Dual Channel Temperature Logger

by John Crow, May2011

Abstract

In this article John shows us how he designed a dual channel temperature logger using e-blocks and some custom hardware. The article breaks down and explains the macros used in the attached Flowcode file.

Requirements

Software:

- Professional licence of Flowcode v4 for PIC.

Hardware:

- EB006 Multiprogrammer board
- Various E-blocks (listed in article)
- Custom 4x20 LCD display

Introduction.

I started this project to develop a temperature logging instrument based around a LM35 integrated circuit. The hardware will be provided by using the Matrix Multimedia EB006 Multi-Programmer and associated E-Blocks. A modular approach will be used to allow for future expansion on both hardware and software.

Required Hardware

1 x EB006 – Multi-Programmer (With 4MHz or 20MHz xtal)
1 x EB014 – Keypad Board
1 x EB016 – Prototyping Board
1 x EB037 – Card Reader Board
1 x EB039 – USB232 Board
1 x Custom Made 4x20 LCD Display Board
1 x Matrix Power Supply
2 x D-Type Ribbon Cables

2 x LM35 Integrated circuits
1 x 18F4550 PIC
1 x SD Memory Card

Connecting wires

Design Brief.

The instrument will be designed to have the following functions.
• Simultaneous display of 2 independent temperatures.
• Record the temperatures to a SD card using a programmable interval.
• Ability to read the temperature outputs by PC, using the USB port and HyperTerminal.

Hardware Setup.

The programmer and E-Blocks are connected as follows:

Port A - Memory Card Reader Board
Port B - Custom LCD Display Board
Port C - USB232 Board
Port D - Keypad Board
Port E - Prototype Board with LM35 IC's

Power is wired to the boards as required using thin coloured wire.

Software.

The software will be developed using Flowcode 4.
The following will outline the operation of the various sections of the program.

The program has been developed using macros, this is to both simplify the program layout and to allow ease of future expansion.

Serial_Setup:

- This sets up the HyperTerminal screen by clearing, and sending the cursor to the home position.

Serial:

- Outputs data to the USB port using the USB232 board.

- Normal ASCII esc codes are used to format the data positions on the screen.

SD_Setup:

This macro sets up the SD card in the following way

- Check if a card is present

- Check if file already exists. If yes delete old data file, then set up a new file

- Write header data to file.

Keypad:

- Reads the delay value from the keypad.

- Up to 3 digits can be entered. If less than 3 are needed, terminate entry with #

Set_Min_Max:

- Takes a snapshot reading of ADC0 & ADC1 and sets min & max to these values before starting the main program loop. These are the start values which are used on reset.

Temp1:

Reads input from ADC0 (Port E - Bit 0)

Uses the ADC function to read the output of the LM35.
The output is 10mV / °C

Temperature is calculated as follows.
Read ADC0 as voltage (Float)
Temp1 = fmul(ADC0, 500)

This is then converted to a string value to allow both display on the LCD and to be sent top the USB port.

Temp1_s = FloatToString$(Temp1)

The data is then just sent to the LCD with normal Flowcode commands.
To display the degree sign print ASCII 178 is used.
This may differ to different makes of display, and is in fact different to the standard Matrix 2x16 LCD E-Block.

Temp2:

Reads input from ADC1 (Port E - Bit 1)
Works in the same way as Temp1

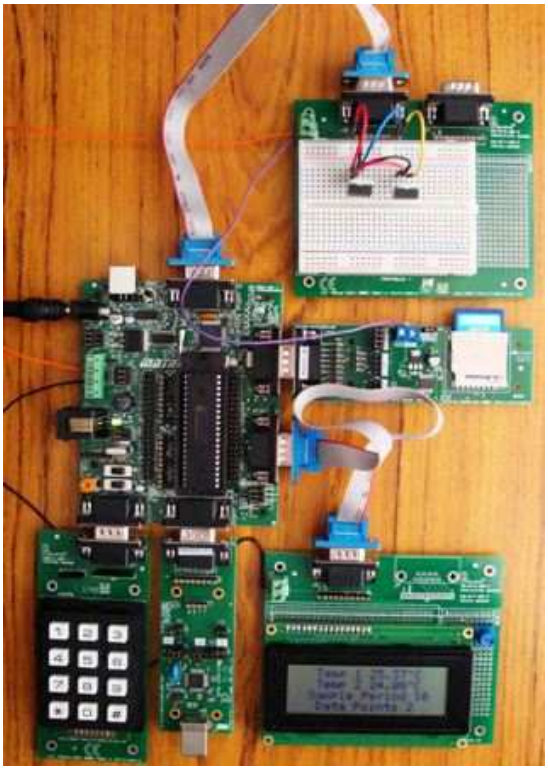
Main:

This is the main part of the program.

- Initialise Variables
- Setup LCD
- Call Serial_Setup
- Call Keypad - Read in the delay needed.
  (Enter in seconds. 0 if no delay)
- Call SD_Setup - Configures the SD card
- Call Set_Max_Min - *Sets* start values for max & min temperature
- Clear LCD

Main loop
- Call Temp1
- Call Temp2
- Write temp values to data card
- Call Serial
- End Main Loop
- On error function for data card error – Halts program execution

Hardware Configuration



I hope this article explains how I tackled the programming.
Also, I found the Type 4 SD cards set up quite a lot faster than the type 2 cards (which is how it should be!)

Further Enhancements

1. Adding the gLCD e-block would allow more information to be displayed, i.e. the max-min temps. However I don't' have one of these at the moment, however it is on the list.

2. A 3rd sensor could be added without too much difficulty, however again, the gLCD would be certainly be needed then to display all 3 temps together.

Further reading

Below are some links to other resources and articles on related subjects, and technical documentation relating to the hardware used for this project...

Flowcode:	http://www.matrixmultimedia.com/flowcode.php
MIAC:	http://www.matrixmultimedia.com/miac.php
Learning Centre:	http://www.matrixmultimedia.com/lc_index.php
User Forums:	http://www.matrixmultimedia.com/mmforums
Product Support:	http://www.matrixmultimedia.com/sup_menu.php