CAN Extension Board

Demo Kit User Guide

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Section 1

Introduction

This document describes the CAN Extension Demo Board dedicated to the Atmel T89C51CC01, T89C51CC02 and AT89C51CC03 microcontrollers. This board works with the Atmel C51/C251 Demo board. The CAN Extension Board plugs into the C51/251 demo board connector.

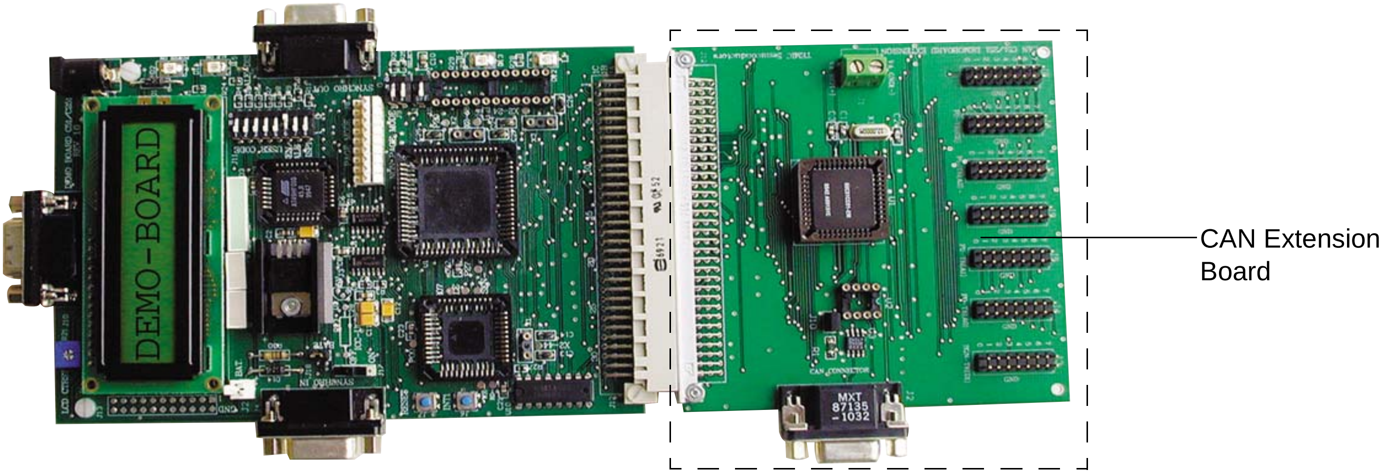
All features provided by the C51/251 demo board can be used (LCD, LED bargraph, hardware capability to program the CAN Microcontrollers on-chip Flash memory, etc.).

1.1 Features

The CAN Extension board work for T89C51CC01 and AT89C51CC03 with the following features:

- CAN (on board CAN transceiver Atmel ATA6660)
- Two different sockets for transceiver: DIL8 and SO8
- D-sub connectors compliant to the CiA (User Group: "CAN in Automation") recommendation for the CAN High Speed Bus
- Analog-to-Digital Converter (Connector for ADC reference voltage VAGND and VAREF)
- The board comes equiped with a T89C51CC01 and a AT89C51CC03 sample in PLCC44 package.
- Support of the T89C51CC02 microncontroller requires the use of a PLCC28 Adapter (ADAPT28).

Figure 1-1. CAN Demoboard Extension Connected to the C51/C251 Demo Board



Section 2

Quick Start

2.1 Package Contents

The CAN Extension Demo Board Package contains the following items:

- C51/251 Demo Board
- CAN Extension Demo Board
- T89C51CC01UA-SLSIM microcontroller (UART Bootloader) AT89C51CC03U-SLSIM microcontroller (UART bootloader)
- RS-232 Series Cable
- CAN CD-ROM

Notes: ***1.*** Ensure FLIP1.8.9 or higher is installed on the PC before attempting to program the AT89C51CC03 (FLIP 1.8.9 can be installed from the CAN CD-ROM).

2. In System Programming over the CAN bus is possible with a CAN dongle supported by Atmel FLIP, and provided that a T89C51CC01CA-SLSIM or AT89C51CC03C-SLSIM is used (these may be ordered separately)

2.2 System Requirements

The minimum Hardware and Software requirements are:

- 486 Processor
- 16 MB RAM
- 12 MB Available Hard Disk Space
- Windows® 95/98/2000/ME, XP, Windows NT® 4.0 or higher, or Linux™
- 115200 Baud RS-232 Port (COM Port)
- 10 - 15V DC Power Supply

2.3 Quick Start

Along with Atmel FLIP software, the board helps to evaluate the Flash and EEPROM In-System Programming functionality of the device.

Designers can use the T89C51CC01 UART connected to a PC serial port, or the CAN bus interface connected to a CAN dongle. See the Section “Getting Started” and the demonstration program in the CAN CD-ROM.

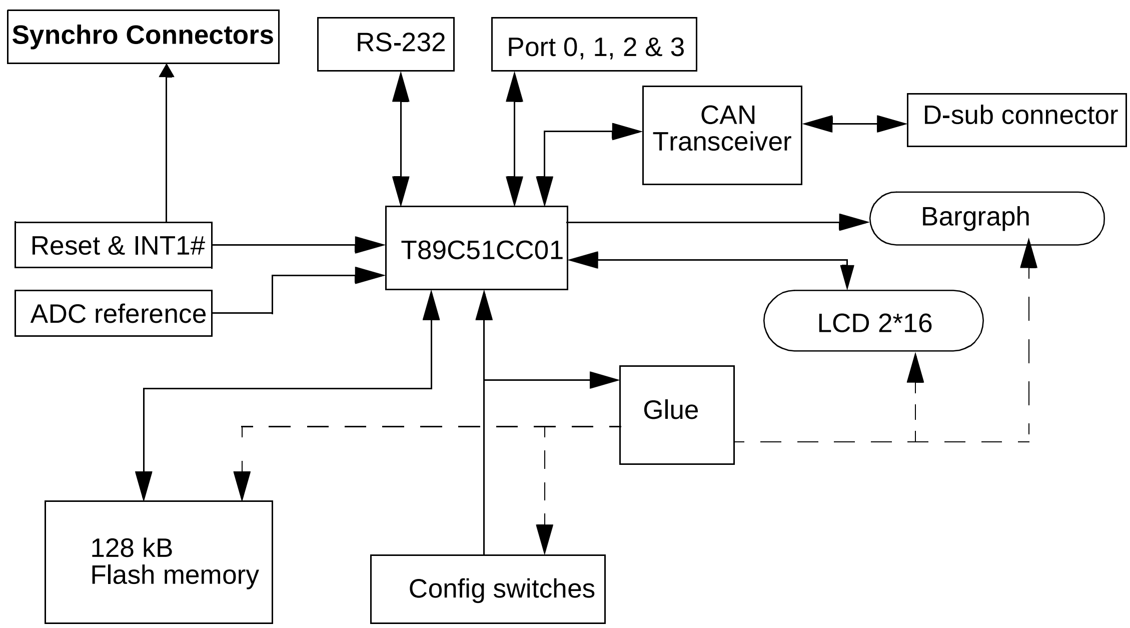
2.4 Connecting the Hardware

The CAN Extension board connects to the 64-pin connector of the C51/251 Demo Board.
Connect the DC power cable between the C51/251 Demo Board and the power supply.

Section 3

Hardware Description

Figure 3-1. CAN Extension Demo Board Components

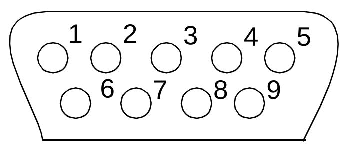


3.1 CAN Components

Different types of transceivers can be plugged on the board (ATA6660, Si9200, PCA82C250, etc.) on socket DIL8 or SO8. Please ensure only one transceiver is connected on the board.

Jumper J10 allows to connect the 120Ω termination resistance. The CAN High Speed Bus must be terminated at both ends with a termination resistance for proper operation.

Figure 3-2. Pinning of the D-sub 9 Connector



Pin 1: N.C.
Pin 2: CAN_L
Pin 3: GND
Pin 4: N.C.
Pin 5: N.C.
Pin 6: GND
Pin 7: CAN_H
Pin 8: N.C.
Pin 9: N.C.

3.2 ADC Feature

To use the ADC feature, a reference voltage must be applied on VAGND and VAREF (3V).

When the ADC is addressed, you cannot control the LCD or the LED bar graph because Port 1 must be left free. Therefore, pay attention to the P3.2 and P3.4 states that are used to select LCD and bargraph (see Table 3-1).

The Port 1 pins serve as an input source to the ADC.

Table 3-1. Chip Select Description

P3.4	P3.2	Designation
0	0	LCD selected
0	1	led bargraph selected
1	0	switch selected
1	1	ADC/Port1 selected

Section 4

Getting Started

The purpose of this section is to acquaint the user with the Atmel CAN Demo Board, the In-System Programming tool (FLIP), the 2 demonstration programs: CAN Generator and CAN Monitor, and finally with the 2 bootloaders (CAN and UART).

4.1 Hardware Requirements

- CAN Demo board plus either a Second CAN demo board(1) and/or a CAN Dongle(1) (IXXAT, PCAN, CANCARDX, CANPARI, or RMCANVIEW)
- RS-232 Serial Cable (DB9/DB9 Male/Female)
- Serial Cable DB9/DB9 Female/Female(1)
- T89C51CC01UA-SLIM or AT89C51CC03U-SLSIM
- T89C51CC01CA-SLSIM(1) or AT89C51CC03C-SLSIM(1)

Note: 1. Not included in CAN Demo Board kit.

4.2 Software Requirements

Various demonstration programs can be found in the accompanying CD-ROM

- CAN generator UART bootloader demonstration program (HEX file)
- CAN monitor UART bootloader demonstration program (HEX file)
- CAN generator CAN bootloader demonstration program (HEX file)
- CAN monitor CAN bootloader demonstration program (HEX file)
- CAN Dongle program (HEX file)
- A self training package is also available on the CAN CD-ROM. It introduces CAN bit timing as welll as the CAN Software Library

4.3 FLIP Software

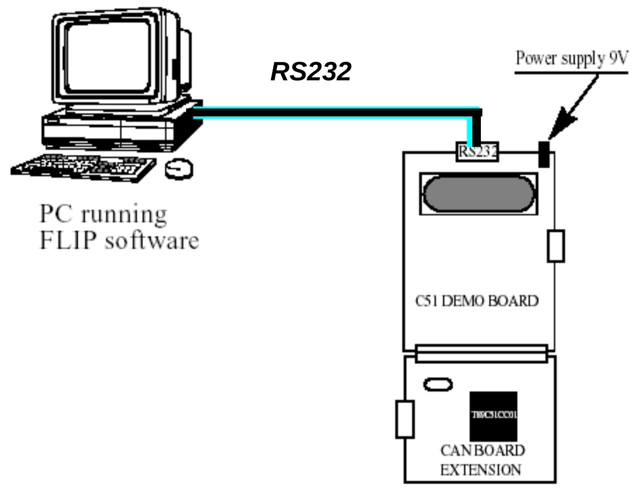
FLIP is software that runs on Windows 98®, ME®, XP®, Windows NT® and Windows 2000®. FLIP supports In-system programming of Flash C51 devices through RS-232 and CAN (with a dongle). The latest version of FLIP software can be found on the Atmel web site. The CAN CD-ROM includes a copy of FLIP 1.8.8, plus the update zip for 1.8.9. The following figures were assembled with Flip 1.8.2.

A Linux version of FLIP is also available.

4.4 UART Bootloader Demonstration Setup

The first demonstration (UART Bootloader) will use a PC running FLIP software to program a CAN Demo board through an RS-232 cable as illustrated in Figure 4-1.

Figure 4-1. PC to CAN Demoboard Through RS-232



4.4.1 Hardware Connection

1. Connect a C51 Demo board and a CAN Demo board.
2. Connect the 9 volts DC power supply.
3. Connect the C51 Demo board to the PC through the RS-232 cable.
4. Ensure a T89C51CC01UA-SLIM or an AT89C51CC03U-SLSIM is connected to the CAN Extension board.

4.4.2 Setting the Hardware Condition

T89C51CC01 and AT89C51CC03 microcontrollers come pre-programmed to start in Bootloader mode at first power-up. In the first ISP demonstration, the user will need to program the sample microcontroller set to boot in bootloader mode as illustrated in Figure 4-2.

The hardware condition is set by forcing EA = 1 and PSEN = 0. After setting the required start up condition on the C51 Demo board, press the Reset button.

The following diagrams illustrate the corresponding positions of the J9, J11, and J16 switches on the C51 demoboard.

Figure 4-2. Hardware Condition Set to Boot in Bootloader Mode

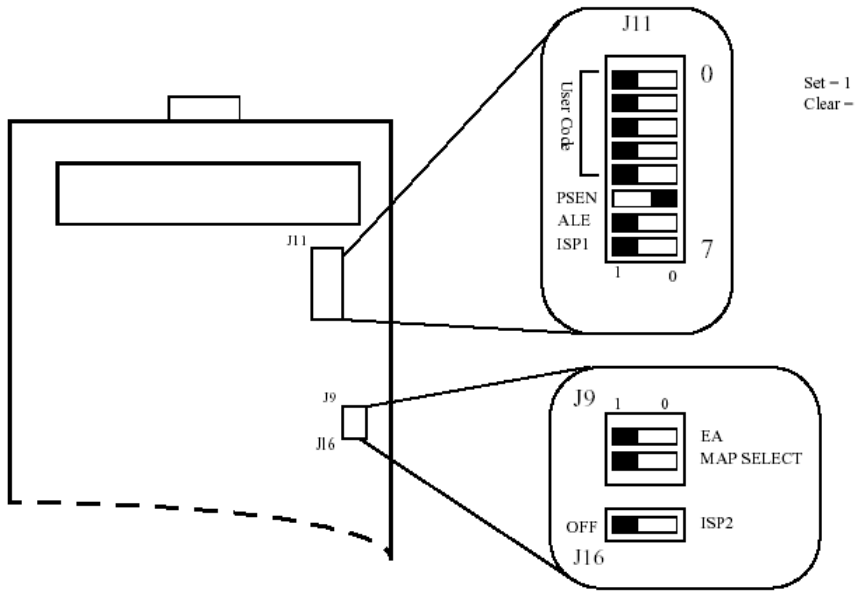
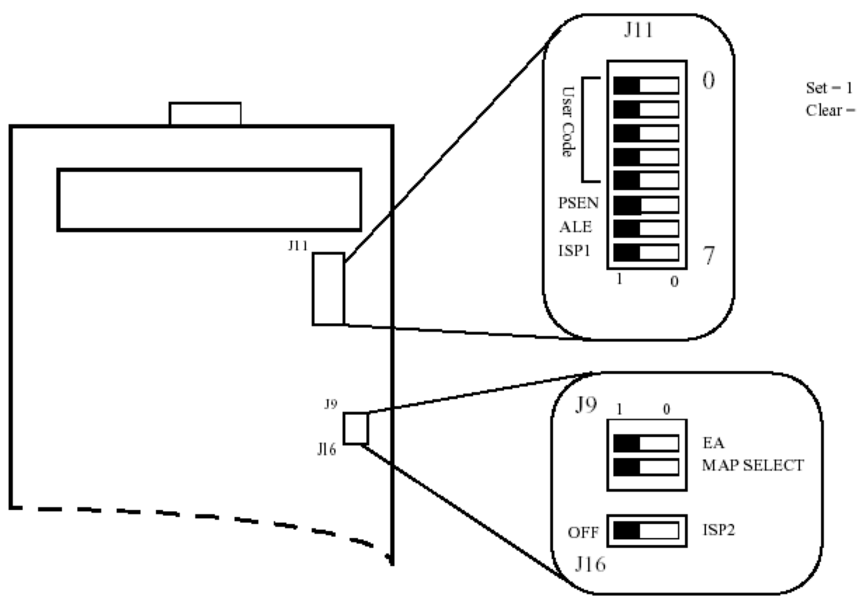


Figure 4-3. Hardware Condition Set to Boot in User Application Mode

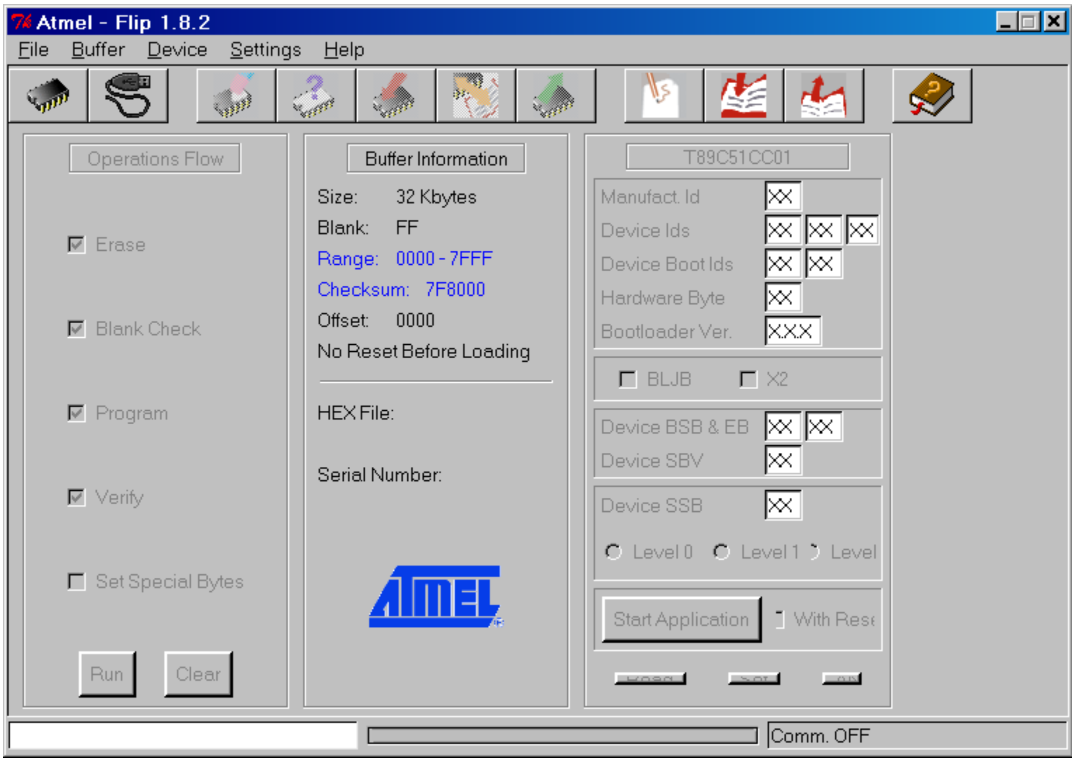


4.5 UART Bootloader Demonstration Program

In this section the user will program the T89C51CC01UA-SLSIM microcontroller through the UART Bootloader using FLIP software. The following procedure will guide you through the programming of the demonstration program.

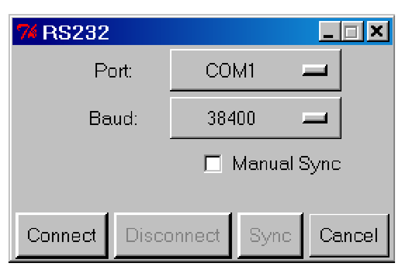
1. Run FLIP software.
2. From the Device Menu, choose Select and select the device (T89C51CC01) that is connected on the CAN extension demo board.

Figure 4-4. FLIP Window



3. Click the ‘Set Communication’ button and indicate the COM port settings and Baud Rate.

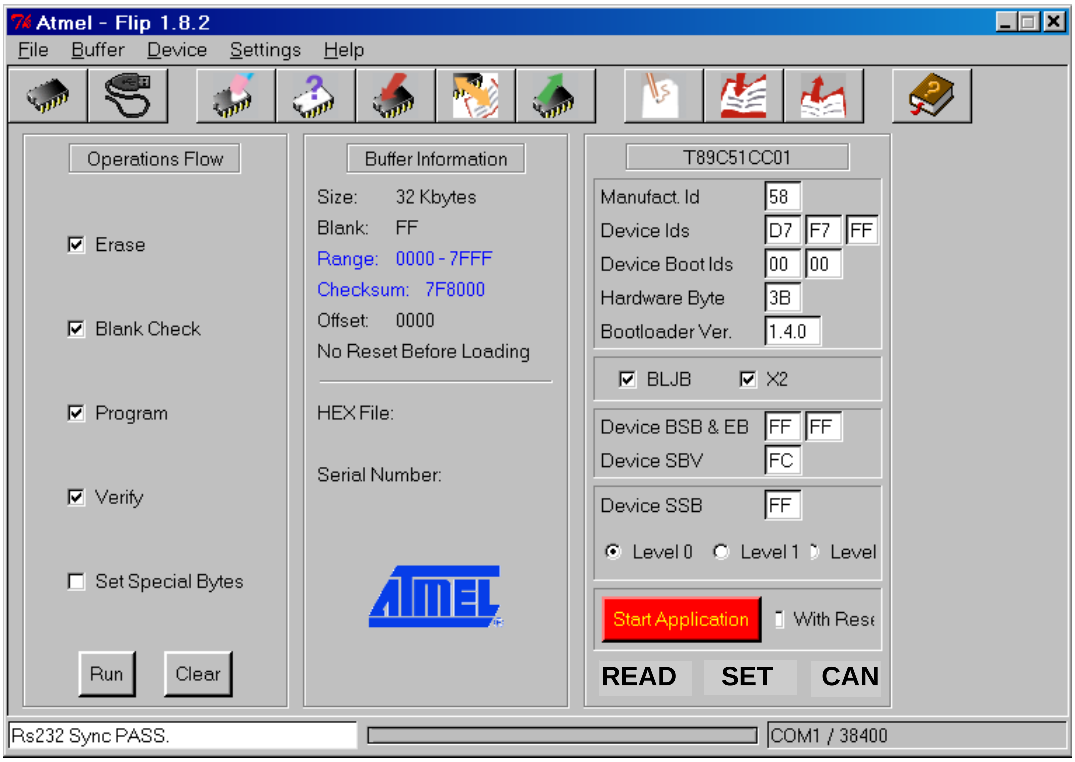
Figure 4-5. COM Port Settings



4. Initialize the communication by selecting the ‘Connect’ button in the RS-232 pop-up window.
   If the connection is successful, the FLIP window should look like Figure 4-6.
   Detailed explanations of the significance of the fields can be found in the product datasheet on the Atmel site www.atmel.com

Note: On certain laptops, such as Dell, it is necessary to perform the following procedure. Click ‘Connect’, reset the C51 Demo board, then click ‘Sync’.

Figure 4-6. Succesful Connection on FLIP



5. In the File menu, select ‘Load HEX’ and choose the demonstration program ‘can_gen.hex’. This is the program that performs the demonstration data exchange.
   The message ‘HEX file can_gen.hex loading done’ is displayed at the bottom of the FLIP window.
6. Ensure the following check boxes are selected in the Operations Flow section of FLIP:

   - Erase
   - Blank Check
   - Program
   - Verify

These are the operations that will be performed on the microcontroller.

7. Press the ‘Run’ button. Programming is executed.
   The “Memory Verify Pass” message confirms programming is successful and that the microcontroller has been programmed.
8. Ensure the BLJB box is unchecked. Press ‘Set’, then ‘Read’ to verify that the BLJB is blank (=1), in order to boot the demonstration program after the next reset.
9. Ensure the ‘With Reset’ box is checked, then press the ‘Start Application’ button. The LCD display on the C51 Demo Board will display the CAN messages that the program generates.

   At this time, it is recommended to switch the demoboard to ‘Normal Condition’ as illustrated in Figure 4-3.

Note: Using FLIP, disconnect the RS-232 connection to FLIP in order to free the computer COM port. In the RS-232 dialog box, click Disconnect.

It is possible to connect a CAN monitoring device such as a CANALYZER or equivalent on the DB9 connector on the CAN Demo Board in order to verify that the messages are transmitted on the CAN Bus.

4.5.1 CAN Monitor Demonstration Program

Using a method similar to that discussed in the demonstration program above, it is possible to program the Monitor Demonstration 'uart_boot_mon.hex'. The Monitor Demonstration displays the content of any incoming messages from an output source on the LCD.

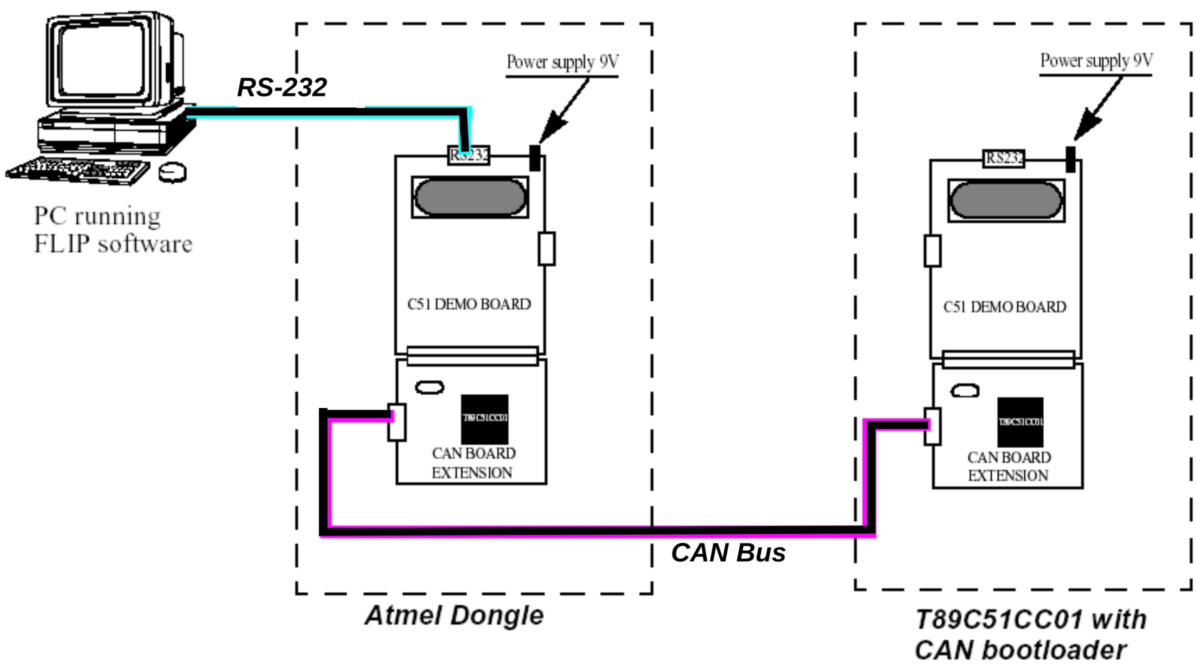
For users with two CAN Demo boards, it is possible to program the CAN generator demonstration 'can_gen.hex' on one board and the CAN Monitor demonstration 'mon_boot_can.hex' on the other. The connection is made using a CAN DB9/DB9 Male/Male cable. The demonstration permits to display data sent through the CAN bus on the second demo boards' LCD.

4.6 CAN Bootloader Demonstration Setup

In this section, 2 demonstration programs will be explained.

First we will program the Atmel Dongle via the UART. Second we will run the demonstration program from the T89C51CC01CA-SLSIM microcontroller through a CAN bus to a second demoboard that will display the results in an LCD.
If you use a CAN Dongle other than Atmel CAN go directly to Section 4.7 "CAN Bootloader Demonstration Program".

Figure 4-7. CAN Dongle for CAN Demo



4.6.1 Hardware Connections

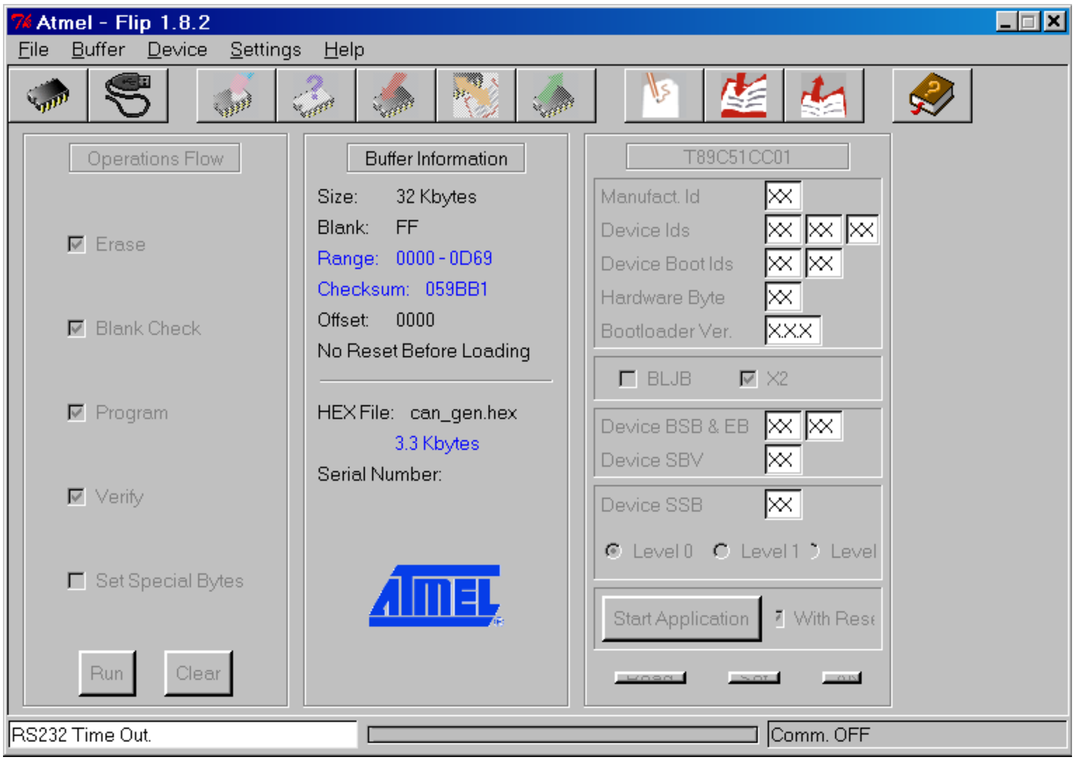
1. Connect a C51 Demo board and a CAN Demo board.
2. Connect a 9 volts DC power supply.
3. Ensure a T89C51CC01CA-SLSIM microcontroller is connected to the CAN board.
4. Connect the RS-232 cable to your PC and to the DB9 female port on the C51 demo board.
5. Connect the CAN bus to the Atmel Dongle on both CAN boards. See Figure 4-7.

4.6.2 Programming Using FLIP

This section allows you to program the T89C51CC01 microcontroller using FLIP software.

1. Run FLIP.

Figure 4-8. FLIP Window



2. From the Device Menu, choose ‘Select’ and select the device (T89C51CC01) that is connected on your demo board.
3. From the ‘Settings’ menu, select ‘Communications’ then ‘RS-232’. Click ‘Connect’.
4. In the File menu, select ‘Load HEX’ and choose the demonstration program ‘Atmel_dongle.hex’.
   The message ‘HEX file Atmel_dongle.hex loading done’ is displayed at the bottom of the FLIP window.
5. Ensure the following check boxes are selected in the Operations Flow section of FLIP:

   - Erase
   - Blank Check
   - Program
   - Verify

These are the operations that will be performed on the microcontroller.

6. Ensure the BLJB box is unchecked. Press ‘Set’, then ‘Read’ to verify that the BLJB is blank (=1), in order to boot the demonstration program after the next reset.
7. Ensure the ‘With Reset’ box is checked, then press the ‘Start Application’ button. The LCD display on the on the C51 Demo Board will display the CAN messages that the program generates.

At this time, it is recommended to switch the demoboard to ‘Normal Condition’ as illustrated in Figure 4-3. Press the ‘Reset’ button on the demo board.
It is recommended to disconnect the RS-232 port to FLIP in order to free the computer COM port.

4.7 CAN Bootloader Demonstration Program

The following procedure will guide you through the execution of the demonstration program.

1. From the FLIP window, click ‘Device’ and select ‘T89C51CC01’.
2. From the ‘Settings’ menu select ‘Communication’ –> ‘CAN’ and choose the type of Dongle you are using.
   If you selected PEAK PCAN the dialog as illustrated in Figure 4-9 is displayed. If you select ‘Systec USB’ the dialog as illustrated in Figure 4-10 is displayed.

Figure 4-9. CAN Peak PCAN-Dongle Configuration

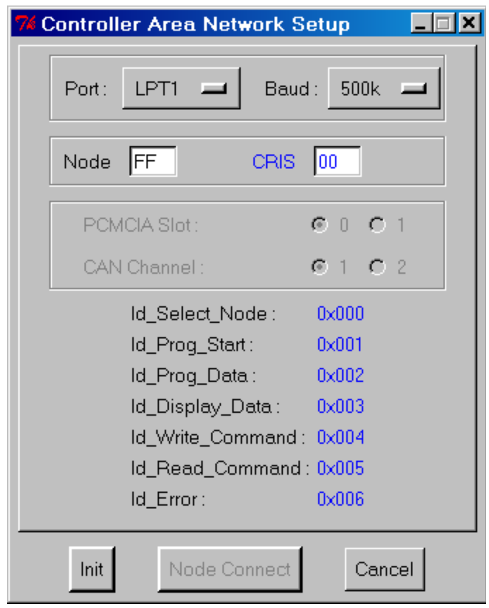
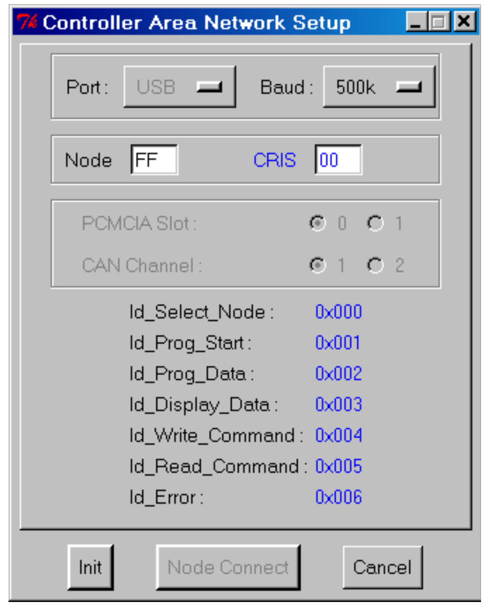


Figure 4-10. Systec USB Dongle Configuration

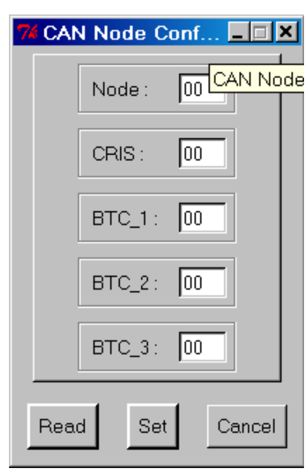


3. Click 'Init', then select 'Node Connect'.
   The dongle sends a node connect message with the Node Number Byte (NNB). 'NNB = FF' is the default NNB to which all T89C51CC01 CAN bootloaders will respond. If NNB is different than FF, the T89C51CC01 microcontroller will respond only if its NNB matches the one specified in FLIP.

   The T89C51CC01 starts autobaud, and once it is ready, acknowledges the message to FLIP to indicate that the communication is established.

   The default CRIS is 00. It is possible to set a different area for the 7 consecutive CAN message identifiers. FLIP and the T89C51CC01 must use the same CRIS to communicate.
4. From the 'File' menu, select 'Load HEX' and select the 'can_gen.hex' file.
5. Click 'Run' on the FLIP window. The CAN Generator program is successfully programmed. We will now program NNB and CRIS to different values.
6. Click the ''Set CAN Node' tab. The CAN Node Configuration dialog is displayed.

Figure 4-11. CAN Node Configuration dialog



7. Change the Node setting to ‘0F’ and CRIS to ‘08’. The BTC (Bit Timing Registers) settings remain unchanged. The NNB and CRIS settings are changed in order to give a unique number to the controller and to adapt it to Message Identifier mapping.
8. Click ‘Set’ to program the settings, then click ‘Read’ to verify that programming was successful.
9. Ensure the ‘With Application’ check box is selected.
10. Click ’Start Application’.
    The microcontroller has been successfully programmed. The generaor program will run (send CAN messages and display on the LCD). The chip will now accept In-System Programming when ‘NNB = FF’ (default) or ‘0F’, and only with ‘CRIS = 08’.

4.8 Conclusion

We have successfully run 2 demonstration programs on the T89C51CC01UA with UART bootloader and 2 demonstration programs on the T89C51CC01CA with CAN bootloader. In the CAN bootloader demonstrations we also modified the NNB and CRIS in order to assign a unique number to the controller and adapt it to a Message Identifier mapping.

Using AT89C51CC03U with UART bootloader and AT89C51CC03C with CAN bootloader, the same demonstration programs can be run on AT89C51CC03. This illustrates the full compatibility between AT89C51CC03 and T89C51CC01.

Thanks to the 64K Bytes Flash and the 2K Bytes RAM included in the AT89C51CC03, large complex application programs such as a full CANopen stack can run on AT89C51CC03.

Section 5

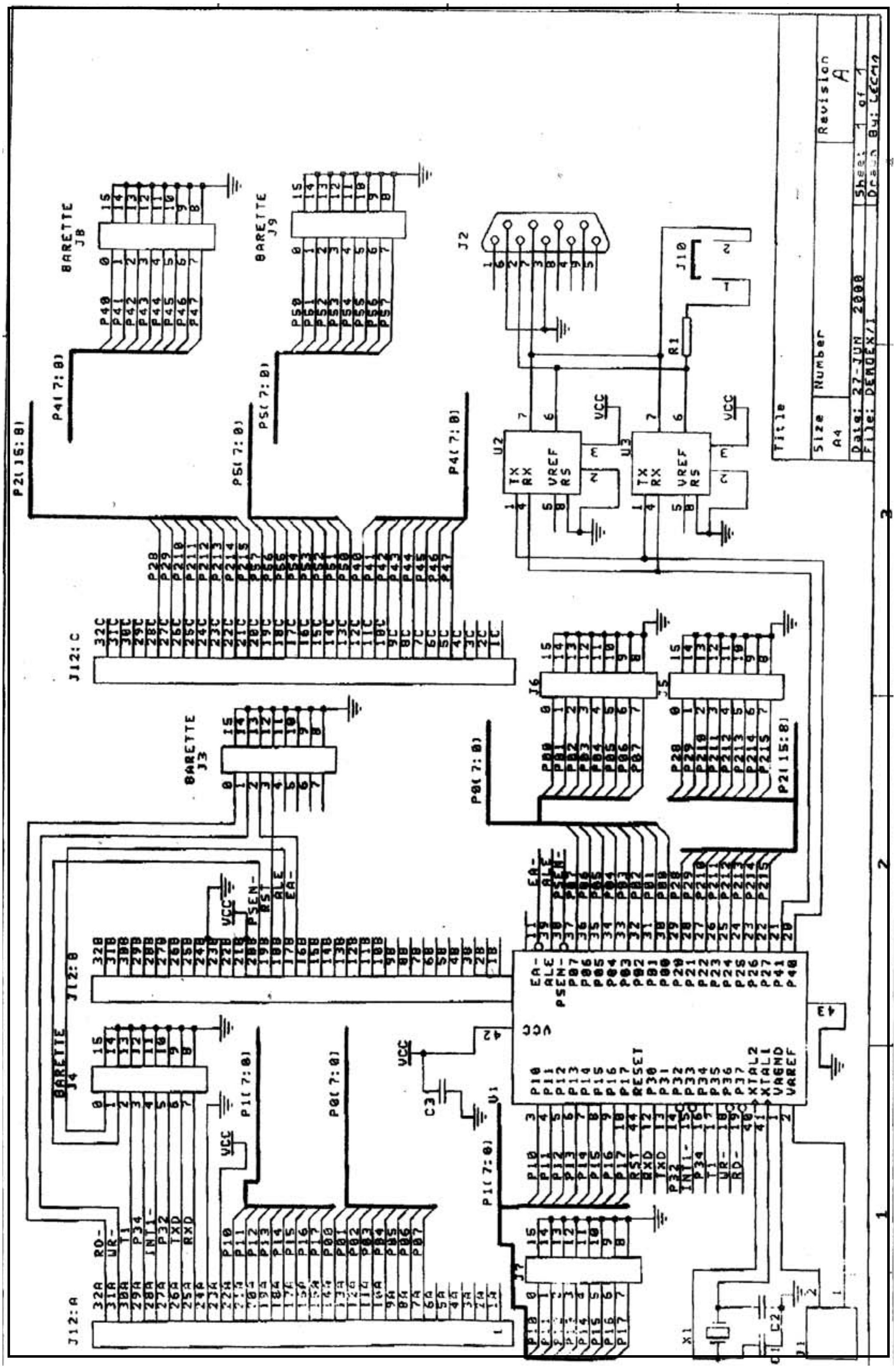
Appendix A

5.1 Bill of Materials

Table 5-1. Bill of Materials

Reference	Value	Quantity
C1,C2	22 pF	2
C3	100 nF	1
J1	2 pin connector	1
J2	DB9 Female Connector	1
R1	120 Ω 1/4W	1
U1	PLCC44 Socket	1
U2	DIP8 socket	1
U3	CAN Driver ATA6660 or compatible	1
X1	12 MHz Crystal	1
J12	DIN3*32 Female Connector	1
J10	Jumper Spacing 2.54 mm	

5.2 Demo Board Schematic



5.3 Support

All code and source files as well as latest software versions can be found on the Atmel website http://www.atmel.com.

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