INSTRUCTION MANUAL

V1.2

Thanks for your purchase of the Habduino Shield.

The Habduino kit is sold as is with no guarantees of performance or operation.

If you decide to use this product under a balloon it's your responsibility to ensure you comply with the local legislation and laws regarding meteorological balloon launching and radio transmission in the air.

The Radiometrix NTX2B 434Mhz is NOT license exempt in the United States of America and does need a radio amateur license.

Use of APRS requires a radio amateur license in all countries and a number of countries don't permit the airborne use of APRS under any circumstances.

The Habduino cannot do APRS without an addon Radiometrix HX1 module (See APRS Section).

It is YOUR responsibility to ensure this kit is used safely please review the safety section.

Please read this guide on High Altitude Ballooning.
http://www.daveakerman.com/?p=1732

Please note the where supplied RG174 pigtail MUST be turned into a suitable antenna. Instructions to do this are here : http://ukhas.org.uk/guides:payloadantenna

The hardware design & code for Habduino is released under a Creative Commons License 3.0 Attribution-ShareAlike License : http://creativecommons.org/licenses/by-sa/3.0/

The latest code and documentation is available here: https://github.com/HABduino

Kit Contents

Habduino Shield
Battery Holder
Active Patch Antenna
RG174 Pigtail to make an antenna (434MHz kit only)

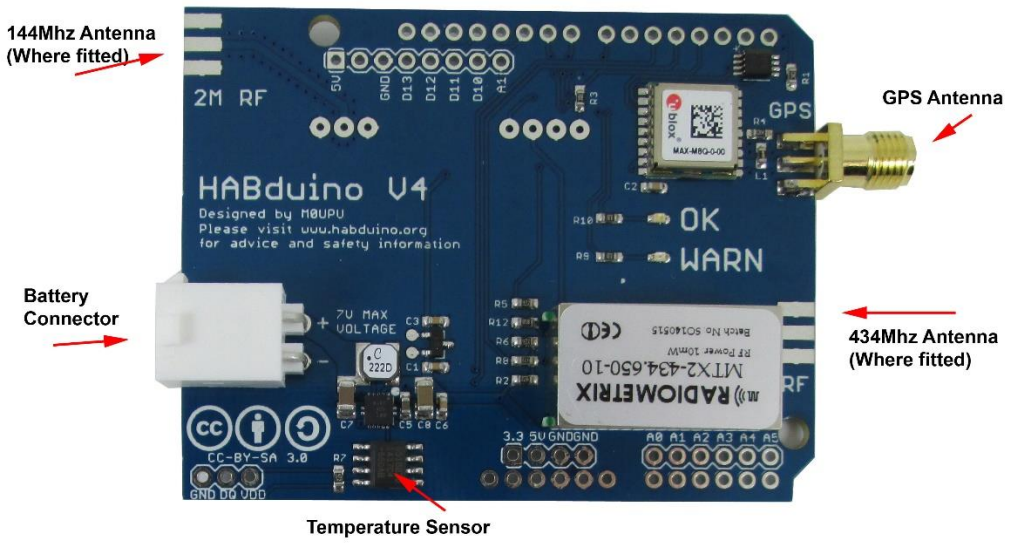
Introduction

Habduino is compatible with the UKHAS telemetry formats and the APRS network where permitted and where the suitable HX1 module is fitted.

Habduino utilises the latest Ublox MAX M8Q GPS rated for altitudes up to 50km, a 434MHz TCXO equipped frequency agile radio transmitter (where fitted) and/or a Radiometrix HX1 (where fitted) to provide APRS transmissions on 2 meters.

An efficient step up power regulator is fitted that powers both the Arduino and shield from a pair of AA batteries without the need for any further power supplies. The code can simultaneously transmit APRS on 2 meters and RTTY on 434MHz.

Radio modules are factory fitted at time of order.



UKHAS Guidelines
Source : http://ukhas.org.uk/guides:guidelines

This set of guidelines has been put together by members of UKHAS (United Kingdom High Altitude Society) as a recommendation of how to operate high altitude balloon flights safely. They are not legally binding rules however UKHAS do recommend that people follow them as they are based on years of experience in the UK and US. Launching a balloon is your own responsibility and while these rules won't protect you if something was to happen we'd expect that by following them you reduce the risk of any incidents.

Generally permission from your local aviation authority must be obtained for a meteorological balloon flight; this will include a NOTAM for the launch site.

Projects should aim to make their payload as light as possible both for safety but also as this will require less gas saving money and resources. Flights with payload weights below 1Kg should be the norm and payload weights above 2Kg are discouraged.

Keep within the ICAO regulations for light payloads:

- Flights with one or more payload packages should have a combined mass of less than 4 kg.
- A force of less than 230 N is required to separate the suspended payload and parachute from the balloon. (See Note1)
- if any package is 2 kg or more the area density must be below 13 g per square centimetre. (See Note2)
- Payloads should have insulation surrounding the equipment both for maintaining temperature but also providing 'padding' on impact.
- Antenna elements that face down should be flexible - avoid metal rods.
- Before launching a balloon run computer modelled flight predictions (See Section Planning for a launch), postpone launch if there is a high chance of the payload landing in urban areas or near to airports. If the payload is predicated to pass through or near NOTAM'd airspace, Danger or Air Traffic Zones then discuss this with the operator of these areas.
- Always get the landowners permission before attempting to recover a payload.
- As there is a chance that your payload may not be recoverable strive to make it as environmentally friendly as possible.
- Seek help from more experienced UKHAS members when encountering an area outside your comfort zone.
- Follow local regulations when operating and storing compressed gases such as Helium or Hydrogen.

Note1: The force to be applied in a direction parallel to the suspension line.

Note2: The area density is determined by dividing the total mass in grams of the payload package by the area in square centimetres of its smallest surface.

Gas Safety

Compressed gas of any type can be dangerous and it is recommended you take advice from the supplier of the cylinders as to safety precautions. Gas cylinders are sometimes subject to local regulations with regards to transport and storage.
We suggest you review http://www.hse.gov.uk/cdg/pdf/safusgc.pdf for safe handling guidelines of all compressed gas.

Should you choose to use Hydrogen additional safety precautions should be adhered too. It is outside of the scope of this instruction manual to discuss here but as always take safety precautions where necessary and review:
http://ukhas.org.uk/guides:hydrogen
http://arhab.org/pdfs/h2_safety_fsheet.pdf

Batteries

Always uses a fresh set of **Energizer Ultimate Lithium** batteries when launching. No other battery is suitable or recommended: http://data.energizer.com/PDFs/l91.pdf.

Cameras

It is possible for cheap key ring cameras to lock the GPS module out, ensure these cameras if used are kept away from the GPS antenna.

GPS Antenna

The GPS Antenna should have a clear unobstructed view of the sky. The signals will pass through foam but not through foil.

Hand Warmers

These are not required, the electronics will keep themselves warm.

Predictions

Use the http://habhub.org/calc/ Balloon Burst calculator (Aim for 5.5m/s ascent rate) and http://predict.habhub.org/ to predict the landing spot of your balloon.

Balloons

Balloons, parachutes and other flight hardware can be purchased from
www.randomengineering.co.uk

Support and Further Information

If you have any doubts or questions please come speak to us on IRC :
http://webchat.freenode.net/?channels=highaltitude

The UKHAS Wiki has lots of information on it : http://ukhas.org.uk/ and will answer many of your questions.

Please read this http://www.daveakerman.com/?p=1732

Getting Started

Hardware

Insert the Habduino shield into your Arduino board. Please note:

Never connect the USB and the external battery pack at the same time.

Screw the GPS antenna firmly onto the GPS SMA connector.

Although the GPS is connected via hardware serial the design means you can program the Arduino as normal without having to remove the shield.

You don't need an antenna on the 434 MHz radio to test but it may help. You can just insert a single core piece of wire 164mm long into the SMA socket for testing.

Use of an antenna with the HX1 module is mandatory due to the higher output power.

Plug the Arduino into your PC via the USB.

We have noticed some Arduinos, especially the clones have poor regulators, if you are experiencing decoding errors please power the boards from the battery pack. We only recommend the use of genuine Arduino boards.

Getting Started

Software

Download 1.6.5 Arduino IDE from www.arduino.cc

https://www.arduino.cc/en/Main/OldSoftwareReleases#previous

Do not use newer versions of Arduino IDE there seems to be a bug and the code won't run.

Downloading the Latest Firmware

Go to https://github.com/daveake/FlexTrack

Click Clone or Download -> Download ZIP

Extract this to your desktop

Rename the folder these files were extracted too from FlexTrack-master to FlexTrack

Run Arduino 1.6.5

File Open -> Locate FlexTrack.ino

Set your board i.e Arduino Uno in Tools -> Board

Set the boards COM port

Click Sketch -> Include Libraries -> Manage Libraries

Search for Onewire

Select the OneWire by Jim Studt and click install

Search for Dallas

Select the DallasTemperature by Miles Burton and click install Now configure as applicable:

434MHz Operation

Amend line 29 to your RTTY call sign.

```
#define RTTY_PAYLOAD_ID   "HABDUINO"          // Do not use spaces.
```

2MTR/APRS Operation

Amend line 55 to your APRS call sign (if applicable)

```
#define APRS_CALLSIGN    "K1ABC"              // Max 6 characters
```

Press Sketch -> Upload

Operation

Once uploaded at power on the board LED's should flash rapidly, this is the initialisation period. After a short period the WARN LED should blink once a second until GPS lock has been achieved at which point the blinking red WARN LED should be replaced by a GREEN OK LED blinking.

Occasionally the WARN LED may blink but quickly switch back to GREEN, this is ok.

Once the module detects its above 1000 meters in altitude the LED's will turn off entirely if you are launching above 1000 meters you can amend the code to stop this.

Below 1000 meters the GPS module is in the more accurate pedestrian mode, above this the code will switch the module to flight mode to ensure it works at high altitude.

The 434Mhz transmissions can be received by any radio capable of reception 434Mhz SSB. RTL dongles work though lack sensitivity, we recommend the Airspy.

There is a guide on receiving and decoding here:

https://ukhas.org.uk/guides:tracking_guide