2005 Programming Quick Start
Team 358

1. Beginners need the following to program the FIRST robot:
   - ❖ FRC (Full-size Robot Controller) RC Default Code
   - ❖ Microchip MPLAB & C compiler
   - ❖ IFI_Loader
   - ❖ A standard serial cable
   - ❖ A Windows PC with a serial port or USB-to-serial converter

2. All default code, updates, documentation, and support information is available at http://www.ifirobotics.com/rc.shtml and http://www.ifirobotics.com/oi.shtml , the Innovation FIRST (IFI) website,   The 2005 default code http://www.ifirobotics.com/docs/frc-code-1-12-2005v2.2.zip comes ready for basic driving and with a variety of sample I/O usages. Optional 2005 default code is also available for use with the CMU camera http://www.ifirobotics.com/docs/frc-code-1-12-2005v2.4.zip. Consult the CMU documentation for other requirements. Useful software examples and documentation, as well as the demonstration code used at kickoff can be found at Kevin Watson's website http://kevin.org/frc/ .

3. MPLAB is the FIRST supplied Windows based development environment (edit, compile, debug) that runs on your desktop computer and is usually provided to each team on a compact disk in the Robovation kit. MPLAB v7.0 is also free on-line at the Microchip website http://microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId=1406&dDocName=en019469&part=SW007002 , but the C compiler is not free except via the Robovation CD and is normally only available online as a time-limited trial copy or for purchase. For a limited time the latest compiler is available from a link on http://www.usfirst.org/ (bottom left of the page where it says "Microchip Software downloads"). After the link is removed the latest compiler must be obtained through FIRST. Manuals for using MPLAB come on the FIRST CD.

4. IFI_Loader (from the CD or IFI website http://www.ifirobotics.com/docs/ifi-loader-v1-0-10.zip) is used to download the compiled code into the RC via a serial cable from your desktop or laptop computer.

5. Check the IFI website periodically for updates to the software that corrects issues and fixes problems. For instance, the first update that must be performed is the downloading of a new Master Controller "patch" http://www.ifirobotics.com/docs/master-software-ver10.zip . Follow directions included with the download.

6. The programming language used is "C" or PIC assembly. Tutorials in C can be found on the web, in your local bookstore or on the FIRST website, e.g.,
   ❖ C Programming Resource Library http://www.usfirst.org/robotics/C_help.htm has a great overview of the programming process.
   ❖ Learn C Programming - Developed by Carnegie Mellon and the National Robotics Engineering Consortium specifically for FIRST, this interactive website will get your team prepared for the FIRST Robotics Competition. http://www.rec.ri.cmu.edu/education/robot_builder/
   ❖ FIRST Robovation - A Primer for Success Learning Modules http://www.usfirst.org/robotics/robovation/primer/index.html

7. Newer laptops no longer come with serial ports. If you have this problem one solution is to use a USB/Serial converter. Various models are available at Radio Shack, CompUSA, or online, however, some models can be temperamental and they generally take longer to download than a built-in serial port (60sec vs 10 sec). Good results have been reported using: Bafo Technologies BF-810 (~$15) and a Radio Shack USB-to-Serial port cable #26-183 ($42).

8. Documentation is your friend. Take the time to at least leaf through each manual, so you have an idea of where information can be found. Most of the basic information beginners require can be found in the IFI documents or MPLAB documents available from the websites:
   a. IFI Quick Start and Overview documents, the 2004 versions apply to 2005 as well
      http://www.ifirobotics.com/docs/frc_system_quick_start_2004-1-14.pdf
      http://www.ifirobotics.com/docs/control-system-overview-2004-01-07.pdf
   b. IFI Programming Reference Guide – basic how to hookup, program and download to the RC, hookup switches and sensors and do normal robot operations. http://www.ifirobotics.com/docs/rc-ref-guide-2005-revnc2.pdf
   c. Useful programming and compiler documents come with the tool installations or are available from the Microchip website. http://www.microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE& nodeId=1406&dDocName=en010014 or http://microchip.com/stellent/idcplg?IdcService=SS_GET_PAGE&nodeId =1406&dDocName=en019469&part=SW007002
      ❖ c18_getting_started_2.4.pdf http://ww1.microchip.com/downloads/en/DeviceDoc/MPLAB_C 18_Getting_Started_51295d.pdf
      ❖ c18_libraries_2.4.pdf – details on timers, interrupts, and various other utility functions available to the programmer. http://ww1.microchip.com/downloads/en/DeviceDoc/C18_Lib_5 1297d.pdf
      ❖ c18_users_guide_2.4.pdf - table of max numbers each variable type will store, compiler options, error messages, detailed descriptions of pragmas and some other advanced topics.

http://ww1.microchip.com/downloads/en/DeviceDoc/C18_UG__51288e.pdf
- ❖ Microchip pic18f8520 data sheet - PIC assembly instruction set and details on EEPROM and other chip specific topics, and several others.
http://ww1.microchip.com/downloads/en/DeviceDoc/39609b.pdf
and mistakes in the datasheet
http://ww1.microchip.com/downloads/en/DeviceDoc/80157d.pdf
- ❖ Microchip PICmicro 18C MCU Family Reference Manual – all things great and small (in excruciating detail) about the processor we use.
http://ww1.microchip.com/downloads/en/DeviceDoc/39500a.pdf
- ❖ MPLAB Quick Start Guide.pdf - basic how to use MPLAB and set options.
http://ww1.microchip.com/downloads/en/DeviceDoc/51281d.pdf
- ❖ MPLAB Users Guide.pdf
http://ww1.microchip.com/downloads/en/DeviceDoc/51519a.pdf

9. Programming limits to the 2004 RC:
    a. 30,720 bytes of program space is available to the user, after 2004 IFI code.
    b. 1,343 bytes of ram available to the user, after 2004 code overhead.
    c. 256 bytes of global variables available within any one MPLAB project file, such as user_routines.c
    d. 120 bytes of variables can be declared within any single routine.
    e. The program and data space your code has used can be checked either by the status line at the bottom of the IFI_Loader window or via the optional .map file that you can set MPLAB to generate for you. Note: the .map file lists % of program space used, but the user will have only 90% available to him or her. The .hex is ASCII and file size is no indication of code size.

10. Visit the ChiefDelphi Programming forum for discussions on all programming topics, problems, and issues http://www.chiefdelphi.com/forums.