



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

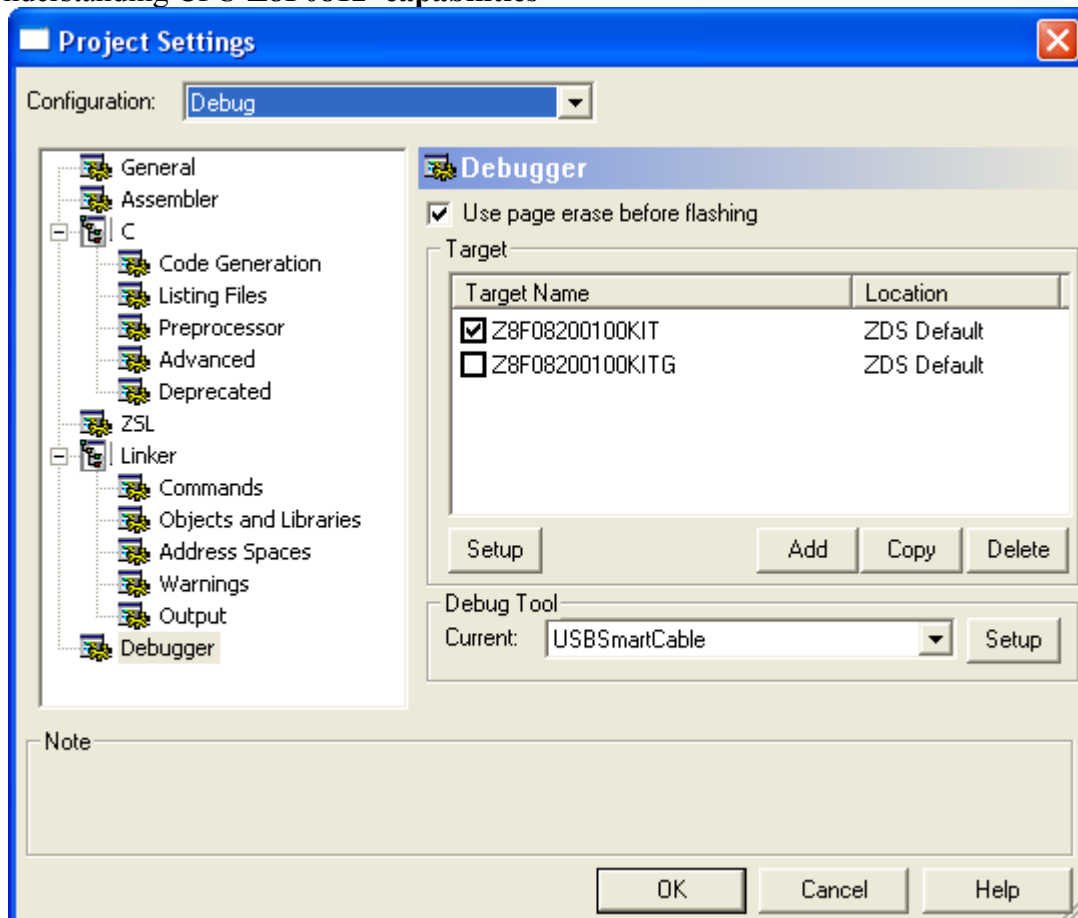
## Processor:

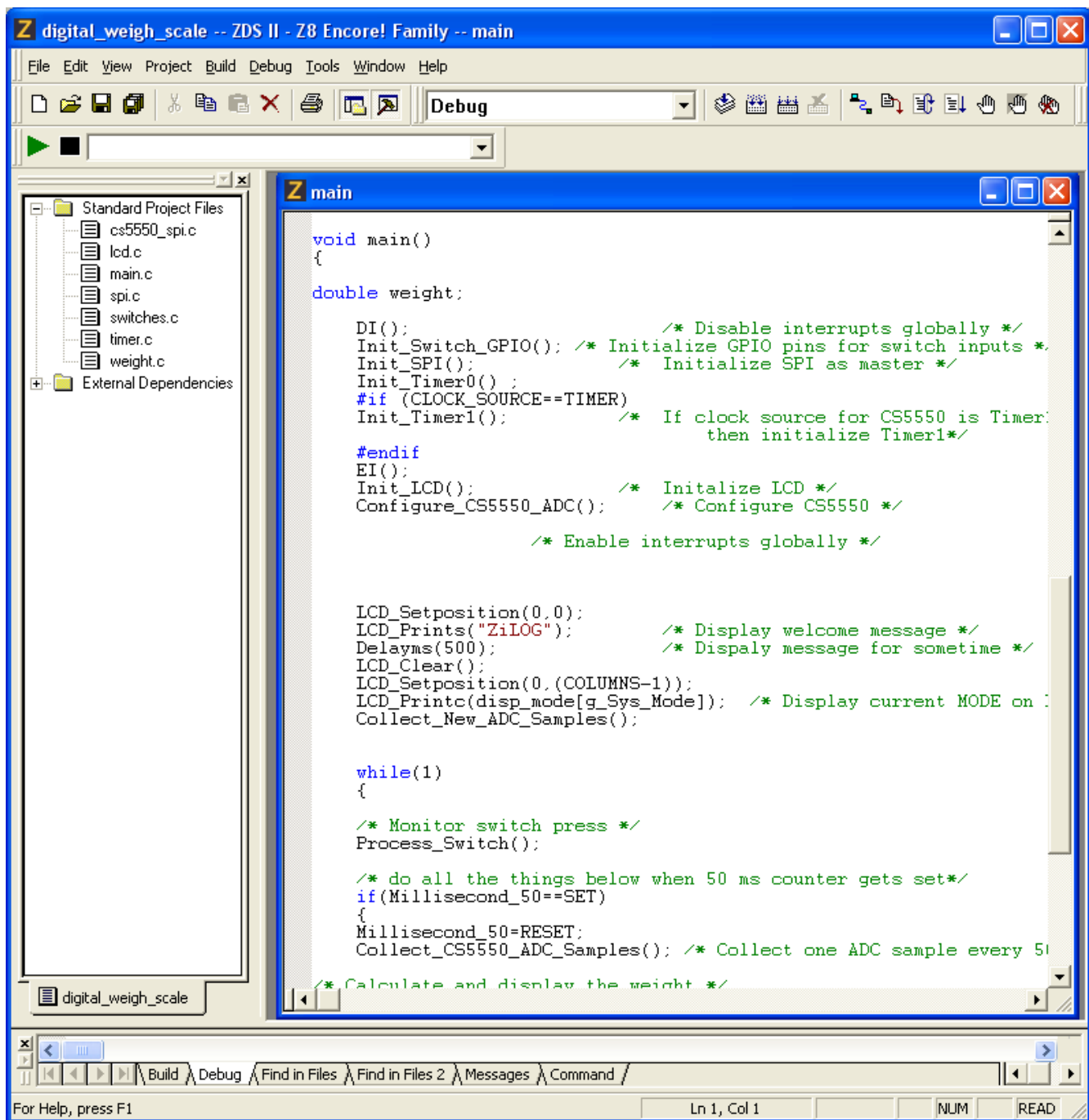
**Z8F0812** ; Development Kit used: **Z8F08200100KIT**

## File → Open Project

### digital\_weigh\_scale

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





## • Hardware Details

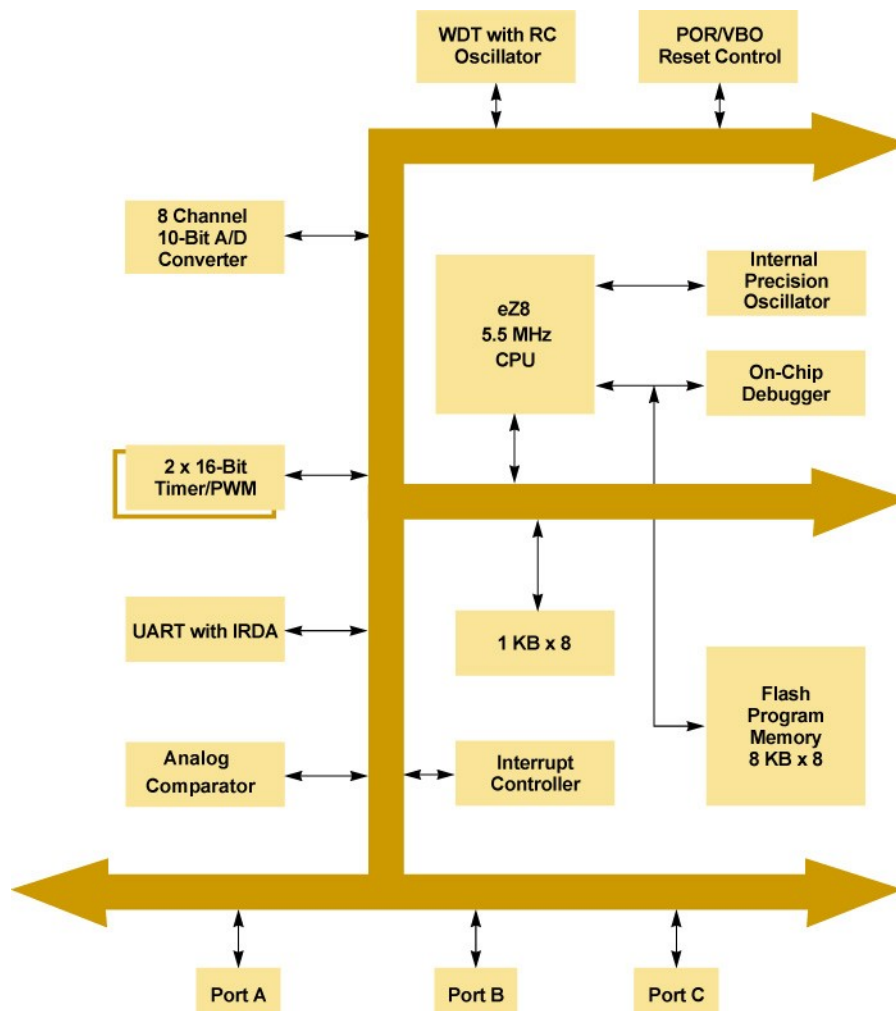
Key features of Z8 Encore! XP F0822 Series include:

- 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://zilog.com/index.php?option=com\\_product&Itemid=26&task=docs&businessLine=1&parent\\_id=2&familyId=6&productId=Z8F0812](http://zilog.com/index.php?option=com_product&Itemid=26&task=docs&businessLine=1&parent_id=2&familyId=6&productId=Z8F0812)
- <http://www.zilog.com/docs/an0306.pdf>
- **Application demonstration**



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**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**