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Debugging nRF24EX/nRF9E5 programs using the Keil µVision2 debugger

1. INTRODUCTION

This paper describes how to set up and debug the nRF24EX and nRF9E5 using the Keil ISD51 in-system debug monitor and µVision2 debugger. It should be read together with the ISD51 User's Guide included with your Keil PK51 installation.

The ISD51 in-system debug monitor supports three kinds of breakpoints; software, hardware and flash breakpoints. Hardware breakpoints require special hardware not available on the nRF24EX/nRF9E5 and will not be discussed in this paper. **Please note that if you want to debug your application at full speed you need to use flash breakpoints as discussed in the section "FLASH BREAKPOINTS" below. This is true even with nRF24EX/nRF9E5 that do not have flash.**

2. REQUIREMENTS

First you will need the **Keil PK51 Professional Developer's Kit V7.08** or higher. Next, you need 500-700 bytes of free program memory and the nRF24EX/ nRF9E5 serial port connected to your PC.

3. SETUP

Assuming you already have an nRF24EX/nRF9E5 project loaded in µVision2 follow these steps to start debugging your application

1. Add the ISD51.H and ISD51.A51 files to your project. These files can be found in the C51\ISD51 folder under your Keil installation.
2. Setup the µVision2 debugger to use the ISD51 protocol: On the µVision2 menu select Project->Options for target 'your project'->Debug and select "KEIL ISD51 In-System Debugger" in the drop down box to the right and click "use:" to the left of it.
3. Check the "Load Application at Startup" box.
4. Setup the µVision2 debugger to communicate at the same BAUD rate as the nRF24E1: On the µVision2 menu select Project->Options for target 'your project'->Debug->Settings to set the baud rate and port. The DTR and RTS should be inactive.
5. On the µVision2 menu select Project->Options for target 'your project'->Debug->Settings and select the type of breakpoint you require; Software or Flash (please see the next section on how to use flash breakpoints).

6. Add a call to the ISDwait() in your main function after the UART is initialized.
7. It is important to enable interrupts after the UART is initialized and before the call to ISDwait().

4. FLASH BREAKPOINTS

The nRF24EX/nRF9E5 supports two kinds of breakpoints offered by the ISD51: software and flash breakpoints. For a complete description of these breakpoints please consult the ISD51 User's Guide included in your Keil installation.

Although the nRF24EX/nRF9E5 does not have flash we can use this type of breakpoint to debug our application at full speed. The use of flash breakpoints requires modifications to the default ISD51.H file as follows:

1. Complete the steps given in the previous section.
2. Copy the ISD51.A51 and ISD51.H files to your project directory and add them to your µVision2 project as described in the previous section.
3. In ISD51.H, set the CMP_END constant to 0x0FFF
4. In ISD51.H, set the flash block size CBLK_SZ to 1
5. In ISD51.H, replace the CWRITE macro with the following code:

```
CWRITE MACRO
     MOV  DPL, R0
     MOV  DPH, A
     MOV  A, CBLK
     MOVX @DPTR,A
     CLR  A
ENDM
```

5. DEBUGGING

To start debugging you must first compile your program and load the generated hex-file into the nRF24EX/nRF9E5 by using nRFPROG. After your program is loaded into the nRF24EX/nRF9E5 follow the steps in the Keil documentation to debug the device.

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