

Getting started with the K-Junior robot: A step-by-step guide for writing, compiling and executing a C application on the K-Junior robot

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Trademark Acknowledgements:

IBM PC: International Business Machines Corp.

Macintosh: Apple Corp.

SUN Sparc-Station: SUN Microsystems Corp.

LabVIEW: National Instruments Corp.

Matlab: MathWorks Corp.

Webots: Cyberbotics

Khepera: K-Team and LAMI

Pic: Microchip Corp.

LEGAL NOTICE:

- The contents of this manual are subject to change without notice
- All efforts have been made to ensure the accuracy of the content of this manual. However, should any error be detected, please inform K-Team.
- The above notwithstanding, K-Team can assume no responsibility for any error in this manual.

1. Robot application development using the CCS PIC C Compiler


A. Tools Installation

Instructions for installing the tools are given in section 3 of the KJOSManual – Usage of the PIC C Compiler.

B. Adding your application to the existing K-Junior Operating System Code

The K-Junior OS manages the resources of K-Junior and it enables you to access the embedded hardware. In order to run your application, its code has to be included in the OS source code.

Step 1 - Copy on your PC the directory “**K-JuniorOS_Sources**” (the latest source code of the K-Junior robot) from the Support CD-ROM or download the last version from the K-Team site: <http://ftp.k-team.com/K-Junior/software/>

Step 2 - Start the PIC C compiler (you can either use the short-cut on the Windows desktop , or the menu bar « Start / Programmes / PIC-C »)

Step 3 – On the upper menu bar click on the “**Project**” tab and in the dialog box select the file “**KJOs.pjt**” from the directory « K-JuniorOS / K-JuniorOS_Sources » copied in your PC. This is the project file for the OS and for your application.

The files included in the project are presented in the table below.

Files Included in The Project	
File	Purpose
KJOs.pjt	- the project file
KJOs.c	Primary file containing the main program; in this file you will include your variables, functions and code.
KJunior.c	This second file contains the low level functions for accessing the K-Junior robot hardware (*).
variables.c	- file containing the internal variables (*)
versions.txt	- file containing the description of the modifications done at every version
KJunior.h	- header file containing the functions prototypes you use and the K-Junior parameters (quartz frequency, baud rate etc) (*)
constants.h	- header file containing the constants definitions (*)
16f887.h	- header file containing the registers addresses of the processor (*)

WARNING It is strongly recommended that the files marked with (*) to be edited only by the experienced users, who may want to improve the K-Junior behavior.

Step 4 – Click on the “View” tab and check the “Project Files” box. The project files will be display in the left side window, as in the figure below.

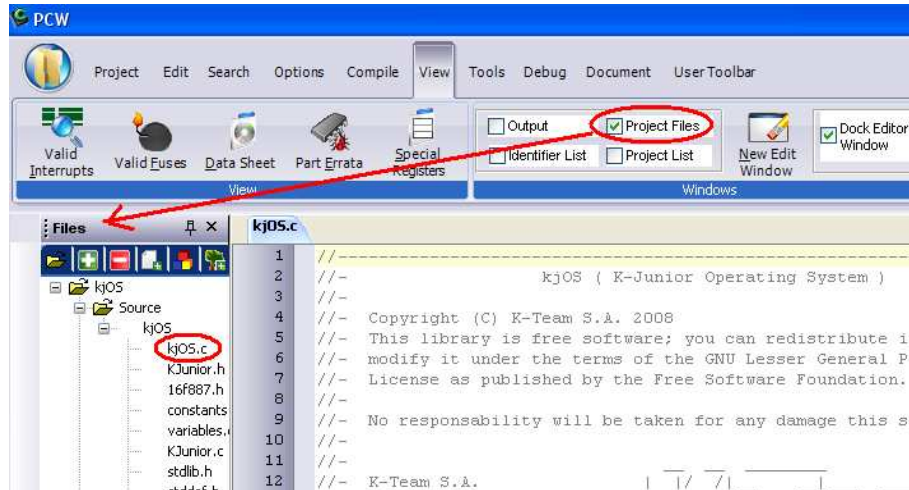


Figure 1: Display the “Project Files” window

Step 5 – Select the file “KJOs.c” from the list and include your code

The “KJOs.c” file contains the “main” function, which already includes an infinite loop. Here you can insert code for repetitive tasks – as seen in figure 2.

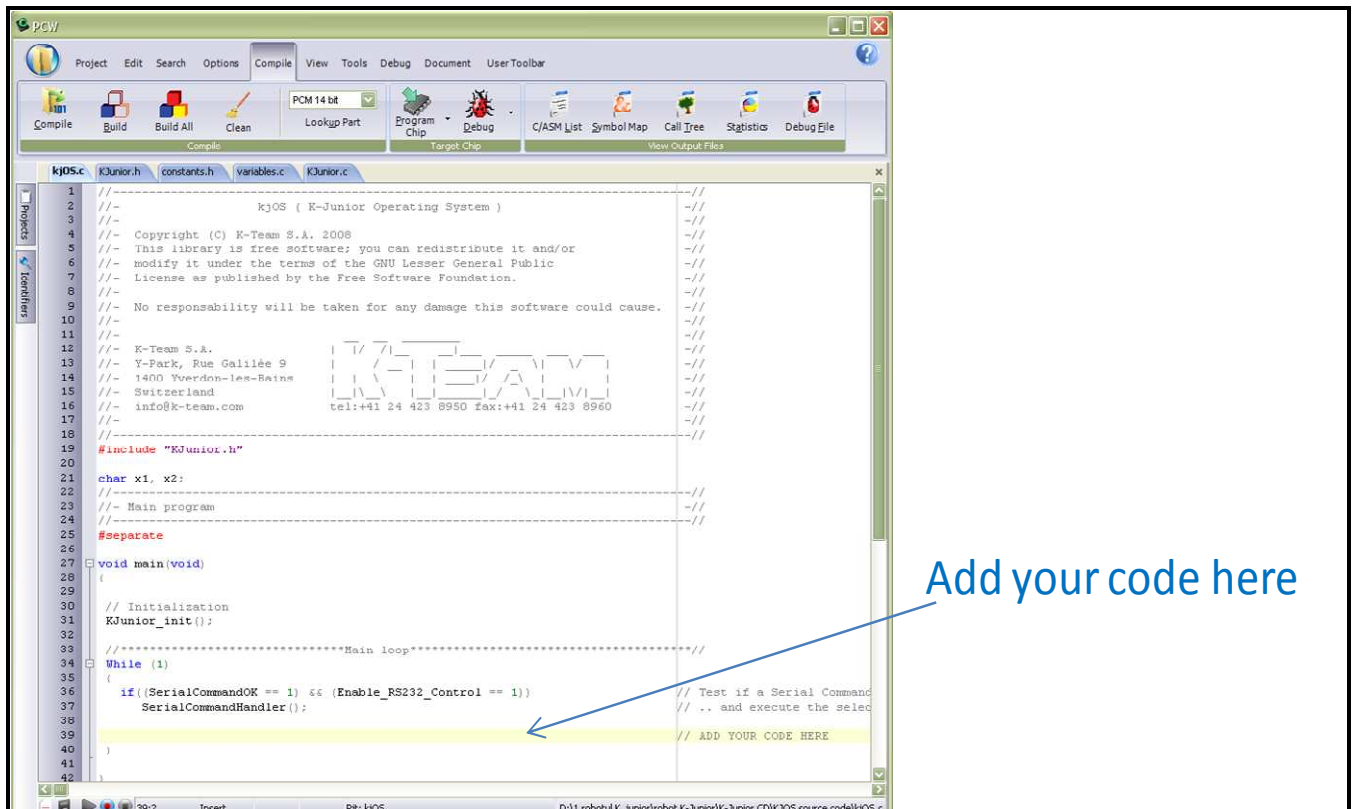


Figure 2: Screenshot from the “KJOs.c” file

❑ **Step 6** – Click on the “**Compile**” tab and select the target chip: first select “PCM 14 bit”, then press “Lookup Part” button and select PIC16F887 in the dialog box, as seen in figure below.

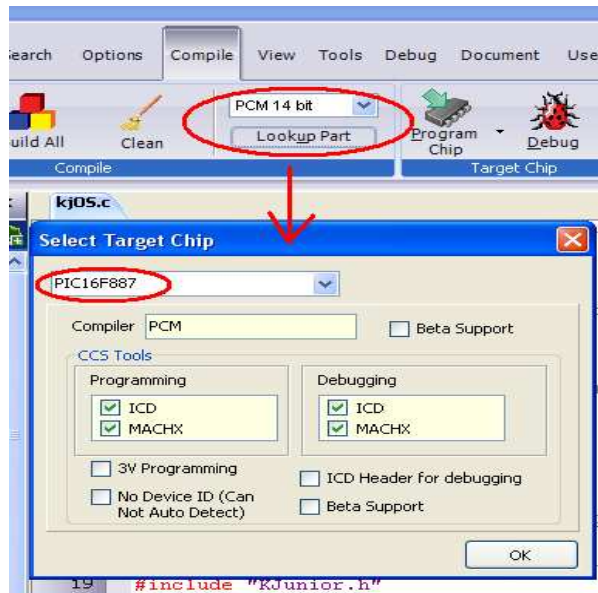


Figure 3: Select the target chip

❑ **Step 7** – Within the “**Compile**” menu press the “**Compile**” button to compile the “**KJOs.c**” file (which now includes also your code). If there is no error in your code click on the “**Build All**” button to generate the executable program for your project: the “**KJOs.hex**”, which must then be uploaded into K-Junior robot.

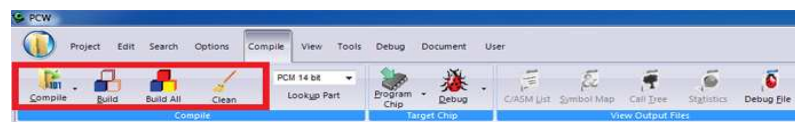


Figure 4: CCS C Compiler (PCW version)

Compilation Options	
Options	Purpose
Compile	Compiles all the units in the current project or a single unit selected from the drop-down menu.
Build	Compiles units that have changed since the last compilation and rebuilds the project.
Build All	Compiles all the units and builds the current project, using the current compiler.
Clean	Deletes the output files for the project.

The files resulted after compiling and building the project are summarized in the table below.

Compilation Files	
File	Purpose
*.err	Error file generated by each unit.

*.esym	Unit symbol file generated by each unit.
KJOs.hex	Executable program generated for the project.
KJOs.lst	C and ASM listing file generated for the project.
KJOs.sym	Project symbols file generated for the project.
KJOs.cof	Debugger file generated for the project.

2. Upload your application on the K-Junior

You can upload the modified KJO.c by using **Tiny Bootloader**, included in the K-Junior CD.

ATTENTION: For safety usage, make sure your resulting program does not occupy more than **95% of the ROM memory**. You can see the used ROM percentage after the “Build All” command, as shown in figure below.

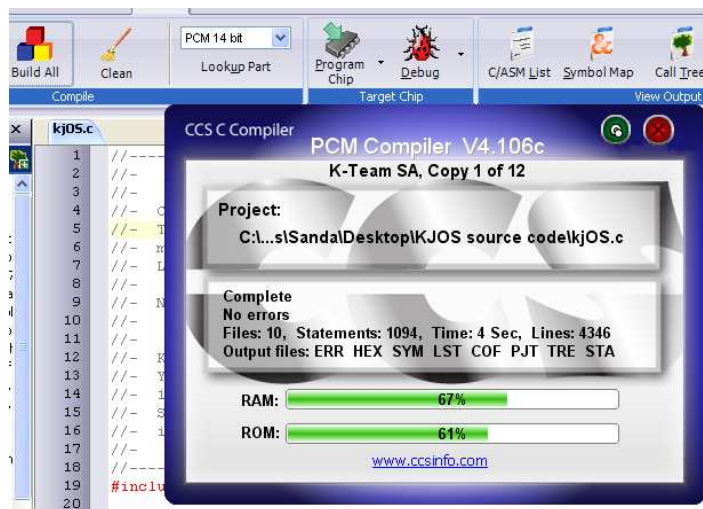


Figure 5: The window that reports information after “**Build All**” command

For more information about the uploading process, please read the KJOSManual (section 4 – USAGE OF THE K-JUNIOR UPLOADER).

Please follow these steps for uploading your own version of KJOs using the **Tiny Bootloader**:

- First connect your K-Junior to your computer with the USB cable.
- Launch the K-Junior Uploader Software “**tinybldWin.exe**”.
- Configure the uploader:
 - Look in << **My Computer**>>**Properties**>>**Device Manager**>>**Ports** >> to find what COM port is assigned to K-Junior robot.
 - Select the correct COM port. If the K-Junior’s COM port doesn’t appear, the COM port name can be directly written, or push the Search button.
 - Set the Baud Speed to 19200

- Browse to find your “**KJOs.hex**” file.
- Press the K-Junior **Turn On** button and **immediately** click on **Write Flash** button (the bootloader waits 1 second to receive the programming data, and then jumps to the resident application on the robot). If you fail to click on the Write Flash button within 1 s, turn K-Junior off and try again.
Another way is to use the **Reset Button**: press and hold the K-Junior’s **Reset Button**, release it and immediately click on **Write Flash** button.
- Wait until the uploading process is finished.
- Once the uploading is finished, your application included in the modified firmware will start automatically. Your application remains in the robot memory and can be restarted every time you turn on the robot, or reset it.

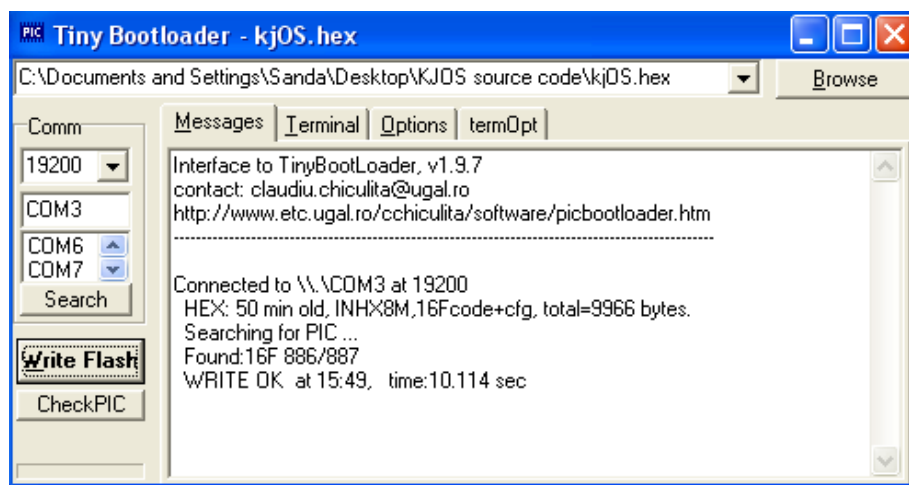


Figure 6: Screenshot from the **K-Junior Uploader**