FIRMTRONICS

DIGIMIX-3

SERVO CONTROLLER & DEVELOPMENT BOARD

INTRODUCTION

DigiMix-3 is the ultimate platform to develop your own servo control software! This includes all types mixing from simple V-tail mixing to gyro stabilised flybarless helicopter rotor heads, and everything in-between. It is supplied with a software update cable to load your custom firmware to the microcontroller. No other hardware is needed! The compiler (GCC) is completely free and is very well supported. It is supplied with example code which will get you up and running in no time at all. The supplied software includes a set of functions that allow you to very easily control and manipulate RC signals. DigiMix-3 has 3 inputs and 2 outputs which can be configured for standard rate (50Hz to 120Hz) and high rate 274Hz output for digital servos. This is an excellent platform for your custom applications, from beginner to high-end, or to learn more about how servos are controlled, or even just to get started with the amazing world of microcontrollers! It contains an industry-leading Atmel AVR microcontroller with a wealth of information, examples and support.

FEATURES

- Contains a powerful Atmel AVR RISC microcontroller.
- Xmodem bootloader allows HypterTerminal (comes free with Windows[1]) firmware updating.
- Open source compiler (GCC) means it's totally free to start developing your own applications.
- A number of powerful example programs are supplied, including V-tail mixing.
- Example programs are precompiled so may be used "as is", with no need to compile anything.
- All timing-critical functions are provided in a library, making development extremely easy.
- 3 inputs, 2 outputs make it suitable for a wide range of applications.
- The 3rd input may be configured as an Analog-to-Digital Converter input (10-bit).

TECHNICAL INFORMATION

Input Timing Resolution	135ns
Output Timing Resolution	135ns
Operating Voltage	1.8 V to 6.0 V
Processor Frequency	7.3728 MIPS (million instructions per second)
Current Consumption	15.0 mA
Weight	+- 25 g
Board Size	38 mm x 14mm x 7mm
Mixing	Fully configurable

NOTE: ***Supplying more than 6 volts to the mixer could cause permanent damage. Please only use 4 cell battery packs.***

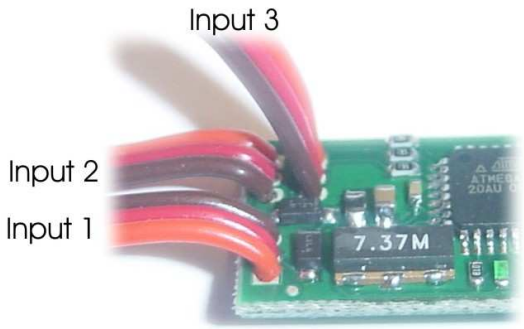
FIRST STEP

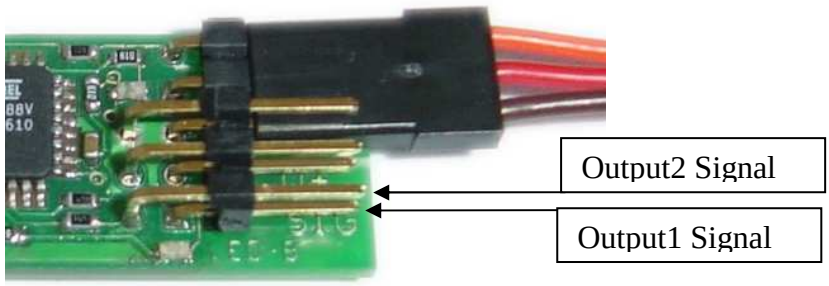
If the source code supplied on a CD, copy the \DigiMix3 v<version> directory to your local hard drive (for example C:\DigiMixDevelopment\) and make all files writeable (right click and choose 'Properties', and make sure the Read-only attribute is unchecked). This will be your working directory and will allow you to edit the source files (since you can't edit files on a CD!).

[1] Windows Vista does not come with HyperTerminal. It can be downloaded for free from http://www.hilgraeve.com/.

Connections

Servos are connected to the “dual-row” connector with the signal pin being closest to the edge of the board. The bottom row is output 2 and the top row is output 1. The two pins next to output 2 are the RS232 pins. These are at TTL levels and require a level shifter if they are to be connected to a PC. The RS232 interface should be connected as shown below right. Below left shows the inputs.





Note that the ground pin for Output 1 shares the ground pin for the RS232 connector. For this reason, Output 1 and the RS232 connector cannot be both connected to the board.

GCC Compiler

All software (firmware, more accurately) is complied using the GNU C/C++ Compiler (GCC). Support for Atmel AVR microcontrollers (http://www.atmel.com) is provided through a free set of open-source development tools called WinAVR (http://winavr.sourceforge.net/). WinAVR runs on Windows platforms. Other platforms are supported but are out of scope of this document. At the time of writing this document, the most recent version of WinAVR is 20081205 which is available on the CD that was supplied with the kit. If there is a newer version available online, you may download it although no guarantees are given. Although C++ is supported, we will stick to programming in straight C. You are of course free to develop your own C++ applications but this is outside the scope of this document.

Useful Documentation

To find out more about the GCC AVR support, please look at the avr-libc documentation which can be found in the C:\WinAVR\doc\avr-libc\ directory once WinAVR has been successfully installed. For microcontroller-specific information, please refer to the ATmega88 datasheet which is available on the supplied CD and on Atmel’s website.

Supplied Examples

A number of examples are supplied with the kit. A description of each example is given at the top of the main.c file in each example directory. The CD also contains the .bin file (compiled object code) which can be uploaded to the microcontroller without having to compile anything, or without even having to install WinAVR. Of course, if you’d like different functionality from what the examples offer, you will have to edit and compile the example code. The following examples are provided:

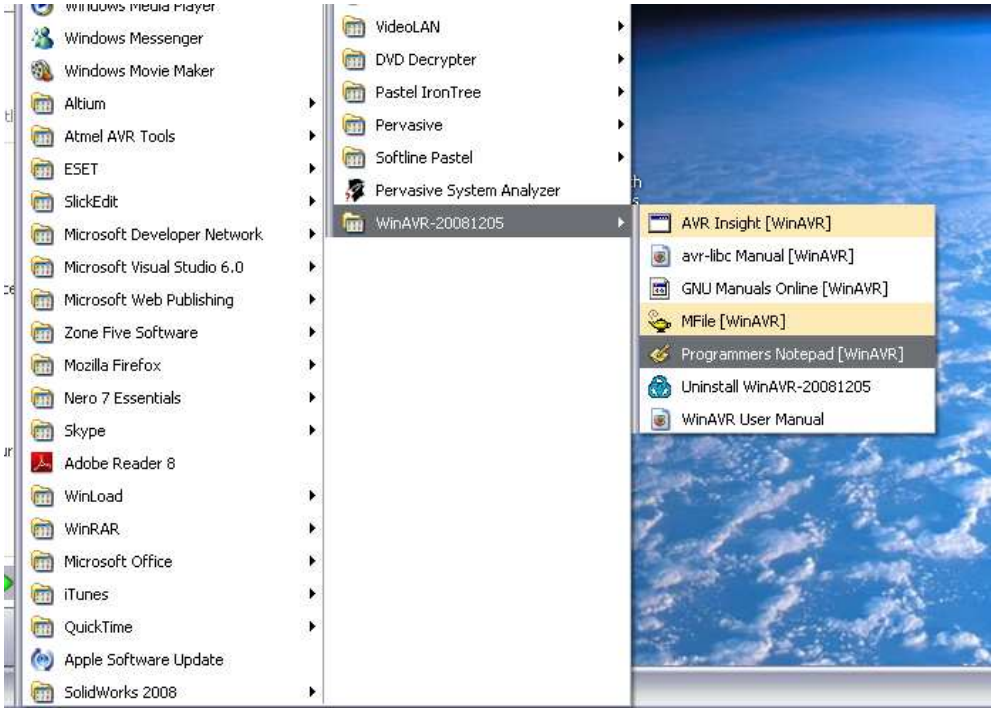
- Basic – shows how to use the UART (serial interface) and basic capture and output of RC pulses.
- Mixer – a mixer which mixes input 1 and 2 either with or without ratio input from input 3.
- Mixer with ADC – as above but with ratio depending on ADC value on input 3. This requires a potentiometer to be connected on input 3.
- TraverseLock – provides a pan and tilt function for camera mounts, etc.

Please go to http://www.firmtronics.com/Apps/ for any updates to the supplied source code and examples.

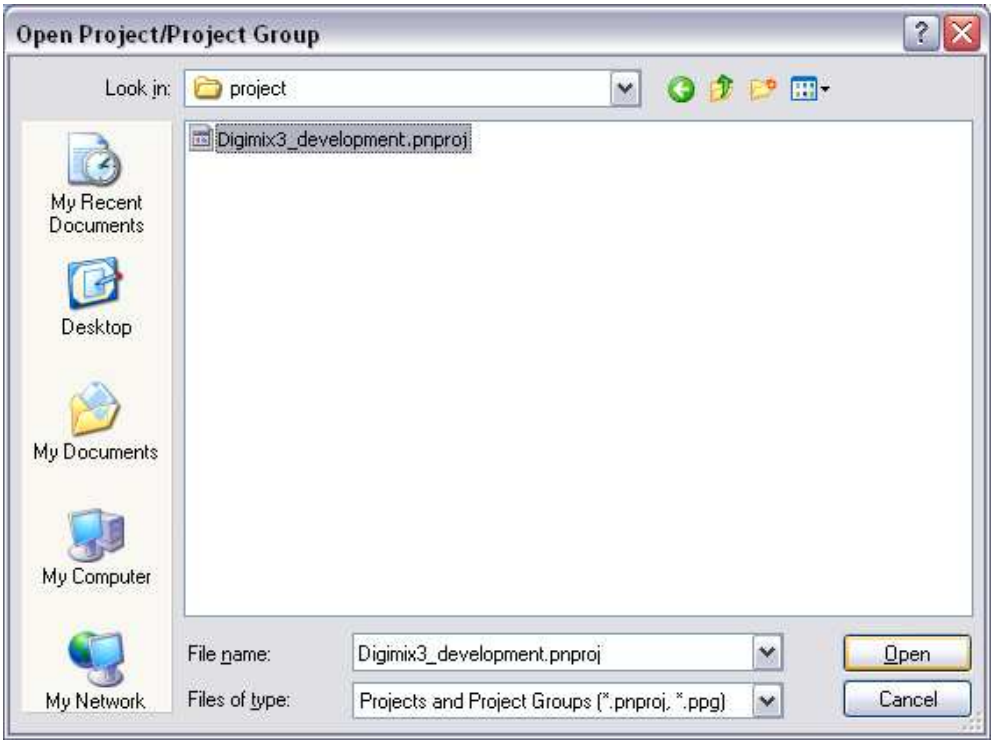
Source Code Editor

Once WinAVR is installed, you should be able to access the program group:
Start->Programs->WinAVR (version).

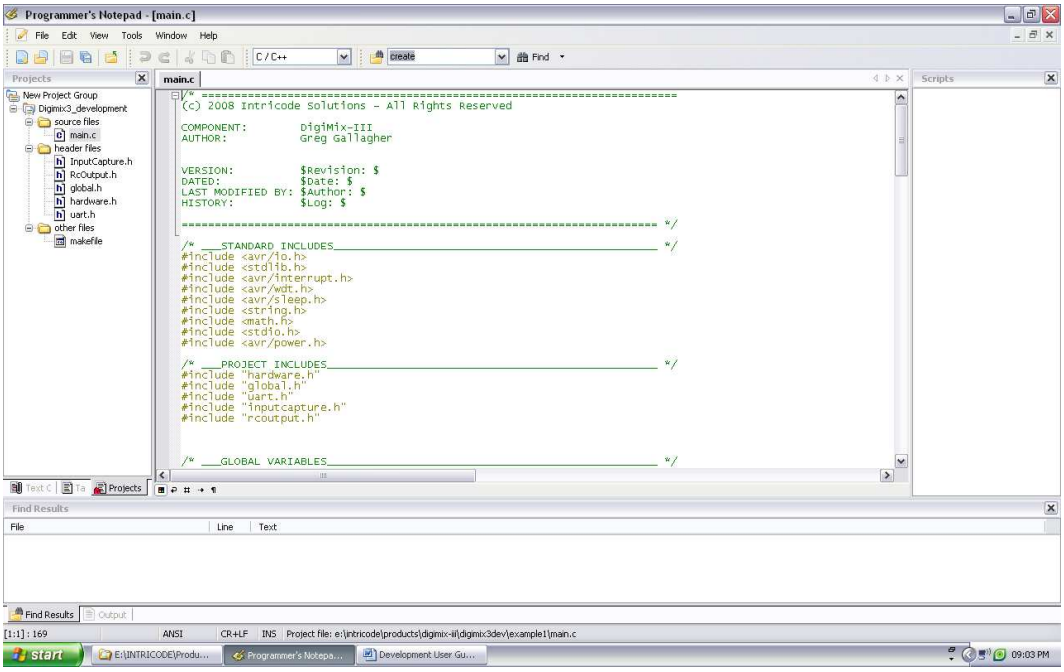
Within this group, the Programmer's Notepad (PN) should be available. This is the editor we will use. Launch PN to begin editing:



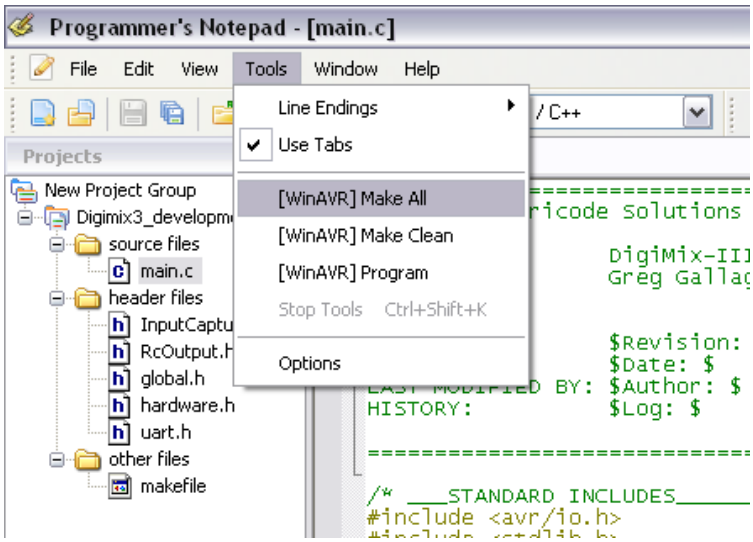
At this point you are ready to edit and compile your own source code. The next step is to open the digimix-3 example1 project supplied with your DigiMix-3 Development Board. In Programmer's Notepad, choose File->Open Project(s)… and navigate to the \\\DigiMix3Dev\examples\basic1\project directory and open it:



Make sure all the files that are shown below are included in the list on the left-hand side of the window. Double-click on the main.c file to open it in the editor.



This example project is immediately ready to compile. Simply choose Tools->Make All:



The complier will compile and link all necessary files and you should be able to see the listing in the output screen, ending in this:

Size after:
AVR Memory Usage

Device: atmega88

Program: 2124 bytes (25.9% Full)
(.text + .data + .bootloader)

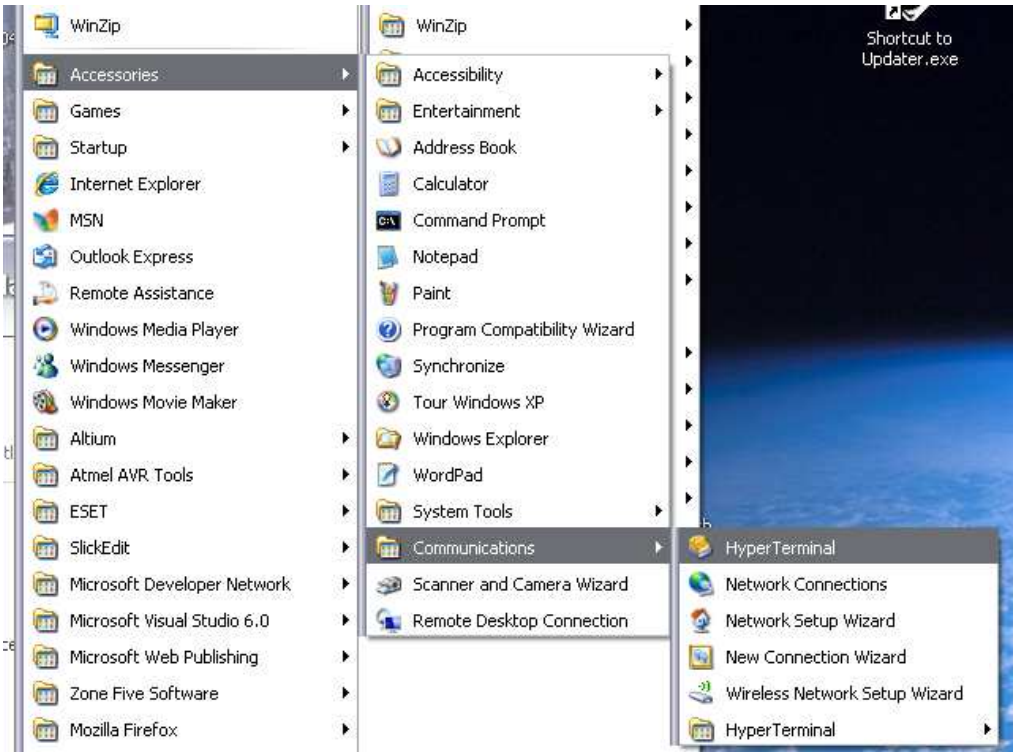
Data: 21 bytes (2.1% Full)
(.data + .bss + .noinit)

-------- end --------

You will now have a number of extra files in your \example1\ directory, one of them being a .bin file (digimix3_example1.bin in this case). This is the firmware file that will be uploaded to the DigiMix-3 Development Board.

Uploading Firmware using HyperTerminal

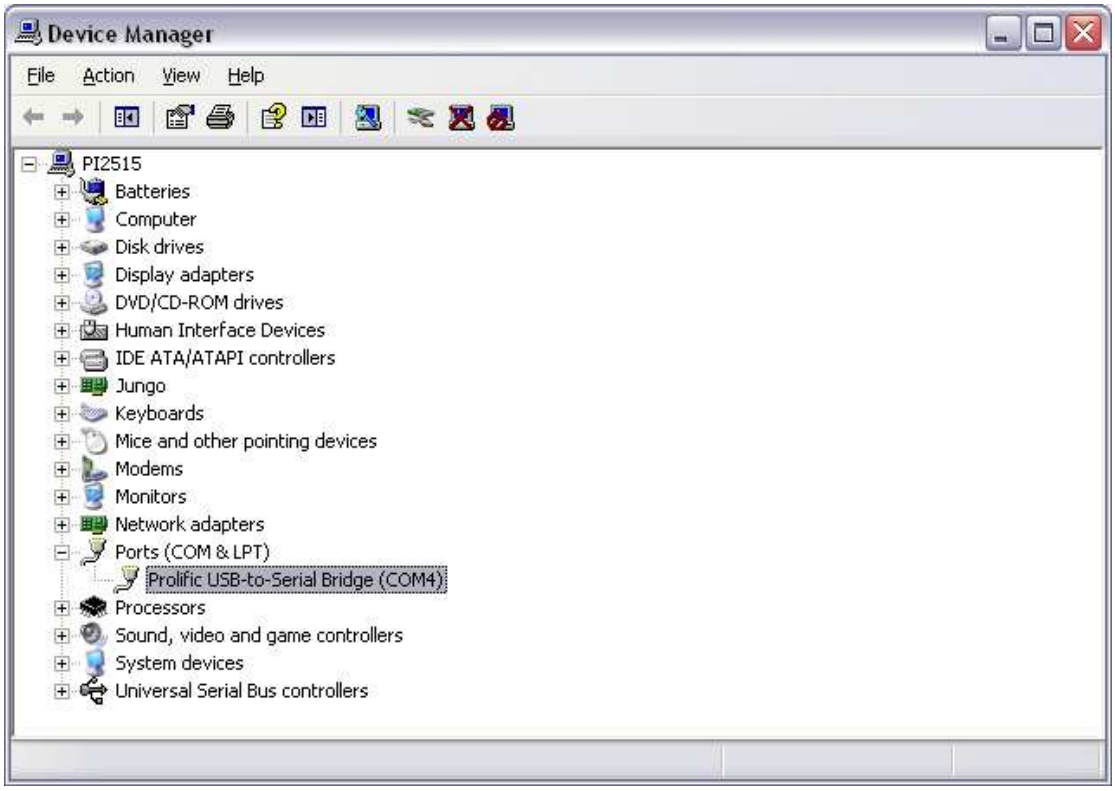
The Development Board is supplied with a simple bootloader application that allows users (that's you!) to upload new firmware to it via HyperTerminal using the Xmodem protocol. Make sure your board is correctly connected to the RS232 interface (see the user manual). Connect this to your PC's RS232 port. If your PC doesn't have a serial port, you'll need to purchase a USB to RS232 converter (available from almost every computer shop). Next, open HyperTerminal. Go to Start->All Programs->Accessories->Communications->HyperTerminal.



HyperTerminal will launch. If you have never used HyperTerminal, you may be asked for your area code and country (which you should enter) before you see the screen below.

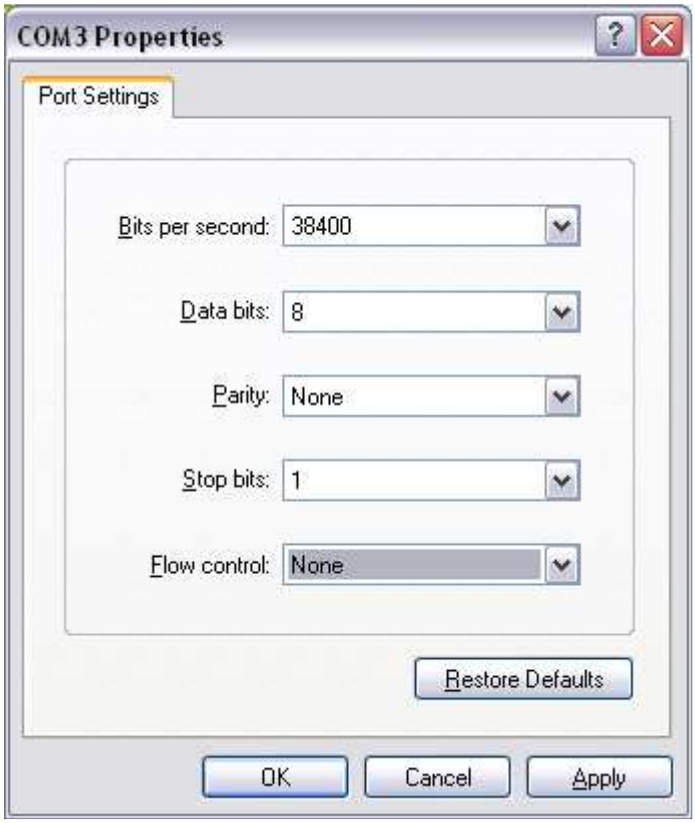
Type in the name DigiMix-3 Development as shown above, then click OK.

Next, choose the COM port your DigiMix-3 Development Board is connected to. If you're using a USB to RS232 converter, you will need to access your hardware device manager and check under Port to see what COM number your USB device has enumerated to.

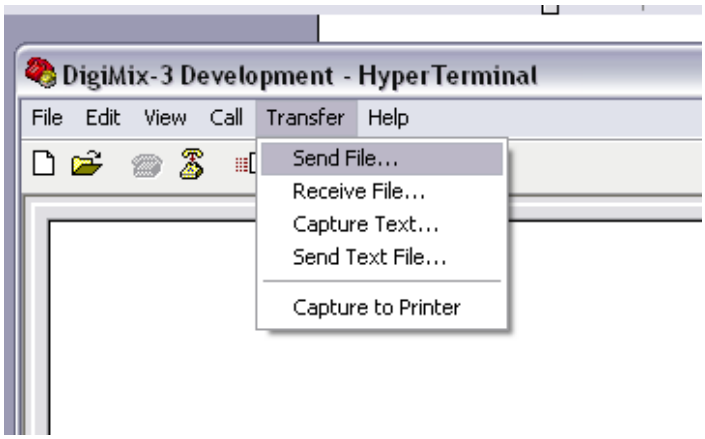


Click OK once you have selected the correct COM port.

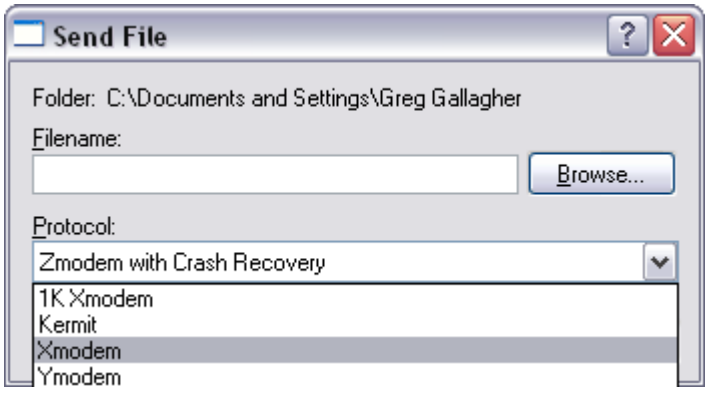
Next, select the settings as shown in the following image, then click OK.



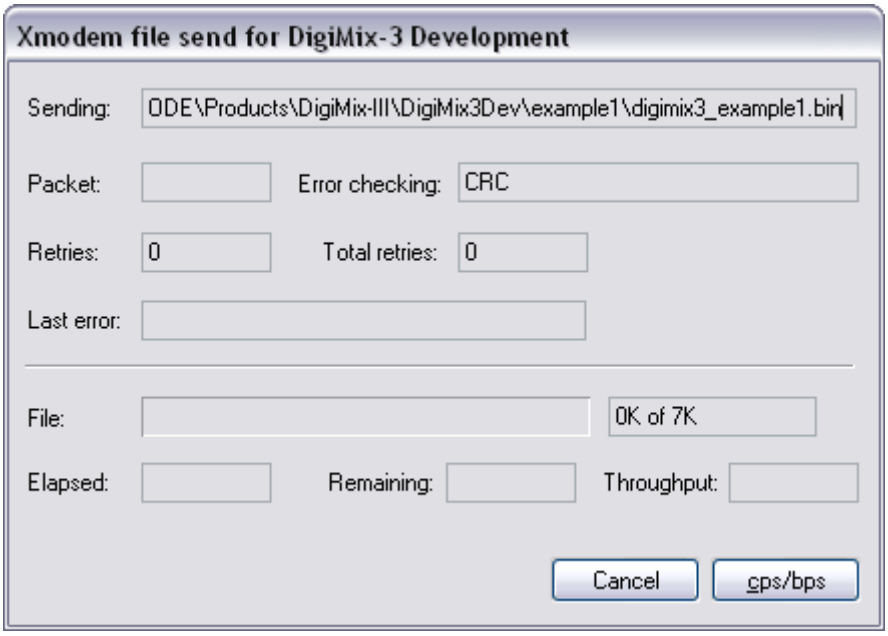
Your HyperTerminal session will now start. At this point, you can send the digimix3_example1.bin file (we created earlier) to the DigiMix-3 Development Board. Start by choosing Transfer->Send File…



Select Xmodem from the drop-down list then Browse… to the digimix3_example1.bin file in the /example1/ directory. Click Send once the .bin file has been selected.



The following screen will appear. This is the screen that waits for a connection to an Xmodem client (i.e. the bootloader).



Applying power to the DigiMix-3 Dev Board will kick off the transfer.

When the transfer has completed, you will see a welcome message appear on the HyperTerminal window. This message has been sent from the microcontroller, as you will notice in the main.c file.

TIP: When you close HyperTerminal, click Yes when you are asked if you'd like to save your settings. The next time HyperTerminal starts, you can simply open the DigiMix-3 Development.ht file which will open HyperTerminal with all the settings you've just set up.

Programming Tips

1. Press F7 to compile (make all)
2. Press CTRL + F7 to clean (make clean)
3. Make sure the main.c file is open before compiling.
4. Double-click on any errors or warnings in the output window – your cursor will go to the error in the source file.

Contact

For any custom designs, please contact us at info@firmtronics.com.