Course
Methods and tools for software quality
Peripheral connection

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Introduction

This document describes the connection of a four-digit, seven-segment display and the connection of two models of compass to the microcontroller evaluation board.
The four-digit, seven-segment display is a COM-11442 from sparkfun. We will use it by means of SPI, so 6 lines are needed: SS, sdi, sdo, sck, Vcc and GND.
The first model of compass is the CMPS03. The second model is CMPS11.
Both models connect by means of an I^2C bus, so four lines are needed. The pinout of both compasses is not compatible, so there are some differences connecting the compass to the robot as function of the compass model you are going to use.
All boards will be designed to use CMPS03, and CMPS11 will be connected by means of aerial wires.

Attaching peripherals to MSP-EXP430G2

In order to attach the different peripherals (compasses and display) we will use a soldering board with two male-female, 10-pins sockets to be plugged in J1 and J2 of microcontroller board.
Two more male-female, 10-pins sockets are used to seat the peripherals. These two sockets are soldered perpendicular to the previous sockets, as you can see in Figure 1. One socket is used to connect the display and the other one is used to connect one of the compasses.

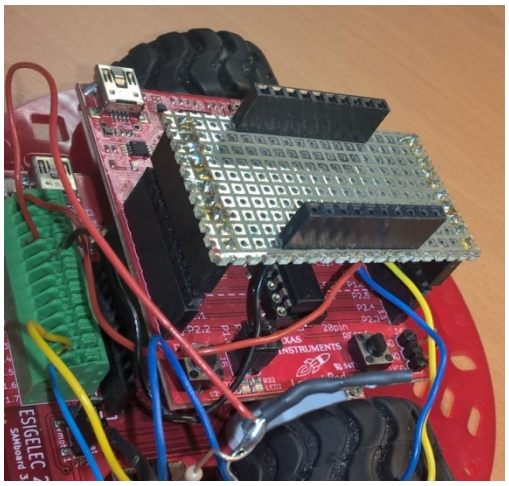
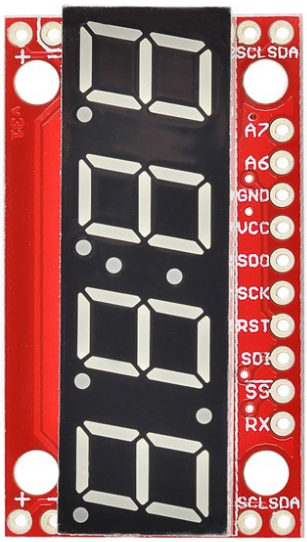


Figure 1. Soldering board with sockets to accommodate display and compass

Connecting the display to MSP-EXP430G2

Four-digit, seven-segment display connects with the microcontroller by means of SPI protocol. Table 1 shows display pinout and connections between display and microcontroller.

Table 1. Display pinout and connections with microcontroller.



A7	NC
A6	NC
gnd	GNd on J2
vcc	Vcc on J1
sdo	P1.1 on J1
sck	P1.4 on J1
rst	NC
sdi	P1.2 on J1
/SS	P1.0 on J1
rx	NC

Connecting CMPS03 to MSP-EXP430G2

Figure 2 shows the pinout of CMPS03. Four pins must be connected: +5v, Ground, SDA and SCL.

I2C bus uses two lines, SDA (Serial Data) and SCL (Serial clock). Both lines are open-drain so pull-up resistors are needed, see Figure 3. Values of pull-up resistors depends on the clock frequency, bus capacitance and power supply. For fast-mode (400Kbits/s) resistors from 1K8 to 4K7 ohms should work.

WARNING. Because MPS430G2553 is 3.3v powered, pull-up resistor for SDA and SCL must be connected to 3.3v as shown in Figure 3, but CMPS03 is 5v powered.

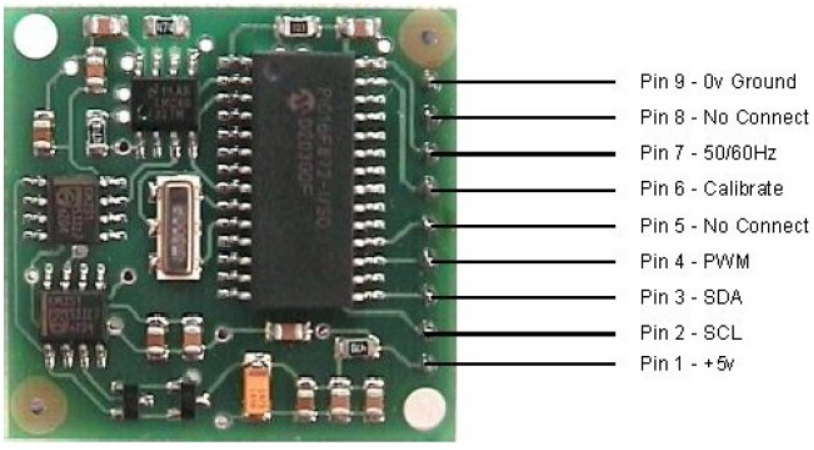


Figure 2. Pinout of CMPS203

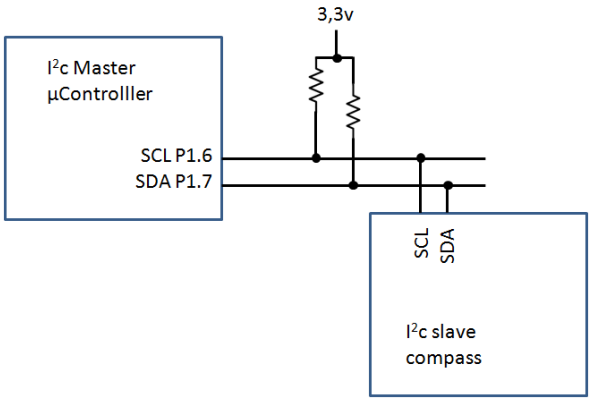


Figure 3. Pull-up resistors connection

Microcontroller UBC0 module is used to communicate with the compass. This module uses P1.6 and P1.7 for SCL and SDA, respectively. This microcontroller pins, together with power and ground can be found in green connector of SAMBOARD, as shown in Figure 4.

WARNING AGAIN. Pay attention, the CMPS03 has only 9 pins, but the socket is 10 pins width, so you have to discard one of the pins of the socket. If you don't mind ☺, align the compass to the right.

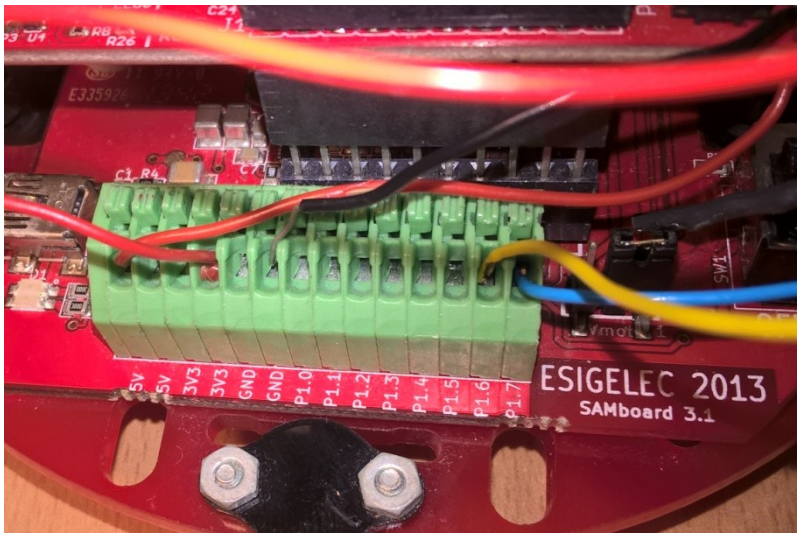


Figure 4. Green connector on SAMboard 3.1

Connecting CMPS11 to MSP-EXP430G2

CMPS11 is connected to the microcontroller in the same way that CMPS03. Figure 5 shows the pinout of CMPS11. The pinout of CMPS11 is not compatible with the pinout of CMPS03. In order to re-use the socket and the I2C bus we built, we will use aerial, male-female wires to connect the CMPS11 to the socket, like in Figure 6. Pay attention, SDA and SCL wires are swapped.

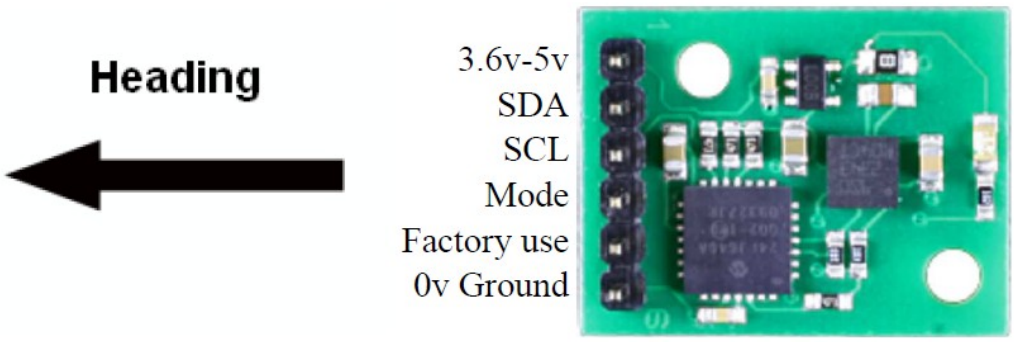


Figure 5. Pinout of CMPS11

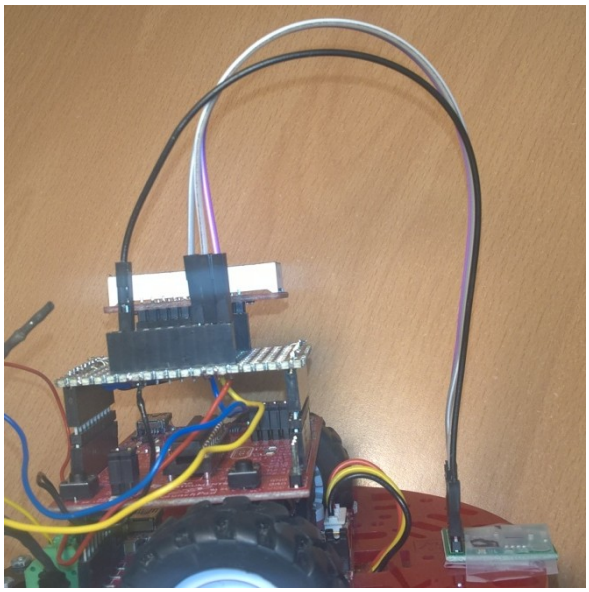


Figure 6. Connection of CMPS11