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Q.bo Wires

If you bought the Q.bo Platform you might find this guide useful.

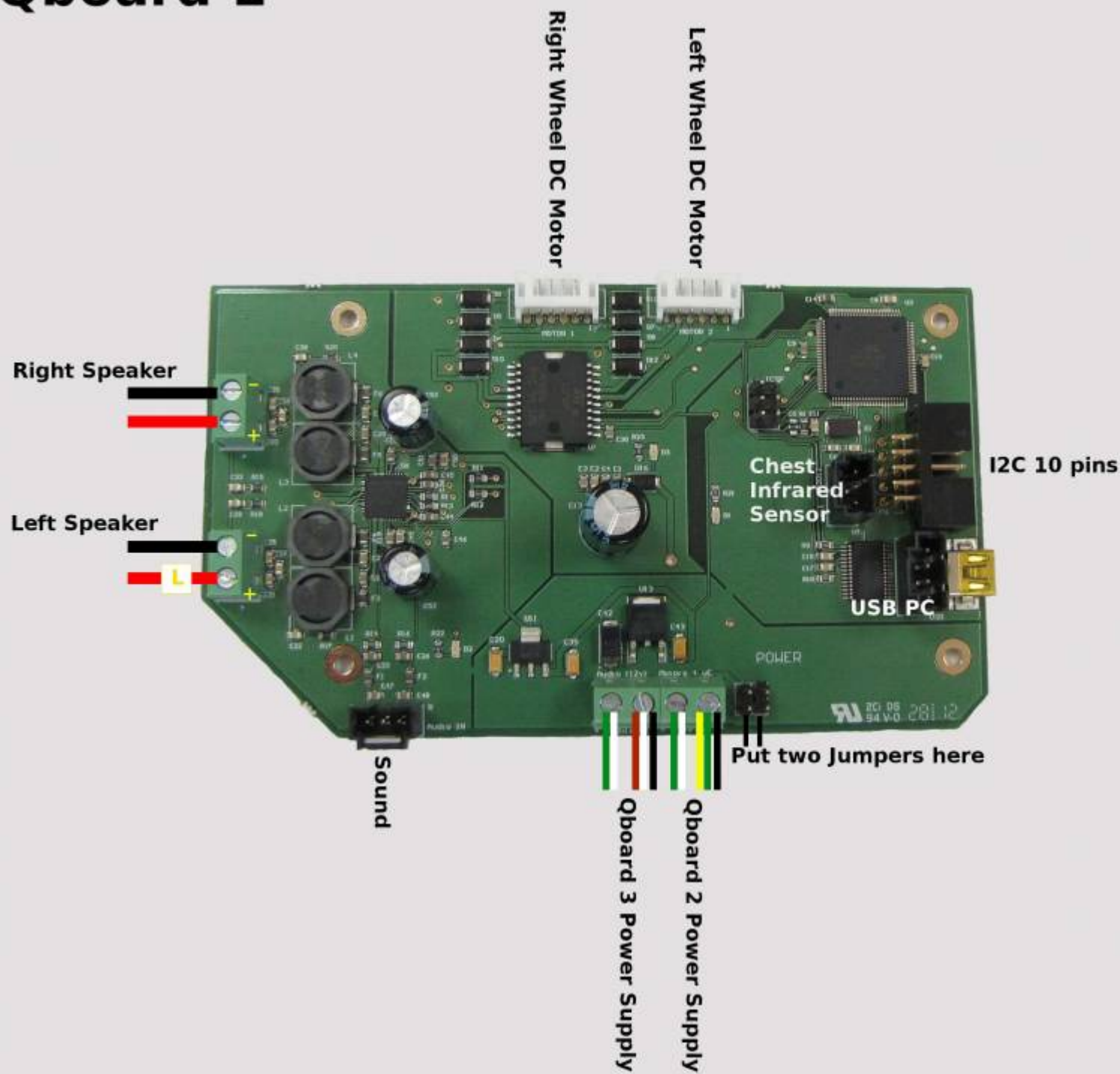
Here you will see where to connect the wires on the Qboards. It is divided into two sections. The first one is fast and easy to see; and the second one is more technical and detailed.

Wires fast view

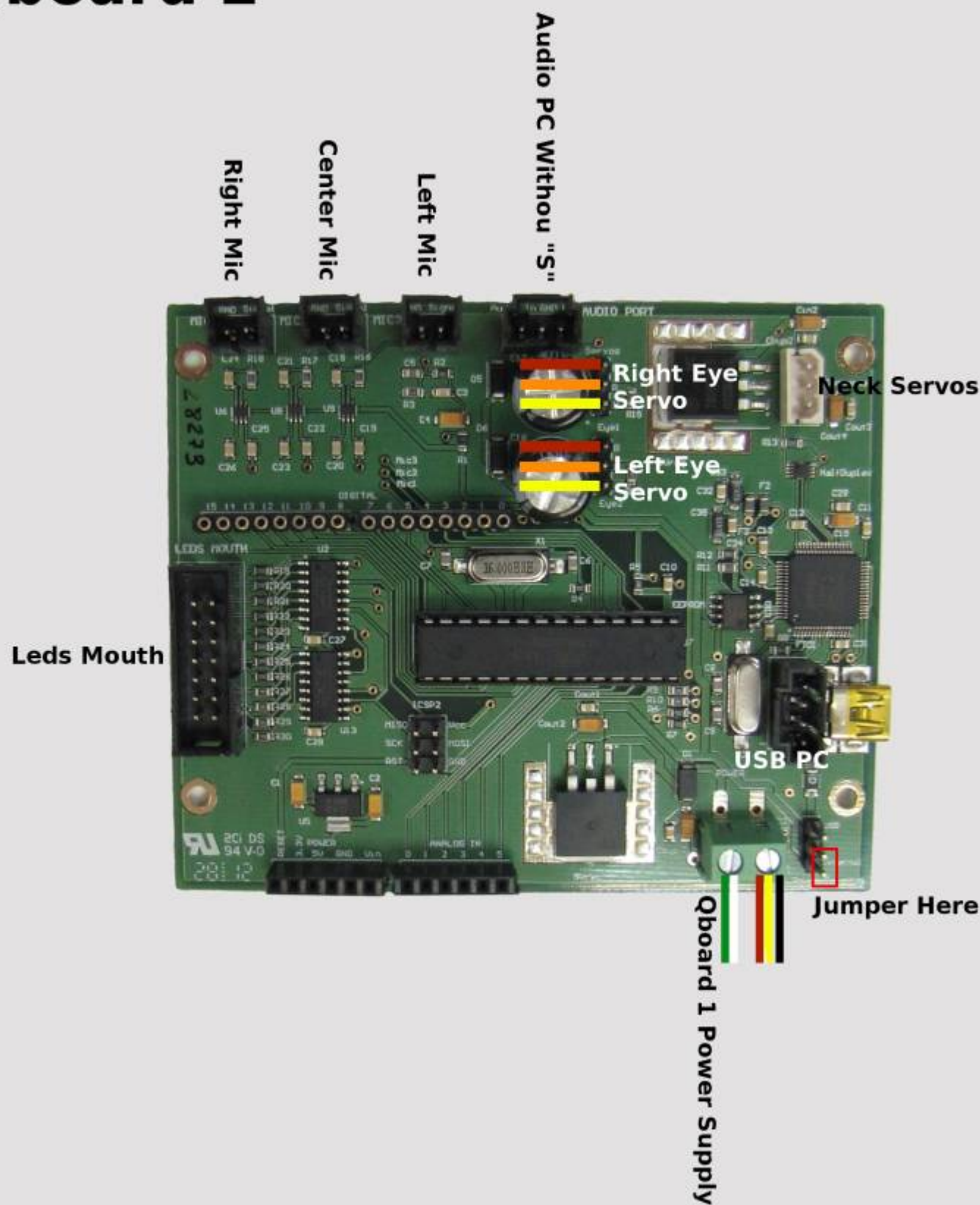


The colors might be different in some of them, like the I2C, which in the actual platform, is black.

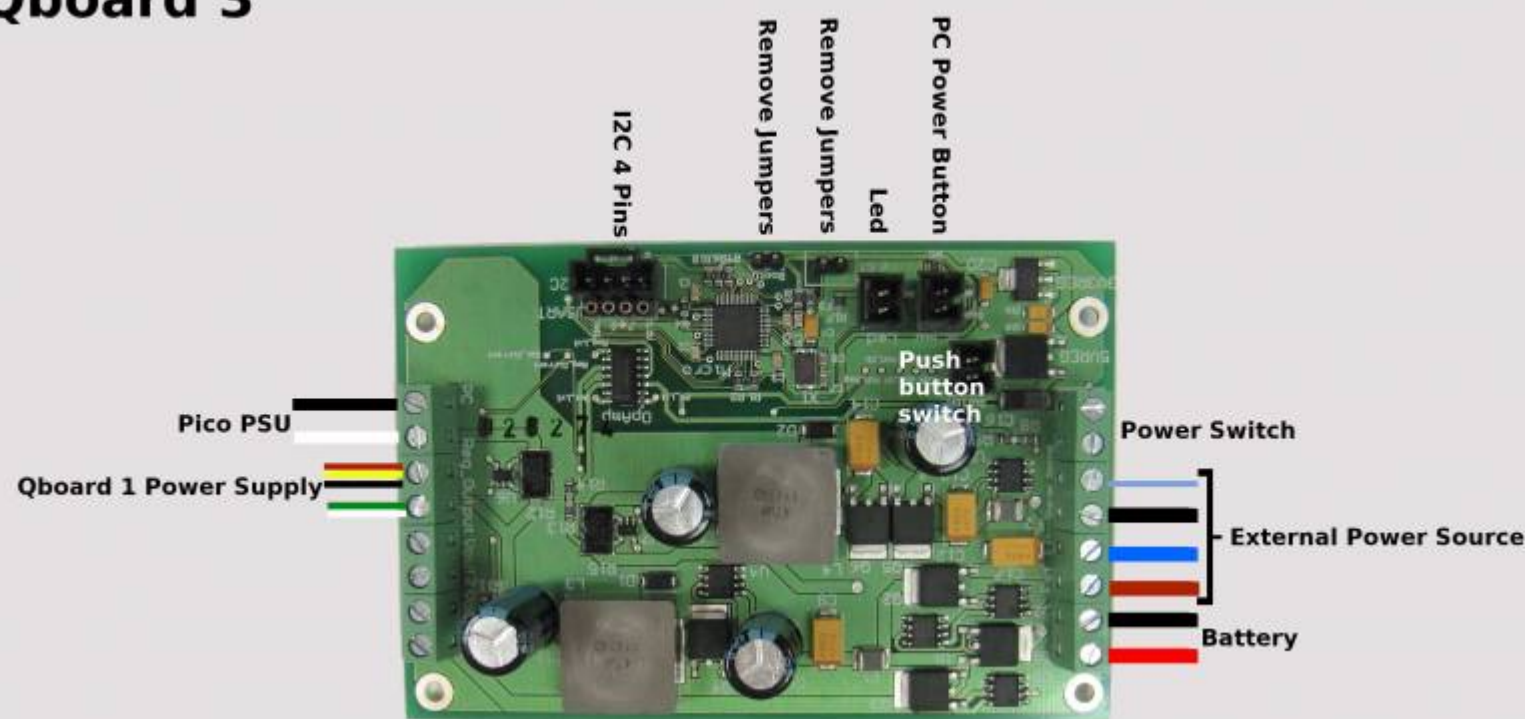
Qboard 1



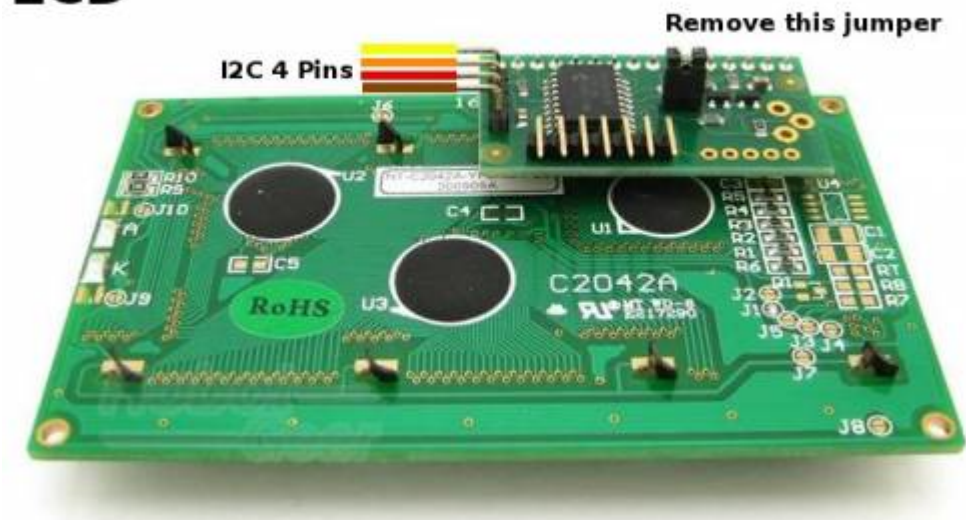
Qboard 2



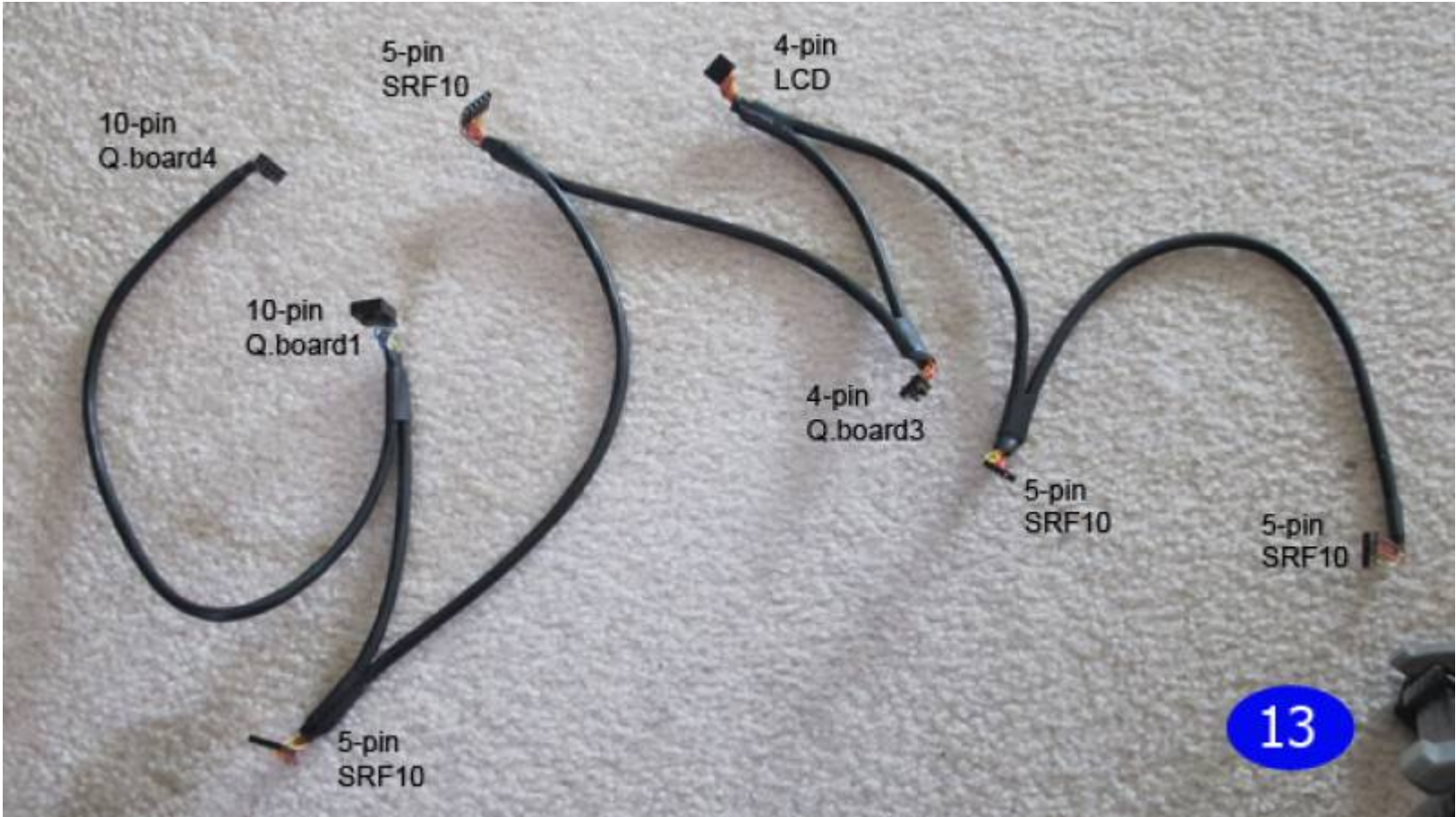
Qboard 3



LCD



This is the I2C bus cable with the description for each connector.



Technical guide

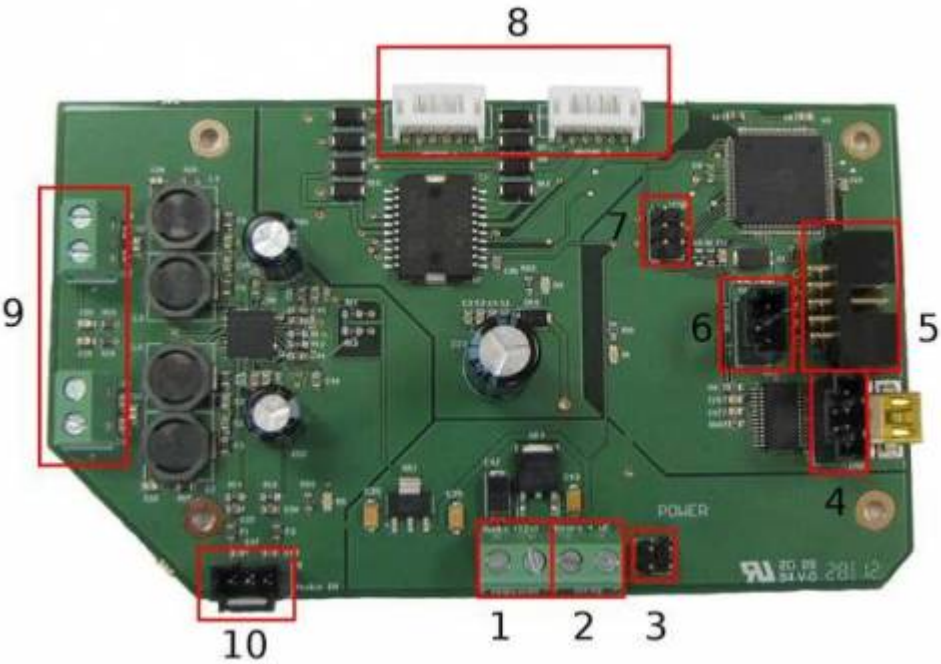
Q.bo has five peripherals boards inside it called Q.Board1, Q.Board2, Q.Board3, Q.Board4 and Q.Board5.

The connections and use of those boards is explained in this document.

Q.Board1

The Q.Board1 board is responsible of the communication between the I²C peripherals and the PC. It also controls the DC motors from the base and has an integrated 20W stereo amplifier.

The Q.Board1 comes programmed with the bootloader of Arduino and a communication protocol to interact with a PC. Its microcontroller is the Atmega 1280.



1.- Regulated Power

This input power connection is used to power the stereo amplifier and the the logic components of the board. It needs a regulated power source of 12V to work properly

12V GND

2.- Unregulated Power

This power connection is used to power the DC motors. It does not need to be regulated

Vin GND

3.- Power switches

This power switches can be used to use only one power input. After plugging the switches, the Unregulated Power connection (2) acts as a regulated power source

4.- USB connection

This connection must be plugged to a computer so the board can communicate with the PC.

GND
D+
D-
5V

5.- I²C connection

The I²C connection has two lines. The top line corresponds to the I²C connection. The bottom line is used to read three digital inputs.

GND NC SCL SDA 5V
GND IR3 IR2 IR1 5V
IR1 Port PE6
IR2 Port PE7
IR3 Port PD2

6.- GP2D12 connection

This connection is used to connect a GP2D12 sensor or similar. Any analog sensor powered by 5V can be connected. The signal pin is connected to the Port PK0 to be programmed through the Arduino IDE.

Vo
GND
5V

7.- ICSP connection

This connection can be used to program the Q.Board1

MISO VCC SCK
MOSI RST GND

8.- DC Motors connection

This connection is used to connect two EMG30 motors with encoder. The pin connection between the motors and the microcontroller can be seen in the following table:

Left Motor PWM Port PH4 Right Motor PWM Port PH5
Left Motor OUT A Port PH2 Right Motor OUT A Port PE2
Left Motor OUT B Port PG4 Right Motor OUT B Port PG3
Left Motor Hall A Port PJ4 Right Motor Hall A Port PJ2
Left Motor Hall B Port PJ5 Right Motor Hall B Port PJ3

9.- Speakers connection

This connection is used to plug two speakers. The stereo amplifier can be controlled with the microcontroller as it has an I²C connection with the microcontroller to adjust the volume. The stereo amplifier used in the Q.Board1 is the [\[MAX9744\]](#)

10.- Audio input connection

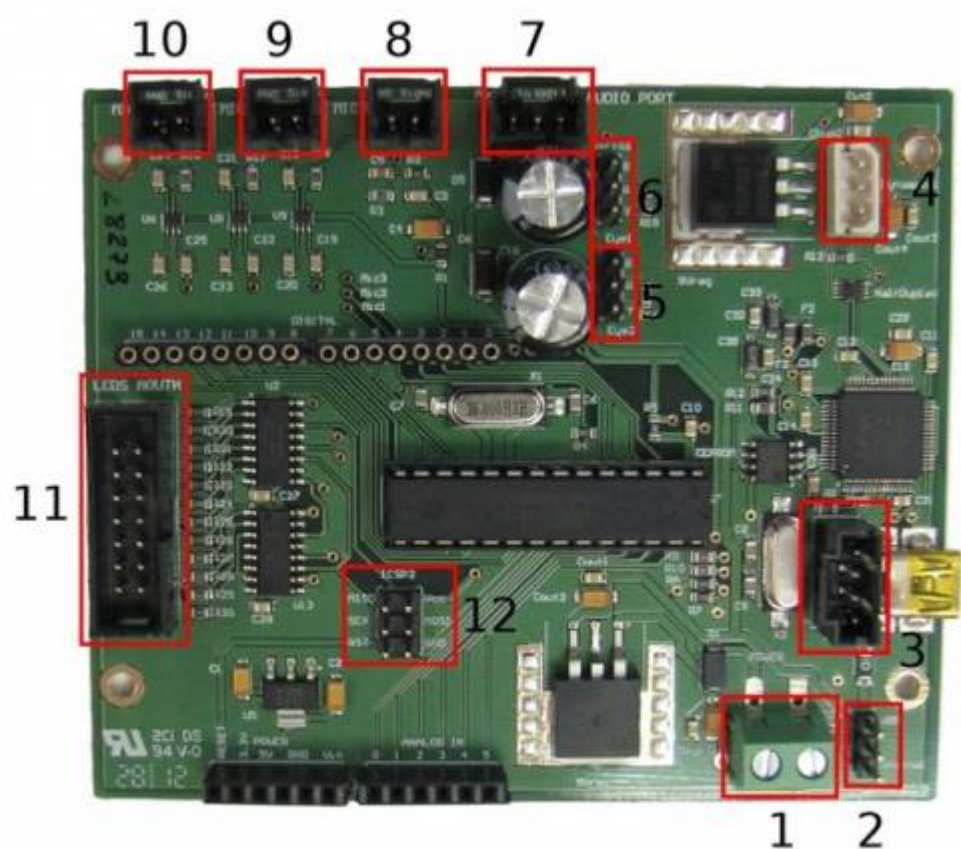
This connection is the audio input of the Q.Board1

Audio Left GND Audio Right

Q.board 2

The Q.Board2 is the responsible of the polarization of the three microphones and control of the Q.Board5 and servos.

The Q.Board2 comes programmed with the bootloader of Arduino and a communication protocol to interact with a PC. Its microcontroller is the Atmega 328P.



1.- Power

This input power connection is used to power two standard servos and the dynamixel servos. It needs a power source between 10V and 15V to work properly

Vin GND

2.- Power Selector

The power selector is used to choose how the logic components of the Q.Board2 are powered up. The logic components can be powered up from the USB connection (3) by connecting the jumper in the top two pins. It can also be powered up from the power input (1) placing the jumper in the bottom pins

USB
Selection
External

3.- USB

The USB connection is the responsible for the communication between the dynamixel servos and a PC, and also the communication between the mouth and standard servos and a PC. The dynamixel servos will be seen as a USB device and the rest of the board as a different device.

GND
D+
D-
5V

4.- Dynamixel

This is the standard connection to control a Dynamixel servo powered at 9V

USB
Selection
External

5.- Servo1

This is a standard connection to control a servo by a PWM signal. The PWM signal for the servo is connected to the Port PB1 to be programmed through the Arduino IDE.

Signal
Vcc
GND

6.- Servo2

This is a standard connection to control a servo by a PWM signal. The PWM signal for the servo is connected to the Port PB2 to be programmed through the Arduino IDE.

Signal
Vcc
GND

7.- Audio I/O

The Audio Out pin is directly the output from the Mic2 connection after being pre-amplified. The Audio In pin is connected to the Port PC3 to be programmed through the Arduino IDE.

Audio In GND Audio Out

8.- Mic3

This connection polarizes an electret microphone. It also pre-amplifies the signal. The signal is connected to the Port PC2 to be programmed through the Arduino IDE.

GND
Signal

9.- Mic2

This connection polarizes an electret microphone. It also pre-amplifies the signal. The signal is connected to the Port PC1 to be programmed through the Arduino IDE. This microphone has a direct connection to the mic output of the Q.Board2

GND
Signal

10.- Mic1

This connection polarizes an electret microphone. It also pre-amplifies the signal. The signal is connected to the Port PC0 to be programmed through the Arduino IDE.

GND
Signal

11.- Mouth

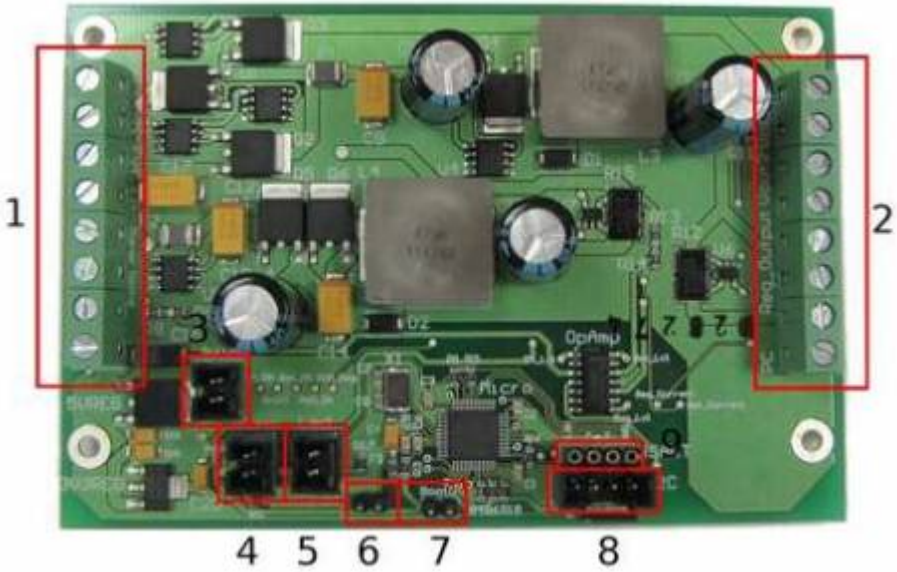
This connection controls the led array that is been used as a mouth by a shift register connected to the microcontroller.

RCLK Port PB0
SRCLK Port PB5
SER Port PB3

The Q.Board2 comes programmed with the bootloader of Arduino and a communication protocol to interact with a PC. This protocol is explained in the ArduQbo Driver manual.

Q.board 3

The Q.Board3 is the responsible of the power management of the robot. It charges the battery and powers up all the subsystems of the robot.



1.- Input Power

- VBat+ Positive pole of the battery
- VBat- Negative pole of the battery
- VCharger+ Positive pole of the charger cable
- VCharger- Negative pole of the charger cable
- Cable Shield Shield of the cable charger (connected to the negative pole)
- Charger Info If the charger is connected to the connector, this signal shorts to ground
- Switch1 Security switch cable connector 1
- Switch2 Security switch cable connector 2

2.- Output Power

- Vout1+ Positive pole of the unregulated output number 1
- Vout1- Negative pole of the unregulated output number 1
- Vout2+ Positive pole of the unregulated output number 2

Vout2-	Negative pole of the unregulated output number 1
Reg Output+	Positive pole of the regulated output
Reg Output-	Negative pole of the regulated output
PC+	Positive pole of the regulated output for the PC PSU
PC-	Negative pole of the regulated output for the PC PSU

3.- Switch

This connector must be connected to an switch to power up and down the systems of the robot

4.- PC Switch

This connector can be plug with a cable to a PC to generate a wake up signal in it

Signal
GND

5.- Status Led

The status led indicates the state of the Q.Board3. If the led is off, all the systems are off. If the led brights continuously, the Q.Board3 is powering the rest of the systems. If the led is blinking, the battery is being recharged.

Signal
GND

6.- Reset

This connector will reset the board program if a short is made between its two pins

7.- Boot

The Boot connector is used only for programming issues. Do not use it.

8.- I²C

The Q.Board3 acts as an I²C slave device. It allows a master I²C device to know the status of the battery and the charger

NC SDA SCL GND

The I²C slave address of the device is the 0x28. To retrieve the battery status a 2 byte reading in this address must be done. The first value indicates the battery level in percentage. The second value indicates the internal state of the Q.Board3. It shows the PC status and the charging status.

The internal state of the Q.Board3 value is a 6 bit value with the following data:

Bat. Charging state [2] (MSB) Bat. Charging state [1] Bat. Charging state [0] Ext. Power Unreg. Output Reg. Output (LSB)

Reg.Output: A value of 1 means that the regulated output is on. A value of 0 means that it is off.

Unreg.Output: A value of 1 means that the unregulated output is on. A value of 0 means that it is off. This output is not used by default in the assembled version of Q.bo.

Ext.Power: A value of 1 means that the external power is present. A value of 0 means that it is not present.

Bat.Charging state: It can take 4 values. 0 (000) means that the battery is fully discharged, 1 (001) means it is charging at constant current, 2 (010) means that it is charging at constant voltage, 3 (011) means that it is fully charged and 4 (100) means that it is discharging.

9.- USART

The USART connector is used only for programming issues. Do not use it. 3.3V

Tx
Rx
GND

Q.Board4

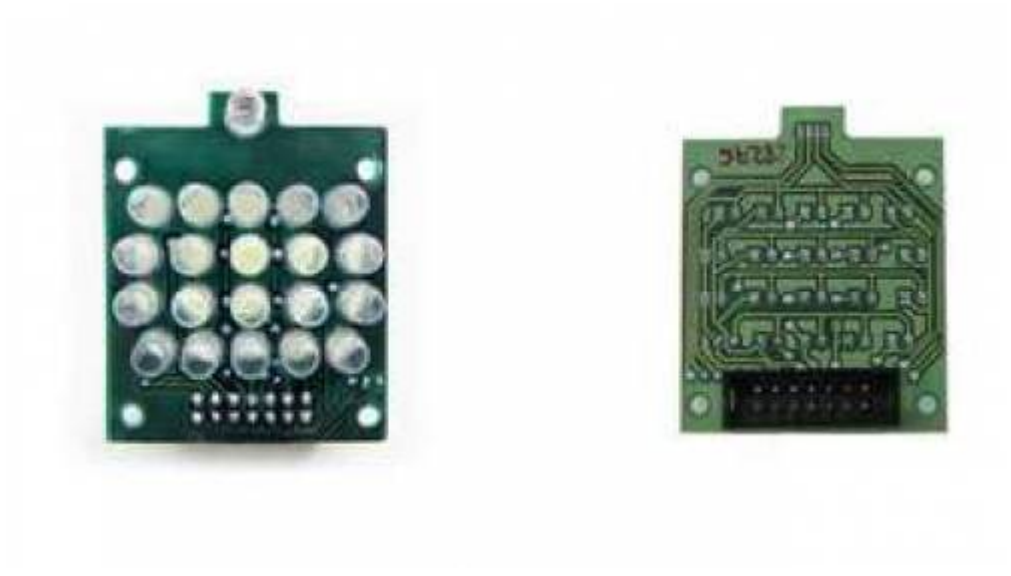
The Q.Board4 is used as an inertial measurement unit by an I²C port. It is also prepared to attach three infrared receivers. It uses the I²C sensors [L3G4200D](#) and [LIS35DE](#).

1.- This is the connector for the Q.Board4. It is attached to the Q.Board1 using the cable I²C

GND NC SCL SDA 5V
GND IR3 IR2 IR1 5V

Q.Board5

The Q.Board5 acts as the nose and mouth of the robot. It is attached to the Q.Board2 by a special cable made for it.



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