CanSat: The best way to start getting involved in space

Open Source Cubesat Workshop 2018
Daniel Sors Raurell
CanSat & CubeSat origins

- Both concepts appeared hand to hand around 20 years ago
- Both with similar purposes: stimulate and simplify access to space
- CubeSat transition into commercial while CanSat remains educational
International CanSat Competition
Cansat

Suborbital satellite in a can

• Primary mission:
  Transmit air temperature and air pressure data at least every second to ground station.

• Secondary mission up to the team:
  • Transmit or gather other sensors information (acc, gyro, GPS, CO2...)
  • Autonomous flight
  • Test lander technologies
  • Ground sampling
Cansat examples
qbcn
DESIGN

Modular

Open Source off the shelf components

Multiuse CanSat/GS/other

Technical features
- 5V and 3.3V additional outputs
- Yaggi antenna addapter
- Maximising payload volume
- Multiple communication channels
<table>
<thead>
<tr>
<th>Component</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arduino Pro Micro</td>
<td>2</td>
</tr>
<tr>
<td>Transceiver RFM69HW 433MHz</td>
<td>2</td>
</tr>
<tr>
<td>Temperature and pressure sensor BMP180</td>
<td>2</td>
</tr>
<tr>
<td>PCB board</td>
<td>2</td>
</tr>
<tr>
<td>Voltage regulator</td>
<td>2</td>
</tr>
<tr>
<td>Logic Level Converter (LLC)</td>
<td>2</td>
</tr>
<tr>
<td>Battery connector</td>
<td>2</td>
</tr>
<tr>
<td>Antenna</td>
<td>2</td>
</tr>
<tr>
<td>Yaggy antenna adapter</td>
<td>1</td>
</tr>
<tr>
<td>USB cable</td>
<td>1</td>
</tr>
<tr>
<td>Shields</td>
<td>4</td>
</tr>
<tr>
<td>M2 rods &amp; M3 rods (threaded)</td>
<td>2 &amp; 4</td>
</tr>
<tr>
<td>Nuts, washes, hook</td>
<td></td>
</tr>
<tr>
<td>Loads</td>
<td></td>
</tr>
</tbody>
</table>
STRUCTURAL TECHNICAL SPECIFICATIONS

- 3D printed Shell (PLA)
- Two rod configuration
  - 3 rod mode
  - 1 rod mode

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total mass</td>
<td>180g</td>
</tr>
<tr>
<td>Total volume</td>
<td>115h 66Φ mm (cil)</td>
</tr>
</tbody>
</table>
ELECTRONIC TECHNICAL SPECIFICATION

- Powered with a standard 9V battery
- Micro USB data connector
- 3 possible configurations
  - Modular
  - Integrated
  - Single PCB

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic’s mass</td>
<td>16g</td>
</tr>
<tr>
<td>Electronic’s volume</td>
<td>40x30x20 mm</td>
</tr>
</tbody>
</table>
Arduino Micro pro

- ATmega32U4 running at 5V/16MHz.
- Easy to program using the Arduino Integrated development environment.
- On-Board micro-USB connector for programming.
- I2C, SPI and UART serial communication ports.
- 4 channels to read analogue signals using a 10-bit analogue to digital converter.
- 5 Pulse Width Modulated output pins.
- 12 Digital Input Output pins.
- Tiny footprint: 33.0 x 17.8 mm
INTEGRATION PROCESS
Single PCB version

Increase in capability compared to the modular version
- 14x digital I/O
- 4x PWMs
- 6x analog I/O
- 2x 5V from voltage converter
- 1x 3V3 from voltage converter
- Raw battery voltage
- I2C, SPI and UART serial communication ports
SOFTWARE

- qbcAN library provided: Contains basic functions to communicate and use the pressure and temperature sensor.
- qbcAN and groundstation code examples provided.
- Arduino: Big community, tons of examples, libraries, tutorials and help online.
- Easy to code and test.
Cansat releasers
qbcan modular

This document is the qbcan modular user manual. It describes the qbcan CanSat kit, the soldering and assembly process and the software setup. It provides a step-by-step guide to help the user go through the development process, from the opening of the qbcan kit to transmitting data from one qbcan to another.

The qbcan kit has been developed by Open Cosmos. Open Cosmos is a start-up willing to use nano-satellites to provide simple and affordable access to space to organisations ranging from SMEs and research institutions to space agencies in developing countries.

Click here to download the qbcan library

Support
In case you have any problem during the assembly or operations please post your questions into the Open Cosmos community so all the users can benefit from the content.

Sensors terminology

| BMP180 | Pressure and temperature sensor |
| LLC    | Low Level Converter              |
| RFM69  | 433 MHz transceiver              |

Contents

1 System description
  1.1 Physical dimensions and mass
  1.2 qbcan assembly, structure
  1.3 Microcontroller
  1.4 Transceiver
  1.5 Temperature and pressure control
  1.6 Power
  1.7 Library
qbcan compact

This document is the qbcan compact user manual. It describes the qbcan compact CanSat kit and the software setup. It provides a step-by-step guide to help the user go through the development process, from the opening of the qbcan kit to transmitting data from one qbcan to another.

The qbcan kit has been developed by Open Cosmos for the users that want to have a working solution out of the box avoiding the assembly of the parts and soldering and hence focus the efforts on the payload.

Support

In case you have any problem during the assembly or operations please post your questions into the Open Cosmos community so all the users can benefit from the content.

Sensors terminology

| BMP180 | Pressure and temperature sensor |
| LLCC   | Low Level Converter              |
| RFM69  | 433 MHz transceiver              |

Contents

1. System description
   1.1 qbcan compact versions
   1.2 qbcan assembly, structure
   1.3 qbcan compact board mechanical interfaces
   1.4 qbcan electrical interfaces
     1.4.1 Reset interface
     1.4.2 Power buses
   1.5 Microcontroller
   1.6 Transceiver and antenna
   1.7 Temperature and pressure control
The Open Cosmos community is a site where all the users of the Open Cosmos products can ask questions, share projects, learn and get support from the Open Cosmos staff and the Open Cosmos community at large.

To learn more about us visit Open Cosmos.
Find the user manuals for Open Cosmos products in the Open Cosmos wiki.
qbcan modular user manual
qbcan compact user manual

Get the source code examples and libraries for qbcan and qbcan Releaser in our GitHub

** Follow this link to visit the qbcan Shop **

<table>
<thead>
<tr>
<th>Topic</th>
<th>Category</th>
<th>Users</th>
<th>Replies</th>
<th>Views</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can't connect a Micro SD Card Adaptor to Qb can compact</td>
<td>qbcan</td>
<td>2</td>
<td>399</td>
<td>Apr 16</td>
<td></td>
</tr>
<tr>
<td>CanSat-Transceiver problem</td>
<td>qbcan</td>
<td>1</td>
<td>159</td>
<td>Mar 7</td>
<td></td>
</tr>
<tr>
<td>Qbcan modular assembly instructions</td>
<td>qbcan</td>
<td>0</td>
<td>152</td>
<td>Jan 5</td>
<td></td>
</tr>
<tr>
<td>ESA Cansat kit assistance</td>
<td>qbcan</td>
<td>10</td>
<td>1.1k</td>
<td>Sep '17</td>
<td></td>
</tr>
<tr>
<td>Stackable Pin headers used in qbcan</td>
<td>qbcan</td>
<td>0</td>
<td>185</td>
<td>Sep '17</td>
<td></td>
</tr>
<tr>
<td>Multiple qbcan in one location - changing RF channels</td>
<td>qbcan</td>
<td>0</td>
<td>312</td>
<td>Mar '17</td>
<td></td>
</tr>
<tr>
<td>Qbcan, how to connect an accelerometer to the Pro Micro board?</td>
<td>qbcan</td>
<td>1</td>
<td>410</td>
<td>Mar '17</td>
<td></td>
</tr>
</tbody>
</table>
Open Cosmos

“Aim high, go beyond”

www.open-cosmos.com
@Open_Cosmos
@open.cosmos.space
Open Cosmos Ltd.