Using Keil FlashMon Emulator with AT89C51CC01/03

AT89C51CC01/03 Microcontrollers

Application Note

1. Summary

Atmel AT89C51CC01/03 are Flash microcontrollers. Keil™ developed an OnChip Debug for these microntrollers taking advantage of the flash byte programming of these microcontrollers. FlashMon is integrated in Keil µVision® IDE. It is using the upper 4Kbytes of the program space, the internal UART as well as one timer (usually timer1)

2. Background overview

Developers using Keil µVision IDE and the AT89C51CC01 or AT89C51CC03 microcontrollers can now do OnChip debug as easily as they are using the µVision IDE simulator. This offers an alternative to the use of full fledge emulators when complex trace capabilities are not required. With a simple evaluation board such as Atmel AT89STK-06 fitted with an T89C51CC01 or AT89C51CC03, CAN software developers using Keil µVision IDE can test their program directly from µVision IDE.

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3. µVision IDE FlashMon

FlashMon is integrated in the µVision IDE programming suite. It can be found in the folder KEIL\C51\FlashMon. All Atmel C51 microcontrollers using a Flash technology allowing single byte programming are supported with a specific folder for each and every one. This includes AT89C51CC03 and T89C51CC01. This technical note is based on µVision IDE V2.40A. Users with an older version of µVision IDE should verify if FlashMon works as indicated in this technical note, otherwise they should update their µVision IDE.

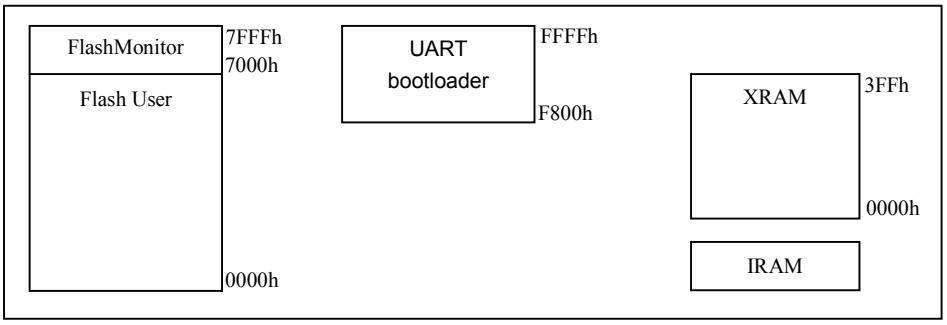
The user shall start the Monitor.UV2 project from the FlashMon selected microcontroller sub folder. Options should be selected as illustrated below, the project re-built then the Monitor.HEX file must be programmed in the microcontroller using Atmel FLIP In System Programming tool. Once done, the user can open his application project and select the Keil Monitor debug option. He can then re-built his project, then start the debug session. At start, the application project will be loaded into the microcontroller directly by µVision (no need to use Atmel FLIP). Then the OnChip debugging can start.

4. T89C51CC01

The T89C51CC01 CAN microcontrollers

The T89C51CC01 memory map is illustrated by the following figure.

Figure 4-1. T89C51CC01 Memory Map when using FlashMon.



IRAM is used by the Monitor but has not to be reserved by the user application. 256 bytes of XRAM above 0700h are used by the monitor.

The Flash is bytes programmable and page programmable, although as indicated in the T89C51CC01 erratasheet, The maximum number of bytes to be loaded in the Flash in one flash page is 16. This limitation is dealt with by the Monitor and is transparent to the user.

The Monitor use the flash library included in the Atmel UART bootloader. Consequently only T89C51CC01UA part number should be used.

User willing to use the CAN bootloader should use the UART bootloader samples for development and debug using FlashMon, and migrate to the CAN bootloader (T89C51CC01CA Part Number) afterward.

5. Getting Started with FlashMon when using T89C51CC01

This chapter will guide the user in setting-up then starting FlashMon with the T89C51CC01 CAN microcontroller.

5.1 FlashMon program and parameters

The CONFIG.INC file in the project is used to configure the proper parameters for FlashMon. Only a limited number of parameters are to be configured by the user.

- SERIAL: This parameter select Onchip UART with Timer1 as Baud rate generator (SERIAL EQU 0) or Timer2 as Baud Rate generator (SERIAL EQU 1). The external UART mode should not be used.
- CPU_CLOCK: the system CPU clock should be entered (ex CPU_CLOCK EQU 20000000 for 20MHz)
- CPU_X2: CPU_X2 EQU 0 for 12 clocks per cycle. CPU_X2 EQU 1 for 6 clocks per cycle. Notice the default mode for T89C51CC01 is 12 clocks per cycle.
- _A0: select _A0 EQU 0 for normal mode and _A0 EQU 1 for ALE disable.

All other parameters should be left unchanged. The Monitor program have an Automatic Baud Rate Detection (Autobaud) with the parameter BAUDRATE EQU 0.

Select rebuild all target files, then program the Monitor.HEX file generated into the T89C51CC01 using FLIP.

The Monitor.HEX file start at address 7000h.

5.2 Constraint in the User Program

The user shall not use the Timer1 if this timer is selected for the Monitor UART Baud Rate Generator. This leaves the more versatile Timer2 for the application. PCA modules can also be used as timers.

The UART interrupt should always remain enabled.

5.3 Programming the Monitor Program with FLIP

Flip should be used to program the Monitor.HEX file into the T89C51CC01.

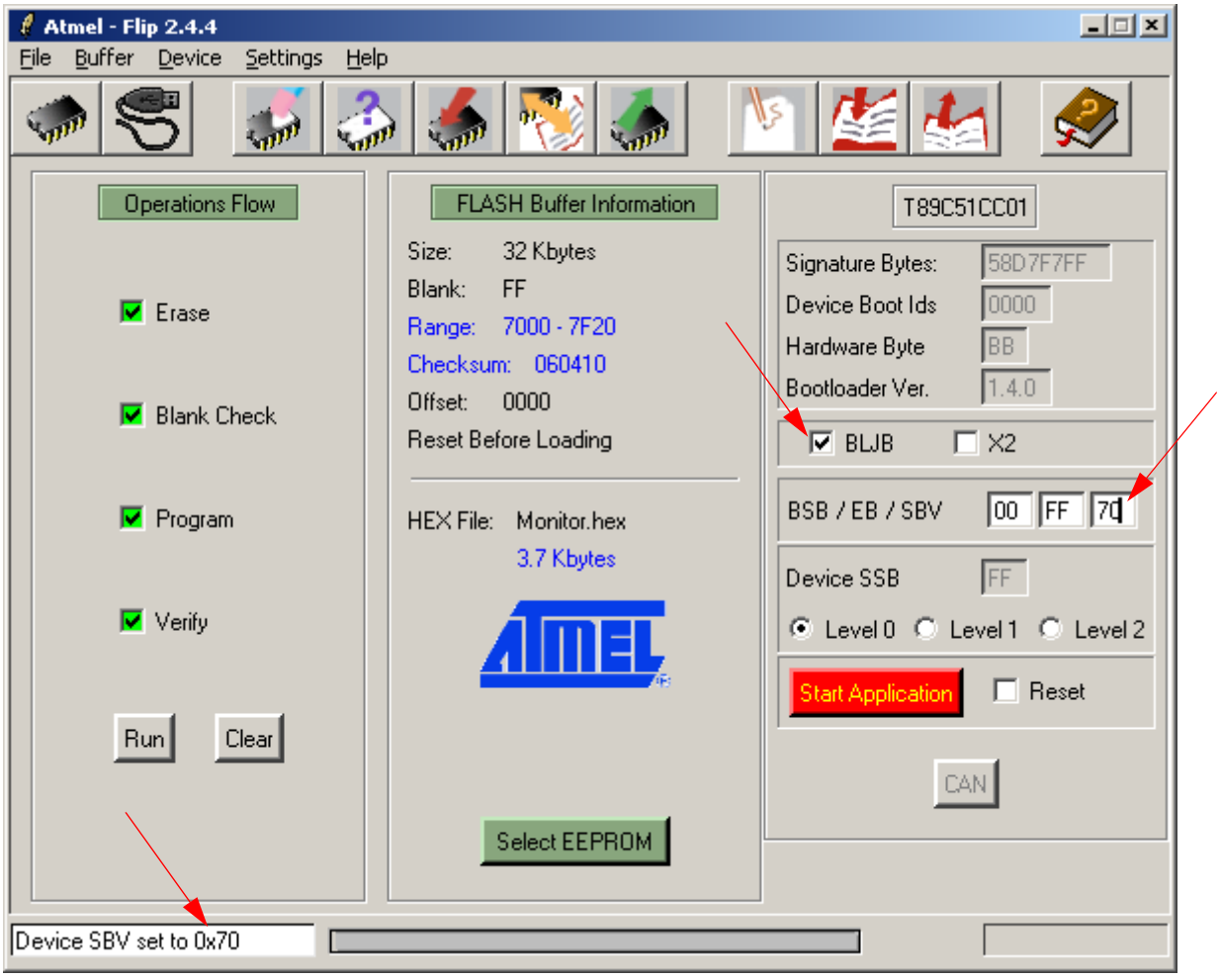
The SBV (Software Boot Vector) should be programmed at 70.

The BLJB bit should be selected (BLJB=0)

With the above setting, after each reset the T89C51CC01 will execute the bootloader and with SBV = 70, It will start the execution of the Monitor Program starting at 7000h.

See below the FLIP configuration (example using FLIP 2.4.4)

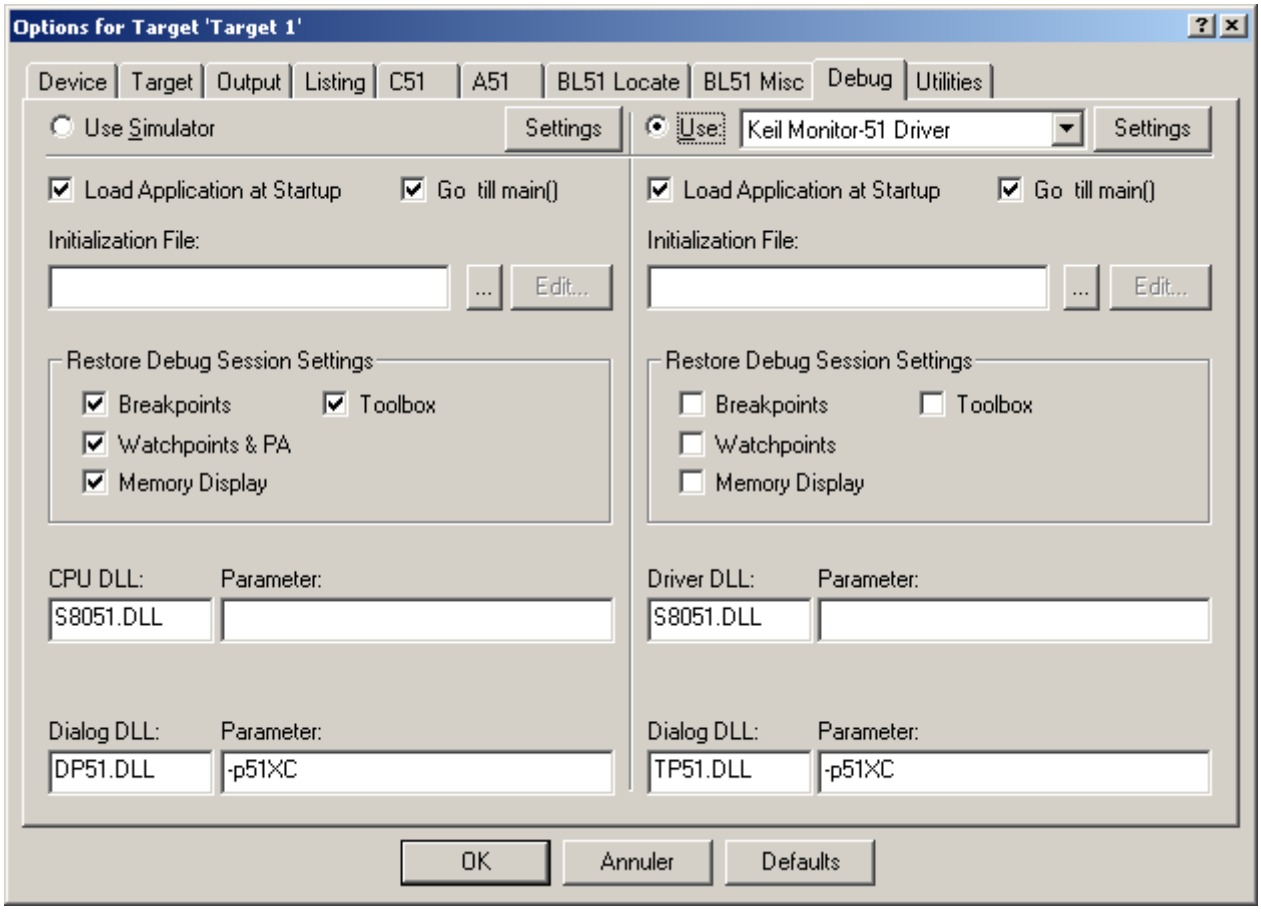
Figure 5-1. FLIP programming



5.4 Selecting the right target debug option in the Application Project

In the Target Debug option, the Keil Monitor-51 should be used as illustrated below.

Figure 5-2. Project target Debug Options



5.5 Starting a Debug Session with FlashMon

The following screens illustrate the debug using FlashMon

For the example, we have selected the CAN generator program available from the Atmel web site. Please notice we have added the instruction enable UART Interrupt as illustrated below.

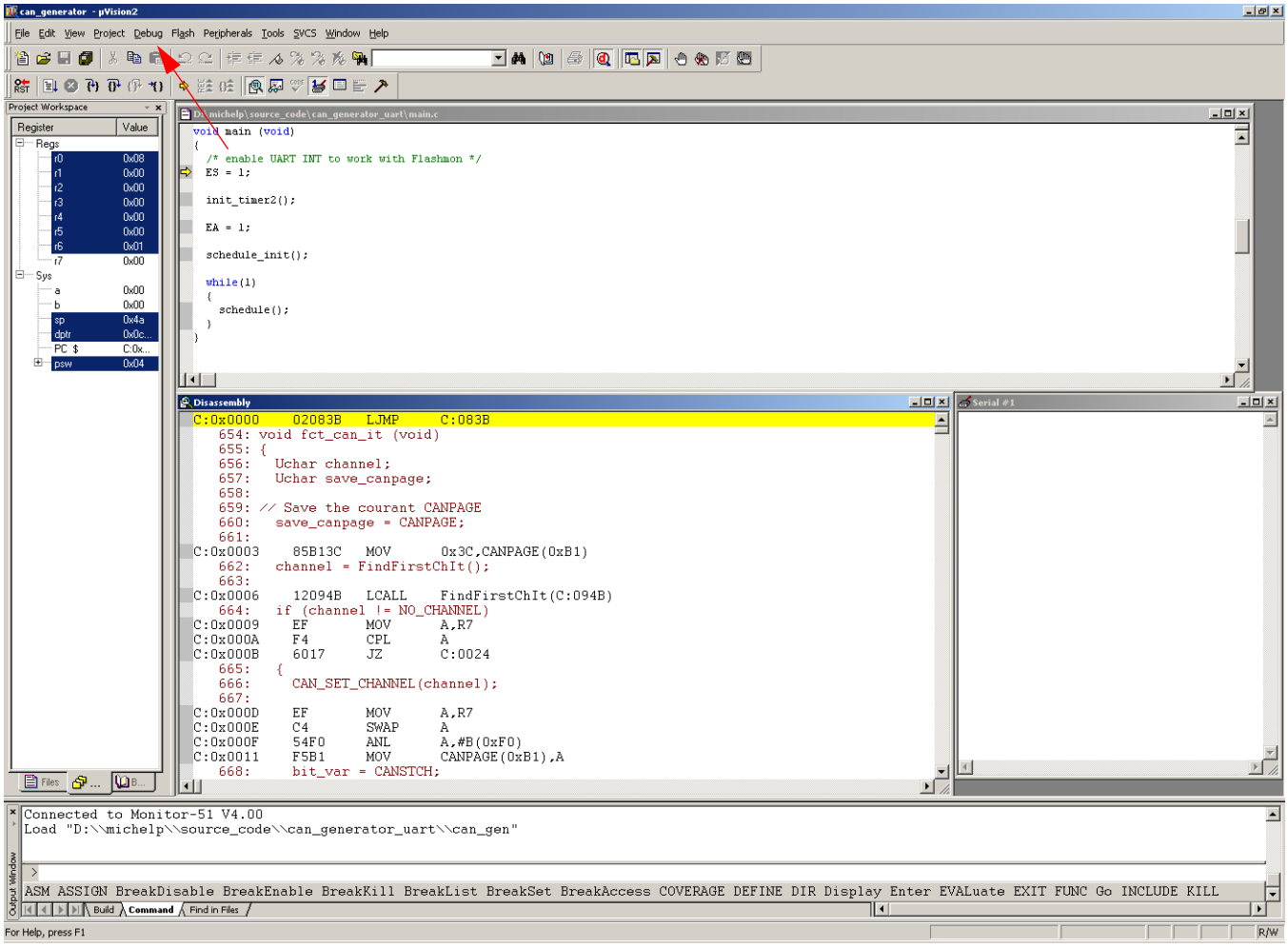
It is recommended to do a Power off / Power on sequence on the target board before starting a debug section.

Note: FlashMon is not subject to the DELL Laptop RS232 initialization problem provided the above Power Off / Power On sequence ran before starting a debug section.

Note: Flashmon has been successfully tested on a Laptop with RS232interface and on a Laptop with no RS232 interface. A Prolific USB to RS232 interface was used for this test.

After selecting the debug tab, end clicking on start debug, FlashMon will download the user program. A progress bar on the bottom of the screen will be available.

Figure 5-3. Loading the User program

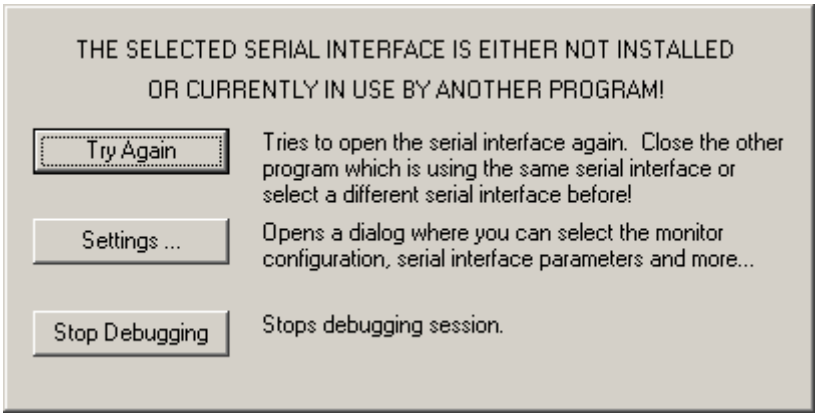


The debug session is now ready.

5.6 Trouble-shouting if FlashMon fails to connect the target with the PC

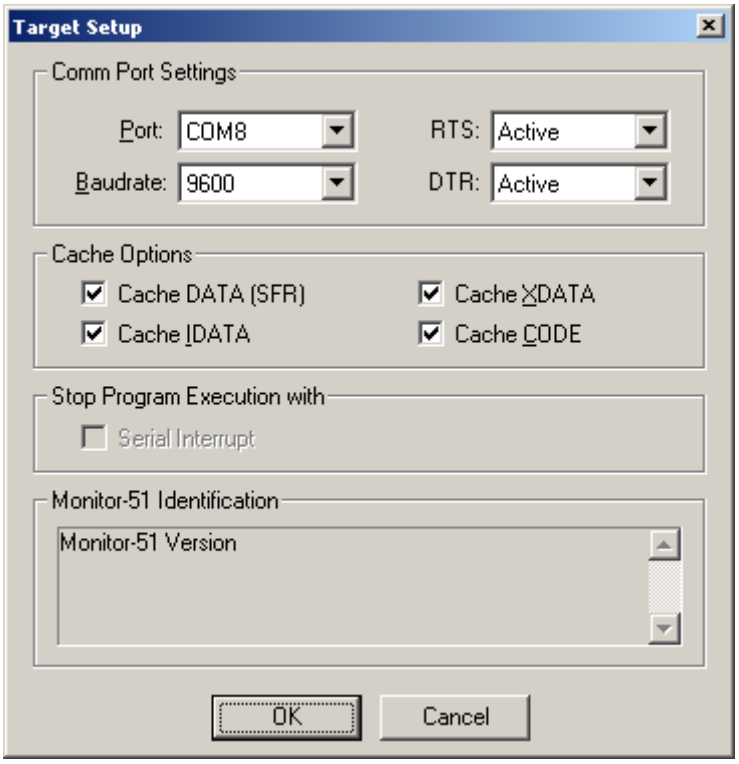
If the PC cannot connect the target the following message will appear.

Figure 5-4. FlashMon connection error message



It is recommended to click on Settings

Figure 5-5. FlashMon Serial Port setting



The Comm Port should correspond to the Serial Port Comm port. If an USB to RS232 adapter is used, the user shall verify in the Windows® Control Panel which Comm Port has been assigned to the adapter. This is the port number that should be entered in the Target Setup.

µVision IDE Comm Port drop down menu offers COM1 to COM8 options. If the USB to RS232 adapter has been assigned a Comm Port number higher that COM8, it is necessary to go to the Windows Control Panel and manually assign a Comm Port acceptable for µVision. (go to Comm

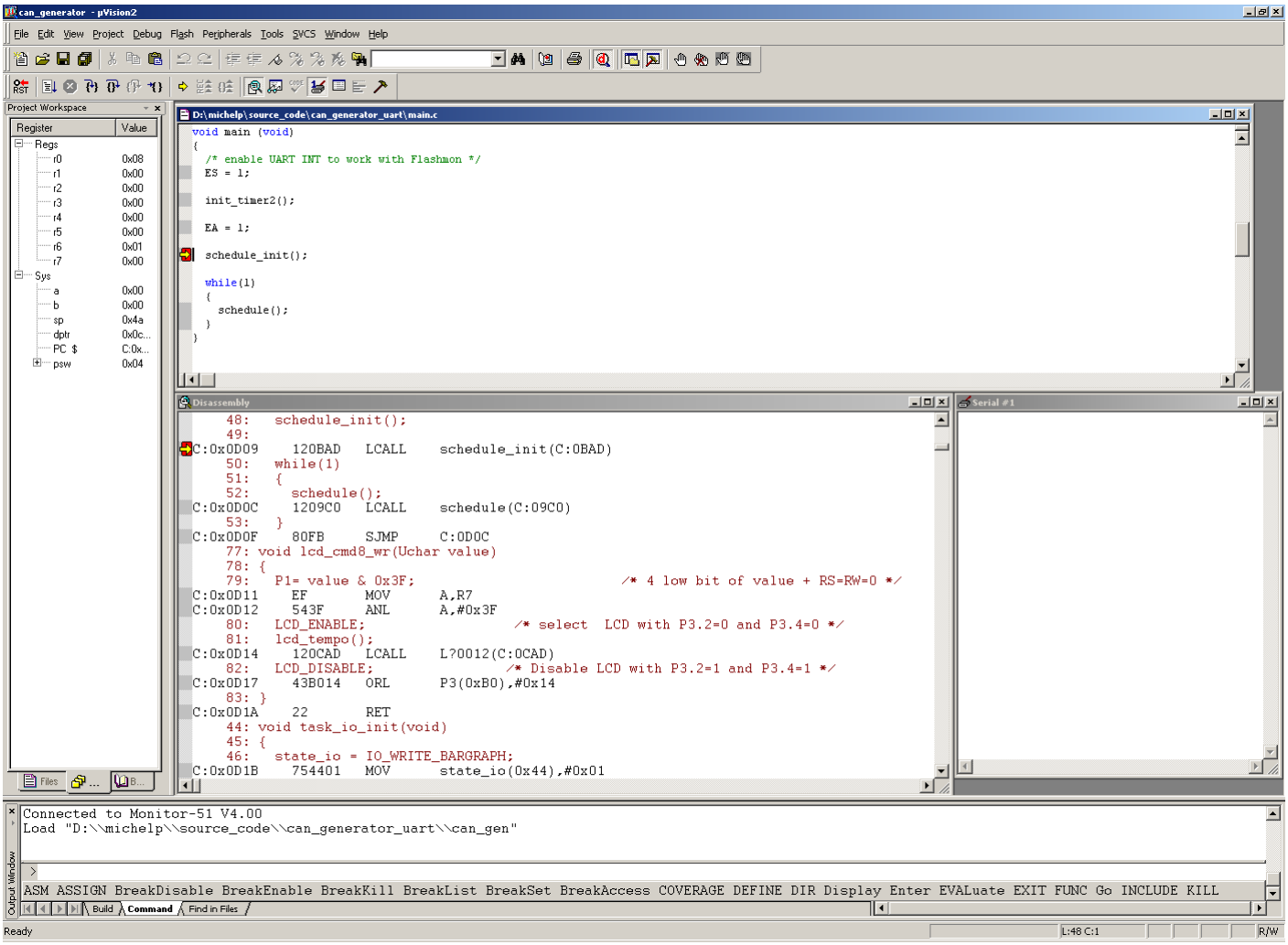
Port Properties then Port Parameters then click on Advance Tab and select a free Comm Port Number between 1 and 8)

5.7 Debugging a program with FlashMon

Now that the debug session is ready, let's insert a breakpoint at the scheduler initialization program line and click on RUN

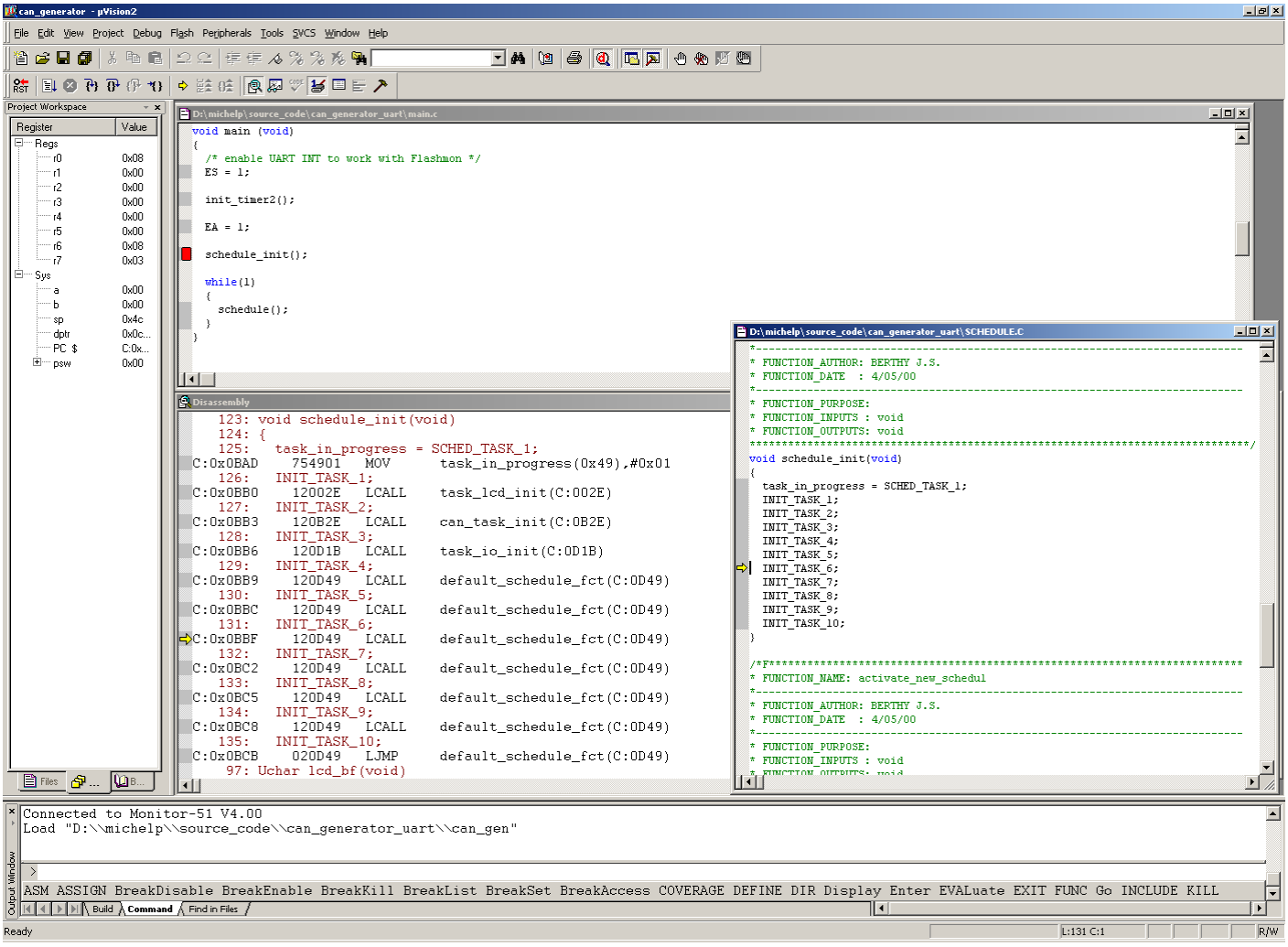
The figure below shows the result after the execution

Figure 5-6. Program stopped at the scheduler initialization break point



We can continue step by step. The following screen show the execution of the task6 initialization after a couple of steps have been executed.

Figure 5-7. Step by Step execution



6. Conclusion

We have demonstrated the use of the FlashMon Keil™ Monitor on the T89C51CC01. We have shown how to configure FlashMon, How to program it at the right place and the right options in the T89C51CC01 using Atmel FLIP. Then we have shown how to configure a Keil™ Project to use FlashMon as the debug mode. Finally we have shown how to insert break points, run to the break point and run step by step using FlashMon.

6.1 AT89C51CC03

FlashMon can also be used with AT89C51CC03 provided AT89C51CC03 with UART bootloader are used. The monitor program starts at E000h. With FLIP, the SBV (Software Boot Vector) should be programmed at E0h.

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