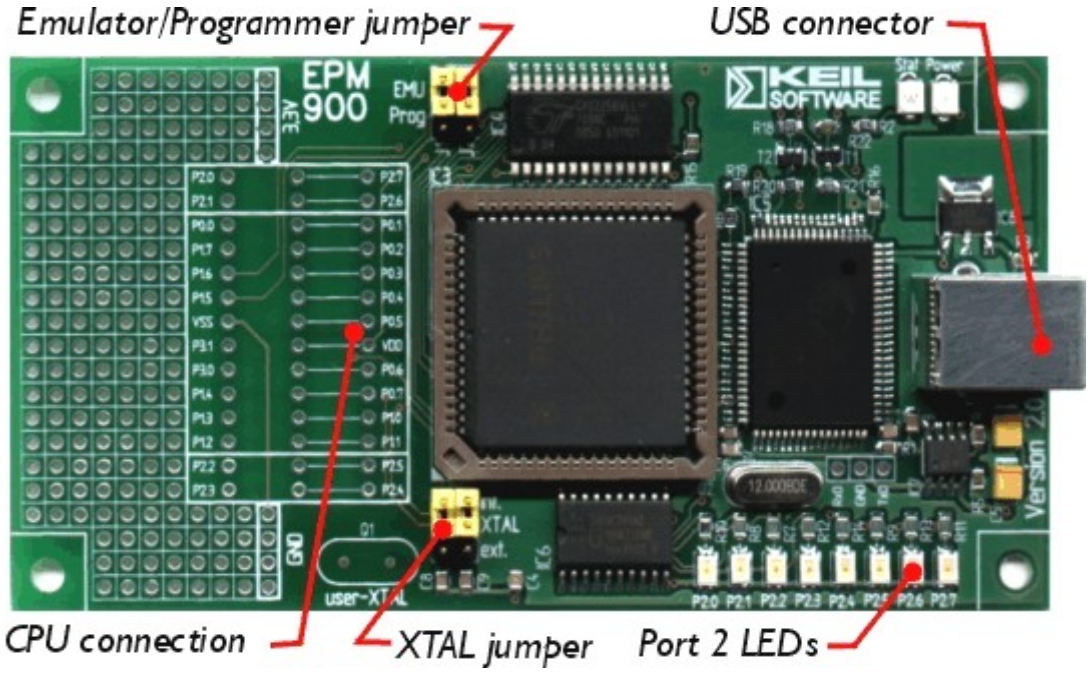
EPM900 - Overview

The Keil **EPM900** supports in-circuit debugging and parallel Flash ROM programming for the Philips P89LPC9xx device family. EPM900 connects directly to the µVision2 Debugger that provides full control over the user program execution.



Features

- USB interface for fast PC communication (power supply via USB)
- Real-time in-circuit emulation up to full device speed including programmable clock sources
- Flash Programming in parallel mode
- 8 buffered LEDs display I/O port 2 status information

Technical Data

- All P89LPC932 pins connected to wrap area: 20mm x 45mm (0,7" x 1,8")
- Small board size: 59mm x 115mm (2,3" x 4,5")

LED Status Information

The **Power** LED signals that the EPM900 is powered.

The **Stat** LED shows the following EPM900 status information:

- USB device detected: ON for 0.3 seconds.
- Start of the µVision2 debugger: ON
- User application runs under debugger: OFF
- Flash programming: ON

The **P2.0** - **P2.7** LEDs are driven by an buffer and show Port 2 status information. The LED driver is disabled by default to avoid oscillation on open device The P2 LEDs are enabled in µVision2 under **Project - Options for Target - Debug - EPM900 Settings - Enable P2 LED driver**.

Supported Devices

The Keil EPM900 Emulator uses the Philips P89LPC932 which is a superset of many other Philips LPC device variants like: P89LPC920, P89LPC921, P89LPC922, P89LPC930, P89LPC931. To connect this device variants the EPM900 board offers flexible connector pads which interface to the target system or to the programming adapter.

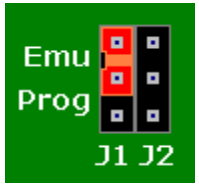
EPM900 - Emulation Mode

Hardware Configuration



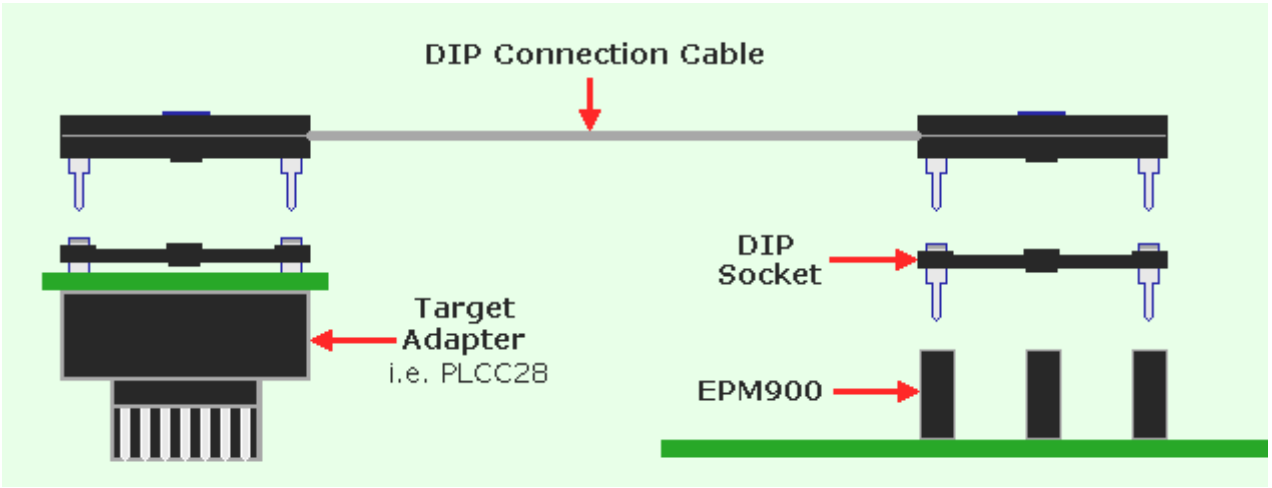
EMP900 is configured for Emulation Mode by setting the jumpers **J1** and **J2** to position **Emu**.

The jumper J2 can be used to disconnect target power supply from the EPM900 power supply. When you remove J2 the VDD pin of the



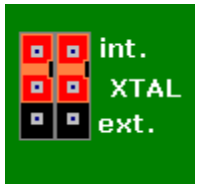
emulation device is no longer supplied from EPM900 with 3.3V.

The EPM900 Emulator is connected to the target system with a DIP connection cable and a target adapter socket. For the various device variants you need target adapters (i.e. TSOP28 or PLCC28).



Note: The Target Adapter Socket is not included in the EPM900 package.

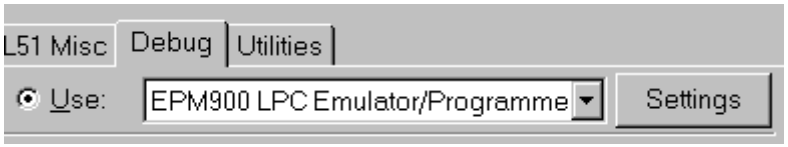
User Clock Source



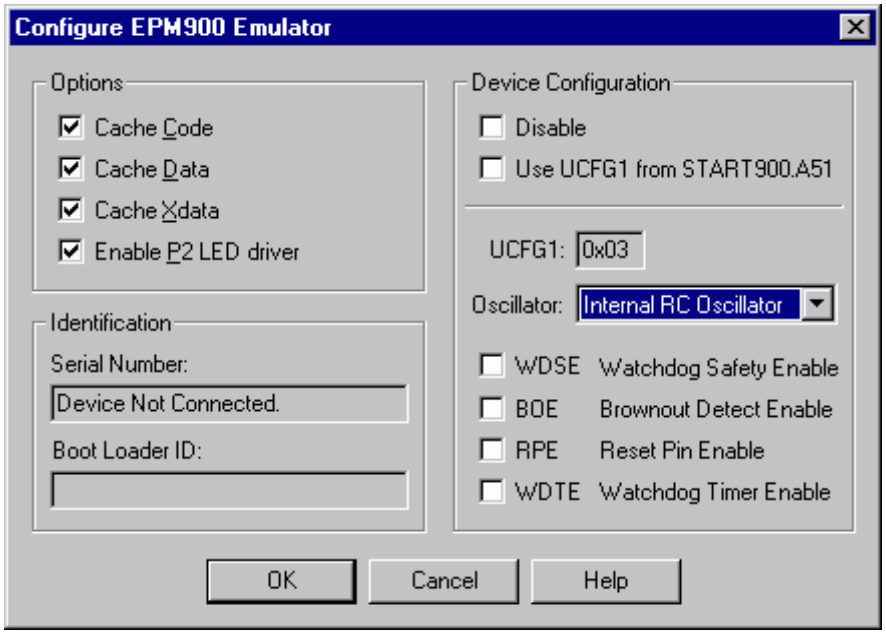
The Philips LPC900 devices offer several clock possibilities. For connecting an external XTAL to the LPC device the EPM900 provides an space Q1 user-XTAL.

Development Tool Configuration

The µVision2 interface to the target hardware for debugging and Flash ROM programming is configured under **Project - Options for Target - Debug**. Select **EPM900 LPC Emulator/Programmer** as shown below.



Click on the **Settings** button to open the **Configure EPM900 Emulator** dialog.



Options

Indentification

Device Configuration

Start Program Debugging

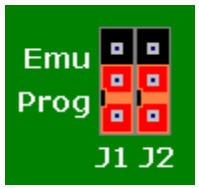
Once the EPM900 is configured, you can start the µVision2 Debugger and use the µVision2 Debug commands. You can find detailed information **µVision2 Started** User's Guide that is available in the **Project window - Books tab**.

The following table gives you a brief introduction into some debug commands.

Debug Command	Description
Step Into Stop Run	Using debugger commands you may single step through code, set breakpoints, and run the application.
Watchwindow Reset CPU	Variables can be review in watch windows. And you may reset the device to re-run the application.
Go to cursor	The yellow arrow marks the current assembler or C statement.
Serial Window	The Serial Window of the µVision2 Simulator acts as a terminal.

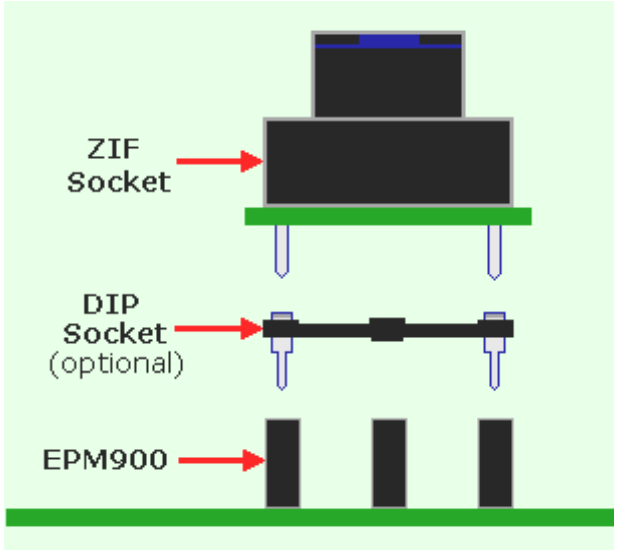
EPM900 - Programming Mode

Hardware Configuration



EMP900 is configured for Programming Mode by setting the jumpers **J1** and **J2** to position **Prog**.

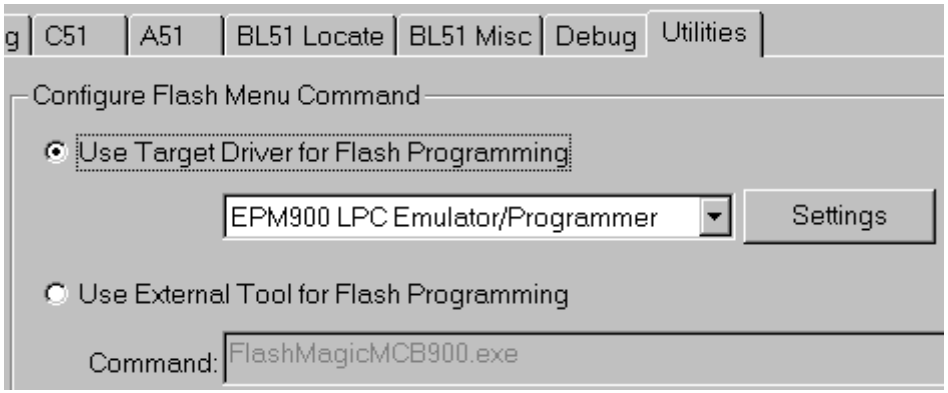
The EPM900 can be equipped in programming mode with various socket adapters as shown in the picture below.



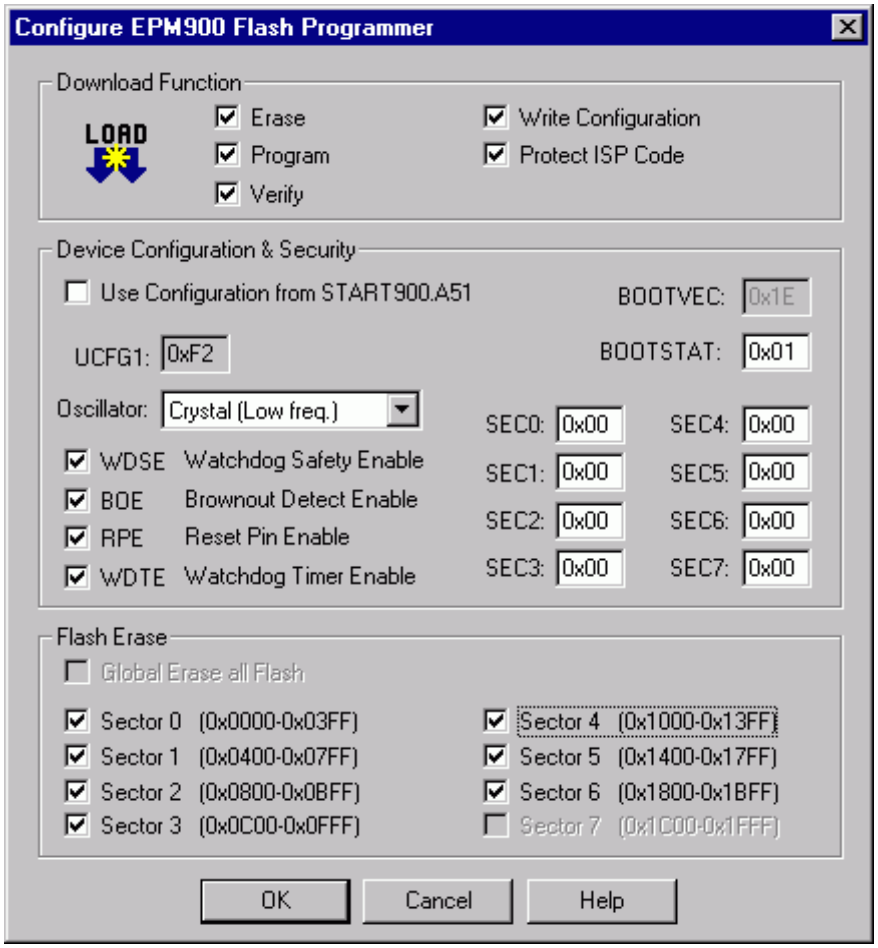
Note: The ZIF Socket is not included in the EPM900 package.

Development Tool Configuration

The µVision2 interface to the target hardware for debugging and Flash ROM programming is configured under **Project - Options for Target - Utilities**. Select Target Driver for Flash Programming the **EPM900 LPC Emulator/Programmer**.



Click on the **Settings** button to open the **Configure EPM900 Flash Programmer** dialog.



Download Function

Device Configuration and Security

Flash Erase

Device Programming

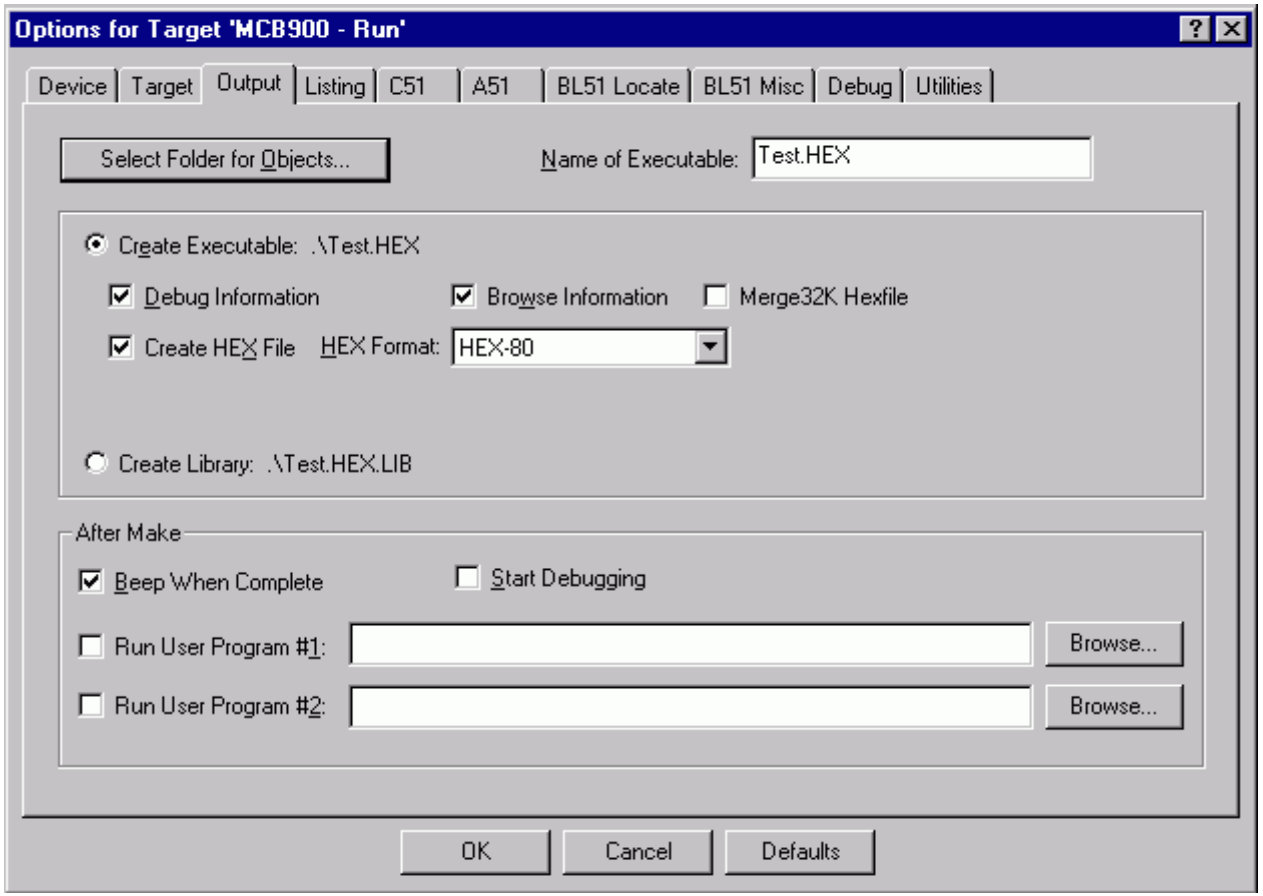
Once the EPM900 is configured, you can use the µVision2 Flash menu commands to program the LPC device. By default, µVision2 uses the absolute object file of your application for Flash programming.

Flash Menu	Description
 Download	Program the application code to the Flash ROM of the LPC device. This function is configured under Development Tool Configuration
 Erase	Erase the complete Flash ROM content of the LPC device.

Program an Intel HEX File

The EPM900 programmer uses by default the absolute object file of the current project for Flash Programming. In case that you need to program an Intel HEX you need to create a µVision2 project as described below:

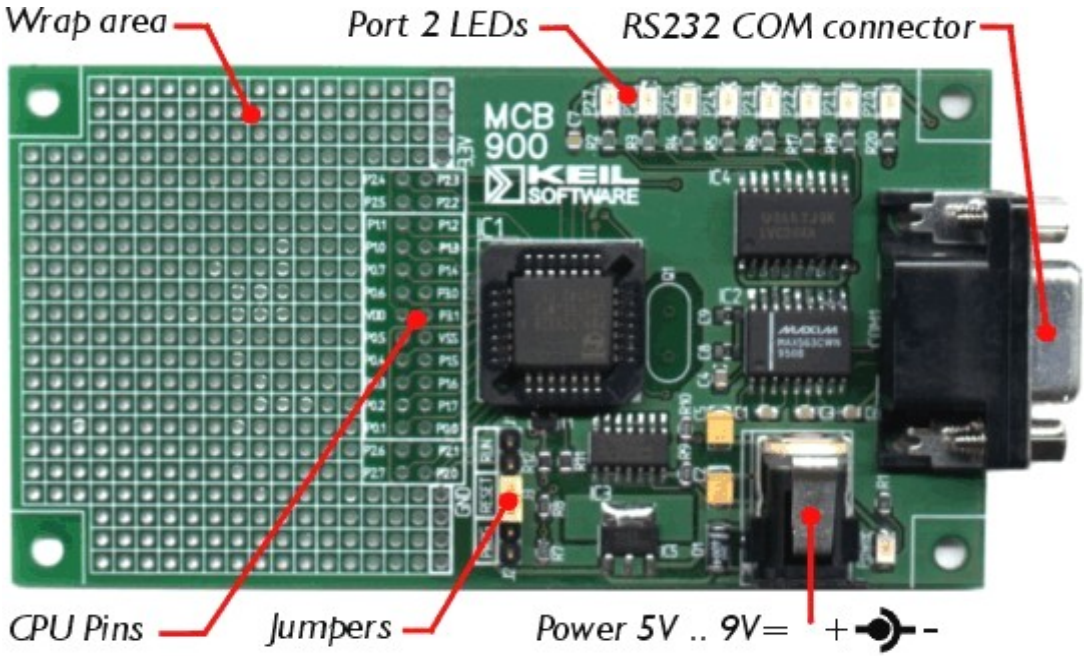
1. Create a new folder and copy the Intel HEX file (i.e. **TEST.HEX**) that should be programmed to this folder.
2. Start µVision2 and use **Project - New Project...** to create a new project file in the folder. As guideline, you should use the base name of the HEX file as project file name (i.e. **TEST.UV2**).
3. Select the LPC device that you are using from the Device Database.
4. Open the dialog **Project - Options for Target - Output** and enter the filename of the Intel HEX file under **Name of Executeable**.



Then you can the Flash Menu commands as described under Device Programming.

MCB900 - Overview

The Keil **MCB900** is a versatile and flexible prototype board for the Philips P89LCP932 microcontroller. MCB900 connects to the a COM port of your PC via the COM interface. MCB900 includes the **Keil µVision2 LPC Development Studio** which allows you to create and debug application programs. Your application programmed into the on-chip Flash ROM of the P89LPC932 device with **FlashMagic**.



Features and Technical Data

- RS232 driver provides a standard COM port interface
- 8 buffered LEDs display I/O port 2 status information
- 3,3V low-drop regulator allows wide power supply range (5V ... 9V=)
- jumpers for flexible ISP and debug configurations
- all P89LPC932 pins connected to wrap area: 55mm x 45mm (2,1" x 1,8")
- small board size: 59mm x 110mm (2,3" x 4,3")

Operating Modes

The MCB900 Board can be configure for the following operating modes using the jumpers:

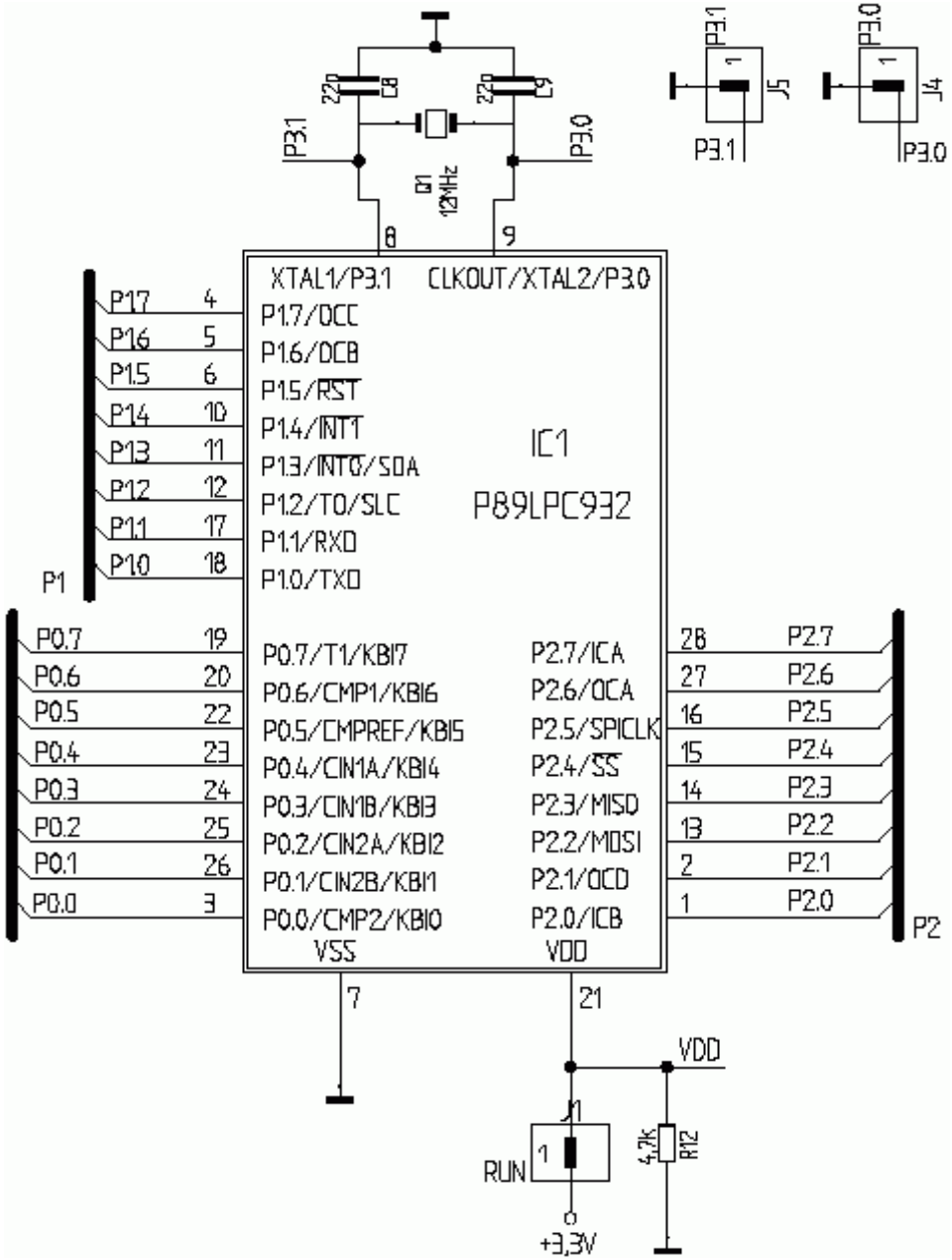
- FlashMagic: programming the on-chip Flash ROM of the P89LCP932. Note that the P89LPC932 on the MCB900 board uses a special ISP Flash Loader.

- µVision2/ISD51: In-System Debugging with the Keil ISD51.
- User Run: execute the application stored in the on-chip Flash ROM of the P89LPC932.

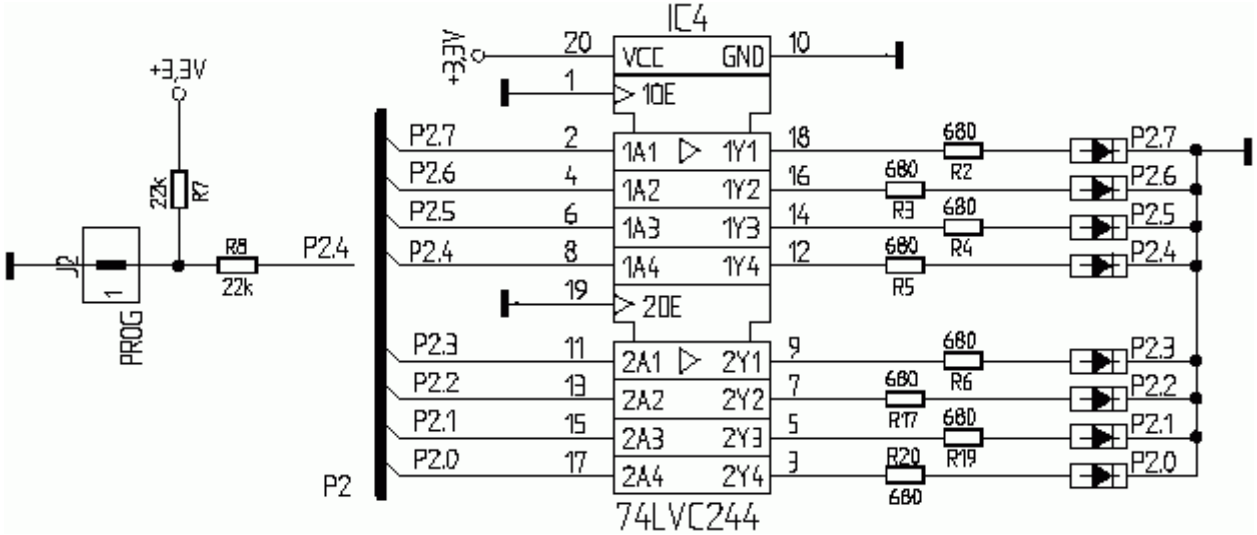
Jumper Setting for:	FlashMagic	µVision2/ISD51	User Run
RUN: fixed 3.3V on VDD	OFF	OFF	ON
RESET: via COM port	OFF	ON	OFF
PROG: ISP mode	ON	OFF	OFF

MCB900 - Schematics

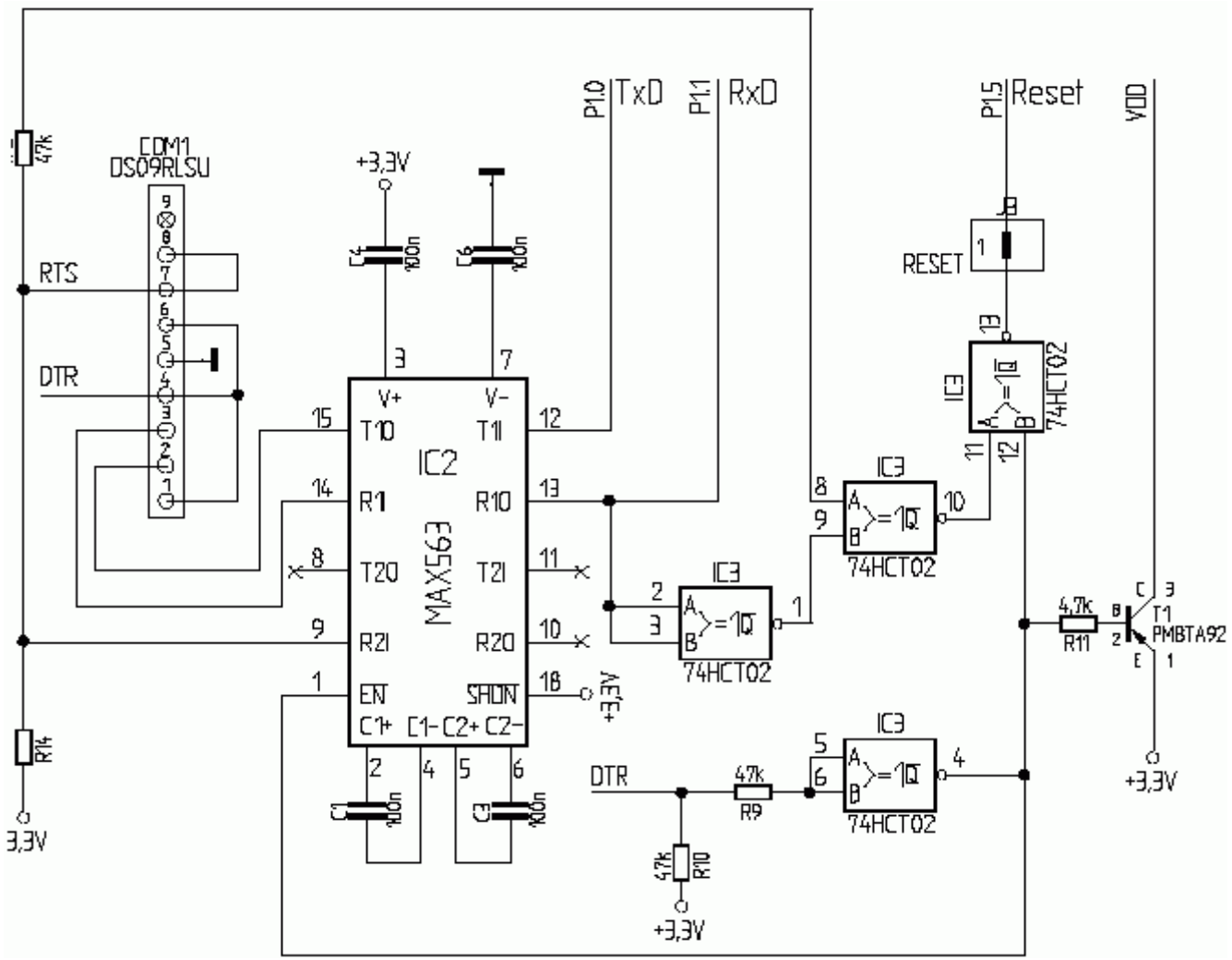
Processor


P3.1
P3.0
22p
C8
22p
C9
Q1
12MHz
P3.1
J5
P3.0
J4
8
9
XTAL1/P3.1
CLKOUT/XTAL2/P3.0
P1.7/OCC
P1.6/OCB
P1.5/RST
P1.4/INT1
P1.3/INT0/SDA
P1.2/T0/SLC
P1.1/RXD
P1.0/TXD
IC1
P89LPC932
P1.7 4
P1.6 5
P1.5 6
P1.4 10
P1.3 11
P1.2 12
P1.1 17
P1.0 18
P1
P0.7 19
P0.6 20
P0.5 22
P0.4 23
P0.3 24
P0.2 25
P0.1 26
P0.0 3
P0.7/T1/KBI7
P0.6/CMP1/KBI6
P0.5/CMPREF/KBI5
P0.4/CIN1A/KBI4
P0.3/CIN1B/KBI3
P0.2/CIN2A/KBI2
P0.1/CIN2B/KBI1
P0.0/CMP2/KBI0
P2.7/ICA
P2.6/OCA
P2.5/SPICLK
P2.4/SS
P2.3/MISO
P2.2/MOSI
P2.1/OCD
P2.0/ICB
28 P2.7
27 P2.6
16 P2.5
15 P2.4
14 P2.3
13 P2.2
2 P2.1
1 P2.0
P2
VSS
VDD
7
21
VDD
J1
RUN
4.7k
R12
+3.3V

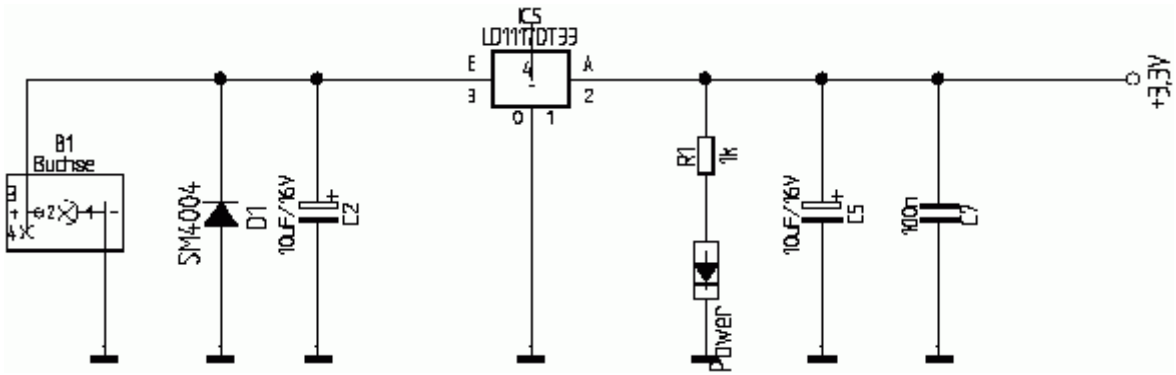
LED Driver



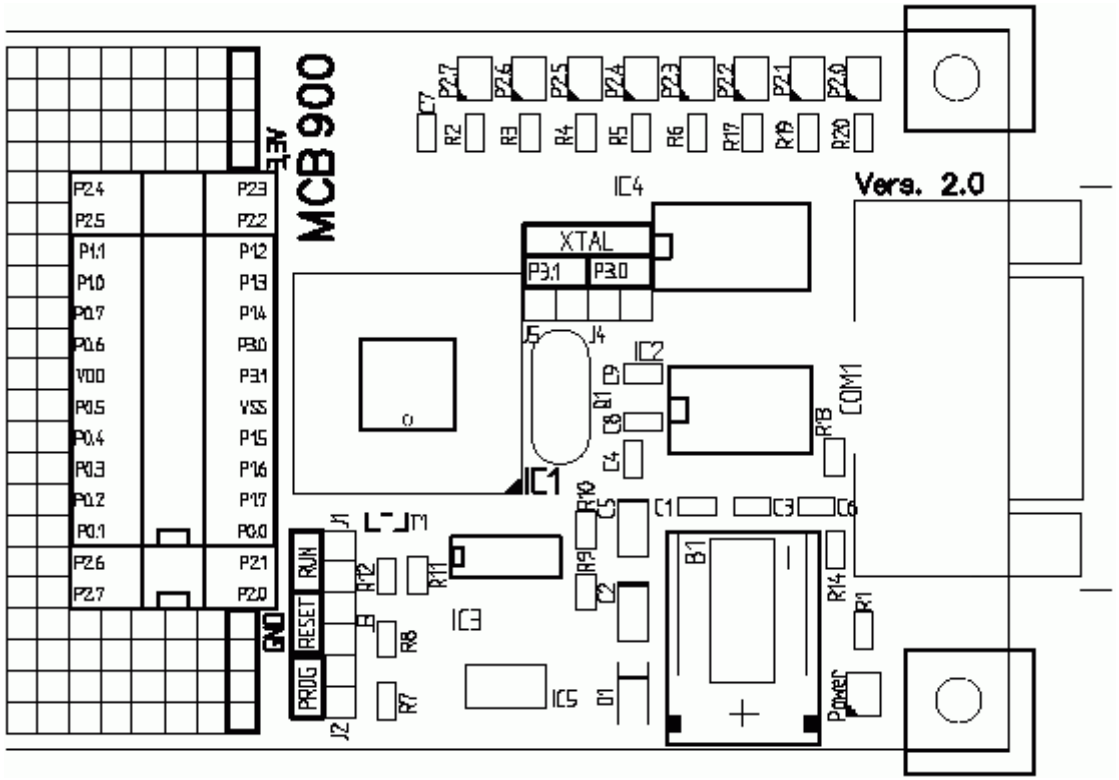
RS232 Interface



Power Supply



Part Placement



µVision2 - LPC Development Studio

The **µVision2 - LPC Development Studio** includes all tools required to generate small LPC applications:

- Powerful and easy-to-use **µVision2 IDE** includes editor, project management and make.
- 4KB code-size limited **C51 Compiler** (ANSI C compiler) and **A51 Macro Assembler**.
- 4KB code-size limited **µVision2 Debugger**with complete CPU and peripheral simulation and ISD51 in-system target debugger.
- **FlashMagic** for programming the on-chip Flash ROM.
- Extensive tutorials and documentation

Restrictions of the LPC900 Studio

The LPC900 Studio is a limited version of the Keil PK51 Professional Developers Kit with the following limitations.

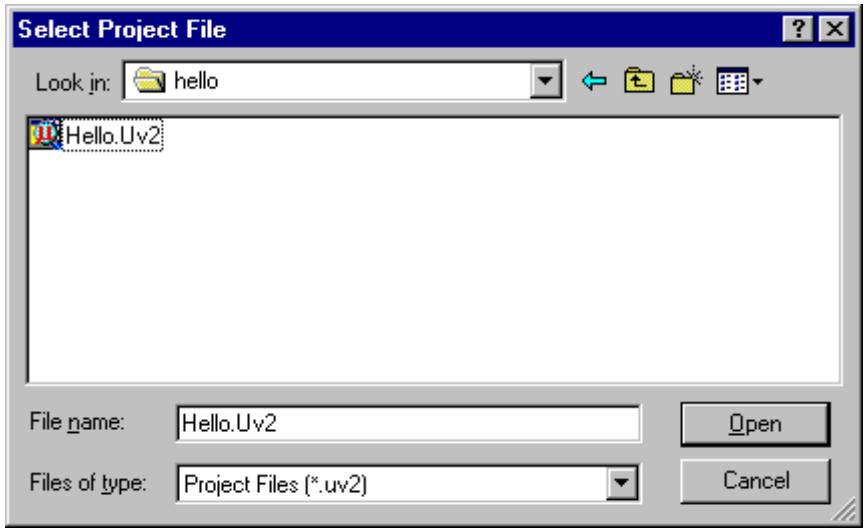
1. The 8051 compiler, assembler, linker, and debugger are limited to 4 Kbytes of object code but source code can be any size. Programs generating more 2 Kbytes of object code will not compile, assemble, or link.
2. The debugger supports 4 Kbyte files or smaller.
3. No hardware support is available for multiple DPTR registers.
4. No support is available for user libraries or floating point arithmetic.
5. The following PK51 components are not included: LX51 Extended Linker, Code Banking Support, Library Manager, and RTX-51 Tiny Real-Time Operating System.
6. It is not possible to generate assembler source files or use in-line assembler features.

HELLO: Your First LPC900 Program

The HELLO sample program is located in **C:\KEIL\C51\EXAMPLES\LPC9XX\HELLO**. HELLO does nothing more than print the text "Hello World" to the port. The entire program is contained in a single source file **HELLO.C**.
This small application helps you confirm that you can compile, link, and debug an application.

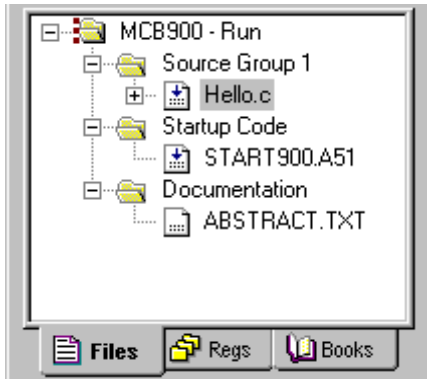
Create the HELLO Application

In µVision, applications are maintained in a project file. A project file has been created for HELLO. To load this project, select **Open Project** from the **Project** and open **HELLO.UV2** from the folder **...\C51\EXAMPLES\LPC9xx\HELLO**.



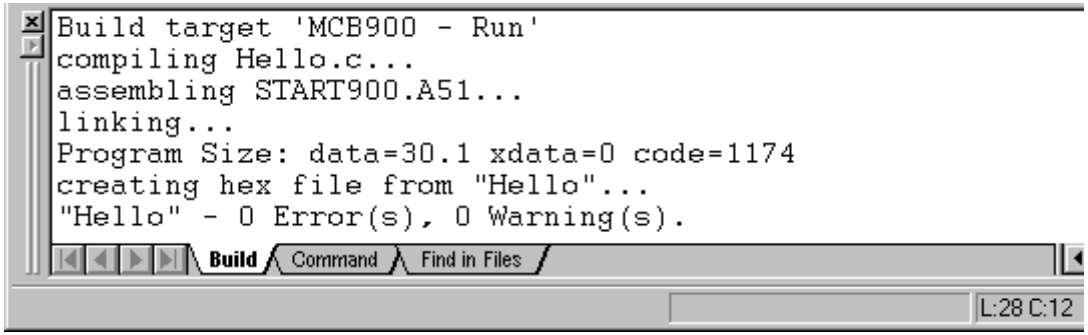
Edit HELLO.C

You can now edit **HELLO.C**. Double click on **HELLO.C** in the Files page of the Project Window. µVision2 loads and displays the contents of HELLO.C in an editor window.



Compile and Link HELLO

When you are ready to compile and link your project, use the **Build Target** command from the **Project** menu or the Build toolbar. µVision2 begins to translate link the source files and creates an absolute object module that you can load into the µVision2 debugger for testing. The status of the build process is listed in **Build** page of the **Output Window**.



Note

- You should encounter no errors when you use µVision2 with the provided sample projects.

Flash Download to MCB900

Once the HELLO program is generated, you can download the HEX file into on-chip Flash ROM of the P89LPC932 device on the MCB900 Evaluation Board. You to setup the MCB900 board as described below:

- Configure the Jumper Settings for FlashMagic: RUN - OFF, RESET - OFF, PROG - ON.
- Connect the COM Port to the PC COM1 interface using a standard 9-pin connector cable.
- Connect the MCB900 Board to a power supply (5V .. 9V=, 100mA)

You have two alternatives for Flash programming: use the µVision2 Flash Download command or use FlashMagic in dialog mode.



Use the µVision2 Flash Download Command

When you use the Download command the first time, you have to configure the Flash options under **Project - Options for Target - Utilities**. Select **External Tool for Flash Programming** and enter:

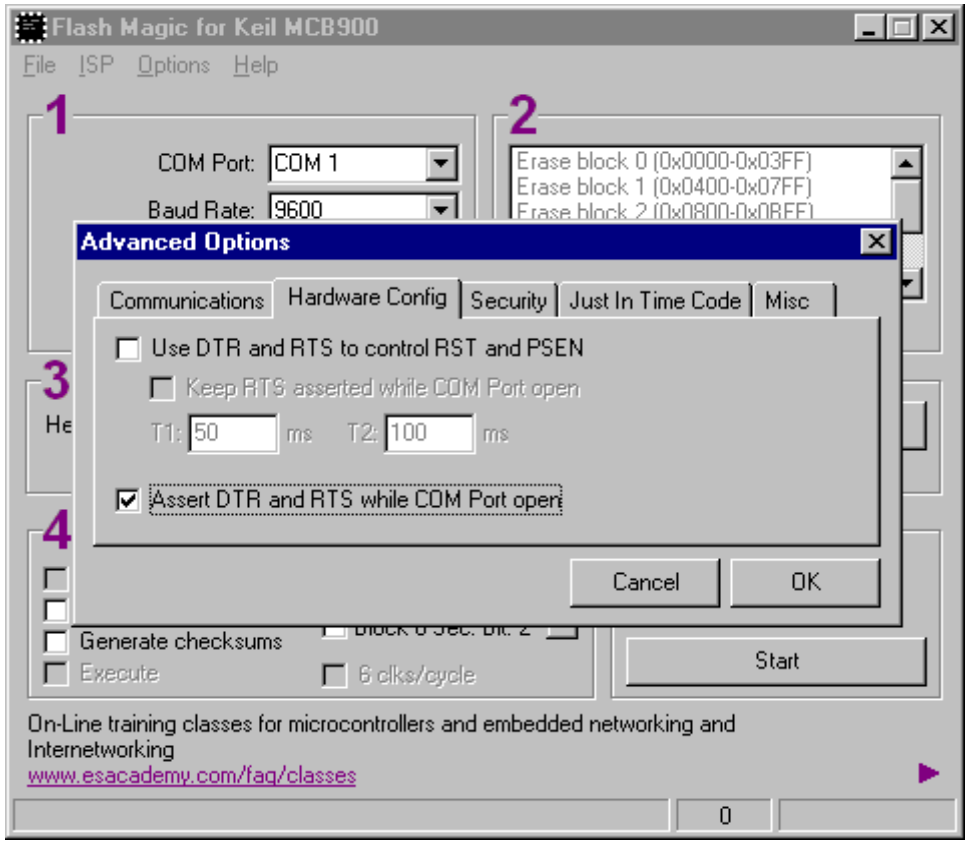
Command: **FM.EXE**
Arguments: **DEVICE($D,$X) ERASE(DEVICE,PROTECTISP) HEXFILE(#H,NOCHECKSUMS,NOFILL,PROTECTISP) COM(1,9600) HARDWARE(ASSERT)**

Now the **Project - Flash Download** command will use FlashMagic in batch mode for Flash programming.

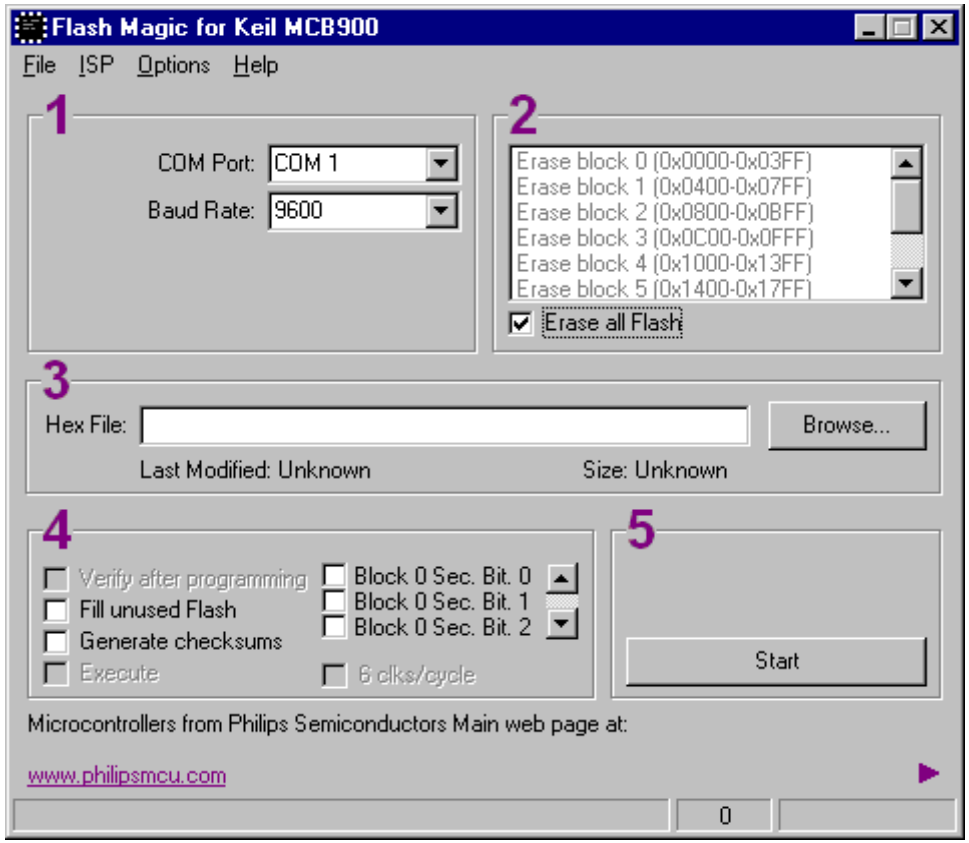
Use FlashMagic in Dialog Mode

Start **Programs - Flash Magic for Keil MCB900 - FlashMagicMCB900**.

1. Select the **COM Port** and specify 9600 as baud rate.
2. Enable **Erease all Flash**.
3. Select the Hex File: **Keil\C51\Examples\LPC9XX\Hello\Hello.hex**.
4. Enable **Assert DTR and RTS while COM Port open** under **Options - Advanced Options - Hardware Config**.



5. Click **Start** to download the Hex File into the Flash ROM of the P89C932.



In case of errors check the power supply, COM interface and jumper settings of the MCB900 board.

Start the HELLO Application on MCB900

Change the Jumper Settings on the MCB900 evaluation board to **User Run**: RUN - ON, RESET - OFF, PROG - OFF and re-power the board. This starts the HELLO application and the Port 2 LEDs will blink.

View Serial Output of the HELLO Application

You may view the serial output of HELLO application with the Microsoft Windows Hyperterminal application: **Start - Programs - Accessories -**

Hyperterminal.

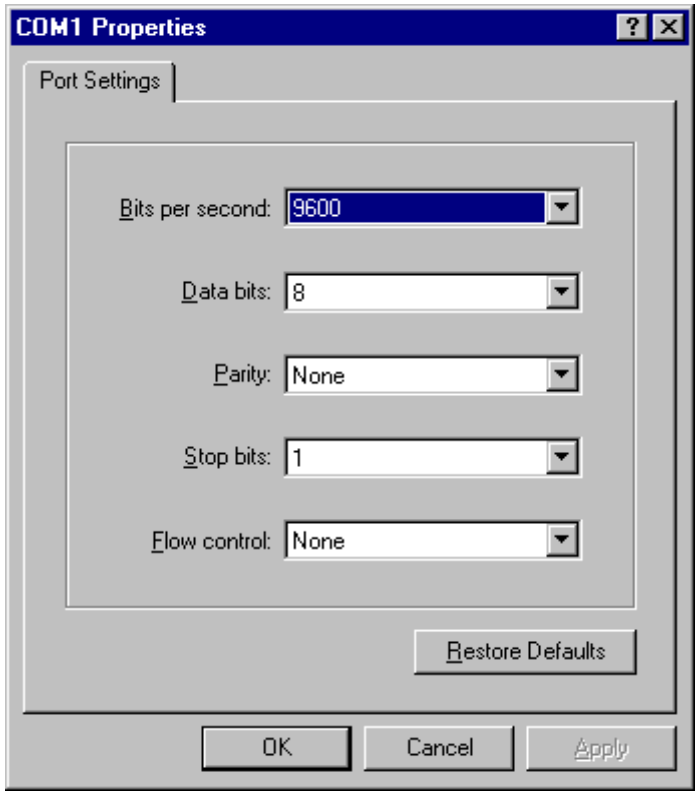
1. Enter a **Name** for the new connection, for example: **MCB900**.



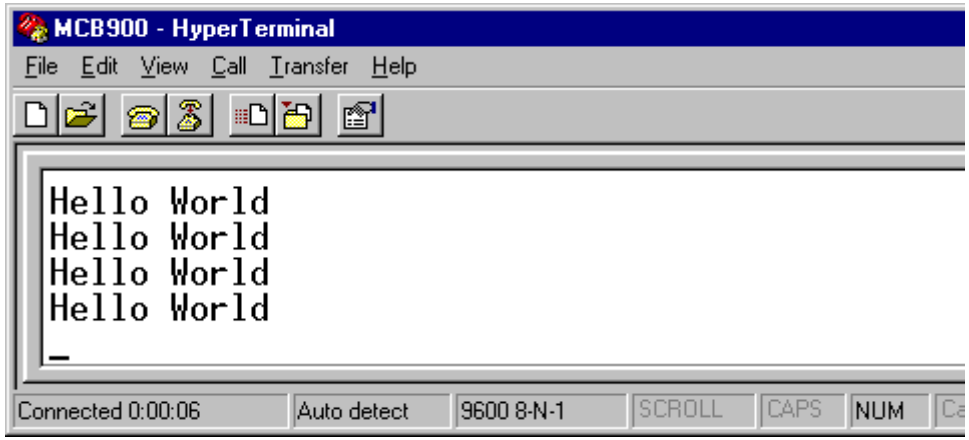
2. Select the PC COM port under **Connect Using**.



3. Select **9600** Bits per second, **8** Data bits, Parity **None**, Stop bits **1** and Flow control **None**.



4. Now you will receive Hello World messages from the MCB900 board.



Technical Support

Technical support for Keil MCB900 and Keil EPM900 is available under http://www.keil.com/lpc. **Self-Service Support** provides access to the Knowledgebase, Application Notes, and Discussion Forum. Please understand that email support is restricted for MCB900 and EPM900 users.