Open Roberta Board

Hardwarespecification

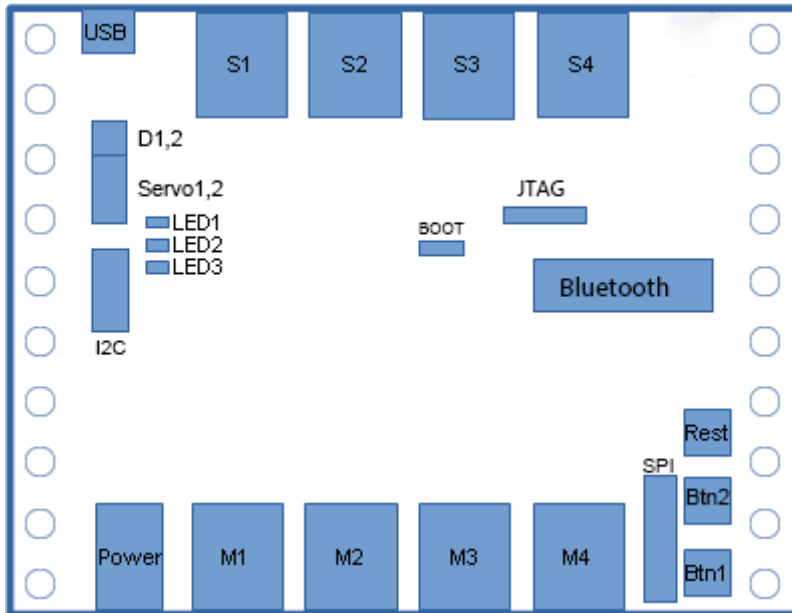# Table of contents

Content

1 ORB Hardware Architecture

1.1 What is where on ORB?

Power	supply voltage
USB	microUSB-connection
M1,...,4	4x motor-Port
S1,...,4	4x sensor-Port
D1,2	2x digital-Input
Servo1,2	2x model making servo
LED1,2	local control active
LED3	battery status
Boot	jumper for firmware download
JTAG	programming connector
Bluetooth	bluetoothmodule
Reset	reset button
Btn1,2	start local control
I2C	I2C connection
SPI	SPI connection

1.2 Pinlayout

1.2.1 Sensorports Sx (NXT-Socket / header connector)
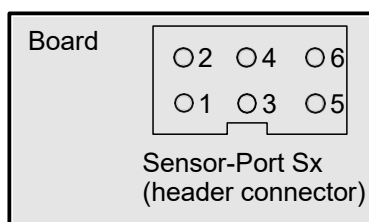
Pin	ORB	Color (NXT-cabel)	NXT-Light	NXT-Sound	NXT-Touch	NXT-Ultrasonic	EV3-Touch	EV3-UART
1	analog in +6,8K Pull-Up	white	analog out	analog out	button-1	analog in, amplitude modulation	pull-down (910R)	GND
2	Digital IO	black	GND	GND	button-2	GND	nc	nc
3	GND	red	GND	GND	button-2	GND	GND	GND
4	VCC	green	VCC	VCC	nc	VCC	button-1	VCC
5	Digital IO	yellow	LED	???	nc	SCL	GND	RXD
6	Digital IO	blue	nc	???	nc	SDA	button-2	TXD

(information from the senor`s point of view) button with 2.2k series resistor

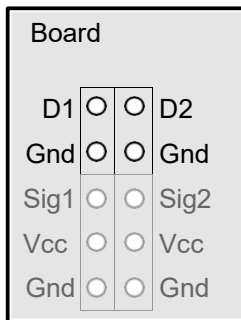### 1.2.2 Motorports Mx (NXT-Socket / header connector)

Pin	ORB	Color (NXT-cabel)
1	motor plus	white
2	motor minus	black
3	GND	red
4	Vcc (5V)	green
5	Encoder A	yellow
6	Encoder B	blue

```
Motor-Port Mx
(header connector)

       5    3    1

       6    4    2
Board
```

1.2.3 Digital-Ports Dx

```
Board

   D1 O  O D2
  Gnd O  O Gnd
  Sig1 O  O Sig2
  Vcc O  O Vcc
  Gnd O  O Gnd
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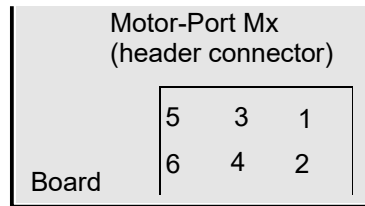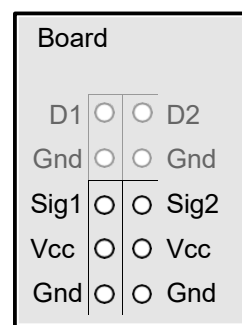
1.2.3 Servo-Ports ServoX

Supply voltage is Vcc = 5 V

Color code of common Servos:

Pin	Color (Futaba)	Color (JR)
1 - Signal	white	orange
2 - Vcc	red	red
3 - Gnd	black	brown

```
Board

   D1 O  O D2
  Gnd O  O Gnd
  Sig1 O  O Sig2
  Vcc O  O Vcc
  Gnd O  O Gnd
```

1.2.5 Boot-Jumper

The boot jumper is used for the firmware download. In the "default" position, the firmware is started. In the "download" position, the firmware can be installed via USB.

The jumper is only evaluated during restart (reset, powerdown).

```
Board

   O ] default
   O
     ] Download
   O
```
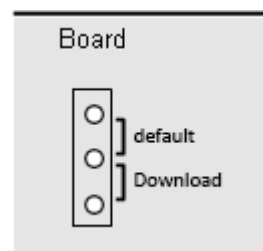
1.2.5 Supply voltage

The ORB is supplied with voltage via a LiPo battery. The connection is made via a T-connector from model making. A voltage of 7.4V is recommended for the battery

2 Actuators

2.1.1 Motor

The firmware can operate the motors on ports M1 to M4 in 4 operating modes:

2.1.1.1   Setting a variable voltage in the +/supply voltage range.

2.1.1.2   Shirt-circuit brake: By short-circuiting the motor connections, they are passively braked.

2.1.1.3   Speed control with PI controller, only for encoder motors. The control parameters and encoder resolution can be set by software, so that different motors can be used.

2.1.1.4   Positioning. A position control is superimposed in the speed control, so a target can be approached. The speed is ramped during start-up and stop and limited to a maximum speed. Ramp slope (acceleration) and maximum speed are configurable.

Speed control and positioning allow synchronous operation of multiple motors, but internally there is no balancing among the motors.

2.1.2 Servo

The ports Servo1 and Servo2 are suitable for model servos. The firmware generates a PWM control signal with variable pulse width of 1-2ms and a period duration of 16ms. The pulse width can be adjusted. Furthermore it can be adjusted how fast the pulse width is adapted from the previous value to a new setting value. The control signal can also be switched off (=ground level).

2.2   Sensorics

2.2.1 Digital

The digital value at pins 2, 5 and 6 of sensor ports S1 to S4 can be rad in at any time regardless of the sensor type used.

2.2.2 Analog

The analog value at pin 1 of sensor ports S1 to S4 can be read at any time regardless of the sensor type.

2.2.3 I2C

The firmware supports the I2C bus at pins 5 and 6 of the sensor ports. On the software side, e.g. the protocol of the NXT ultrasonic sensor is supported.

2.2.4 UART

Pins 5 and 6 can be operated as UART interface. The firmware supports the protocol of the Mindstorms EV3 sensors.

2.2.5 Digital inputs

The additional digital inputs D1 and D2 can be acquired.

2.3 Communication

For communication with the firmware, either USB or Bluetooth can be used. The communication protocol applies to USB, Bluetooth and UDP.

2.3.1 USB

USB-Class:	Vendor Specific Class
VID:	0x1000
PID:	0x0023
Endpoint:	1, Interrupt, Interval = 10ms
MaxPacketSize:	64

2.3.2 Bluetooth

The Bluetooth module of ORB is connected to the controller via UART. The UART settings are:

```
460800 baud, no parity, 1 stop-bit
```

2.4 Other

2.4.1 Battery control

LED3 (red) indicates the status of the power supply:

Voltage V_{CC}	Indication LED3 (rot)
Voltage OK $V_{OK} \leq V_{CC}$	permanently on − − − − − − − − − −
Voltage critical $V_{low} < V_{CC} < V_{OK}$	flashes with short interruptions − − − − _ − − − − _
Voltage to low $V_{CC} \leq V_{low}$	flashes fast − _ − _ − _ − _ − _

The voltage thresholds can be set. The indication is not valid during a download of the application software or an update of the firmware.