



Code: **PSEMBP 100** Category: **STEM** Level: **High School/Community C.**

At the end of this project you should be able to write 'C' Language code for a digital weigh-scale (DWS) based on Z8F0812 microcontroller from ZiLOG's Z8 Encore! series. A 24 bit ADC, CS5550 is used to accurately measure the load cell output. The ADC is interfaced to the microcontroller via SPI. The measured weight is displayed on LCD

Objective:

At the end of this session, you will have a fair understanding of

- Z8 Encore! language tools including C compiler, assembler, linker/locator, and librarian
- Instruction set simulator and disassembler
- Zilog Standard Library (ZSL)
- In-Circuit Z8 Encore! Flash MCU debugger and programmer
- USB Smart Cable

Additional project details:

The DWS reference design supports following features

- 10gm to 40Kg weight measurement, with 10gm resolution
- Tare
- Count
- Offset and gain calibration for ADC
- Choice of clock source for ADC
 - TIMER output of Z8F0812
 - Crystal
- Choice of internal or external reference voltage for ADC
- On-board excitation voltage for load cell

The reference design offers a ready to productize digital weigh-scale solution that can be easily scaled to measure high capacity loads.

Z8Encore! Digital Weigh-Scale File List

Here is a list of all documented files with brief descriptions:cs5550_spi.c [code] This file contains routines to write to and read from CS5550 ADC

cs5550_spi.h [code] This file contains function prototypes and constant definitions used by cs5550_spi.c

lcd.c [code] This file contains LCD related routines

lcd.h [code] This file contains function prototypes and constant definitions used by lcd.c

main.c [code] This file contains the entry point function of the application

spi.c [code] This file contains SPI related routines

spi.h [code] This file contains function prototypes and constant definitions used by spi.c

switches.c [code] This file contains GPIO interrupt service and switch functionality routines

switches.h [code] This file contains function prototypes and constant definitions used by switches.c

timer.c [code] This file contains Timer related routines

timer.h [code] This file contains function prototypes used by timer.c

weight.c [code] This file contains routines to calculate weight of the object from the ADC value and display the weight on LCD

weight.h [code] This file contains function prototypes used by weight.c

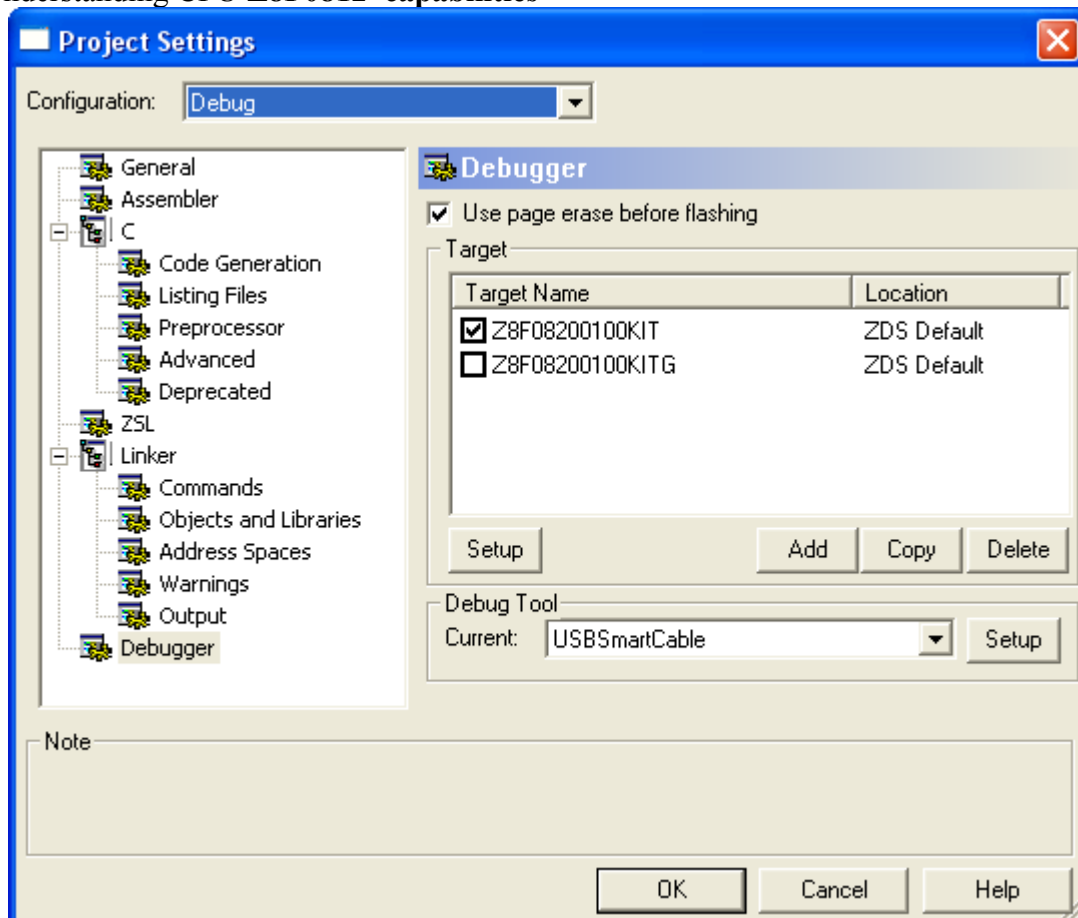
Processor:

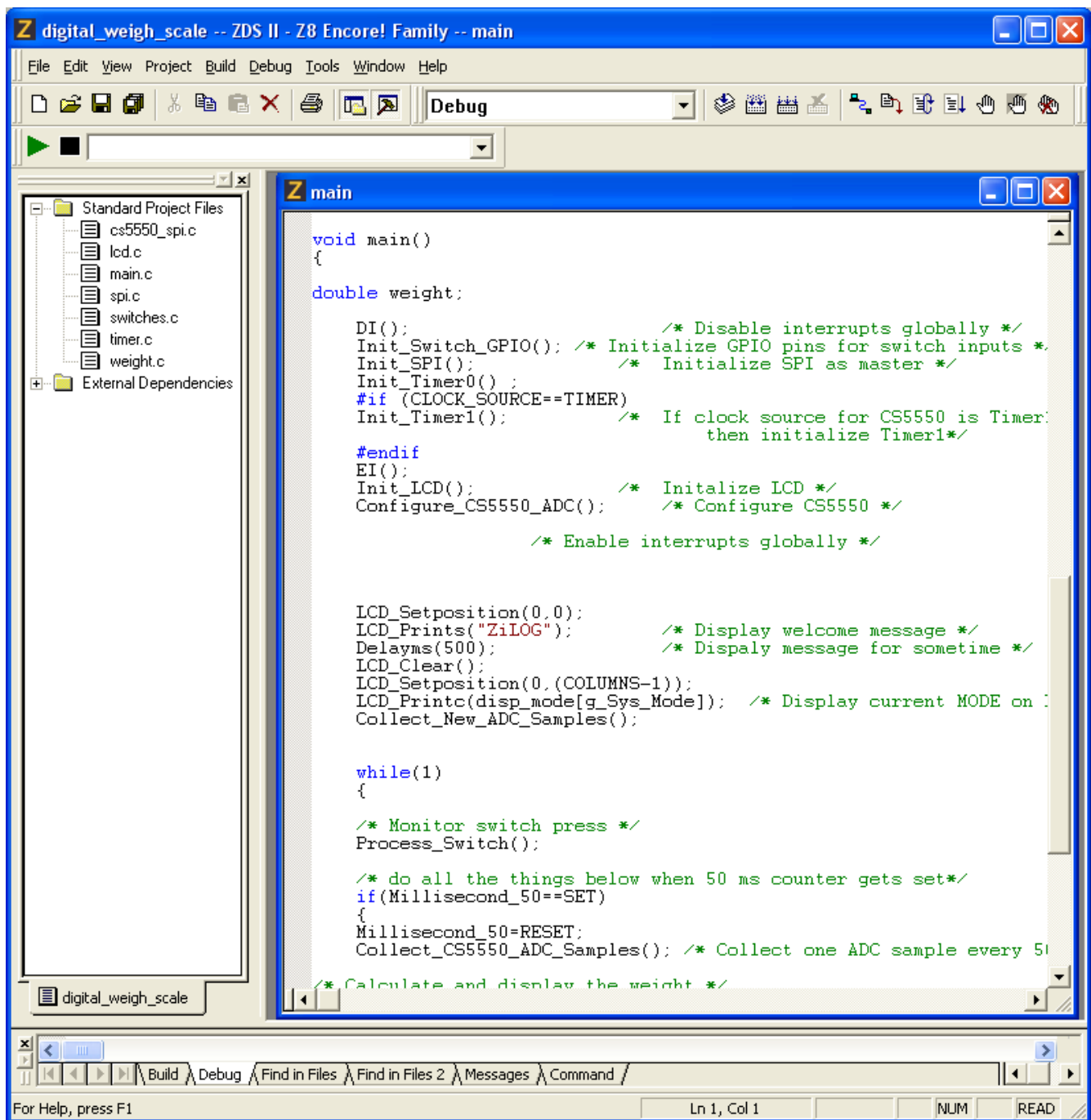
Z8F0812 ; Development Kit used: **Z8F08200100KIT**

File → Open Project

digital_weigh_scale

- C Programming fundamentals (1 week)
- Understanding CPU **Z8F0812** capabilities





• Hardware Details

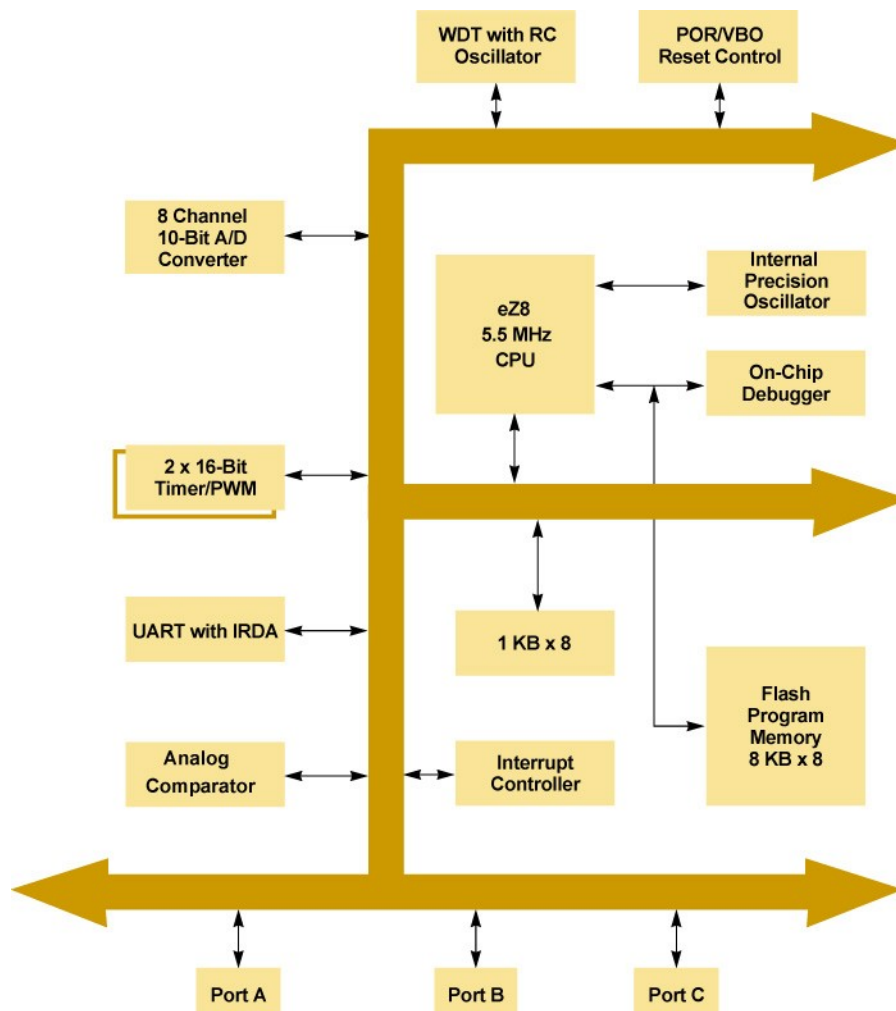
Key features of Z8 Encore! XP F0822 Series include:

- 20 MHz eZ8 CPU core
- Up to 8 KB Flash memory with in-circuit programming capability
- 1 KB register RAM
- Optional 2- or 5-channel, 10-bit analog-to digital converter (ADC)
- Full-duplex 9-bit UART with bus transceiver Driver Enable Control
- I2C ports
- Serial Peripheral Interface (SPI)

- Hardware Details

- Infrared Data Association (IrDA)-compliant infrared encoder/decoders
- Two 16-bit timers with capture, compare, and PWM capability
- Watchdog Timer (WDT) with internal RC oscillator
- 11 to 9 I/O pins depending upon package
- Up to 19 interrupts with configurable priority
- On-Chip Debugger (OCD)
- Voltage Brownout (VBO) protection
- Power-On Reset (POR)
- Crystal oscillator with three power settings and external RC network option
- 2.7 V to 3.6 V operating voltage with 5 V-tolerant inputs
- 20-/28-pin packages
- 0 °C to +70 °C standard temperature and -40 °C to +105 °C extended temperature operating ranges

- Connecting the Development Kit to the smart USB cable and uploading the firmware to CPU flash memory.
- Running the program
- Single stepping the program and monitor the registers
- Z8 Encore **Z8F08200100KIT** Dev Kit User Manual UM0187.pdf
- http://zilong.com/index.php?option=com_product&Itemid=26&task=docs&businessLine=1&parent_id=2&familyId=6&productId=Z8F0812
- <http://www.zilong.com/docs/an0306.pdf>
- **Application demonstration**



The source code is designed for Digital Weigh-Scale reference design board.

Setup

- Connect the load cell bridge excitation terminals to the connector J16 as shown in schematic.
- Connect the differential output of the load cell to the connector J4 which is input to the analog input channel 2.
- Plug in a 9 Volt/10W DC adapter to J1.
- Put the SPDT switch SW6 in ON position to power up the board.
- Build the **digital_weigh_scale.zdsproj** project in ZDSII and download the code to the target board.

Basic weight measurement

Put some weight on the load cell and observe the measured weight on the LCD

Development Kit: The student would be recommended to buy an appropriate Development kit from Zilog. All programming and technical support and guidance would be provided by ProjectSchool.

Recommended for : **High School STEM students/Community College**