1 – Source Code Guide

# Changelog

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| Date | Author(s) | Confirmation Signature(s) | Description |
| 01/05/2019 | Richard Bamford |  | Created brief descriptions of each file. |
| 02/05/2019 | Richard Bamford |  | Layout improvements. |
| 05/05/2019 | Richard Bamford |  | Changelog added |

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# Introduction

This document is to specify, in English, what can be found in the satellite’s source code files.

It is written with software developers in mind to guide them to specific elements such as; Password, Callsign, Carrier Frequency definitions and also specific functions for example; Analog to float conversions, String checking, EEPROM writing.

# Configuration (configuration.cpp/.h)

## Radio Configuration

RTTY transmissions are in the FSK modem direct mode - with the default carrier frequency of 434.0 MHz.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Modem | Band | Carrier Frequency (mHz) | Current Limit (mA) | Frequency Derivation (Hz) | RX Bandwidth (KHz) | Bit rate (bps) | Data shaping | Output Power (dBm) |
| FSK | Amateur | 434.0 | 10.0 | 10.0 | 250.0 | 100.0 | 0.5 | 10.0 |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Modem | Band | Carrier Frequency (MHz) | Bandwidth (KHz) | Spreading Factor | Coding Rate | Output Power (dBm) |
| LoRa | Amateur | 434.0 | 125.0 | 9 | 8 | 6 |
| LoRa | ISM | 434.0 | 125.0 | 9 | 8 | 10 |

## Definitions

1. Enable RTTY transmission flag.
2. Board and Battery TMP100 I2C addresses.
3. EEPROM addresses.
   1. Deployed flag.
   2. Restart counter.
   3. Transmission state.
4. RTTY callsign transmission counter threshold.
   1. Each transmission increments the RTTY callsign counter, and when it reaches this defined threshold, the RTTY callsign is transmitted.
5. Debug flag
   1. Removes the print to serial code if undefined.
6. Maximum length of a string received.
   1. 64 chars.
7. Input pin numbers
   1. Analog
      1. MPPT enable and disable pin. (enable and disable battery charging
      2. Solar cells
         1. Side A cell
         2. Side B cell
         3. Side C cell
      3. Current battery charging voltage (MPPT).
      4. Current battery voltage (MPPT disabled).
8. Output pin numbers
   1. Digital
      1. Deployment MOSFET controllers.
         1. Dual MOSFET (MOSFET 1).
         2. Single high power MOSFET (MOSFET 2).
      2. Watchdog hardware pin.
      3. SX1278 pin numbers.

## Global Variables

1. LoRa library object.
2. Callsign.
3. Password.
4. Enable and disable transmission bool.
5. Restart counter.
6. Stop counter.
   1. The program increments this integer every time it attempts to restart the satellite. If it exceeds the threshold defined as STOPPED\_COUNTER\_MAX, it resumes sending the hardware watchdog a voltage.

## Functions

1. Setup pin INPUT/OUTPUT directions.

# Main program control (BeaconTest1.ino)

## Functions

1. Setup
   1. Increment or initialize EEPROM based restart counter.
   2. Set temperature sensor resolution.
   3. Set the *STATE\_STARTED* flag in the communications system.
   4. Invoke the Power Control system to enable to disable the MPPT circuit.
2. Loop function
   1. Run the deployment sequence if is has not been ran.
   2. Invoke the power control system to enable or disable the MPPT circuit.
   3. Switch Modem mode to LoRa.
   4. Transmit the system information packet.
   5. Receive transmissions on the amateur band.
   6. Switch radio frequency to ISM band
   7. Receive transmissions.
   8. Switch Modem mode to FSK.
   9. Receive transmissions.

# Hardware Interface (pin\_interface.cpp/.h)

## Global Variables

1. Watchdog heartbeat state.

## Hardware pin access functions

1. Battery charging voltage.
2. Battery operating voltage.
3. Battery temperature.
4. Board temperature.
5. Solar Cell voltages.
6. EEPROM reset.
7. Watchdog pin toggle.

## Hardware analog to float conversion functions

1. Convert an analog reading 0-1023 to a voltage divided value 0V-5V
2. Convert an analog reading 0-1023 to a current value.

# Safety & Security (safety\_security.cpp/.h)

## Functions

1. Check if a String is safe.
2. Check the deployment EEPROM address for faults.
3. Check RadioLib status codes.
   1. Startup codes.
   2. Transmission codes.
   3. Reception codes.
   4. Setting change codes.

# Debugging (debugging\_utilities.cpp/.h)

1. Print a string to the serial port which can be turned off.

# Persistent Storage (persistent\_storage.cpp/.h)

## Functions

1. Wipe all memory.
   1. Read from address.
   2. Reads from 6 different locations and finds the most common.
2. Write to address.
   1. Writes to 6 different locations

# Deployment (deployment.cpp/.h)

## Functions

1. Run the deployment sequence.
2. Get deployment sequence EEPROM value.

# System Information (system\_info.cpp/.h)

1. Restart counter
   1. Get counter value.
   2. Increment the counter value.
   3. Load the restart counter into RAM.
2. Password
   1. Get the transmission password variable.
3. Callsign
   1. Setting the callsign string.
   2. Getting the callsign string.

# Communication system (communication.cpp/.h)

## Variables

1. Message bound for repeater.

## Functions

1. Switching the modem
   1. FSK
   2. LoRa
2. Configurating Radio settings
   1. Amateur frequency band.
   2. ISM frequency band.
3. Transmission control router
   1. Route a given transmission string to a function.
4. Transmit a string of characters.
5. Transmission enable or disable state control
   1. Disable
   2. Enable
   3. Get value.
6. Protocol functions
   1. To-Ground Transmissions
      1. Started signal
      2. Stopped signal
      3. Radio Initialized successfully
      4. Deployment success
      5. Pong
      6. Power Info
      7. Payload Message
      8. Repeater Message
   2. To-Satellite Transmissions
      1. Ping.
      2. Stop Transmitting.
      3. Start Transmitting.
      4. Reset EEPROM.
      5. Begin deployment sequence.

# Battery Control (power\_control.cpp/.h)

## Variables

1. Battery on or off.

## Functions

1. Check the temperature of the battery and switch the MPPT circuits.

# Automatic Interval Control (automatic\_interval\_control.cpp/.h)

## Functions

1. Takes the current battery voltage and returns an interval value based of it.