

Oregon RFID manufactures equipment for tracking fish and wildlife (and rocks!) using low frequency passive RFID tags and readers. Our products are used worldwide for scientific research and commercial operations.



ATC Autotuner User Guide

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1 Introduction

The Autotuner is a tuner that automatically tunes itself when used with the ORSR Single Antenna reader or ORMR Multiple Antenna reader. During the tuning process, capacitors on the autotuner are switched on/off by transistors such that the HDX system resonates at 134.2 kHz, the international standard frequency for animal tracking. The transistors are kept on/off by storing their value in onboard non-volatile memory.

This document describes the usage of the Autotuner.

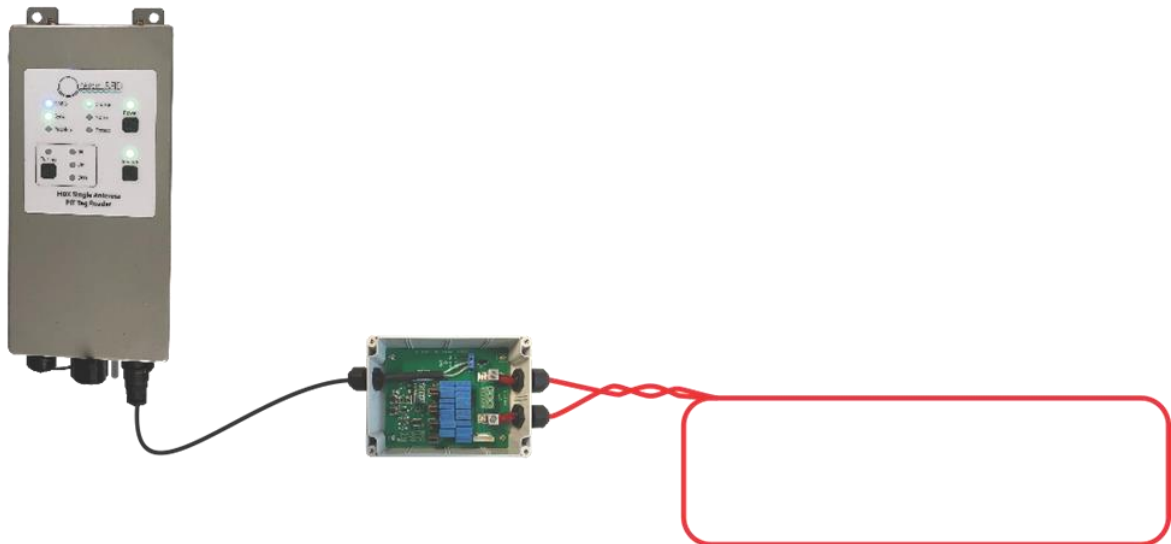


Figure 1 HDX system components

2 Description

The AutoTuner has individual capacitors that are connected in 512 combinations to produce a capacitance range from 11 μF to 85 μF (micro Farads). This corresponds to an inductance range of the antenna from 11 μH to 135 μH (microHenries). The Twinax cable connecting the reader with the Autotuner adds a small amount of capacitance per meter which decreases the inductance range a little depending on the cable length.

It is best to use antennas that have an inductance away from the high and low values for dependable operation. The inductance can change if the loop shape is altered, requiring retuning. The autotuner can only tune if the inductance stays within range.

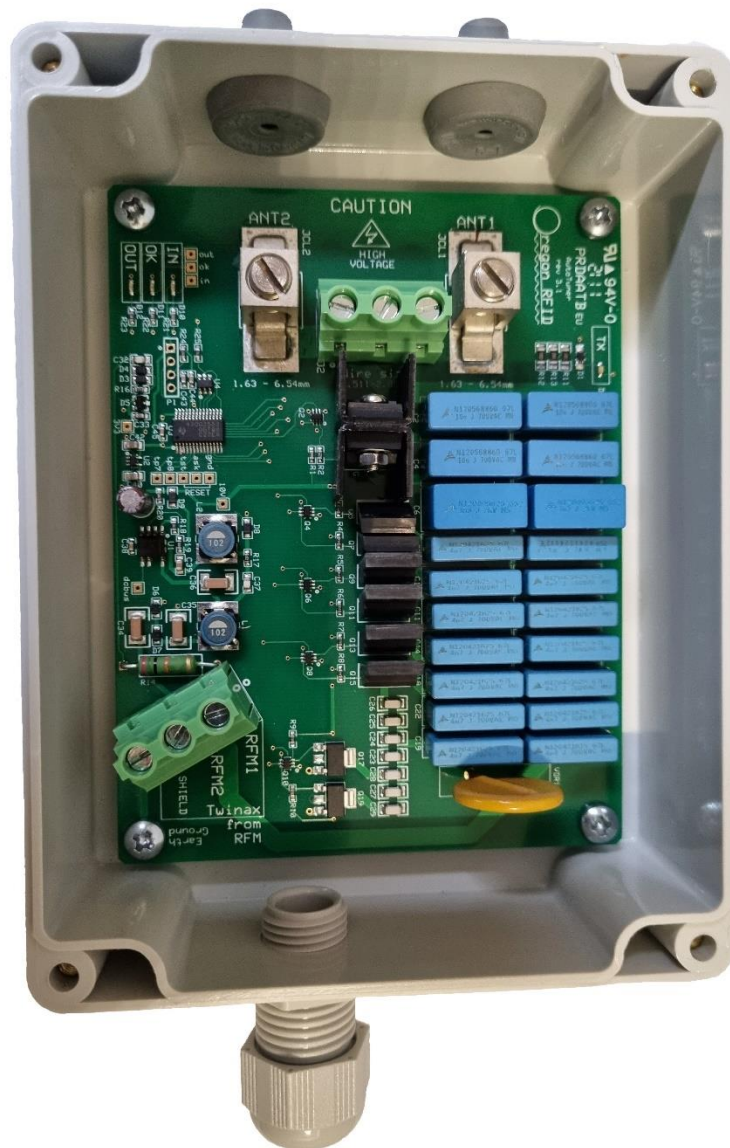


Figure 2 Autotuner

3 Installation

The assembly is very easy and should not take more than 5 minutes.

3.1 Connecting the antenna

The antenna cables are fed into the autotuner through two rubber terminal on the top side. Punch a small hole into the rubber grip and push the wires through. If a watertight connection is needed, replace the rubber grips with cable connectors as used for the Twinax cable.

3.2 Connecting the Twinax cable

Twinax cable connects the Autotuner to the reader. It supplies power to the antenna for it to resonate; additionally, it sends the received data back to the reader. The Twinax cable can be up to 130 meters long.

1. Strip 3 cm of the outer insulation to expose the shield.



Figure 3 Twinax cable preparation

2. Separate the shield from the two inner wires and trim 1cm from the ends.
3. Twist shield as shown.
4. Solder trimmed cable ends if possible.



Figure 4 Twinax cable stripped

5. Pass the Twinax cable through the bottom grip.
6. Loosen the three screws of the green terminal.
7. Feed the two wires into the terminals marked RFM1 and RFM2, tighten terminal screws (polarity is irrelevant).
8. Connect the shield to the third terminal (optional).
9. Tighten the cable grip.



Figure 5 Twinax connection

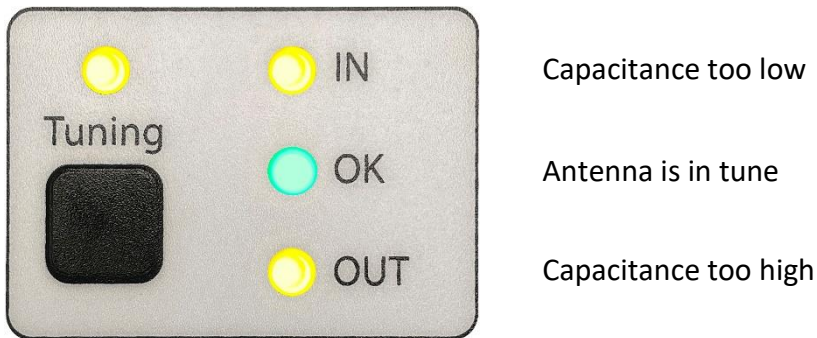
4 Operation

Before the system can work, it needs to be tuned to resonance. Every change of the system requires a new tuning process.

4.1 Tuning with push buttons

The tuning process is started by pushing the “Tuning” button on the reader.

While tuning, there are 3 LED that indicate the status as it adjusts the capacitor value:



If the tuning only shows IN or OUT, the antenna inductance is out of the range of the capacitors. An inductance meter can be used to measure the antenna inductance to verify this.

If the antenna is broken or has been disconnected, the tuning will stay on OUT permanently.

4.2 Tuning with console command

The tuning process is started by the **TU** command.

When the tuning is complete it will show the antenna inductance, capacitance of the autotuner, the antenna voltage and current.

```
HSG*> TU
I..
Tuned: 2023-01-14 09:42:30
28.4 uH, 49.5 nF, 107 V, 3.1 A
```

4.3 Antenna analysis

The Autotuner is also used to analyze the antenna by measuring the antenna Q and the antenna Effective Series Resistance at the operating frequency. The **MQ** command is used to start the analysis.

```
HSG*> MQ
This will take 60 to 80 seconds
Are you sure? (Y/N) Y
.....
.....
.....
.....
```

.....
Q measurement: 2023-01-14 09:45:07
Q 74.6
R 316 milliohms

When measuring Q, the antenna voltage for each of the 512 capacitance steps is saved. The values can be displayed with the SM command and can be plotted in a spreadsheet or using our Android app to see the Q curve.

4.4 Periodic autotuning

The reader has a timer feature to periodically tune the antennas. If the antenna can change shape, the feature keeps the antenna in tune. See the **AP** command in the reader User Guide.

4.5 Broken antenna detection

A reader should not be operated for a long time without an antenna. The **MP** command is used to detect when an antenna is disconnected or the wire is broken to stop scanning. See the User Guide to configure this feature.

5 Troubleshooting

The LED only flash rapidly between IN and OUT.

This can happen if the tuner has a small gap between capacitor steps. Changing the antenna shape a little will change the inductance which will move the tuning point. Another solution is to use a different autotuner.

The LED show a constant IN or OUT.

If the LEDs are stuck on IN or OUT, measure the antenna's inductance to be sure that it is within the tuning range. Disconnect the antenna when measuring the loop inductance.

The autotuning process will not work if something is mis-wired. Verify that everything is correctly wired and try again.

A lot of metal near the antenna can also prevent the antenna from tuning, such as if the antenna is placed against a metal surface. Screws and mounting brackets are too small to affect the tuning but metal that is close to an extended portion of the antenna can affect the tuning.