Quick Start Guide

Hitex Starter Kit for ARM®

with

MCB2100 Evaluation Board

hitex
DEVELOPMENT TOOLS

04/2006 - 006 - 5.2 - 30.17.0011.0

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04/2006 - 006 - 5.2

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1 Introduction

This starter kit is intended to give a fast introduction into the Philips LPC2000 ARM microcontroller family, the development of ARM code and the debugging using the debug hardware **Tantino for ARM 7-9** with HiTOP.

The best way getting started is to follow the instructions of this small guide.

To get more information about the **Hitex Tool chain for ARM**, refer to **http://www.hitex.com/perm/arm_toolchain.html**.

A comprehensive introduction to the HiTOP5 user interface will be given in our video tutorials. Feel free to download the movies on **http://www.hitex.com/perm/video_tutorials.html**.

We wish you a fast and high quality embedded development using the Philips LPC2000 microcontroller.

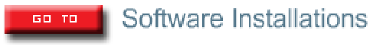
Your Hitex Team

2 Installing Software and Hardware

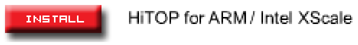
Installing the Software

For the installation of HiTOP please insert the CD and follow the instructions on the screen. If the auto run feature of your CD drive is disabled, open the CD drive folder and start **setup.exe**.

Click on



and



and follow the instructions on the screen.

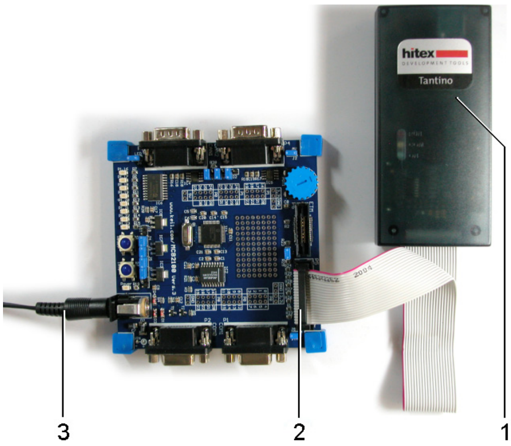
After installing HiTOP, check the jumpers and switches of the MCB2100 evaluation board.

Now the debug hardware Tantino and the evaluation board may be installed.

Installing the Hardware

Tantino for ARM 7-9

- Connect the Tantino to the PC's USB port via the USB cable (1).
- Connect the 20-pin cable to the board's JTAG connector (2).
- Connect the board's power supply (3).



For more details refer to the manual included in the board delivery package and the **Getting Started** topic of the Tantino online help.

3 Starting a Project in HiTOP

Start HiTOP by double clicking the desktop icon:

The tip of the day is presented which contains useful information when working with HiTOP.

If HiTOP is started for the first time, select the **System > Connect** command.

Choose the debugger hardware (**Tantino for ARM 7-9** according to the bottom side label of your Tantino system) and click on **Next**.

Select as the vendor **Philips**, as the controller type **LPC2129**, as the ARM core type **ARM7** and as byte order **Little Endian**. Click on **Next**.

Select as communication port **USB** and enter the serial number of your Tantino (without leading zeros).[1] Click on **Connect** and HiTOP will be connected to the Tantino.

If you still have no valid HiTOP license, you will have to fill in the HiTOP registration dialog.

Now you may load a program into the FLASH or into the RAM. The project file names show the usage of the memory remapping after reset.

[1] The serial number can be found on the down side of the device.

Starting a FLASH Project

Start the FLASH project using the **Project > Open** command and in the **..\Examples\LPC2000\MCB2100\GNU** folder, select the following project file:

Clock_MCB2100_Gnu_Flash.htp

When the **Download** dialog is presented, click on **Ok**.

Continue with section **Project Loaded** (p. 10).

Starting a RAM Project

The RAM project is using only RAM. The necessary remapping after start will be performed by starting the project.

Start the RAM project using the **Project > Open** command and in the **..\Examples\LPC2000\MCB2100\GNU** folder, select the following project file:

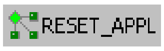
Clock_MCB2100_Gnu_RAM.htp

Continue with section **Project Loaded** (p. 10).

Project Loaded

After having loaded the project successfully, proceed as follows:

When pressing the target's reset button or performing a target reset using HiTOP's **Debug > Reset** command, execute the script file by clicking on the following toolbar icon:



RESET_APPL

You may now arrange the windows according to your needs. Note, that using the **View > Save screen layout** and **View > Load screen layout** commands different window layouts can be stored and reloaded.[1]

Do not forget to save the project after such changes (**Project > Save**).

[1] More about the handling of HiTOP is shown in the online help system and in the video tutorials.

4 The First Steps of Debugging

Now the application is at the starting point ("appl_entry").

If using the flash project, the start address of the FLASH is 0. If using the RAM project, the start address of the RAM is 0x2000000.

In the **Source** window, start debugging with some single steps by

- clicking on the **Step Into** icon ,
- using the **Debug > Step Instruction** command, or
- via the **F9** function key.

It is also possible to go to a desired code line by moving the cursor over the window's left side column. The cursor will get a different shape:

Click on the rectangle using the left mouse button. In the **Disassembly** tab of the **Source** window the code can also be patched by editing the contents of the instruction column. If the code is in RAM this is done in the target RAM. If the code is in FLASH, the patch is performed in a cache.

If the changes shall be programmed into the FLASH please right click into the **Source** window and select the context menu's **Write Flash Changes** item.

To start debugging in the main C application you may execute the application until the function 'main' using

- the **Go until** icon ⇨, or
- the **Debug > Go until** dialog (entering 'main').

If the C source file is not opened automatically click on the toolbar's **Show PC** icon: ⇨ (**Debug > Show PC Location** command).

You can now examine the code and the variables on source level.

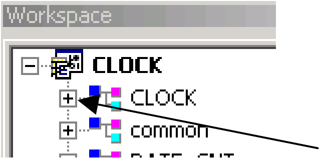
Let us now explore the application using breakpoints. The ARM core has a limited debug functionality which has to be taken into account during the session, especially when debugging in ROM/FLASH.

The ARM core has two hardware breakpoint resources. This is why only two breakpoints (code or data breakpoints) can be set when debugging in ROM/FLASH. When stepping through the application or when using a **Debug > Go until** command, breakpoints are also used. Trying to set more than two hardware breakpoints in ROM/FLASH or to step or anything else will cause the following (or similar) message:

No more breakpoints available

In this case you will have to disable or remove the two breakpoints. When debugging on RAM, there is an unlimited number of software breakpoints and one hardware breakpoint (code breakpoint in ROM or data breakpoint).[1]

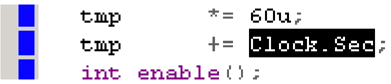
To show the features of these breakpoints, please do the following. We are now at the function 'main'. In the workspace window click on the plus sign (⊞) of the 'Clock' module (if it is a minus sign please skip this action).



Now the symbols of the 'Clock' module are displayed. Click with the right mouse button on the function 'get_clock' and select the context menu's **Set Breakpoint** command.

[1] This is why ARM recommends to test in RAM.

After starting emulation by clicking on the **Go** icon, emulation will stop at the breakpoint. Open the **Source** window's context menu right clicking on the green bar and select **Disable Breakpoint**. Mark 'Clock.Sec', 4 lines below the current line with the mouse, the text 'Clock.Sec' now has a black background



```
tmp       *= 60u;
tmp       += Clock.Sec;
int enable();
```

.

Open the **Breakpoint** window via **Debug > Breakpoints** and move it to a position that the marked 'Clock.Sec' can be seen. Now select the data tab of the **Breakpoint** window and drag&drop the marked text into the **Breakpoint** window. This sets a data breakpoint on a write access to the 'Sec' element of the 'Clock' structure.

Now, the default setting of this breakpoint has to be modified.

Open the **Breakpoint** window's context menu right clicking on the data line and select **Change**. Click on the **Advanced** button.

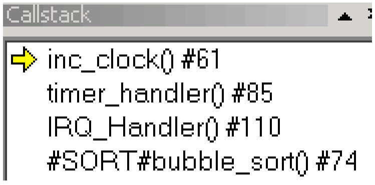
As Type select **Byte** and as Value Range Minimum enter **10**. Close the dialog clicking on **Ok**.

In the **Watch** window, activate another tab than **Locals**. Drag&drop the marked 'Clock.Sec' text into the **Watch** window. The current value of 'Clock.Sec' is displayed, it should be 0.

Now start the emulation via the **Go** icon:

After about 10 seconds the application will be stopped and 'Clock.Sec' shows the value 10. This was the intended action of this data breakpoint.

In the **Callstack** window we see the calling sequence.



```
inc_clock() #61
timer_handler() #85
IRQ_Handler() #110
#SORT#bubble_sort() #74
```

The current function 'inc_clock' was called by the 'timer_handler' which itself was called by the 'IRQ-handler'. The next function listed is where the interrupt occurred, here it is the function 'bubble_sort', in your case it is probably another one.

5 Modifying an Application

To change the code of the application, the **Source** window's editor can be used. After saving the files (**File** menu), the application has to be rebuilt and reloaded.

If you have installed the GNU compiler included in the installation CD, you may rebuild the application using the following button in HiTOP's toolbar:

Results of the build process can be seen in the **Output** window's **Build** tab. Do not forget to download your modified application again (**Debug > Download** command).

Details about the GNU compiler can be found in the documentation included in the compiler's installation files.

6 Trace Debugging (ETM Support)

The Keil MCB2100 board includes the possibility to access the ARM Embedded Trace Macro Cell (ETM).

Hitex's **Tanto for ARM®**, the advanced JTAG Development Tool, can be expanded with an Add-On Module for on-chip ETM support.

Please contact Hitex for more details or visit our WEB site at **http://www.hitex.com/perm/arm_toolchain.html**