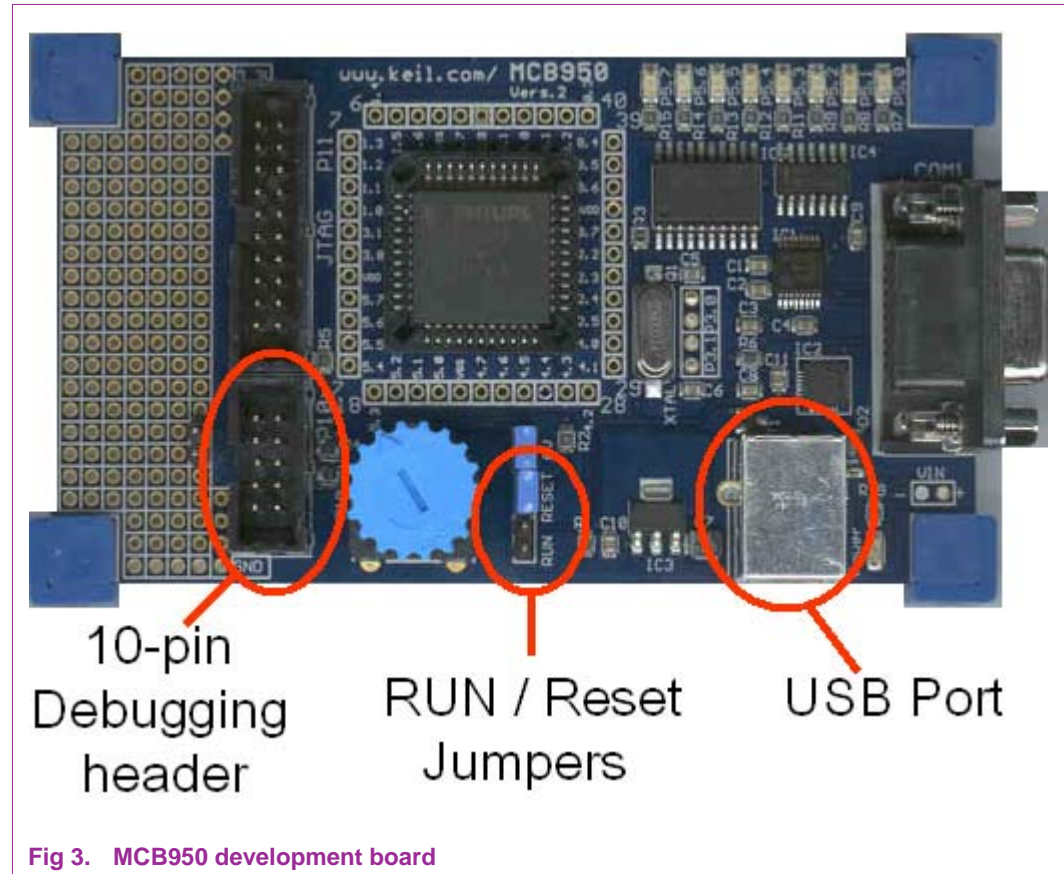
In section 2.2 the FS2 System Navigator and the software installation for this tool was described.

In this section we will look at how to use the System Navigator and the  $\mu$ Vision 3 IDE to program the Flash memory of the LPC952 on the MCB950.

## 3.1 Hooking up the system navigator to the MCB950

The power for the MCB950 is supplied through the USB cable. The System Navigator can be hooked up to the 10-pin connector on the MCB950. Make sure the Jumper on the MCB is in the RUN position.

Fig 3 shows the MCB950 development board.



### 3.1.1 System navigator set-up

The System Navigator can be set-up with the Console program that is included with the System Navigator software.

Start up the System Navigator Console (with Connect Dialog). You should get a window as in Fig 4.

Click the following radio buttons:

- SysNav
- USB
- FS2DI

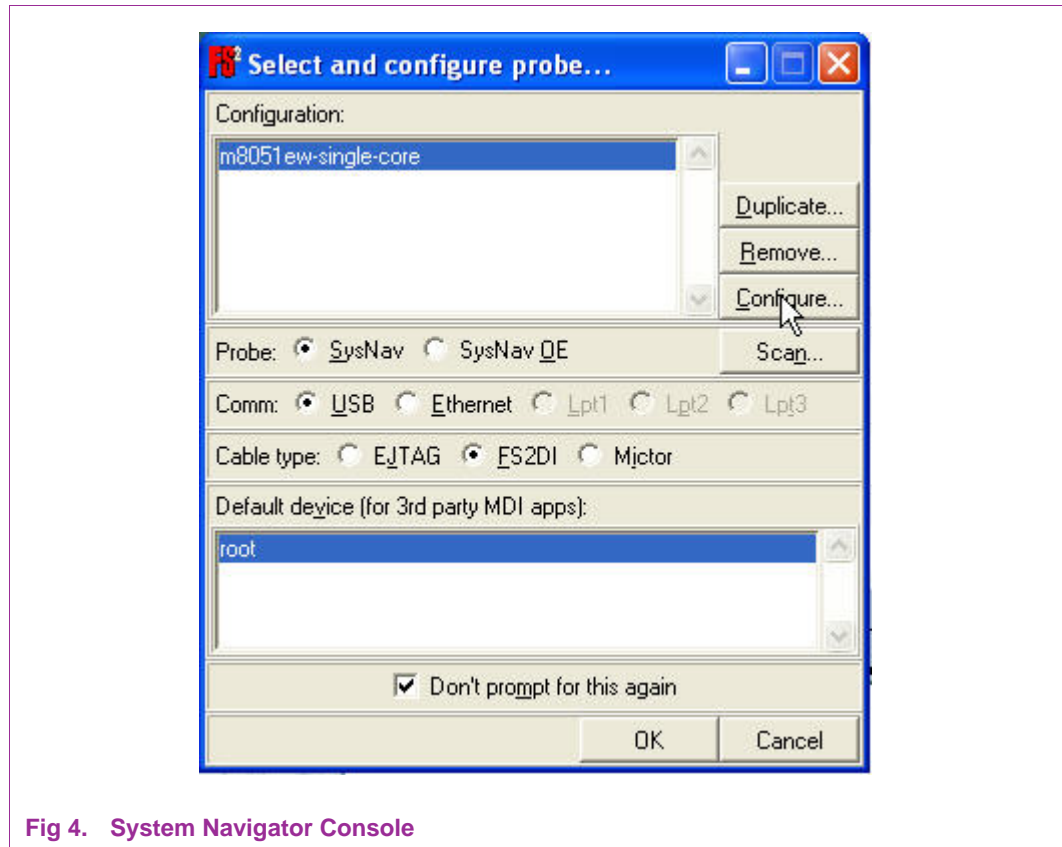


Fig 4. System Navigator Console

Next go to the Configure window in the System Navigator Console. In the Configure window make sure the following settings are made in the window:

- Tck Rate is set to 1000000
- ResetDuration is set to 100
- ResetAsserted is set to low
- ResetNegated is set to off

The settings in the Configure window are shown in Fig 5.

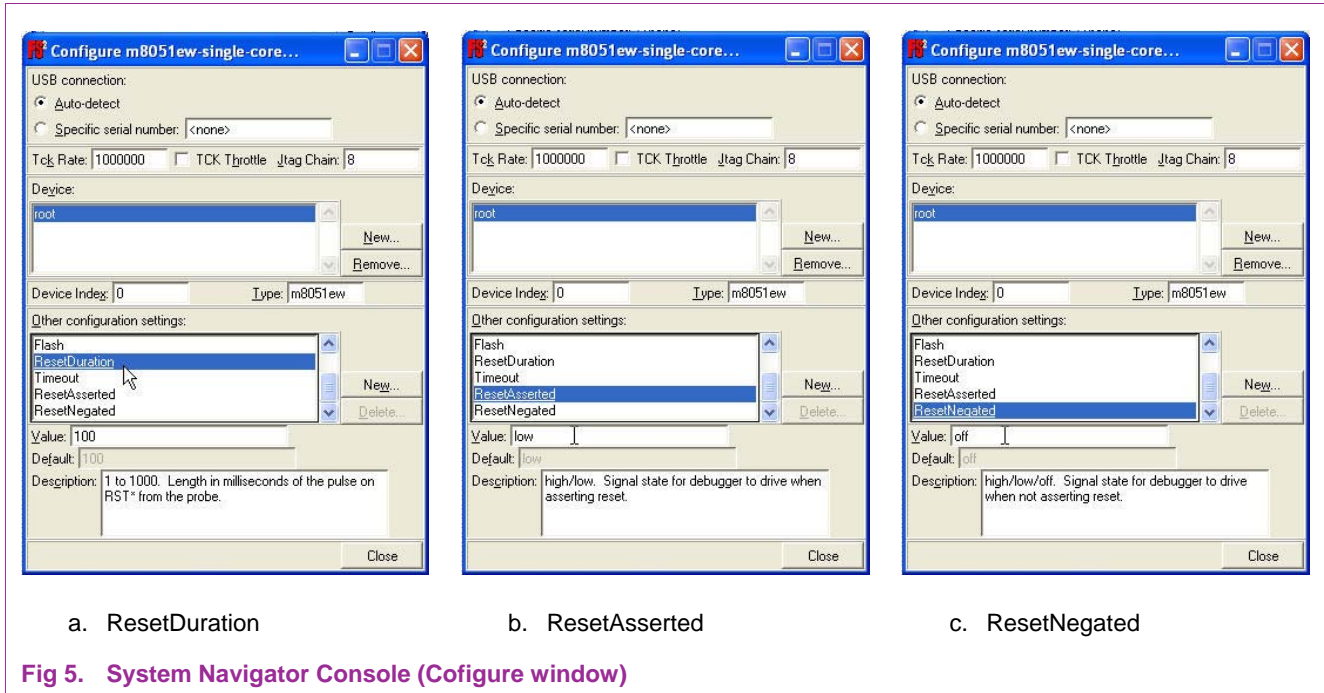


Fig 5. System Navigator Console (Cofigure window)

### 3.1.2 Testing the set-up

After the System Navigator is set-up the console window will open. From this console a variety of commands can be used. All the different commands for the System Navigator are described in the FS2 Getting Started manual. For the purposes of this appnote we will just use 1 command to test the communication between the LPC952 microcontroller and the System Navigator.

In the System Navigator Console type the "Status" command. The Console will display the OCI version of the LPC952 device. The correct OCI version for the LPC952 microcontroller is 0xF2.

Fig 6 shows the System Navigator Console return the correct OCI version.

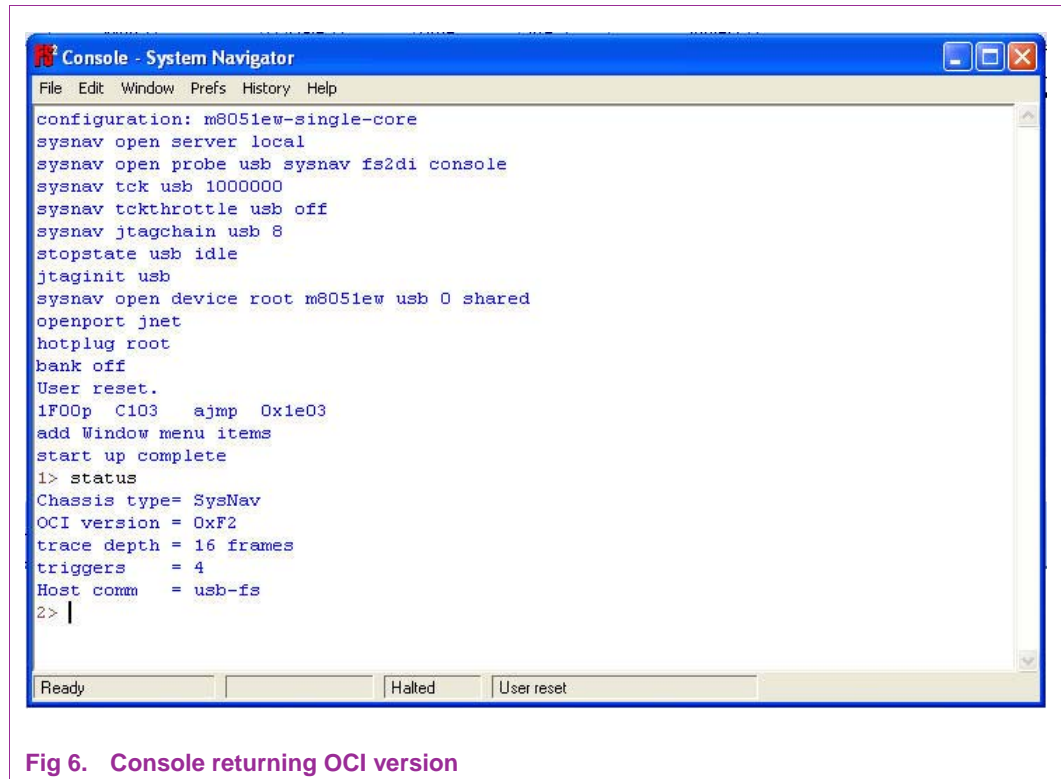


Fig 6. Console returning OCI version

If an error occurs check that the USB is powering the MCB950 board, the Power light should be on.

Check if the RUN / Reset jumper is set on the RUN position.

## 3.2 Using $\mu$ Vision3 to program the LPC952

The  $\mu$ Vision3 IDE can interface to the FS2 System Navigator Console software. This way the LPC952 can be programmed through the same IDE as the code / firmware for the LPC952 is developed in.

### 3.2.1 Setting up $\mu$ Vision3 to use the FS2 System Navigator as Programmer

Open  $\mu$ Vision 3, open the project that you would like to program / debug using the System Navigator. If you don't have a project the P5\_Blinky example, that is include in the ZIP file with this appnote, can be used.

Go to options for Target select the Utilities tab. From the list of "Target Driver for Flash Programming" select the FS2/Keil M8051E Driver. The selection of the driver is shown in Fig 7.



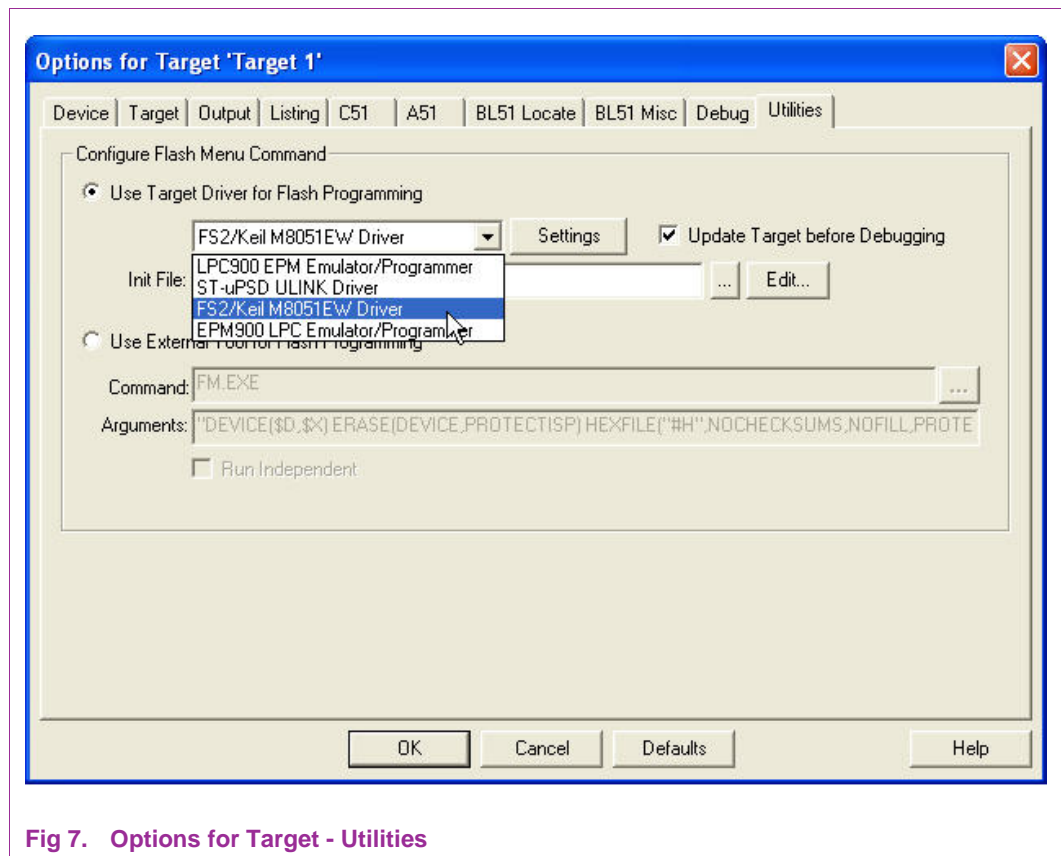


Fig 7. Options for Target - Utilities

Go to the Settings of the target driver and make sure the following are set-up

- Erase is selected
- Program is selected
- Verify is selected
- Protect ISP is selected
- Write configuration

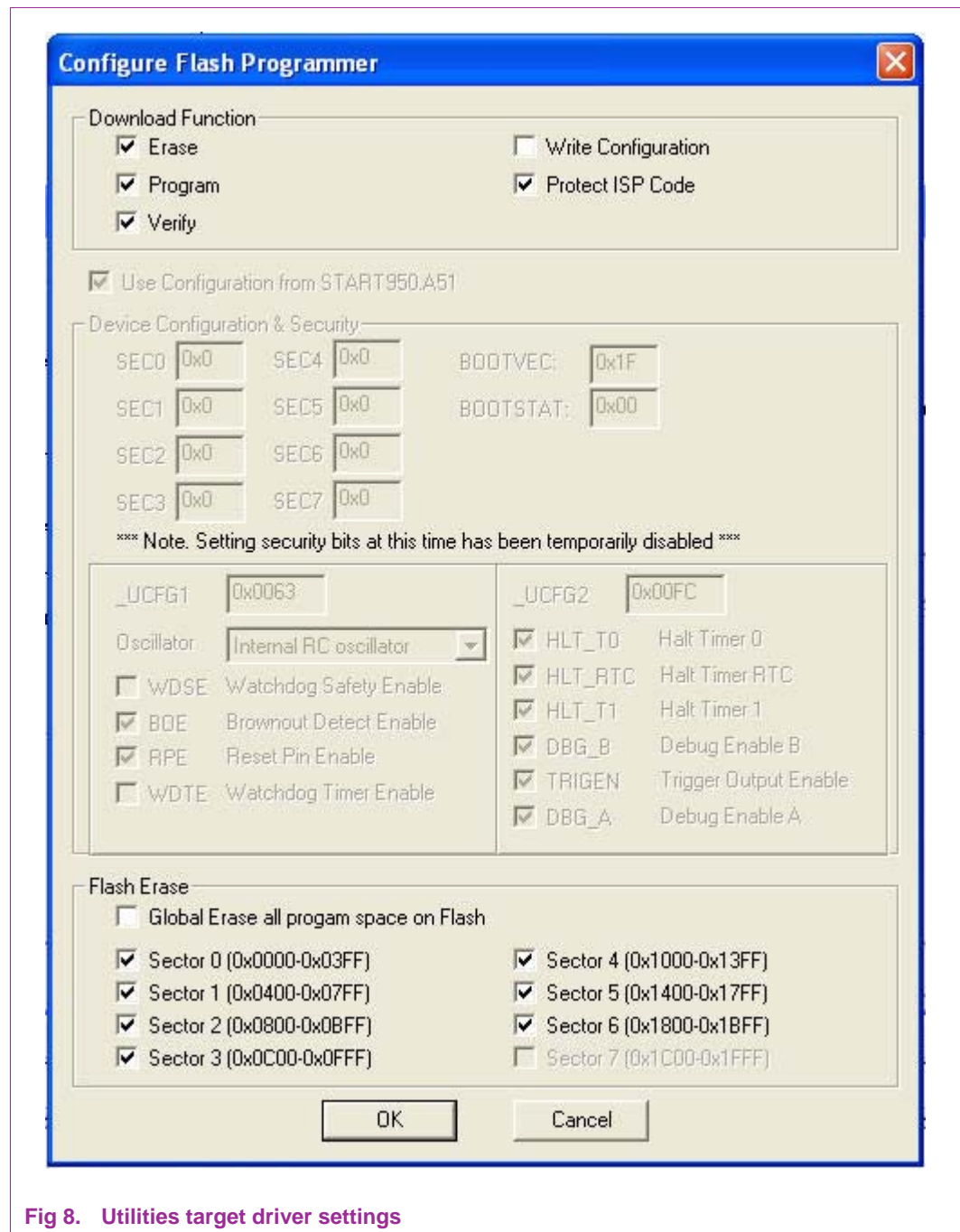


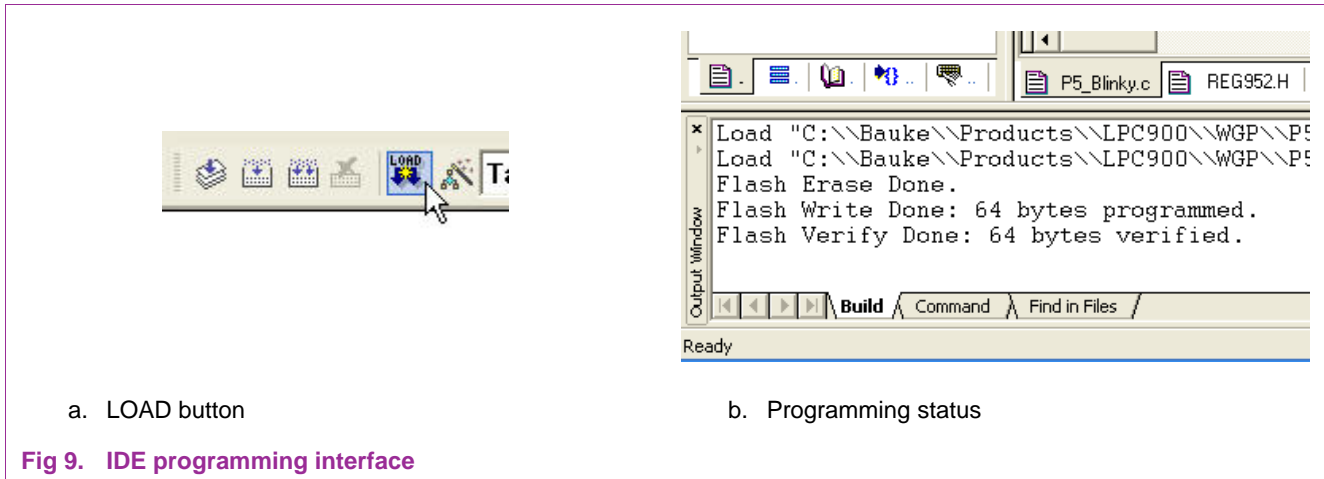
Fig 8. Utilities target driver settings

### 3.2.2 Programming the LPC952

Once the  $\mu$ Vision IDE is set up to use the System Navigator it is quite easy to program an LPC952 device.

The  $\mu$ Vision IDE has a LOAD shortcut button that will program the selected target with the selected target driver settings. Once the LOAD button is pressed  $\mu$ Vision 3 will open a System Navigator Console and send the correct commands through the console to the LPC952 microcontroller for erasing, programming and verifying.

Fig 9 shows the LOAD button, and the IDE status



## 4. Debugging the LPC952 using the FS2 System Navigator

This section describes how the System Navigator can be used to debug the LPC952 in an application target. How to interface the debugger to the  $\mu$ Vision IDE will also be shown.

### 4.1 Setting up $\mu$ Vision3 to use the FS2 System Navigator as Programmer

Setting up the System Navigator as a debugger should be quite easy if you have followed the previous steps with programming the LPC952 with the System Navigator.

Open  $\mu$ Vision 3, open the project that you would like to program / debug using the System Navigator. If you don't have a project the P5\_Blinky example, that is include in the ZIP file with this appnote, can be used.

Go to options for Target; select the Debug tab. Select to use the FS2/Keil M8051E Driver. The selection of the driver is shown in Fig 10.

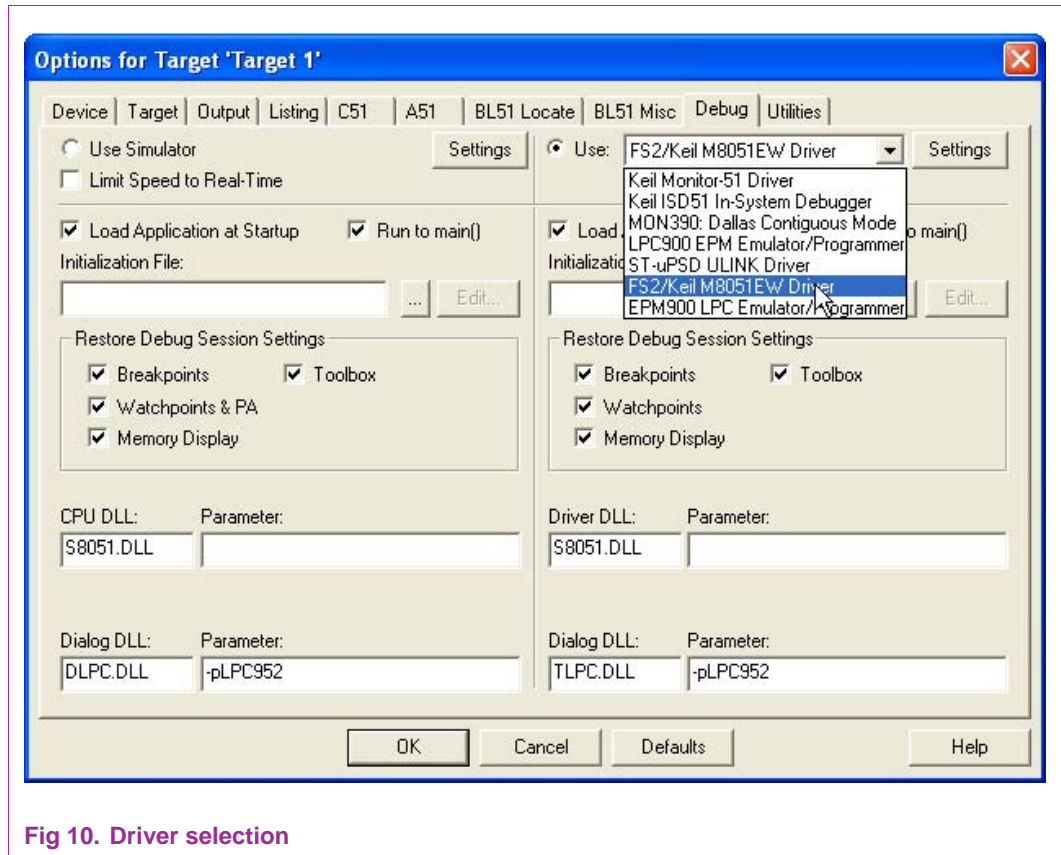


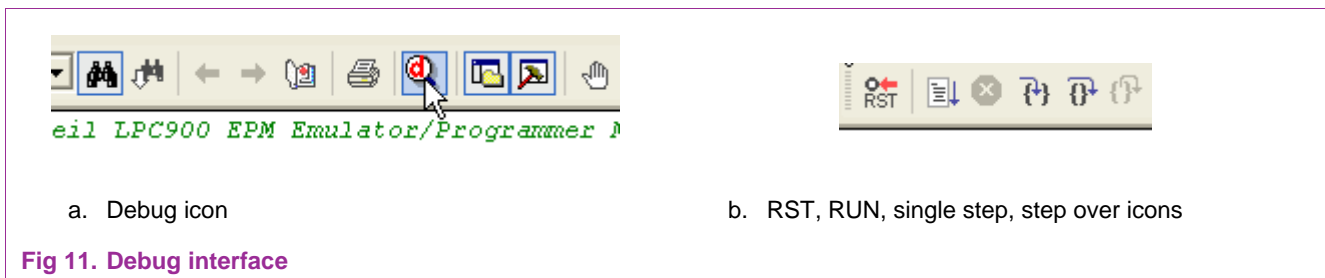
Fig 10. Driver selection

In the settings window the FS2 System Navigator Console will be opened and the same settings as described in section 3.1 can be used.

### 4.2 Entering debug mode

Once the debugger is set-up correctly the device has to be programmed with the code from the project you would like to debug. The steps that are shown in section 3 cover programming. Once the programming is set-up the LOAD button from the µVision 3 IDE can be used to program the code from the latest build of the open project.

Now clicking on the debug icon can enter debug-mode. Fig 11 shows some debug icons.



a. Debug icon

b. RST, RUN, single step, step over icons

Fig 11. Debug interface

Once in debug-mode, double clicking on a code line can set breakpoints. Fig 12 shows a breakpoint in the C code. The yellow cursor indicates where the program counter is currently pointing in the code.

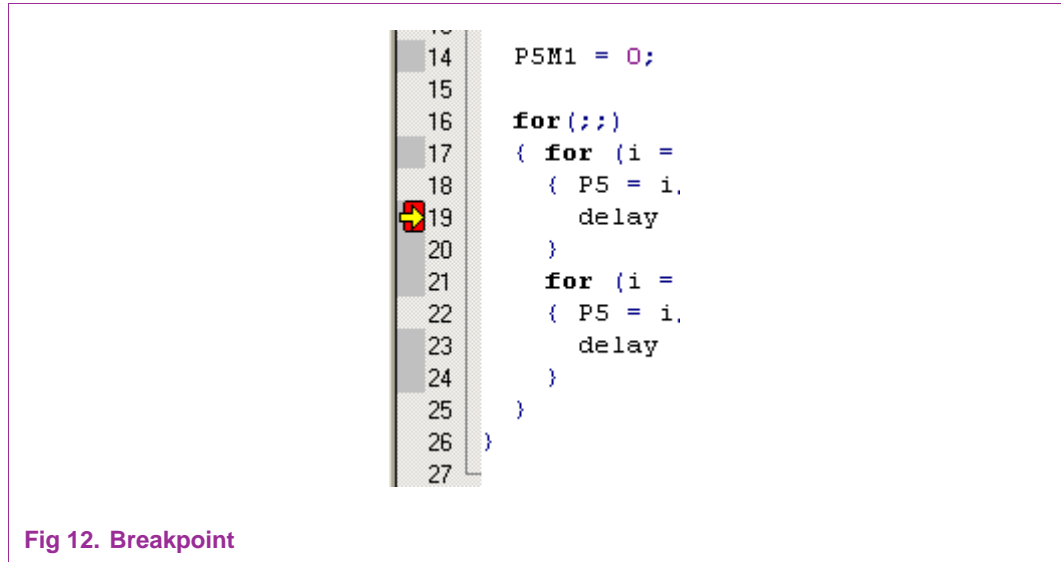


Fig 12. Breakpoint

The µVision IDE can also be used to display a memory window. Fig 13 shows a memory window of the on-chip data RAM.

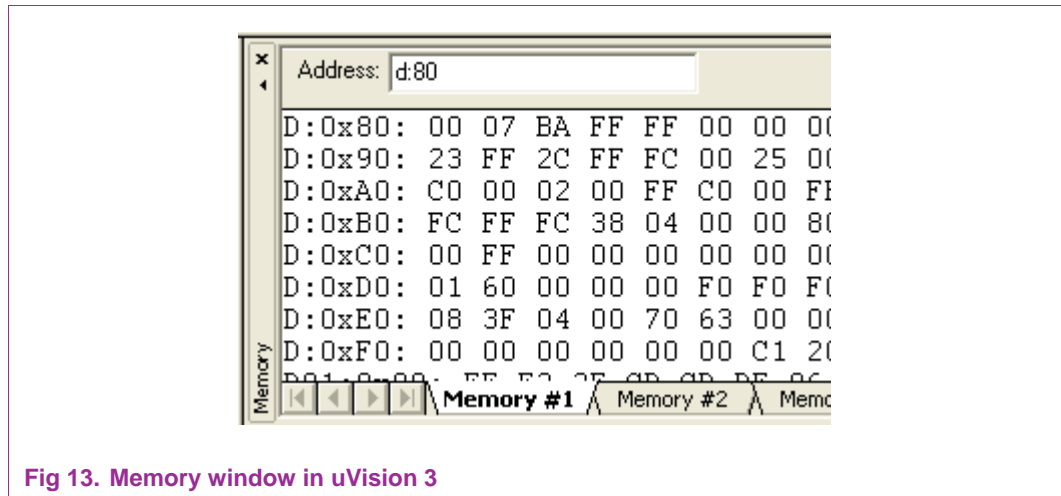


Fig 13. Memory window in uVision 3

## 5. Conclusion

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In this appnote the detailed steps have been described how to program and debug the LPC952 microcontroller with the FS2 System Navigator and the  $\mu$ Vision 3 IDE. This knowledge can be used to program and debug LPC952 applications in the end target instead of on the MCB950 development board.

If the provisions for debugging have been made on the target board, this set-up can even be used out in the field if a problem occurs. The same debugger can be hooked up to a target board to debug the actual system and conditions that cause a failure.

If the firmware of the LPC952 needs to be updated in the field the LPC952 can be used to reprogram the LPC952 if needed.

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