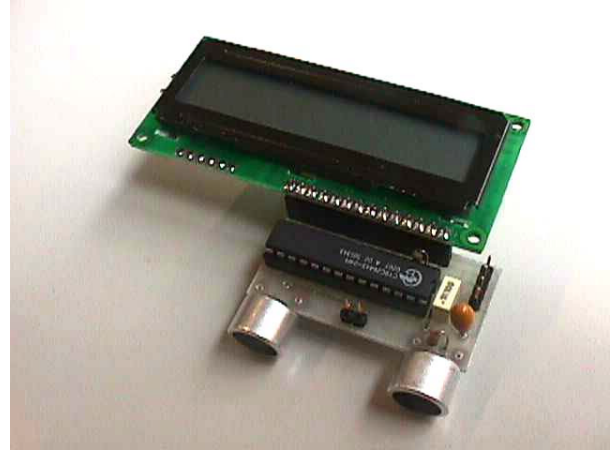
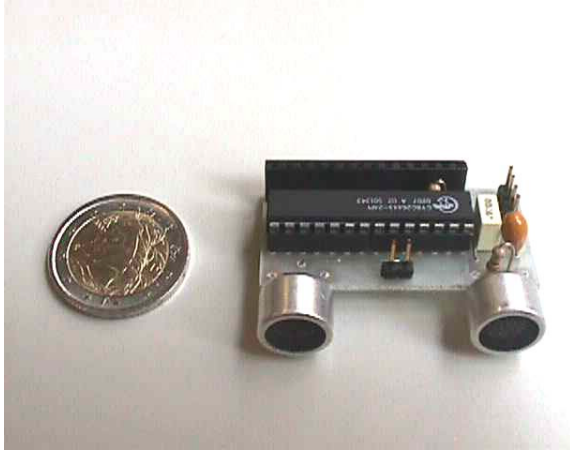


PsoC Rangefinder



This project is a simple ultrasonic distance meter.

The only components required are the PSoC device, two 40 kHz ultrasonic transducers, two resistors and two capacitors. Similar circuits are very complicated and expensive.

Using this microcontroller family, all the digital and analog devices are supplied by Programmable System on Chip

Typical applications include positioning for robotics, generic distance measurement and contactless liquid level measurement.

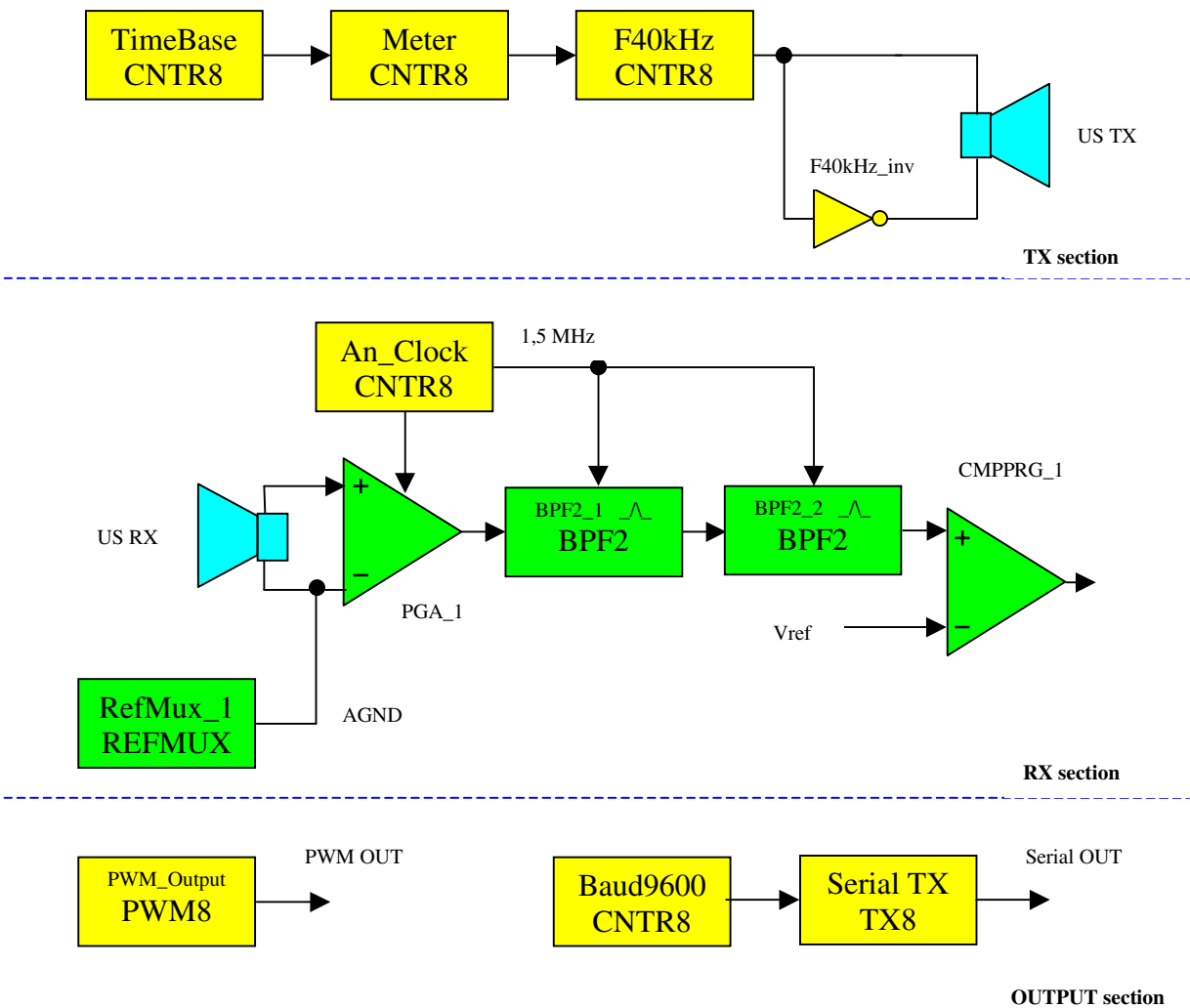


Figure 1: block diagram (yellow = digital blocks, green = analog blocks)

Main features

- Operating frequency: 40 kHz
- Range: 25 – 220 cm
- Resolution: 1 cm
- Supply voltage: 5 Vcc
- Current draft: 25 mA (23 mA without LCD)
- Outputs: 1 PWM, 1 TTL level serial (9600, n, 8, 1)
- Optional 16 X 2 LCD intelligent display
- Software calibration
- Dynamic receiver stage gain increment

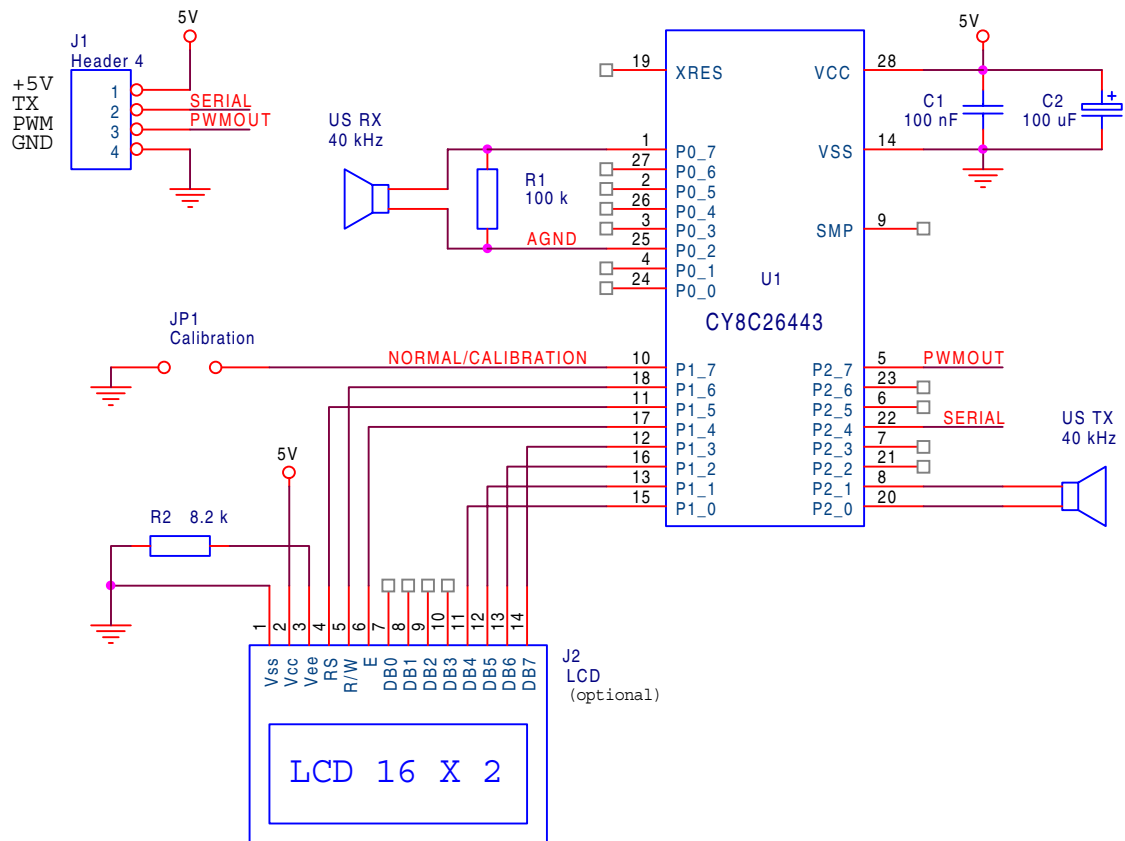


Figure 3: schematic diagram

The software

The flowchart of the microcontroller software is shown in Figure 4. The main program first set up the analog and digital blocks and then tests for JP1 to determine normal or calibration mode.

Normal mode: the software continuously run the transmitted ultrasonic burst (ping) and, after a blank time, wait for return ultrasonic signal (pong). The time between the start of transmitted burst and the start of received burst is proportional to distance between rangefinder and obstacle. Polling the Comparator bus register (see TimeBase_int) we can measure this time and store it into a RAM location. Finally, the range value is written to the LCD (if present), sent to serial interface and the PWM duty cycle is set to a value proportional to distance.

Calibration mode : the software is similar to normal mode but the measured value is compared with the constant value 50 and the resultant offset is stored in an EEPROM non-volatile memory location and added to the measured range in normal mode.

TimeBase_int is the interrupt subroutine for TimeBase 8-bit counter. When time1 is greater than value of blank time (blank time is necessary for prevent false echoes caused by lateral receiving of transmitted 40 kHz burst)) the software tests the logical value of comparator. If a pong was received the time1 is stored in

RAM location “range” and the TimeBase interrupt is disabled, so the value stored in range location represents the measured distance. If comparator output is equal to 0 then PGA_1 gain is dynamically incremented in 16 steps from 1 to 16 modifying the corresponding gain register, so the far echoes are much more amplified.

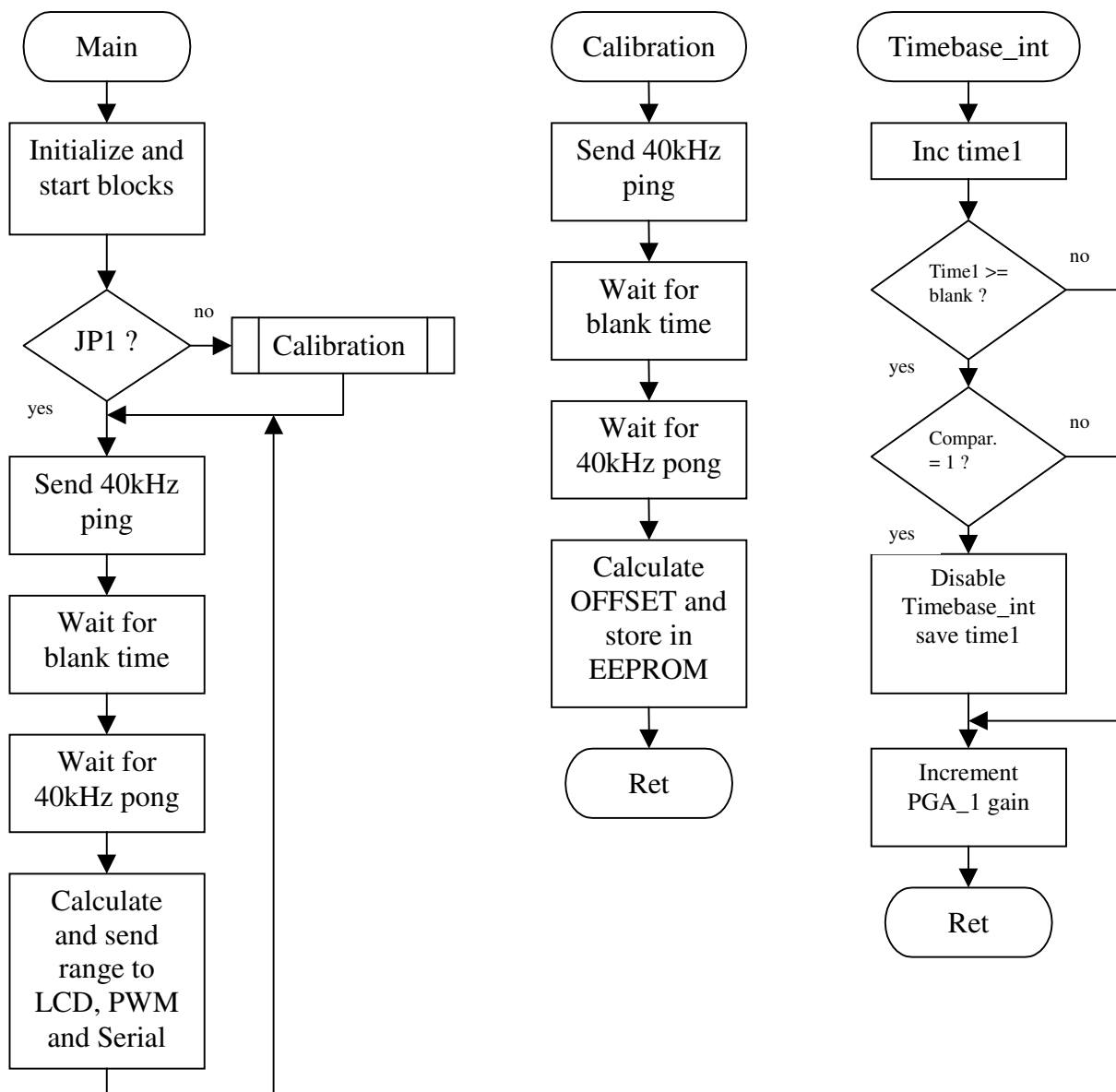


Figure 4: microcontroller software flowchart