UgCS DDC

Secondary channel Version 3.0

User Guide

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Secondary channel

During a drone show stable Wi-Fi connection with all drones cannot be guaranteed. However, even when drones are flying autonomously and are not controlled from the ground, they still need to receive RTK GPS corrections and must respond to emergency commands such as ('HOLD', 'LAND', 'RETURN HOME' or 'DISARM'). A secondary channel is designed to reduce the risk of losing control of a drone during a show.

Architecture

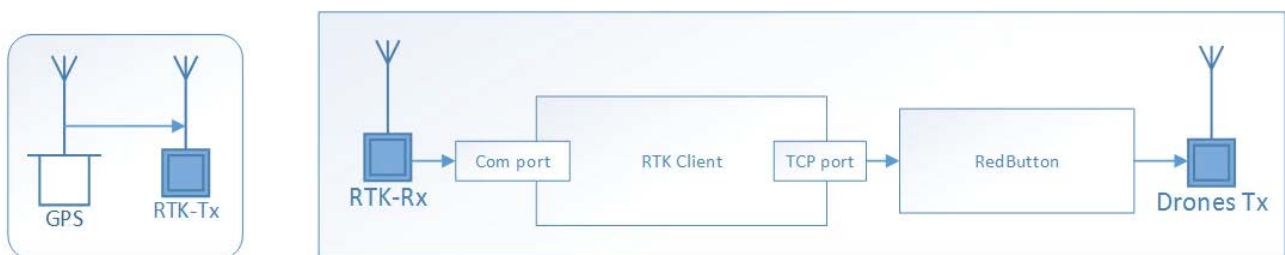**Reading RTCM corrections via a radio link:**

Figure 1. Reading RTCM corrections via a radio link

This option is good in a situation when an RTK GPS base station is located away from operators.
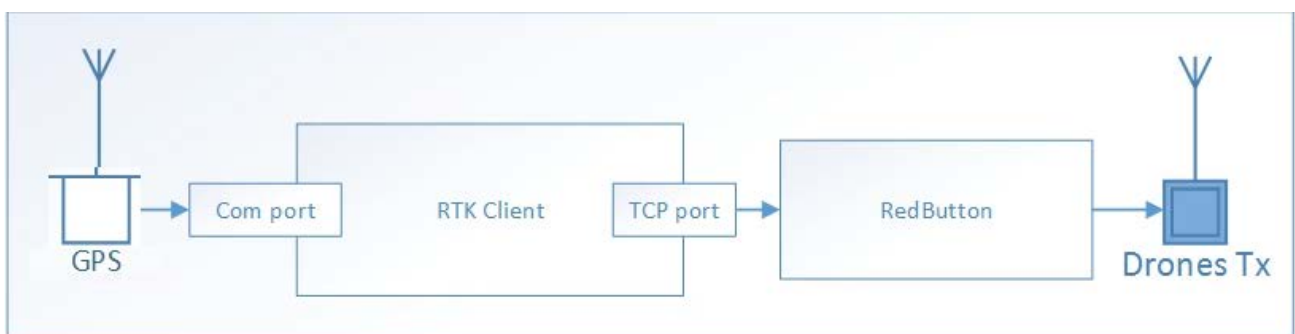
Direct connection:

Figure 2. Direct connection

Direct connection is good when high interference is expected.

An RTK GPS base station is operating at a fixed location and sending its RTCM data to RTK Client application.

RTK Client parses incoming packages, "wraps" them into MAVLink, and retransmits them to consumer sinks.

RedButton is responsible for sending commands to a swarm of drones. It reads data from one of RTK Client's sinks and broadcasts packages to the fleet.

Hardware

Radios

3DR radios have been chosen as a secondary channel between drones and flight control software. Depending on the region, various versions (433, 868 or 915 MHz) can be used to satisfy local requirements.
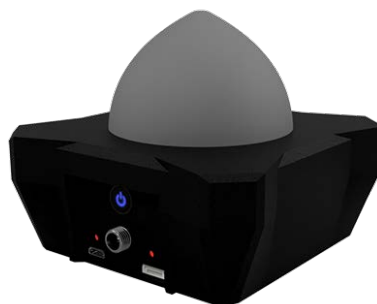

Figure 3. 3DR radio modules

Be aware that the default firmware does not support any encryption or channel securing, and communication can therefore be subject to hijacking.

GPS

A module based on u-blox NEO-M8P-2 chip is used as the RTK GPS base station.

Figure 4. RTK GPS base station based on u-blox NEO-M8P-2 chip

The base station can be connected and configured either locally via USB or remotely via radio modems. RTK Client application is ideal for this purpose.

Software

Installing drivers

Windows 10 users (and perhaps others) will need to download and install the u-blox GNSS Standard Driver for Windows, v1.2.0.8.

If this link is broken you may find a newer version under the Driver section of this ublox page.

When first installed, the device may show up in the Sensors category in Device Manager. In this case, please right-click it and select Update Driver Software —> Browse my computer for driver software —> Let me pick from a list of devices. In the next screen, you will see a list of possible drivers. Select USB Serial Device —> Next —> Finish.

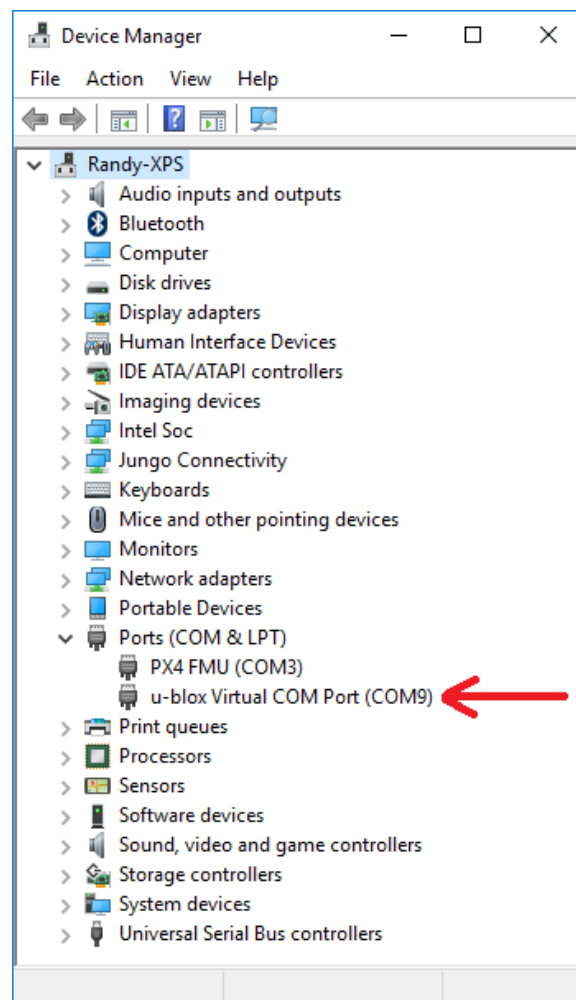If installed correctly, the GPS should appear in the Device Manager as USB Serial Device when plugged in.

Figure 5. Device Manager

RTK Client

This tool is designed to configure an RTK GPS base station and read corrections provided by it, as well as retransmit data as MAVLink messages to multiple consumers.
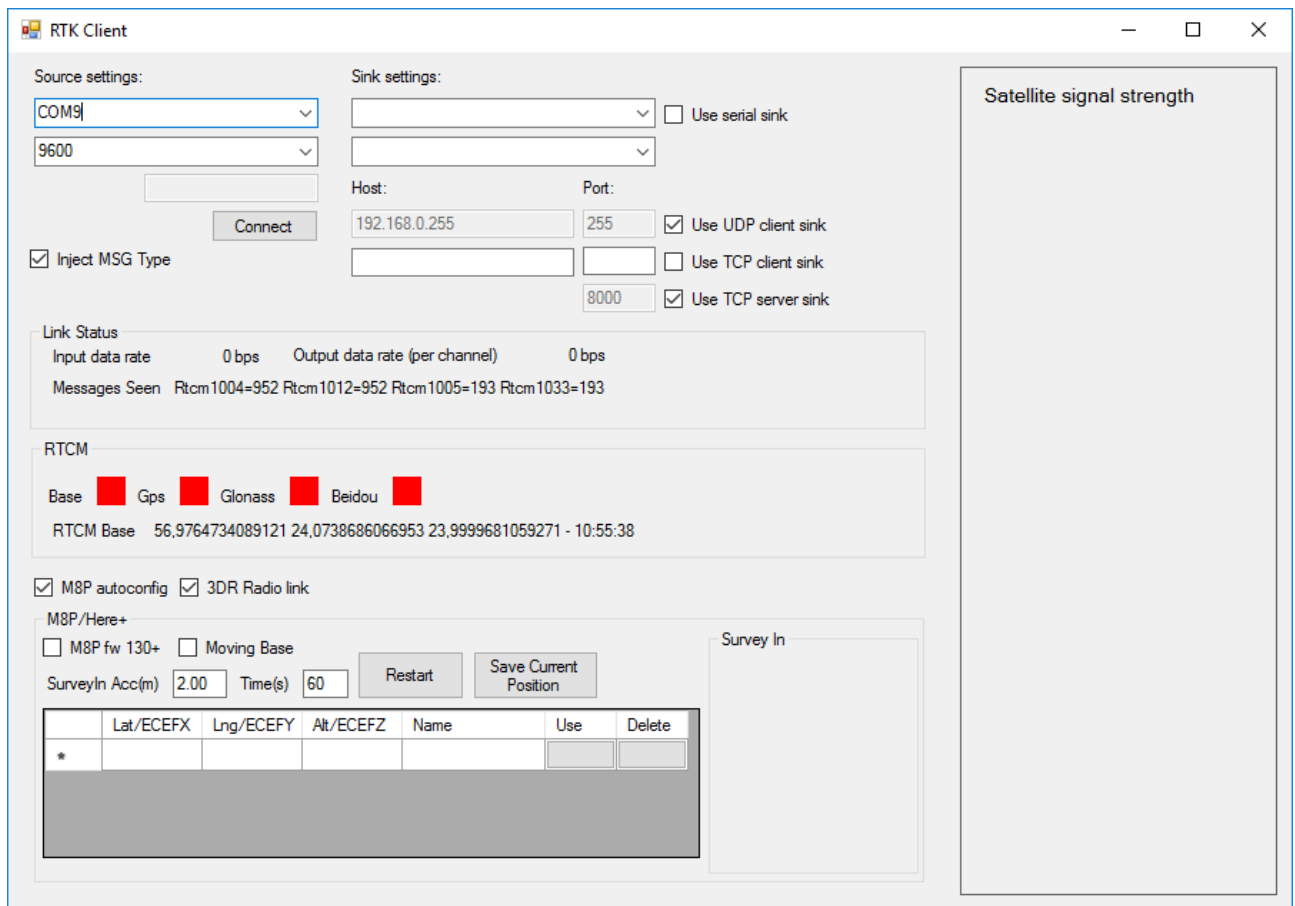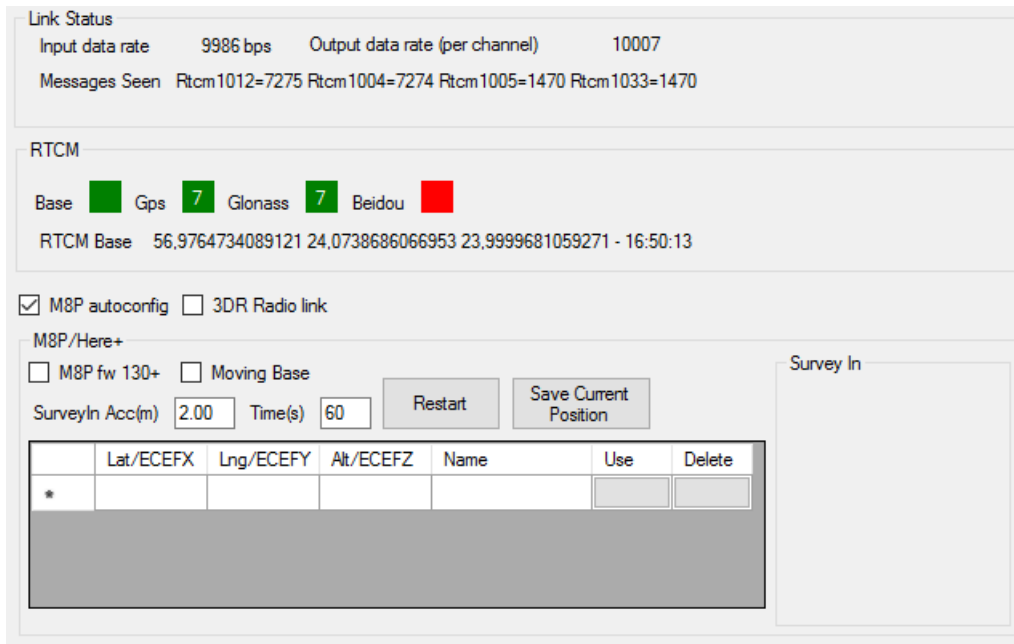
Figure 6. RTK Client

Typical use case:

- Connect RTK base station to your workstation

- Identify "Source settings" - COM port and baud rate to be used by RTK GPS base station (default baud rate after the GPS restart is 9600). Refer to VCP Device driver manual (https://www.u-blox.com/en/product/u-center-windows)

- Choose a desired port and baud rate in Source settings (COM9 and 9600)

- If you are using a secondary channel, in the field "Sink settings" enter the COM port and baud rate (default 56700)

- Choose consumer sinks. Fill text fields and click the desired checkboxes:

  o Use UDP client sink (broadcasts UDP corrections to drones via Wi-Fi network) (192.168.0.255, port: 14555)

  o (optional) Use TCP client sink (a direct TCP connection to a remote host)

  o Use TCP server sink (opens a server port and delivers RTCP corrections to external clients) (port: 8000)

- Click Connect.

If everything is connected correctly, the following green boxes will appear:

Figure 7. RTK Client (2)

If RTK GPS base station is connected to the workstation using USB cable, then GPS module will be automatically configured when M8P autoconfig is checked.

If RTK GPS base station is connected via radio modems like 3DR Radios, then check 3DR Radio link checkbox to prevent the base station from using higher speed.

In the SurveyIn Acc field, enter the absolute geographic accuracy that you expect from your RTK GPS base station. The default accuracy is 2 meters. In the Time field enter the minimum survey time you expect. The default suggested surveying time is 60 seconds. Click Restart; RTK Client will transfer the entered data to the RTK GPS base station, which will start a new round of surveying.

The Survey In field will display: InProgress indicates that the survey is ongoing. A completed survey of the current base station position is indicated by the status messages SurveyIn Valid: True and InProgress: false.

Duration: the survey duration in seconds.

Obs: the number of observations used for the survey.

Acc: current accuracy in meters

- When the survey is completed, as indicated by the SurveyIn: True message, you may click Save Current Position and enter a name for the saved position.

- RTK messages from the base station are sent to a drone as MAVLink message through consumers sinks.

RedButton

This app is a supporting tool for DDC Client. Its key function is to control individual drones or the whole fleet. It also sends RTCM corrections through an emergency radio channel.

Main screen shows all drones in a fleet with buttons against each one. Commands may be broadcasted by clicking buttons in the bottom of the screen.

Figure 8. Main screen

Color boxes next to the drone number allow you to send commands to particular drones to change the LED colour, allowing you to easily detect problems such as malfunctioning LED modules or incorrectly connected wiring.

- D – Disarm (no confirmation required, be careful)

- L – Land

- R – Return Home

- Hold – Suspend mission performance if something goes wrong

RedButtonDDC.exe.config is a configuration file for RedButton application. Here are its key parameters:

```
<applicationSettings>
  <Drones.Properties.Settings>

    <setting name="BaudRate" serializeAs="String">
      <value>57600</value>
    </setting>
    <setting name="PortName" serializeAs="String">
      <value>com3</value>
    </setting>
    <setting name="ddcClientConfig" serializeAs="String">
      <value>c:\Program Files (x86)\UgCS\client-DDC\DDClient.exe.config</value>
    </setting>
    <setting name="RtcmSourceHost" serializeAs="String">
      <value>localhost</value>
    </setting>
    <setting name="RtcmSourcePort" serializeAs="String">
      <value>8000</value>
    </setting>
  </Drones.Properties.Settings>
</applicationSettings>
</configuration>
```

Figure 9. Configuration file

- BaudRate – baud rate for a radio link used to send commands to drone fleet

- PortNumber – COM port where a radio link is detected

- ddcClientConfig – a path to DDC Client configuration file used by RedButton to retrieve the list of detected vehicles

- RtcmSourceHost – a host where RTK Client opening its server port and supplies packed RTCM corrections

- RtcnSourcePort – a port number at RTK Client to read RTCM corrections