

# ORSR / ORMR

## User Guide



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Oregon RFID, Inc  
Portland, Oregon

# ORSR Single Antenna Reader

The ORSR Single Antenna PIT Tag Reader detects HDX PIT tags and timestamps each event before writing it to the log file. It is designed for unattended remote operation with an internal datalogger and power level monitor.

The front panel displays the reader status and has pushbutton controls to turn the reader on and off, enable the beeper and start tuning mode. The reader can also be remotely operated by typing commands to the serial port console using a USB-to-serial cable or Bluetooth with a laptop and a terminal program.

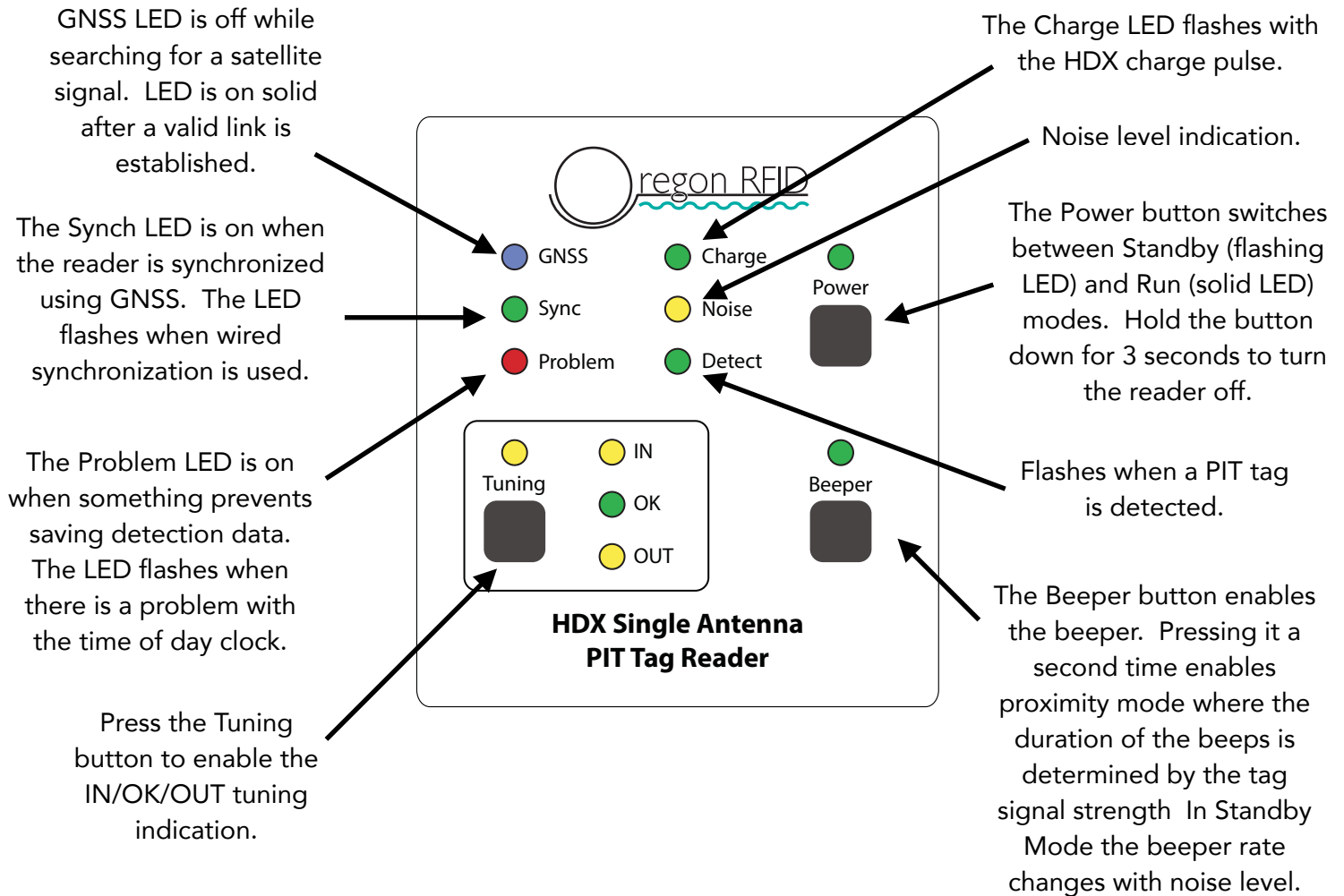
The reader can be powered from 10 to 20 volts DC. The amperage required will depend on the antenna characteristics but it is usually between 1 and 2 amps. Antennas with a higher current draw do not work well. The rated limit is 4 amps.

The reader will automatically shut down when the voltage falls below 10 volts. The MV command can be used to adjust the threshold and restart voltage.



## ORSR Front Panel Indicators and Controls

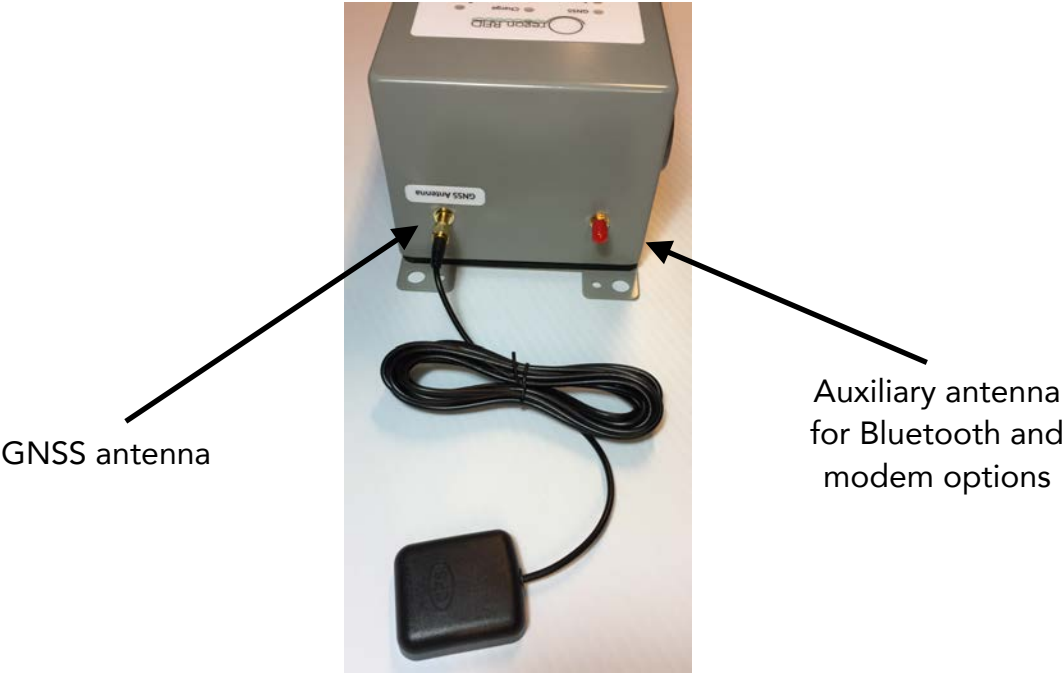
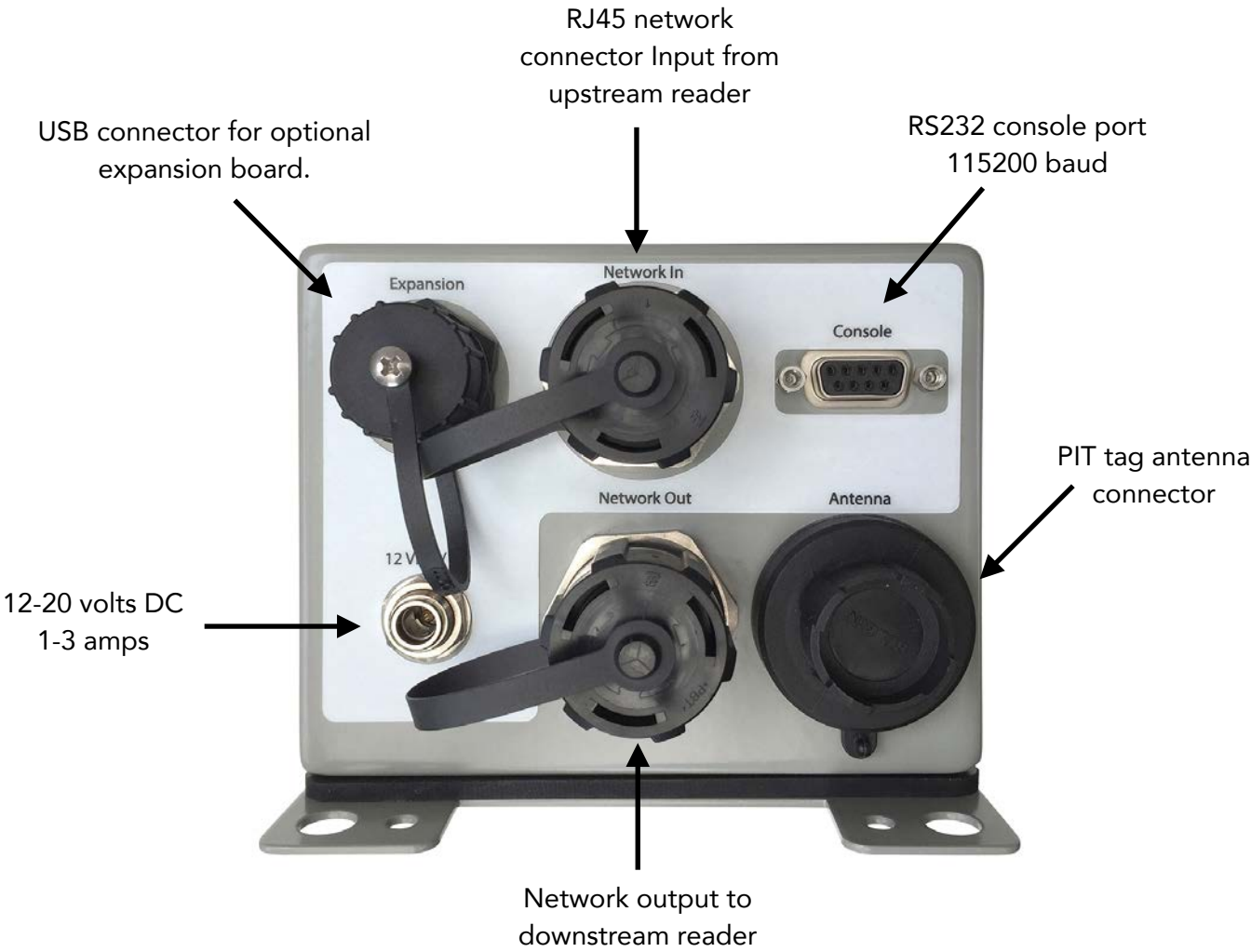
The reader can be operated with the button and LED indicators on the front. All functions can also be accessed remotely with the USB-to-Serial cable and a computer with a terminal emulator program.



Hold Power+Beeper+Tuning buttons down at the same time for 1.5 seconds to restart the reader.

**Do not use run mode unless an antenna is attached.**

# ORSR Reader Connections



## ORMR Multiple Antenna Reader

The ORMR Multiple Antenna PIT Tag Reader has four channels that switch up to four antennas. The antenna sequence is entered with the MX command so, for example to read all four antennas the setting is "MX1234".

Antennas are read one at a time, in the order of the MX sequence. The antenna number is stored with detection records.

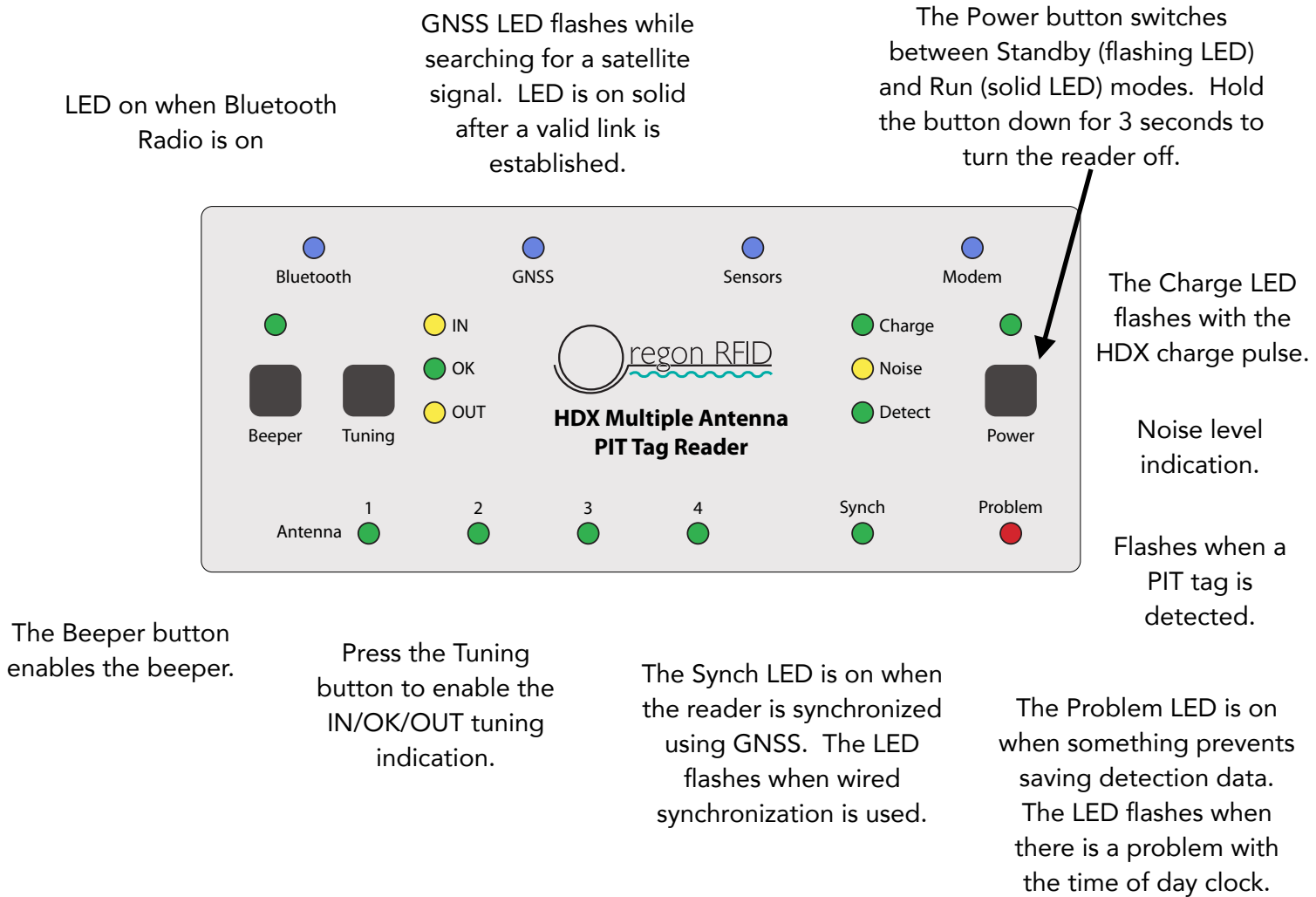
The read speed for any one channel is divided by the number of antennas. With two antennas, the read speed of each is half of the reader speed. With four antennas, the read speed for any one antenna is 1/4 of the reader speed. The reader speed can be adjusted with the HD command. It is important to make sure that the tag velocity is over the speed that the reader can detect. Contact Oregon RFID Tech Support for assistance.

The power used by the ORMR is equivalent to one reader since only one antenna is on at a time. Four ORSRs could read all antennas at full speed but take four times the power.



## ORMR Front Panel Indicators and Controls

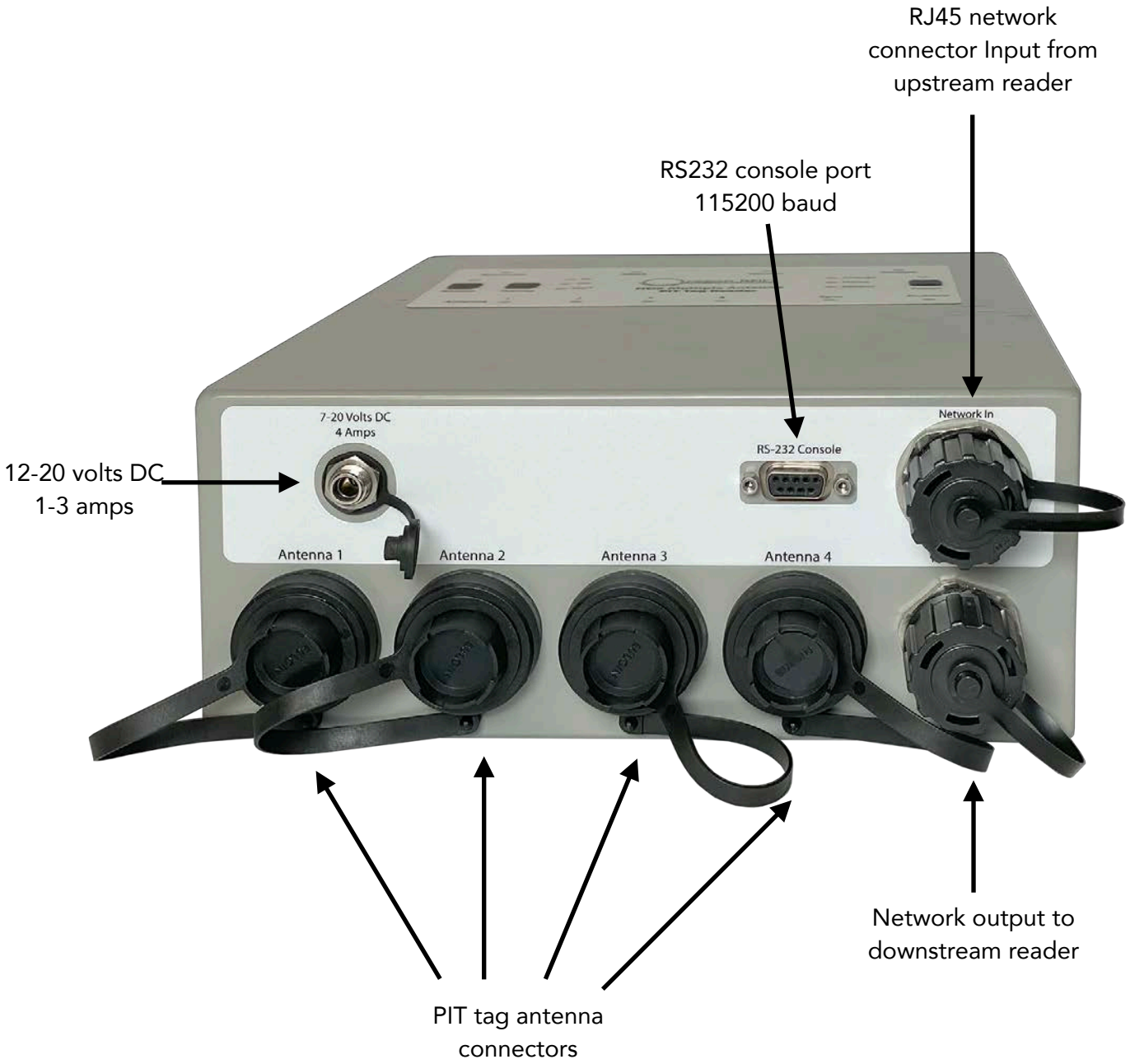
The reader can be operated with the button and LED indicators on the front. All functions can also be accessed remotely with the USB-to-Serial cable and a computer with a terminal emulator program.



Hold Power+Beeper+Tuning buttons down at the same time for 1.5 seconds to restart the reader.

**Do not use run mode unless an antenna is attached.**

# ORMR Reader Connections





## Reader Operation

The reader has four operating modes:

<b><u>RUN</u></b>	Reader scans for tags and logs detections
<b><u>STANDBY</u></b>	Reader is off, settings can be changed and data can be downloaded with or without an antenna attached
<b><u>OFF</u></b>	Reader and datalogger are off with power connected, the GNSS radio remains on, and a subset of commands can be sent
<b><u>DEEP SLEEP</u></b>	OFF with power removed, the internal clock runs

The reader mode is selected with the Power button. When the reader is off, pressing once starts Standby mode and the green Power LED will flash. Pressing the Power button a second time will start the reader and the Power LED will stop flashing.

To turn the reader off, press and hold the Power button for three seconds.

Hold Power+Beeper+Tuning buttons down at the same time for 1.5 seconds to restart the reader.

**Do not use Run mode for long periods unless an antenna is attached. Use Standby mode.**

## Beeper Modes



The beeper has two different operating modes.

### Beeper mode 1

When the beeper is on (one press), a short beep sound will be made every time a tag is detected. Typing the command BP1 in the terminal program can also enable this.

### Beeper mode 2

When the button is pressed a second time, the Beeper LED will flash and the beeper becomes an indicator. BP2 can be typed at the command line.

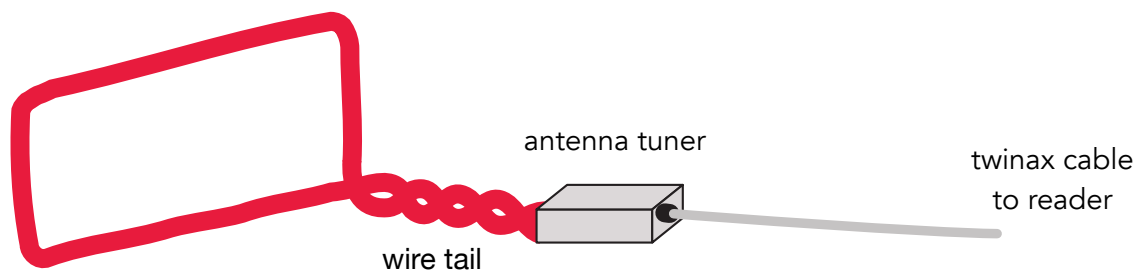
In Run mode, the duration of the beep will be related to the strength of the tag signal (proximity mode). The closer the antenna is to a tag, the shorter time it will beep. This facilitates locating tag using a mobile antenna.

In Standby mode, the beeper rate changes with the noise level so noise sources can be located with a mobile antenna.

## Antennas

A PIT Tag antenna is a loop of wire to generate a magnetic field when electrical current flows through it. The antenna and capacitor form a resonant electrical circuit that creates an oscillating magnetic field that reverses N-S polarity at the required frequency.

The loop can be long in one axis but the other is limited to a few feet. An antenna that is large in both axes will have a hole in the center where the tag cannot be read because it is too far from any side.



The wire tail between the loop and tuning capacitors should be twisted together. This reduces noise and stabilizes the tuning. The inductance changes when loose wires move around.

Tuning capacitors are attached to the antenna and the capacitance is adjusted to tune to the frequency used by PIT tags. They are mounted as close as possible to the antenna. There are practical situations where this may not be possible but the power level will decrease with longer tail lengths.

## Twinax Cable

Twinax cable efficiently passes power from the reader to the tuning capacitors and so can be quite long. It should be kept separate from power and other antenna cables to prevent interference passing between them.

## **Making an Antenna**

Antennas are made from loops of wire. Any loop of wire has an electrical characteristic called inductance (magnetic capacity). The inductance of the loop must be within the tuning range of the capacitors.

Each of our tuning capacitor products have different ranges. They are shown in the descriptions on the following pages.

Inductance is easy to measure with an inductance meter by connecting to the ends of the antenna loop without any capacitors attached. By changing the antenna shape, the inductance will also change.

The simplest antenna to make is a single turn loop. The inductance of a loop about 30' to 190' wide will usually be one turn of wire.

Loops smaller than approximately 30' wide will have low inductance and so will need two or more turns to raise the value back into range.

## **Antenna Wire Size**

The size of the wire is related to the electrical resistance. Thinner wire has higher resistance to electrical flow than thicker wire. Large antennas are made from long lengths of wire which increase resistance and lower power levels. To compensate a larger diameter wire is used on large antennas to lower the resistance.

Small diameter antennas are made of many turns of thin diameter wire. If the wire is too thick then the antenna will consume an excessive amount of wire that shortens the run time from batteries and heats up the electronics.

Trying different wire sizes is the best way to find the optimum choice. There are manufacturing differences in wire and the environment of the antenna that can change which wire works best for a specific situation.

Contact Oregon RFID Tech Support for suggestions of what wire size to try. It is a critical decision that determines how well the antenna will work.

## Test Antenna

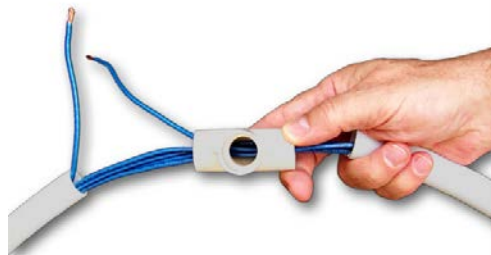
A simple antenna can be made from inexpensive stranded wire used in building construction (the wire in the wall). The wire thickness (gauge) controls the power level with thicker wires letting more current through. When designing an antenna, the choice of wire size depends on the size of the antenna. Larger antennas use thicker wire.



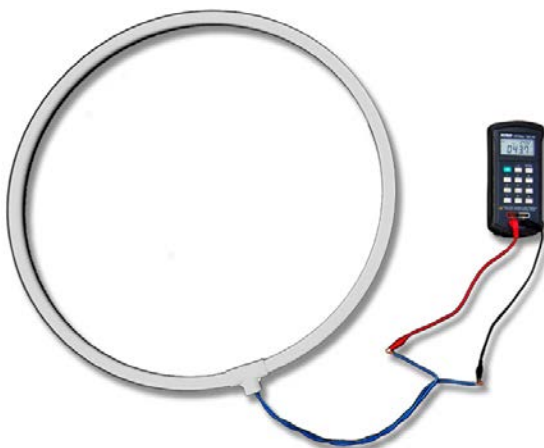
For these antennas, use  
22 to 18 AWG  
0.35 mm<sup>2</sup> to 0.80 mm<sup>2</sup>



Soft PVC pipe is a good structure for an antenna. A tee is used to bring the loop together and provide an exit for the wires.



The number of turns depends on the area of the loop. Here are the number of turns for a 2' and 3' loop. Twist the wire tails and connect to a tuner.



Loop Diameter	Loop Turns
3'	3
2'	5

## Tuners

PIT tag antenna tuners have multiple discrete capacitors that can be connected in combination to provide a range of capacitance. Here are the capacitance ranges of our tuning products. The minimum value is the lowest value capacitor. The maximum value is with all capacitors combined.

The relationship of capacitance C to inductance L is determined by formula for resonance which reduces to  $L=1406/C$  at 134.2 kHz.

$$f = \frac{1}{2\pi\sqrt{LC}}$$

Tuning capacitors have either manual or automatic tuning. Manual tuners have LEDs to indicate which jumpers to insert to select capacitor combinations. Autotuners try all settings and pick the best one.

The capacitance range determines the inductance range that the antenna can have.



**Autotuner**

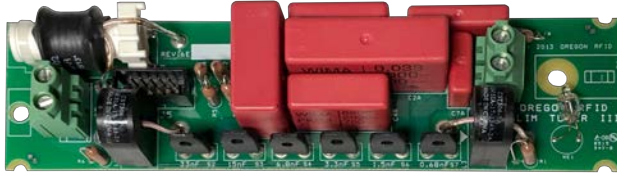
Capacitance range 10 to 85 nF  
Inductance range 16 to 135  $\mu$ H



**Manual tuner**

Capacitance range 15 to 75 nF  
Inductance range 18 to 95  $\mu$ H

The ORSR reader can also be used with other tuning capacitors. These have a variable adjustment screw for fine tuning.



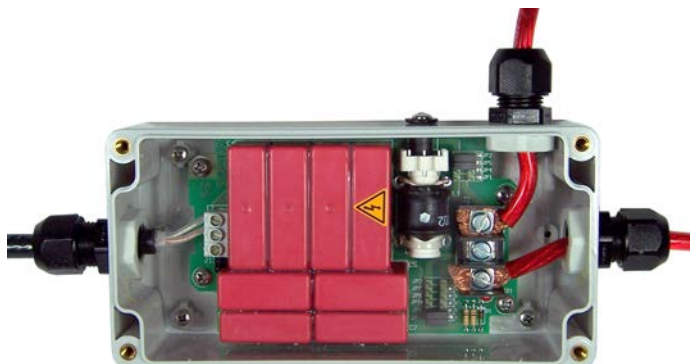
**Slim Tuner**  
used in Pole Antenna

Capacitance range 14 to 61 nF  
Inductance range 22 to 100  $\mu$ H



**EasyTuner**  
(discontinued)

Capacitance range 14 to 64 nF  
Inductance range 22 to 100  $\mu$ H



**Standard Tuner**  
**Texas Instruments**  
(discontinued)

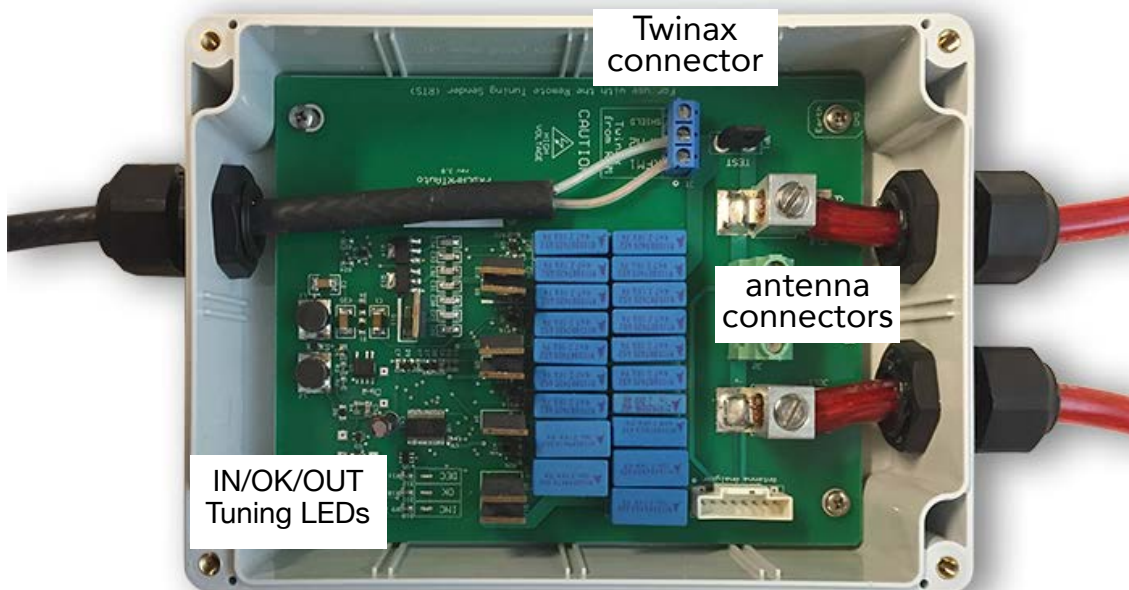
Capacitance range 28 to 176 nF  
Inductance range 8 to 80  $\mu$ H

## Wiring Instructions

Connect twinax cable to the connector. Take care to make sure the wires are properly attached. Tighten the grip around the cable so twinax cannot twist and break the connection.

Connect antenna wires to the large lug connectors. The hole size in the grips can tighten over wire diameters 0.23" to .4", 5.8 to 10.2 mm. If the wire is larger or smaller than the hole, then it should be connected by using a short piece of wire that will properly fill the grip. Make sure the wire junction is waterproof - heat shrink tubing is a good solution.

After the cables are attached and the grips are tight, the lid can be sealed with vinyl electrical tape around the outside edge.



## Tuning Gaps

Capacitance values are in discrete steps so sometimes there can be small gaps in the overall range. If the antenna is in the tuning range but won't tune, try adjusting the antenna inductance by changing the shape a small amount.

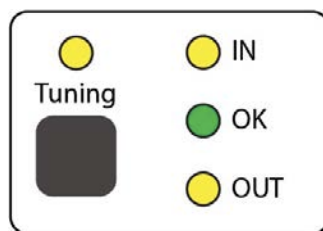
Twinax adds about 15 pF/ft (51 pF/m) of capacitance. For example 10 meters of twinax will add 0.5 nF.



## Auto Tuner

An autotuner electronically switches capacitors to try all combinations. Tuning is started in standby mode by pressing the front panel pushbutton or typing the "TU" command (plus the antenna number on ORMR). On the ORMR, each time the tuning button is pressed, the next antenna will be tuned.

The "AP" command enables automatic tuning adjustments periodically while running. "AP1" will tune ever hour on the hour. "AP6" will tune at 0600, 1200, 1800 and 2400.



While tuning, the LEDs on the reader and tuning capacitors will show IN, OK or OUT status. When tuning is complete, OK LED on the reader will be on and the IN and OUT LEDs on the tuning capacitors will flash a few times. The autotuner capacitor choices are kept in flash memory to remember them after power is switched off.

If the antenna is not within the tuning range then the IN or OUT LED will remain on. Use an inductance meter to measure the antenna (loop only without capacitors) and make sure it is within the tuning range for the capacitors being used. Contact Oregon RFID Technical Support for assistance.

## Manual Tuner

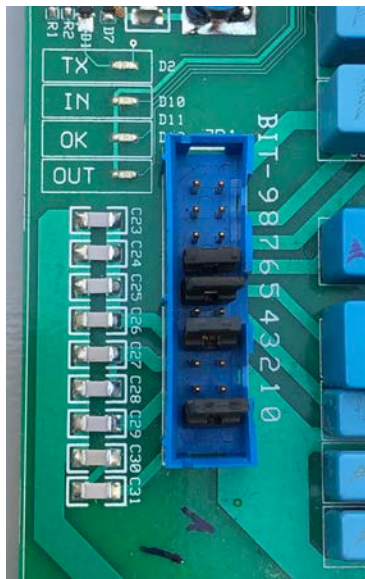
The Manual tuner has IN/OK/OUT indicators to assist in manually tuning the capacitors. Press the Tune button to start the tuning process.

Manual tuners use jumpers (shunts) to choose capacitor combinations to arrive at an overall tuner value.

The tuning procedure for the manual tuner is:

- Remove all jumpers
- Type "TU" (with antenna number on ORMR) or press TUNE button
- Starting at bit 9, insert one jumper at a time
- For each step, follow the LED guidance  
IN = leave it in, OUT = take it out
- Repeat for each socket position
- Stop when the green OK LED is on

**IN/OK/OUT  
Tuning LEDs**



**Jumpers**



The Tuning button can also be used with legacy manual tuning capacitors (Standard, Easy, Slim). Press the Tune button and then make the jumper adjustments by following the IN, OK and OUT LEDs on the front of the reader. Fine tune with a plastic screwdriver.

## Antenna performance measurement

The Autotuner can help measure antenna performance factors.

After tuning completes, the inductance and capacitance values are shown, which determine the frequency. The antenna voltage and current are also shown which reflect the power level of the antenna.

Tuned: 2023-01-29 14:53:38  
28.4  $\mu$ H, 49.5 nF, 107 V, 3.1 A

The magnetic field strength from the antenna is directly related to the current (amperage) flowing through the wire. However an antenna also needs to be sensitive to listen for tag signals and so a balance of transmit strength and also to detect weak signals is the challenge of antenna design.

## Measuring antenna Q

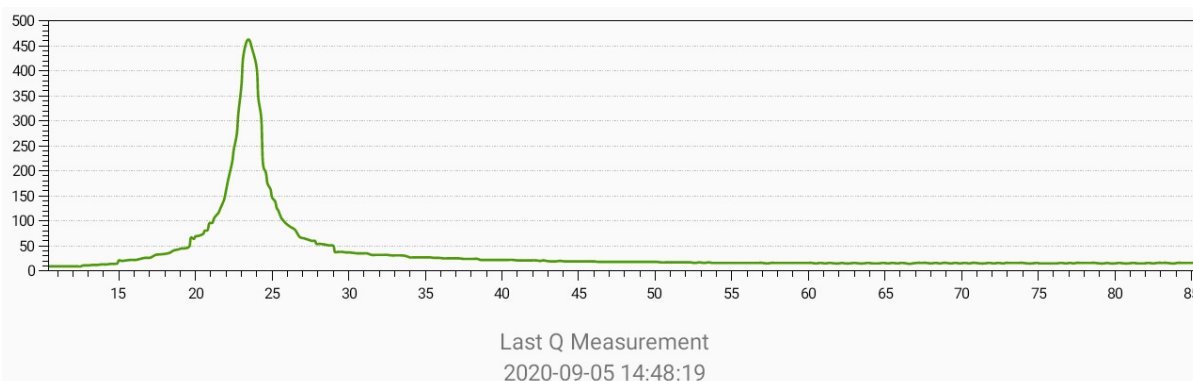
The Q of an antenna is a measurement of how it performs across a range of frequencies. The MQ command starts a 1 minute analysis of the antenna by scanning across the autotuner settings and measuring the voltage.

The result is 512 voltage values that can be plotted in a spreadsheet (use SMA command) or on our Android app to show the Q curve.

The curve should be tall (high voltage) that is not too wide or narrow. A narrow curve limits the frequency which helps block noise. If it is too narrow it may not be able to detect the two frequencies used in HDX to transmit 1's and 0's.

The electrical resistance is a measurement at 134.2 kHz of the antenna wire. This is the factor that controls the antenna power level. It is the ESR or effective series resistance that is the sum of AC and DC components.

```
NSNB> mq
This will take 60 to 80 seconds
Are you sure? (Y/N) Y
.....
.....
.....
.....
.....
Q measurement: 2023-01-29 15:01:06
Q 74.1
ESR 318 milliohms
```



## Reader Console

The reader console is accessed using the RS232 serial port or Bluetooth. The console commands allow complete control for remote operation and monitoring.

A USB-to-serial cable is included to connect to a Windows, Mac or Linux computer. Many terminal emulator programs are available that can be used. See Oregon RFID's YouTube channel for instructions for setting up and using CoolTerm.

The commands are listed in Appendix 2.

```

HZUB> ST

Oregon RFID HDX Multiple Antenna Reader V1.999
2022-01-01 01:04:42.848 U (UT+0) Supply 13.5 volts

HSUB> COMM ready
HSUB> Database file open

HSUB> HD
HDR    10    scan rate
HDC    50    charge ms
HDL    50    listen ms

```

## Bluetooth Radio

The Bluetooth radio is an optional feature on the ORSR and included on all ORMR readers. It broadcasts the console serial port to wirelessly connect laptops and Android phones or tablets.

The Bluetooth interface can be used with terminal programs such as HyperTerminal, CoolTerm, BlueTerm and Putty.

The Bluetooth is turned on and off with the BT1 and BT0 commands.

Firmware updates cannot be performed over the Bluetooth port.

## GNSS Receiver

An integrated Global Navigation Satellite System (GNSS) receiver maintains the time of day when a signal is available. A temperature compensated oscillator maintains the clock during signal dropouts.

The receiver detects signals from these systems:

- GPS (USA)
- GLONASS (RU)
- Galileo (EU)
- QZSS (JP)

It has a horizontal position accuracy of 1.5 meters. The vertical accuracy is not rated by the manufacturer.

When searching for a signal the GNSS LED will be off until one is found. The first search can take a few minutes. Once the device has obtained tracking information from a satellite it will usually re-acquire the signals much faster, often within a few seconds.

When there is a valid GNSS signal, the prompt time status will be G.

HSGB>

## GNSS record

The GN command shows the full NMEA records sent by the GNSS module. Two lines are sent every second. Typing any character stops the output.

A = active signal (OK)	date
V = not valid	dd mm yy
\$GPRMC, <u>031153.000</u> , <u>A</u> , <u>4528.2604,N</u> , <u>12237.0970,W</u> , <u>0.0</u> , <u>0.0</u> , <u>040920</u> ,, <u>A*76</u>	
\$GPGLL, <u>031153.000</u> , <u>4528.2604,N</u> , <u>12237.0970,W</u> , <u>1</u> , <u>06</u> , <u>1.5</u> , <u>083.18,M</u> , <u>-19.4,M</u> ,, <u>*5A</u>	
time UT	location
	number of satellites in view
	altitude
	HDOP

## Time of Day References

There are four time references used by the reader and the type designation is displayed after the time of day. The reference is automatically chosen within 2 seconds of any change (GNSS starts of stops, etc).

E Elapsed since startup, used when there is no other time value

U Uncalibrated (entered with DT command)

G GNSS time

N Network time using CAT5 cable

When the time reference changes, a record is written to the datalogger to show the old and new times to allow updating records to another time reference.

The time reference can fade or disconnect so each reader has a high precision temperature compensated oscillator (TXCO) that will maintain accurate time until a reference returns.

The resolution of the internal clock is 1 millisecond. When referenced to GNSS, the start of each "tick" is within 1 microsecond of UT.

## Elapsed Time Since Startup

After the reader has been rebooted, the time is not known. The amount of time that has passed since the reader started is used for the time, designated with an E. Once the time is known, the difference is written to the log file to allow calculating when E records occurred.

## Uncalibrated Time

The date and time can be entered with the DT command which will be labeled as an uncalibrated time. The U type will also be shown when a GNSS or Network time reference stops updating.

## **GNSS Time**

GNSS time is from the internal GNSS receiver that provides a reference to UT within microseconds. The blue GNSS LED will be on to indicate GNSS is active.

## **Network Time**

The fourth time reference is over the reader network and CAT5 cable. The head end of the reader network sends the time to connected readers. If the host reader has GNSS then all connected readers will use the G designation and their blue LEDS will be on.

If the host is unreferenced, the rest of the readers on the network will have the exact same time. The designation will be N if they are getting unreferenced network time.

## **Accurate Time Between Readers is Important**

It is important that the charge pulses are synchronized when readers are operated near each other to prevent interference. Readers using GNSS or connected by the network cable will all have the exact same time that is used to time simultaneous charge and listen pulse times.

When a reader has both GNSS time from its receiver and a network time from the cable, the network time will be chosen by default. This can be overridden to select GNSS using the OV command. In most cases the network time should be prioritized so all readers are using the same time, calibrated or not.

## **Time Zone Offset**

All internal records of time of day are stored in UT. The TZ command is used to change the output for a local time zone. The stored time of day is not changed, only the displayed value.



## Tag Detection Event Records

A PIT tag is repeatedly detected while in the antenna field at the rate set by the HDR command (1 to 40 scans per second). Multiple consecutive detections of the same tag are accumulated into one detection record that is written to the datalogger file after the tag leaves.

## MG Command

The MG command sets the amount of time after the tag is gone before the record is written. The default value is 1.5 seconds. You can see the delay by holding a tag in the field and then removing it while watching the console.

```
I 2022-01-03 01:10:00.700 G 00:00:00.000 A A2 900_228000004947 AAA 1 0.3
I 2022-01-03 01:10:00.700 G 00:00:00.200 A A2 900_228000004947 AAA 2 0.3
I 2022-01-03 01:10:00.700 G 00:00:00.400 A A2 900_228000004947 AAA 3 0.3
I 2022-01-03 01:10:00.700 G 00:00:00.600 A A2 900_228000004947 AAA 4 0.3
I 2022-01-03 01:10:00.700 G 00:00:00.800 A A2 900_228000004947 AAA 5 0.3
S 2022-01-03 01:10:00.700 G 00:00:00.800 A A2 900_228000004947 AAA 5 0.3
```

An "I" detection record is written each time it is read. After the detections stop, there is a pause before the S record is shown, which is written to the file showing the start time, duration in the field and the number of scans in the event.

If the MG value is zero seconds, every time a scan is skipped because the tag is on the edge of the field and the signal is weak, multiple records can be generated while the same tag is in the field. A short delay after the tag leaves will ignore short detection gaps.

## Datalogger

The datalogger stores up to 1 million records. Three record types are defined with the first character in the output.

I	Individual scan record (one scan)
S	Summary detection record
E	Event record

The UP command is used to upload records. It will display any new records since the last time UP was typed. If there have been no new detections the message "Nothing to upload" will be displayed.

The list of uploads can be shown with the UH command. The UP date and time are when the upload was made.

```
HSGB> UH
Reader: Reader name Site: SMT
Upload Histories: 2
      Num    UP Date    Time    Records
      1    2019-09-30 12:00:19      455
      2    2020-07-14 05:47:05      734
NEW
                                151
                                TOTAL 1340
```

The UD command will show records for a date. The number of days to display can be added after the date.

```
UD 2020-07-12, 3
```

The UT command can display all records for a tag number.

```
UT 900_228000999997
```

The ER command will display the system status for every minute for a date. This can be useful for tracking the rate of battery discharge or see what happened after a problem occurs.

```
ER 2020-06-22
```

## Detection Record format

A tag detection causes the datalogger to store a record with a few dozen fields in the database. All of this data is written for every detection.

When uploading the log file, the output record from the database displays selected fields that are determined by a format definition. The default format is:

```
ORSR DTY ARR SPC TRF DUR SPC TTY SPC TAG SCD NCD EFA
ORMR DTY ARR SPC TRF DUR SPC TTY SPC ANT TAG SCD NCD EFA
```

DTY	Detection type	S
ARR	Arrival time and date	2019-03-16 23:22:20.500
SPC	Output one space character	
TRF	Time reference	G
DUR	Duration	00:00:00.300
SPC	Output one space character	
TTY	Tag type	A
SPC	Output one space character	
ANT	Antenna number (ORMR)	
TAG	Tag ID number	900_226000078747
SCD	Site code	AAA
NCD	Number of consecutive detections	4
EFA	Effective amps	0.5

This creates the record shown below.

```
ORSR S 2019-03-16 23:22:20.500 G 00:00:00.300 A 900_226000078747 AAA 4 0.5
ORMR S 2019-03-16 23:22:20.500 G 00:00:00.300 A A2 900_226000078747 AAA 4 0.5
```

## Customizing the Record Format

The format can be customized according to your needs with the FM command. When using the reader as a mobile backpack it is useful to show the longitude and latitude of the detections. This can be done by adding LON and LAT to the default format.

```
FM DTY ARR SPC TRF DUR SPC TTY SPC TAG SCD NCD EFA LON LAT
```

## Event Records

The datalogger writes an event record every minute that the reader is in standby or run mode that can be viewed with the ER command. Event records have the current voltages, amperages, GNSS status and other values that can be useful to monitor battery discharge rates,

### ORSR

NSNB> ER

Date	V	A_L	A_C	EA	AntN	R	H	T	V	Chg	Lst
2023-01-15 10:48	12.4	0.1	1.1	0.1	27	R	N	G	15	50	50
2023-01-15 10:49	12.3	0.1	1.1	0.1	15	R	N	G	9	50	50

V	Supply voltage
A_L	Amperage during listen cycle
A_C	Amperage during charge pulse
AntN	Antenna noise level
EA	Effective Amperage
R	Run or standby mode
H	Host or node status
T	Time reference (GNSS, network, unreferenced)
V	GNSS satellites in view
Chg	Charge pulse time ms
Lst	Listen

### ORMR

SUB> er

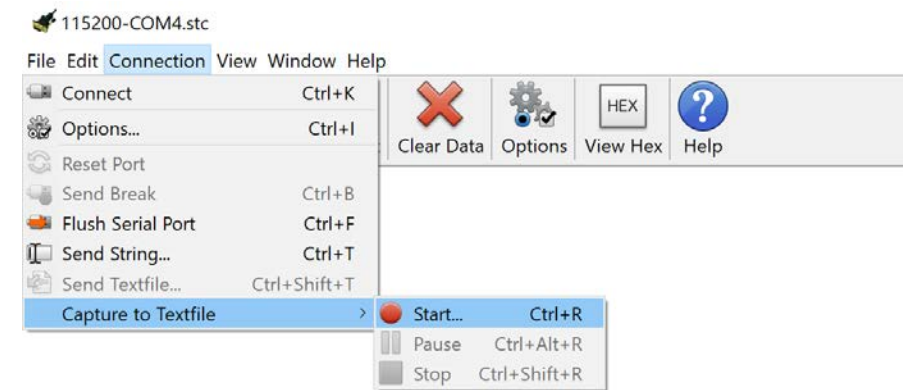
Date	V	A_L	A_C	AntN	A_C	AntN	A_C	AntN	A_C	AntN	EA	R	H	T	V	Chg	Lst			
2023-01-21 12:05	13.2	0.2	0.0	0.0	22	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	S	H	U	0	50	50
2023-01-21 12:06	13.6	0.2	0.0	0.0	16	0.0	0.0	0	0.0	0.0	0	0.0	0.0	0	S	H	U	0	50	50

V	Supply voltage
A_L	Amperage during listen cycle
A_C	Antenna 1 Amperage during charge pulse
AntN	Antenna 1 Antenna noise level
A_C	Antenna 2 Amperage during charge pulse
AntN	Antenna 2 Antenna noise level
A_C	Antenna 3 Amperage during charge pulse
AntN	Antenna 3 Antenna noise level
A_C	Antenna 4 Amperage during charge pulse
AntN	Antenna 4 Antenna noise level
EA	Effective Amperage
R	Run or standby mode
H	Host or node status
T	Time reference (GNSS, network, unreferenced)
V	GNSS satellites in view
Chg	Charge pulse time ms
Lst	Listen

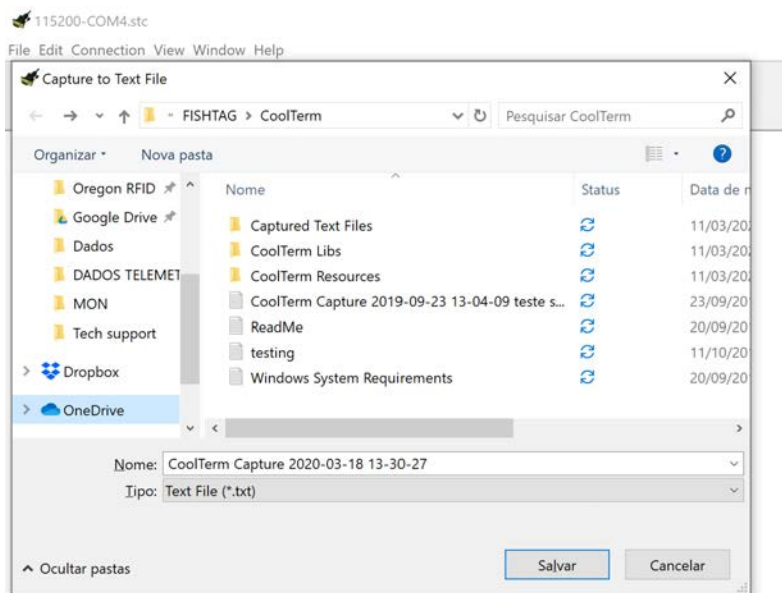
## Uploading Data

A terminal program is used to upload detection data from the reader. Any terminal program can be used. The example below shows CoolTerm. See the [Terminal Emulator Guide](#) for details on other choices.

Open a new capture file

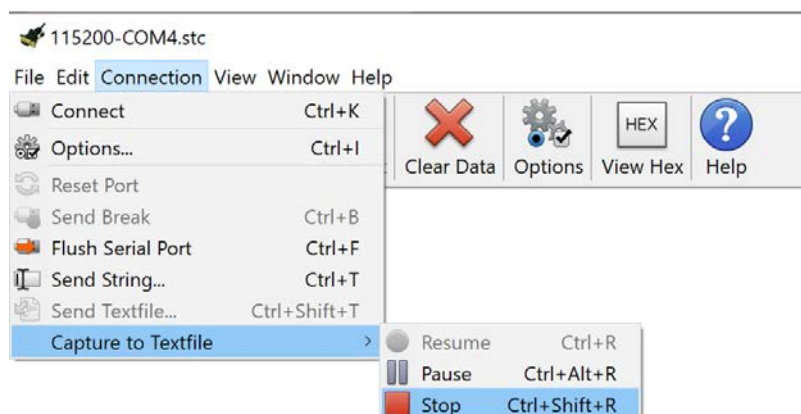


Save it



Type commands to upload data that will appear on the screen and be written to the capture file. Use UP for the newest data. UP\* for all data in the file.

Close the capture file



## Reports

Detection records can be uploaded using these commands. The format can be customized with the FM command.

UP	Upload detections since the last UP command
UD	Upload detections by date

## Mobile Reader Reports

**Mobile Reader Firmware**

The mobile reader has these additional commands.

The UT command will list all detections for a tag number, which can be used to plot the GNSS positions on a map to see the movement over time.

UT	Upload detections for selected tag number
----	---

A cumulative list of all tag numbers seen along with the time of last detection can be displayed three different ways.

TL	List by tag number
TLD	List by date, newest first
TLR	List by date, oldest first

\

## Export/Import System Configuration

The BC command will export all of the current settings with a 2 letter type code. The BCR command is used to import the list to transfer configurations between readers. After typing BCR, paste the list of settings.

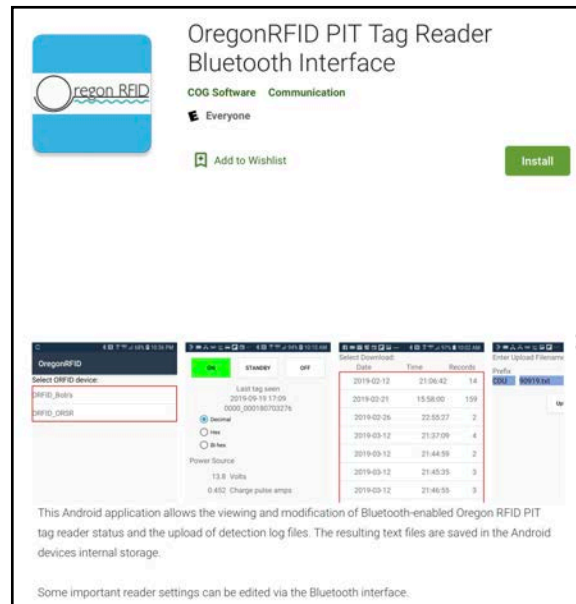
```
HZUB> BC
WS1
WE0
CS83
MG1500
RNMultiple Ant Reader
SCMUX
TF68
HC50
HL50
SS10
FS0
FMDTYARRSPCTRFDURSPCTTYSPCANTTAGSCDNCDEFA
MX1234
AS0
DM7
BP1
TZ0
DK0
OV0
MV9000,12000
TM0,0
BR3
PH0
RE0
MP0
AP0
```

```
HZUB> BCR
Start
WS1
WE0
CS83
MG1500
RNMultiple Ant Reader
SCMUX
TF68
HC50
HL50
SS10
FS0
FMDTYARRSPCTRFDURSPCTTYSPCANTTAGSCDNCDEFA
MX1234
AS0
DM7
BP1
TZ0
DK0
OV0
MV9000,12000
TM0,0
BR3
PH0
RE0
MP0
AP0
Done
```

# Android App

The Oregon RFID Android App for phones and tablets can be downloaded for free from the Google Play store.

<https://play.google.com/store/apps/details?id=com.oregonrfid.btinterface>



Select which upload and create a file on the device. The file can be emailed or placed on a cloud service.

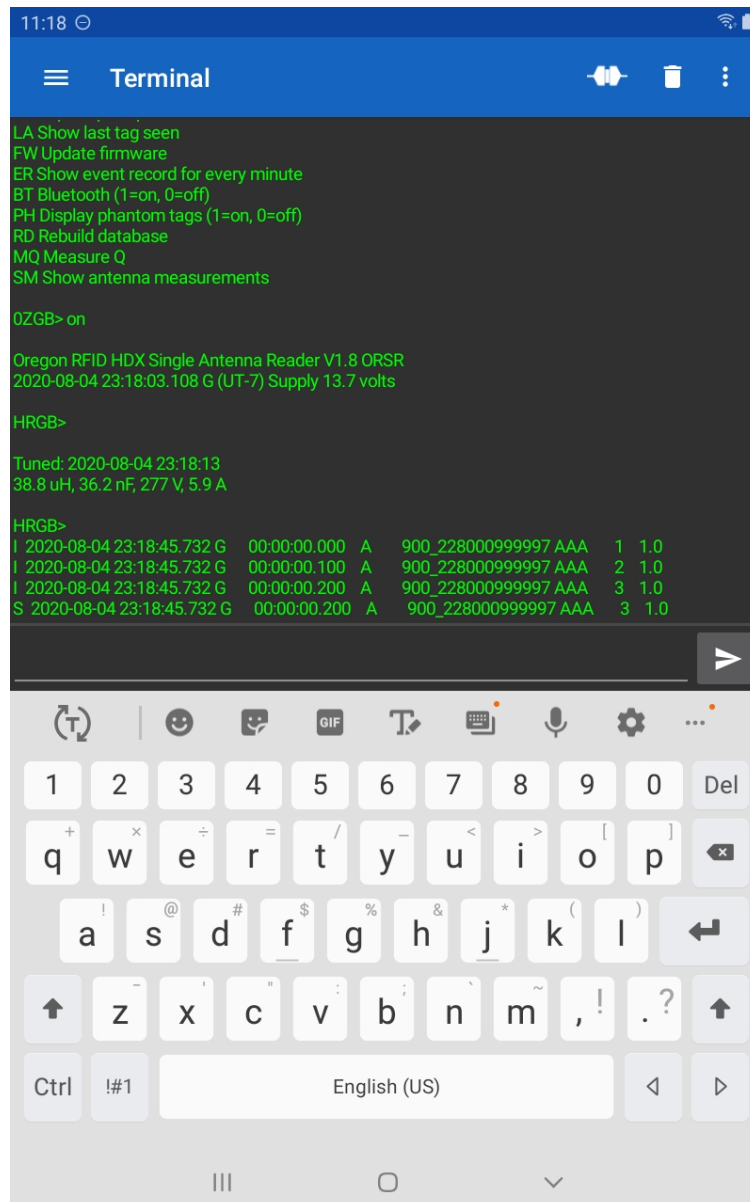




# Android App

Kai's Bluetooth Serial Terminal app connects wirelessly to the command line console to upload data and configure the reader. Details on how to setup the program are in the Terminal Emulator Guide.

[https://play.google.com/store/apps/details?id=de.kai\\_morich.serial\\_bluetooth\\_terminal](https://play.google.com/store/apps/details?id=de.kai_morich.serial_bluetooth_terminal)



## HDX Cycle Timing

Half Duplex sends a short magnetic pulse from the antenna to inductively charge a PIT tag and then listens for a response. The factory setting is 50 ms to charge and 50 ms to listen which results in 10 scans per second. The charge and listen times can be adjusted to control the speed and optimize the charge time for least power consumption. The scan speed is also adjusted to increase the detection probability if the tag velocity is high (fast water flow or fast swimmer species).

The HD command displays the current setting. The speed can be changed with the HDR command or the charge and listen times can be adjusted separately. The minimum value allowed for the listen time is 20 ms, the time that it takes for the tag to send a reply.

<b>HDR</b>	<b>10</b>	<b>scan rate</b>
<b>HDC</b>	<b>50</b>	<b>charge ms</b>
<b>HDL</b>	<b>50</b>	<b>listen ms</b>

Changing the charge or listen time will cause a corresponding change to the other value to maintain the same scan rate. Shortening the charge time, for example, will lengthen the listen time the same amount.

<b>&gt; HDR10</b>			<b>&gt; HDR5</b>		
<b>HDR</b>	<b>10</b>	<b>scan rate</b>	<b>HDR</b>	<b>5</b>	<b>scan rate</b>
<b>HDC</b>	<b>50</b>	<b>charge ms</b>	<b>HDC</b>	<b>50</b>	<b>charge ms</b>
<b>HDL</b>	<b>50</b>	<b>listen ms</b>	<b>HDL</b>	<b>150</b>	<b>listen ms</b>
<b>&gt; HDR20</b>			<b>&gt; HDR1</b>		
<b>HDR</b>	<b>20</b>	<b>scan rate</b>	<b>HDR</b>	<b>1</b>	<b>scan rate</b>
<b>HDC</b>	<b>30</b>	<b>charge ms</b>	<b>HDC</b>	<b>50</b>	<b>charge ms</b>
<b>HDL</b>	<b>20</b>	<b>listen ms</b>	<b>HDL</b>	<b>950</b>	<b>listen ms</b>

It is important to have sufficient speed to detect tags moving through the field. Decreasing the read speed will lower the overall power consumption and increase run time from batteries.

## Finding Minimum Charge Pulse Time

The charge pulse takes more power than the listen time. A shorter charge pulse (and longer listen time), will reduce the reader power requirements. Depending on the situation, it is possible to cut power requirements in half or more by adjusting the charge and listen times.

The MC command is used to determine the minimum time a tag needs to charge. Once you find a good value using all tag sizes, enter the time with the HDC command. For example if the MC command shows the charge pulse will be sufficient at 35 ms, type HDC35.

## Fast Scan Mode

The FS1 command enables a special mode to scan as fast as possible. The minimum HDX listen cycle is 20 ms to hear the tag message but in Fast Scan mode, the reader listens for a few milliseconds and if no tag is responding another charge pulse will begin immediately. If there is tag in the field, the reader will listen for the full 20 ms period. Because the charge pulse is on most of the time the reader power consumption and temperature will increase.

**Fast Scan mode cannot be synchronized with other readers.**

## Range Extender

The RE1 command enables shortcut when a tag is detected. If the tag number is the same as the previous detection, the read cycle stops without waiting to check the CRC. This can sometimes extend the read range a little.

## Reader Synchronization

Readers need to be synchronized when they are close enough to each other that the signals will interfere. When synchronized, the charge and listen pulses from all readers are turned on and off at the same time (within 1 millisecond). If not synchronized, one reader may be listening while another one is sending out a charge pulse, which will block tag detections.

A simple test to see if there is interference between readers is to turn only on one at a time and measure the read range. Then turn on all readers together and see if the read range on each antenna is the same. If they are synchronized properly the read range will be the same.

## GNSS Synchronization is the Easiest Way to Synchronize

The ORSR and ORMR readers use timing signals from a GNSS radio. This is the easiest way to synchronize readers by just turning them on to wait for the blue GNSS LED to be illuminated. The SYNCH LED will also be on when the readers are synchronized.

## Common Reader Settings

In order for GNSS synch to operate properly, the speed settings (HDC and HDL commands) must be the same. Readers cannot be synchronized with others operating at different scan rates.

## **Clock Synchronization**

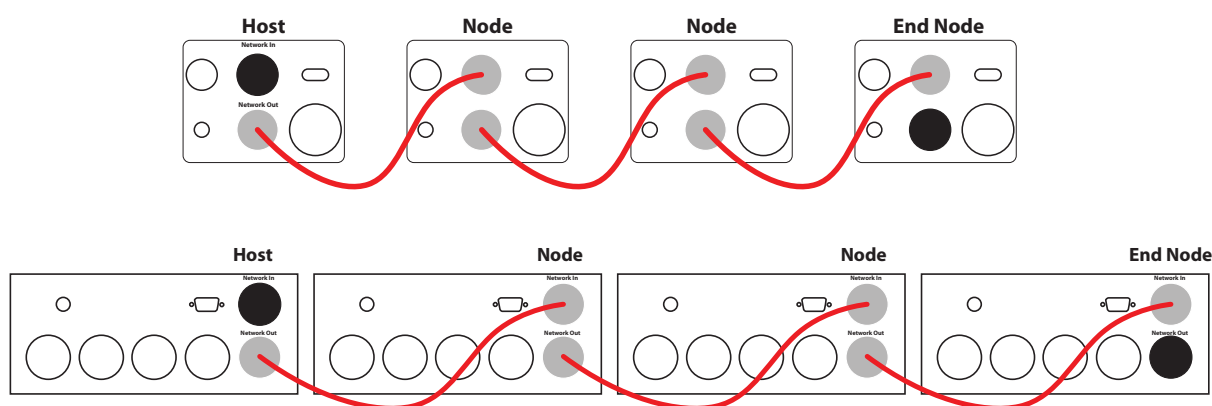
When GNSS signals are unavailable, readers can be connected by CAT5 cable with RJ45 connectors to have a common time reference.

All node readers receive a signal from the host's OUT port to synchronize readers and the time of day clocks. All nodes will all have the same time of day as the host. If the host has a GNSS signal then the time on all the readers will be referenced to it. The GNSS LED will be illuminated on all nodes even if they have no GNSS signal since it is inherited from the host.

## Host and Nodes on a Wired Network

Readers can be connected by cable to synchronize clocks and transfer data. The network host is the reader at the head of the network (see diagram below) and generates timing signals for the time of day and to synchronize all node readers. The first letter in the console prompt shows H or N to indicate the current mode. A reader not connected to any other reader will operate as a host.

```
HZGB> Host, Sleeping, GNSS time, beeper on
NSG*> Node, Standby, GNSS time, beeper off
NRUB> Node, Run mode, Uncalibrated time, beeper on
```



Cables are plugged into the IN and OUT waterproof RJ45 connectors. The OUT from one reader plugs into the IN of another. The host reader has no cable plugged into the IN plug. Nodes have a cable to the IN from another reader's OUT.

## Reader Data Network

The cabled network is used to connect to any node's console from the host. The list of readers on the network is shown with the NL command:

```
HZGB> NL
```

	Type	Version	St	Mode	SupplyV	EffA	New/Recs	Beep	Site Name
Host	MUX ORMR	V1.999	OK	Z	13.6	0.1		1	Multiple Ant Reader
1	SGL ORSR	V1.999	OK	R	12.4	0.1	25 / 430	0	Single Ant Reader
2	HFR ORHF	V1.999	OK	S	24.6	0.2	156 / 156	1	HF Reader

Each line shows the three letter code for assigned to the reader with the SC command, the reader type (ORSR, ORMR or ORHF), the current status and mode, supply voltage, effective amperage, database record count, beep status and the reader name from the RN command.

## Connecting to a reader

The SL command is used on the host to select a node reader using the three letter site code. The prompt starts with the site code in square brackets to indicate that this is the selected node's console. Typing just "SL" disconnects the host from the node.

```
HZGB> SL SGL
```

```
[SGL]NSG*> SY
Oregon RFID HDX Single Antenna Reader with RFM009
V2.0 0004-000A-1531-3334-3159-39
Single Ant Reader
Standby mode
Supply voltage      12.4
Standby amps        0.129
Effective amps       0.1
Shutdown supercap   5.2
Sleep battery        3.3
Tags in archive     0
Bluetooth is off

[SGL]NSG*> SL
HZGB>
```

## **SYNCH and GNSS LED patterns**

When connected with cables, the SYNCH LED will flash on nodes to indicate the clocks are getting the time from the host.. The SYNCH LED on the host will be on steady since it is the reference.

When the host has a GNSS signal, all nodes connected to it will have the blue GNSS LED on and the time reference code will be 'G'. When there is no GNSS signal on the host, the blue GNSS LED on all nodes will also be turned off even if there is a good GNSS signal on a node.

The time reference code on the host will be 'U' since it is unreferenced to UT and 'N' on all nodes to indicate it is unreferenced network time. All readers on the network will have the same time, whether referenced to GNSS or not.



## Network Cable Pinout

CAT5 cable (three twisted pairs of wire) can be used to network multiple readers together. The RJ45 connectors are wired the same on each end of the cable.

IMPORTANT: BE SURE TO PUT THE WATERPROOF HOUSING ON THE CABLE BEFORE ATTACHING THE RJ45 CONNECTORS.

Use the cable to connect the OUT connector (bottom) to IN (top).

See our Oregon RFID Youtube channel for a video showing how to assemble the RJ45 connectors.



## Phantom Tags

Phantom tags are false detections caused by random noise that generates the correct pattern that matches a PIT tag with a valid checksum. The tag number will appear for only one scan and will not be repeated. They usually have tag numbers outside any known range (Animal tags with prefexes outside the range 900-999).

Phantom tags are identified with the type code P (instead of A, R or W). Tag codes are listed in Appendix 3. These records can be shown in reports along with real detections with the PH1 command. To block the tags from being displayed use the PH0 command.

Even if they are not displayed, phantom tags are still stored in the datalogger file and can be shown with the commands UPP (since last upload) and UDP (for date).

Phantom tags occur more often when there are higher noise levels. The PF1 command enables a check to block most phantom tags. The read range may be slightly shortened when this is enabled. Compare the read range after the commands PF0 and PF1 are entered to see the difference.

# Appendix 1

## Reader Components

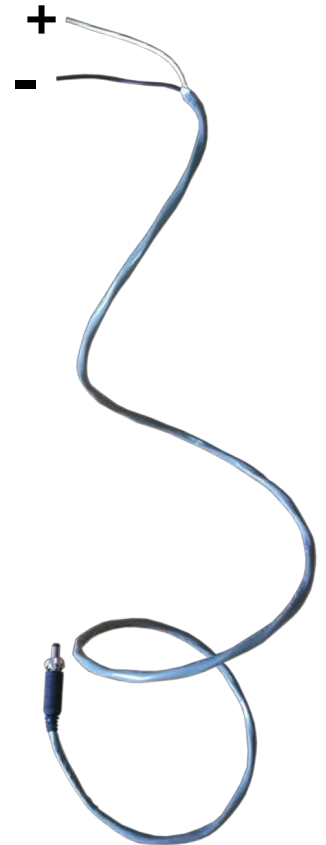
## Included With Reader



USB to RS232  
serial cable



Waterproof Twinax  
connector  
Bulgin PX0731/P



Power cable with  
waterproof connector



Waterproof RJ45  
connector caps



GNSS antenna with  
SMA connector

**The black wire is  
ground/earth**

## Appendix 2

### Console Commands

# Console Commands

## Reader Operation

ON	Reader power on	Starts the reader scanning and detecting tags.
ST	Reader standby	Places the reader in standby mode with reader not scanning, database is open for uploads, and settings can be changed.
OF	Reader power off	Turns the reader off, closes the database.
BT	Turn Bluetooth radio on/off	BT1 to turn on, BT0 to turn off (Bluetooth reader only)
SY	Display system status	Shows short report with voltages, amperages, noise levels
BP	Beeper (0=off, 1=on, 2=proximity)	Enable the piezoelectric beeper to make noise whenever a tag is detected. 0 = off 1 = on 2 = proximity mode
BR	LED brightness levels	BR1 for dim, BR2 for medium and BR3 for bright.
DK	Minutes before display goes dark	The LEDs consume power so they will turn off after there is no activity on the front panel or the console serial port. Pressing any button or sending any command will wake the LEDs. The default value is DK0 which means it will not turn off.
BC	Export/Import all settings	BCR to read them (paste the list)

## Antennas

TU	Tune antenna	Start autotuner if attached or display IN/OK/OUT if using a manual tuner. Displays '+' or '-' while tuning, '.' when in tune.
TO	Tuning override	Adjust autotuner setting with + and - keys
AP	Set autotuning period in hours	
AS	Autostart running after tuning	
MQ	Measure Q, ESR	Pause for 60-80 seconds to evaluate antenna
SM	Show antenna measurements	Show most recent results, SMA for Q table values

## Console Commands (continued)

### Configuration

MX	Define multiplexer sequence (ORMR)	MX1234 for all antennas MX121314 increases relative read speed of A1
MV	Minimum voltage before shutdown	When the supply voltage goes below this value, the reader will drop into standby mode. The reader will go to standby when the voltage drops below 10 volts.
TM	Timer	TM hh:mm hh:mm (start and stop time)
DM	Display mode in real time	DM I=Initial scan, C=consecutive, F=final, A=all
RN	Reader name	Up to 15 character name for the reader.
SC	3 letter site code	3 letter site code used for file names and can be displayed in the record with the SCD token.

### HDX Settings

HD	HDX scan speed settings	HDR enter read speed in scans per second HDC enter charge pulse time HDL enter listen time
MC	Find minimum charge pulse time	Hold a tag in the field to see the value
FS	Fast scan mode (1=on, 0=off)	After the charge pulse ends, if a tag is not detected within 4 ms, the charge pulse is started again. CANNOT BE SYNCHRONIZED WITH OTHER READERS.
TF	Tag format	D=decimal, H=hex, B=bi hex
TC	Show the tag classifications	Classification field is in tag detection record
RE	Range extender	Increases read distance
MP	Set minimum pulse amperage	Broken antenna detection setting. Reader will stop if the charge pulse amperage is below the value for a few seconds Value is in milliamps.
PH	Show/hide phantom detections	PH1 to enable, PH0 to disable them

## Console Commands (continued)

### Datalogger

UH	Show upload history	Displays a list of datalogger file uploads. Each time the UP command is typed to upload data, a new entry is added to the list.
UP	Upload records since last	Uploads all new datalogger records since the last time UP was typed. Previous uploads can be listed by typing UP plus the number from the UH command. UP* will show all records in the database. UPS will only show summary records.
UD	Upload records by date	UD 2018-12-1, 14 (number of days)
UT	Upload records for tag number	UT 900_226000054842
ER	Show event records for date	Shows measurements recorded every minute
CO	Add comment	Timestamps and saves message in log file
TL	Show the accumulated tag list	All tags listed in tag order with time last seen
FM	View or change record field names	Edit the record format for detection records. Type FM to see the current format. Type FM plus the field names to edit.
FN	Display database field names	Show all field names available for FM command. See next section for the list of field names
WE	Write every scan record	In addition to summary record, the reader will store all individual detections (I records). WE1 to turn on. WE0 to turn off. This will generate many times more data than just a summary.
LA	Last tag seen	
CS	Column separator	S=space, C=comma, T=tab
MG	Max delay gap	Time in seconds to wait after a tag has been detected before deciding that it has left the detection zone

### Antennas

NL	Show readers on the network	
SL	Select one node reader	Use "SL" without a node name to disconnect



## Console Commands (continued)

### Time and Location

DT	Show date	View or enter date in ISO form. YYYY-MM-DD HH:MM:SS.TTT The letter after the date is the reference used G GNSS signal N reader network time E elapsed since startup U unreferenced
TZ	Set time zone	Hours from UT (TZ-8 for Pacific)
LO	Show GNSS location	Show the current location from the GNSS receiver.
OV	Override with GNSS or NET	When both GNSS and NET connections are valid, OVG selects GNSS and OVN selects the NET.

### Utility Commands

NO	Display noise level	Show the minimum and maximum values every second. Standby mode only.
CV	Convert tag number	Enter a tag number and the other forms will be displayed. Converts between decimal, hexadecimal and bi-hex formats.
FR	Factory reset	Initializes all settings to factory values. FRD Factory reset the database file FRR Factory reset the reader settings FRA Factory reset all FRD+FRR
AB	About memory, copyrights	Firmware V1.0 (c)2019 Oregon RFID, Inc. Serial number 0010-0003-0B37-3933-3155-37 FatFS R0.13a (c) 2017 ChaN, all rights reserved GCC (c) Free Software Foundation, Inc. All rights reserved by respective holder
QU	Explain prompt codes	Shows the current meaning of the four character prompt.
FW	Update firmware	
RD	Rebuild the database	Reads log file and creates indexes for UD, UT and TL commands
RB	Reboot	Restart the reader firmware and enable firmware update.
HE	Help	Lists all commands

## Console Commands

### AB

The About command shows the firmware version number, serial number and copyright information.

```
HDX Single Antenna Reader
Firmware V1.71d ORSR (c)2017-2019 Oregon RFID, Inc.
Reader serial number 0004-0007-1139-3633-3459-36
FAT Filesystem Module FatFS R0.13a (c) 2017 ChaN
GCC (c) Free Software Foundation, Inc.
All rights reserved by respective holders
```

### AP

Set the period in hours to automatically autotune. **AP1** will start a timer to tune every hour. All times start from midnight and tuning is done on the hour. **AP12** will autotune at midnight and noon every day. **AP0** disables the feature (the factory setting). The reader cannot detect tags when the antenna is being tuned.

```
HSGB> AP1
Autotune period 1
```

If there are multiple readers in the same area, they will all tune at exactly the same time, which can cause interference between them. A second number can be added to the command to specify how many minutes after the hour to wait before tuning.

For example, one reader would use the setting AP1,0 to tune every hour. The next reader would be set to AP1,2 which would tune two minutes after the hour.

## Console Commands

### AS

AS Auto start run mode after tuning.

```
NSG*> AS1
Start scanning after tuning is complete
```

### BC

Export/import all settings to transfer configurations between readers.

### BP

Show or change the beeper mode.

```
HSGB> BP1
Beeper on
HSG*> BP0
Beeper off
HSGB> BP2
Beeper controlled by tag signal strength
```

### BR

Set LED brightness level.

```
HSGB> BR3
3=Bright
```

### BT

Enable or disable Bluetooth serial link. BT will show the broadcast name.

```
> BT 1
Bluetooth is on
> BT
Bluetooth name: ORFID_695797311
Bluetooth is on
```

## CO

Comments are timestamped and stored in the log file as an E record.

```
HSGB> CO Changing batteries
```

## CS

Reports can be listed using spaces to separate the numbers, or with tabs or comma separators.

```
HSG*> CSS
Column separator changed to space
HSG*> CSC
Column separator changed to comma
```

## CV

A calculator to convert tag numbers between types.

```
HSG*> CV 900_230000002954
ICAR registered animal
ISO: 900_230000002954
HEX: 8000E1358D11878A
Bi-HEX: 384_358D11878A
```

## DK

Set a timeout interval after the last pushbutton press or command typed before LEDs turn off. The reader continues to run. Pressing any button or typing any command will wake the LEDs.

```
HSGB> DK
0 minute(s) before LEDs off
```

## DM

Select the types of detection records to show in real time while a tag is being read. I=Initial Scan, C=Consecutive Scan, F=Final, A=All

## DT

DT shows the current date and time, the time reference (G, N, U) and the time zone difference.

```
HSGB> dt
2020-05-29 00:42:05.866 G (UT-7)
```

## ER

Show system status every minute for a date. Measurements include the reader supply voltage, amperage, noise level and others.

```
HSG*> er
2020-05-29          V      A      A AntN  R H T S    Chg  Lst  Tmp
2020-05-29 00:00  13.7  0.1  0.3 254  R H G 15   50   50
```

## FM

Show and change the fields shown in datalogger output.

```
>FM
DTY ARR SPC TRF DUR SPC SPC ANT TAG SCD NCD
HSUB> FM DTY ARR SPC TRF DUR SPC SPC ANT TAG SCD NCD TSS
```

## FN

Show the list of available field names for the FM command. The list and description of each field is in Appendix X.

## FR

Factory reset.

```
> FRA
Reset to factory settings and reset database
Are you sure? (Y/N)

> FRD
Reset database
Are you sure? (Y/N)

> FRR
Reset to factory settings
Are you sure? (Y/N)
```

## FS

Enable fast scan mode. When there is no tag in the field, the listen cycle stops early (3 milliseconds after the charge pulse ends) and starts another read cycle. It is not possible to synchronize readers using fast scan mode with others.

```
HSG*> FS1
Synchronization disabled in fast scan mode
Fast scan enabled
```

## FW

Write reader firmware. See separate instructions.

## HD

Set the HDX read speed, charge and listen times. They are interrelated so changing one will change others.

```
HSG*> HDR10
HDR      10    scan rate
HDC      50    charge ms
HDL      50    listen ms
```

```
HSG*> HDR20
HDR      20    scan rate
HDC      30    charge ms
HDL      20    listen ms
```

## LA

Show the last tag seen.

```
HSG*> tl
Tag number order
Record          Tag          Detects          Last seen
      1      900_230000002954  AC          1 2020-05-29 05:03:13.786 G
Most recent detection 1
```

## LO

Show latest GNSS location and number of satellites in view.

```
> LO
42 38.2687N 121 33.1042W
Altit m      137.68
HDOP m       19.4
Time to valid GNSS signal 07:10
Number of satellites      8
```

## MC

Show the minimum charge time to read a tag held at the edge of the detection field. Change the reader setting with the HDC command.

```
> MC
===== 30
===== 45
===== 40
===== 20
===== 30
===== 30
===== 25
===== 30
===== 25
===== 30
===== 25
===== 30
===== 35
```

## MG

The MG command sets the time to wait after the last detection of a tag before writing the detection summary record to the log file.

Repeated detections of the same tag are accumulated into a detection record. Each summary record has the number of repeated detections instead of a record for each scan.

If there is no gap (MG0), a weak tag signal can go on and off quickly, creating a lot of records. This can happen when the tag remains at the edge of the detection field for a long period. With a the setting of MG1.5, there can be up to 1.5 seconds between repeated detections before the record is saved.

When the gap time ends, the detection record will be sent to the datalogger file and an 'S' summary record is shown on the console.

```
HSG*> MG 1.5
Gap time seconds 1.5
```

## MP

### Broken Antenna Detection

Set the minimum power supply amperage during the charge pulse when running. When the antenna is disconnected or the wire is broken, the resonant circuit stops and the antenna power drops significantly. When this falls below the specified level, the reader will stop scanning and enter Standby mode to prevent damage to the reader electronics when an antenna is broken by debris.

This feature can be used to stop the reader when the antenna is broken to prevent damage to the reader electronics. If an antenna is not connected, the amperage decreases to around 300-600 milliamps.

To enable the feature, disconnect the antenna, start the reader and read the charge pulse amperage with the SY command. Only run the reader for a few long enough to see the value. Set the threshold to a value a little bigger than that. The command MP0 will disable the feature (factory setting).

```
HSG*> MP400
HRG*>
```

## MQ

Measure antenna Q

```
HSGB> MQ
This will take 60 to 80 seconds
Are you sure? (Y/N) Y
.....
.....
.....
.....
...
Q measurement: 2020-06-01 08:22:15
Q 86.7
ESR 384 milliohms
```



## MV

Sets the minimum voltage before the reader will automatically shut off

```
HSG*> MV
Min voltage before shutdown 10.0
Restart voltage 12.0
```

## MX (ORMR)

Enter the antenna scanning sequence

```
HSG*> MX 135
```

## NL

Show the list of readers connected to the network.

```
HZGB> NL
```

	Type	Version	St	Mode	SupplyV	EffA	New/Recs	Beep	Site Name
Host	MUX	ORMR	V1.999	OK	Z	13.6	0.1	1	Multiple Ant Reader
1	SGL	ORSR	V1.999	OK	R	12.4	0.1	25 / 430	0 Single Ant Reader
2	HFR	ORHF	V1.999	OK	S	24.6	0.2	156 / 156	1 HF Reader

## NO

Show minimum and maximum noise levels, updated every second

## OF

The reader is turned off to close the log file, turns off the front panel LEDs and runs in low power mode. The GNSS receiver is still operating, Bluetooth is still on, the front panel buttons are enabled and the console port accepts commands.

```
HSG*> OF
Shutting off
```

## ON

Start scanning for PIT tags. The prompt will show R for Run mode.

```
HSG*> on
HF reader ready
```

## OV

If a reader has both a GNSS signal and a cable between them, the default action is to use the network for time of day and reader synchronization and only use GNSS for the the location. The OV command determines which has priority so that typing "OVG" selects GNSS and ignores the wired synchronization. "OVN" is the factory setting.

## PH

Enable/disable phantom tag recognition

## QU

Describe prompt codes.

```
HSGB> QU
H Host mode
S Standby
G GNSS time
B Beeper on
```

## RB

Reboot the reader to reset all systems.

```
> RB
Are you sure? (Y/N) N
```

## RE

Enable or disable Range Extension. When a tag is detected a CRC checksum is sent after the tag ID to verify the message. If RE is enabled, only the first in a series of repeat detections checks the checksum. After that, only the tag number is compared with the previous one to see if it is valid. This can sometimes result in a mild the read range increase.

```
HRG*> RE1
Range extender on
```

## RD

Rebuild database tables needed by the UD, UT and TL commands. This can take a while depending on how many detection records are in the file.

```
> RD
Are you sure? (Y/N) N
```

## RN

Enter the reader name that is shown in reports.

```
HSG*> RN Smith Creek
Smith Creek
```

## SC

Enter a three letter site code used in files created by the reader and shown in reports.

```
HSG*> SC SMT
Site code SMT
```

## SL

Select a reader on the network by site code.

```
HSG*> SL SMT  
[SMT]NZGB>
```

## SM

Show the antenna measurements made after tuning and measuring Q.

```
HSGB> SM  
Tuned: 2020-06-01 08:12:40  
38.4 uH, 36.6 nF, 251 V, 5.5 A  
Q measurement: 2020-06-01 08:22:15  
Q 86.7  
R 384 milliohms
```

## SMA

Lists all 512 antenna voltage values measured while calculating Q. The first number is the capacitance value in nF.

```
HSGB> SMA  
nF, Ant_volts  
Tuned: 2020-06-01 08:12:40  
38.4 uH, 36.6 nF, 251 V, 5.5 A  
Q measurement: 2020-06-01 08:22:15  
Q 86.7  
R 384 milliohms
```

```
10.4, 14  
10.5, 14  
10.6, 13  
10.8, 14  
10.9, 14  
11.1, 14  
11.2, 14
```

...

```
79.3, 12  
79.7, 13  
80.3, 12  
80.9, 12  
81.5, 12  
82.0, 12  
82.6, 12  
83.2, 11  
83.8, 12  
84.4, 11  
85.0, 12
```

## ST

Enter standby mode. The reader is on but not scanning for tags. No antenna needs to be attached. Data can be uploaded and reader settings changed. The prompt will show S for Standby mode.

```
HRG*> ST
HSG*>
```

## SY

Display the system status

```
> SY
Oregon RFID HF Multiple Antenna Reader
V1.994 0000-0010-0333-3039-3058-35
Reader name
Standby mode
Supply voltage      25.1
Standby amps        0.540
Shutdown supercap   5.2
Sleep battery       3.3
Tags in archive     52
Bluetooth is on
```

## TC

Show list of tag codes.

## TF

The TF selects the tag display format to use in reports.

```
HSG*> TFD
Decimal tag format
HSG*> TFH
Hex tag format
```

## TL

The reader keeps a cumulative list of tags that have been detected, up to 4000. After the list is full, additional tag numbers will not be stored.

TL list the tags in order of tag number. TLD will list them by date.

```
HSG*> TK
Tag number order
Record      Tag      Detects      Last seen
1      900_230000002954 Y      17 2022-01-17 00:05:20.717 G A2
2      900_1800000059537 Y      18 2022-01-17 00:05:20.714 G A2
3      900_1800000193749 Y      13 2022-01-17 00:05:20.986 G A2
4      900_2300000014689 Y      37 2022-01-17 00:05:20.713 G A2
5      900_2700000001542 Y      18 2022-01-17 00:05:20.721 G A2
Most recent detection record 5
```

## TM

Enable or disable the timer. Reader will go from run to standby and back at the times specified.

```
HSGB> TM 6:00 18:00
Run timer starts at 06:00 and stops at 18:00

HSGB> TM 0
Run timer disabled
```

The messages "Stopped by timer" will be displayed when the reader goes to standby and "Started by timer" when the timer returns to run mode.

The prompt will start with T when the timer has stopped the reader. The operating mode in the ER record will also be T.

>THSGB

The reader will not go to standby (ST or the POWER button) if the timer says it should be running. The problem LED will go on and an error message "Run timer is on" will be displayed.

If the timer puts the reader in standby, it can be turned off (OF or POWER button). It will go to RUN mode according to the timer.

## TS

Read the Oregon RFID Inductive Temperature Sensor. Also set the read period in minutes. Periodic reads are written to the log file.

```
HSU*> ts
Period (m) 0
Charge time (ms) 500,70
Temperature 23.4C 74.1F 612 ms
```

```
HSU*> ts1
Period (m) 1
Charge time (ms) 500,70
Temperature 23.4C 74.1F 612 ms
```

## TO

Override the autotunes settings. Press + to increase the capacitance one step. Press - to decrease. Type Q to stop

```
HSUB> to
+ Increase capacitance
- Decrease capacitance
Q Quit
- 41.1nF
- 41.0nF
- 40.8nF
Q
```

## TU

Tune the antenna. Displays the tuning status with 'I' for IN, 'O' for OUT and '.' for OK. The command can be used with automatic or manual tuners. When the antenna is OK for a few seconds, tuning will stop.

If the antenna won't tune, type TU0 to stop.

```
HSGB> TU1
0000000...
```

After tuning completes, the inductance and capacitance values are shown, which determine the frequency. The antenna voltage and current are also shown which reflect the power level of the antenna.

```
Tuned: 2023-01-29 14:53:38
28.4 uH, 49.5 nF, 107 V, 3.1 A
```

## TZ

Displays and changes the time zone difference from UT.

```
HSGB> CO Setting clock to Newfoundland time
HSGB> TZ-2:30
HSGB> CO Portland summer time
HSGB> TZ-7
```

## UD

List log file records for a date. The number of days can be specified.

```
HSG*> UD 2020-5-22
HSG*> UD 2020-5-22, 3
```

## UH

Show a numbered list of uploads. Each time UP is typed, a new record is added to the list. Previous uploads can be listed by typing UP with the upload history number.

```
HSG*> UH
Reader: Smith Creek Site: SMT
Upload Histories: 3
```

Num	UP Date	Time	Records
1	2020-05-22	02:36:14	16
2	2020-05-22	02:39:13	3
3	2020-05-29	04:58:35	116
NEW			1
		TOTAL	136



## UP

Upload log file data since the last time the UP command was typed. To list all records in the file, type "UP\*". "UPS" will show only summary records, "UPE" will only show event records.

```
HSG*> UP
Reader: Smith Creek  Site: SMT
----- Upload #3, 116 records -----
```

## UT

List log file records for a tag. The most recent detection will be shown first.

```
HSG*> UT 900_230000002954
```

## WE

This command enables saving all individual 'I' detection records to the log file. This will cause a significant increase in the number of records and will extend the time needed to upload log files. It is only recommended to enable this when it is necessary to have the raw data from every scan that is summarized with the 'S' record.

```
HRG*> WE0
Not writing every record

HSG*>
```

## Appendix 3

### Data Record Field Names

## Full list of field names

DTY	Detection type, S summary, I individual, E event
TCH	Tag technology HDX, FDX, HF
TTY	Tag type A=Animal, R=Read only, W=Writeable, P=Phantom
PFG	Phantom flag (P or N)
TAG	Tag ID number
ANT	Antenna number (always 1 on ORSR)
ARR	Arrival date and time
TRF	Time reference G=GNSS, N=network, U=unreferenced
DEP	Departure date and time
NCD	Number of consecutive detections
EMP	Number of empty scans preceding detection
LAT	Latitude
LON	Longitude
ALT	Altitude in meters
SIV	Satellites in view
HDP	Location horizontal accuracy (m)
TSS	Tag signal strength
SPV	Power supply voltage
CPA	Power supply amperage during charge pulse
LSA	Power supply amperage with charge pulse off (listen)
EFA	Effective amps (weighted average of CPA and LSA)
CPT	Charge pulse time in milliseconds (HDC setting)
LST	Listen time in milliseconds (HDL setting)
ANV	Antenna voltage
ANA	Antenna amperage
NOI	Noise
DUR	Duration of tag detection event
CLS	Tag size class (12mm, 23mm, etc)
SCD	Site code
SPC	Output one space character

# Appendix 4

## Command Line Prompt

## Command prompt format

Each command line prompt displays the current system status. The characters used are listed below

<b>O</b>	Off with power connected
<b>H</b>	Host mode (generates system timing for network)
<b>N</b>	Node mode (synchronized to host)
<b>R</b>	Running, detections saved to file
<b>S</b>	Standby, not scanning, database accessible
<b>Z</b>	Off
<b>G</b>	Synch to GNSS signals
<b>N</b>	Synch to network signal
<b>U</b>	Unsynchronized
<b>B</b>	Beeper on
<b>*</b>	Beeper not on

When the reader is stopped due the timer, the prompt will begin with the letter T.

## Time types

A character after the time indicates the reference.

14:44:57.876 U

<b>G</b>	Referenced to the GNSS signal
<b>N</b>	Referenced to network signal on cable between readers
<b>U</b>	Unreferenced time, using local clock

## Appendix 5

### Assembling Waterproof Twinax Connectors

## Assembling Waterproof Twinax Connectors

See the Oregon RFID channel for a video showing this process.

Disassemble the connector by unscrewing the lock ring using the protective cap from the reader as a tool.



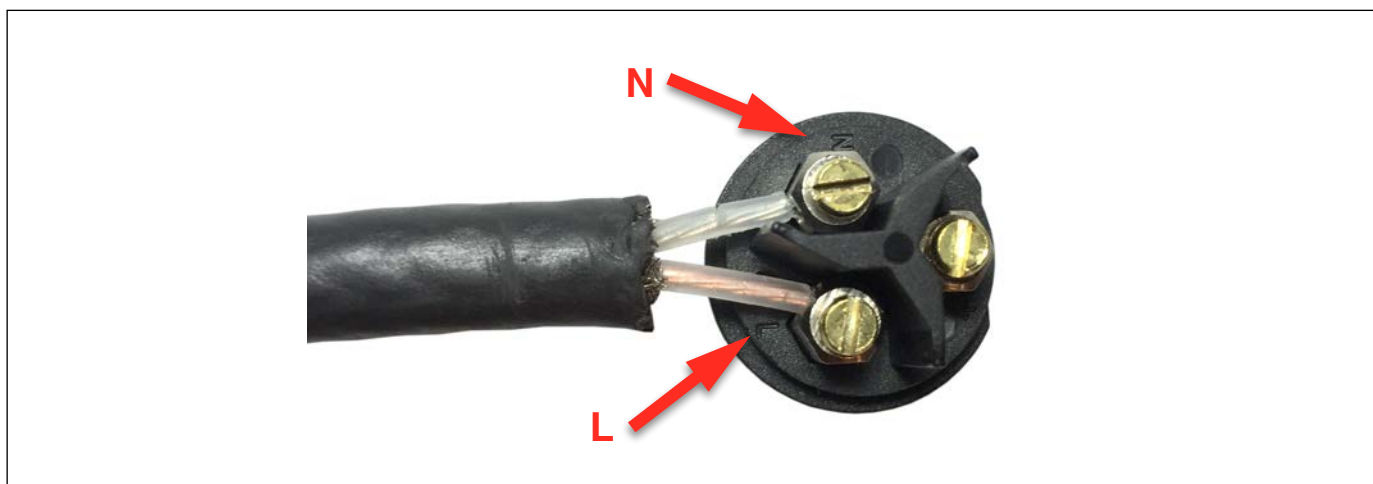
Remove the ring and inside assembly.



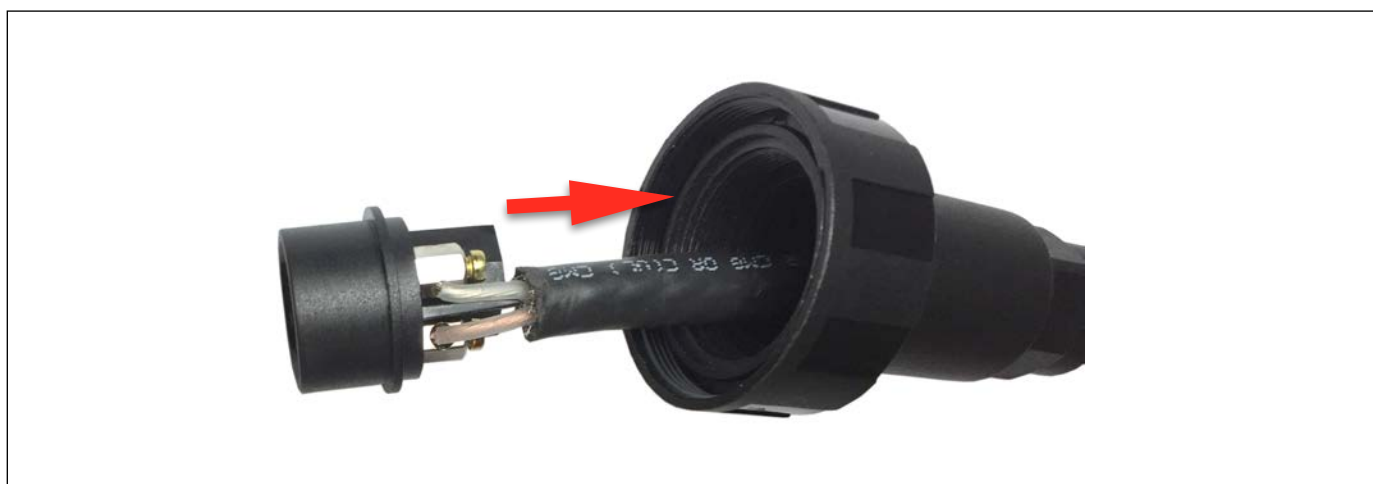
Place the parts on the twinax cable as shown. Strip off the ends of the wire.



Connect the twinax cable ends to the terminals marked N and L.



Pull the cable so the assembly goes back in the housing.





Push the seals into the connector and tighten the threaded nut.  
Carefully push and hand tighten the nut until the plastic threads are inside the connector. This can require patience to get started.



After the nut is engaged, use two hand wrenches (3/4" and 11/16") to tighten the seal.



**IMPORTANT:** Twist the cable and connector in opposite directions make sure that the cable cannot twist inside the connector. There should be no movement or the wires will break inside the connector.

Replace the lock ring and tighten using the protective cap.



Completed assembly



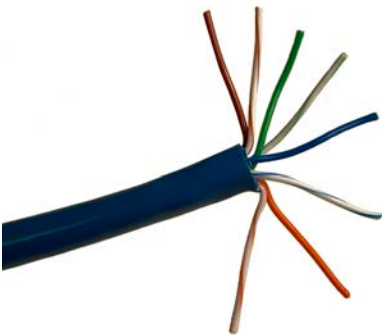
## Appendix 6

### Assembling Network Cable

## Network Cable

The reader network uses CAT5 (ethernet) cable to connect readers up to 1000' apart. There is no limit to the number of readers that can be connected together this way.

Two waterproof RJ45 caps are included with the reader. Place them on the cable before attaching the clear plastic RJ45 connector to the cable.



Cut the insulation from the end of the CAT5 cable and straighten each wire. Then push the wires into the black frame and cut them so all ends are the same length.

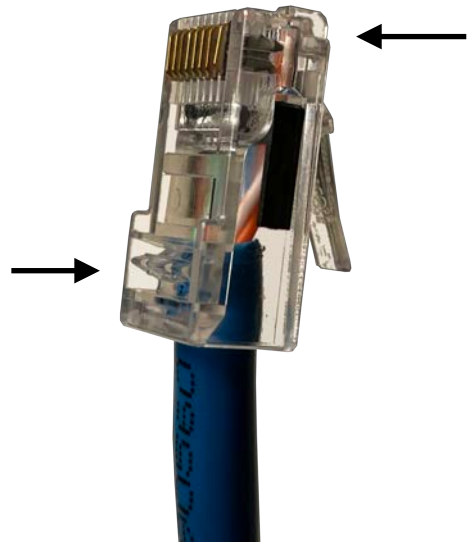


The two ends of the cable should be wired the same (pass through) and in pairs (brown with brown stripe, etc).

## Network Cable

Attach the RJ45 connector, making sure the wire ends reach the end of the connector (top arrow). The tab at the other end (bottom arrow) should grip the outside insulation.

Make sure the black waterproof covers are on the cable before assembling both ends.



Use an RJ45 tool to crimp the assembly together.



Place the waterproof housings over the RJ45 connectors and tighten the nut on to tightly grip the cable.

## Appendix 7

### Updating Reader Firmware

## Update Firmware

Firmware update files are issued by Oregon RFID to add new features and fix bugs. The latest version is posted on this web page:

<https://www.oregonrfid.com/resources/software-manuals/>

Notifications of new versions are sent out on our mailing list.

Updating the firmware will not affect the data stored in the log file.

There are three firmware files for the ORMR reader.

ORMR\_FW1\_vvvv.TXT

ORMR\_FW2\_vvvv.TXT

ORMR\_FW3\_vvvv.TXT

“vvvv” is the version number.

There are two different firmware files for the ORSR reader, depending on the mode of operation

ORSR\_FW4\_vvvv.TXT                      stationary reader

ORSR\_FW4\_vvvvM.TXT                    mobile reader

The stationary reader firmware includes the network with the commands NL and SL. The mobile firmware does not have the reader network function but includes the UT and TL commands.

To update the reader, open the update firmware with a text editor, select the entire file and copy it to the clipboard. Open the serial connection with the reader and start a terminal program. The step-by-step instructions are on the following pages.

It is not possible to update the firmware over the Bluetooth link.

## ORSR Firmware

```
>FW
ORSR MCU4
Update(Y)? Y
Start
```

Paste the firmware after **Start** is shown. After the file is uploaded, the number of lines and bytes are shown and the file is evaluated. If the checksum is okay the reader firmware is updated.

ORSR MCU4
Update(Y)?y
Start
.....
.....
.....
.....
.....
Received 7088/311749
Checksums OK
-----
-----
-----
-----
-----



## ORMR Firmware

The ORMR has three microprocessors and three firmware files. Update them one at a time.

Paste the firmware after **Start** is shown. After each file is uploaded, the number of lines and bytes are shown and the file is evaluated. If the checksum is okay the reader firmware is updated.

HZUB> FW1

CTRL MCU1

Update(Y)?Y **paste the first file**

Start

.....  
.....  
.....  
.....

Received 5002/224979

Checksums OK

-----  
-----  
-----  
-----

HZEB> FW2

COMM MCU2

Update(Y)?Y **paste the second file**

Start

.....  
.....  
.....

Received 4204/184842

Checksums OK

-----  
-----  
-----

HZEB> FW3

ORMR MCU3

Update(Y)?Y **paste the third file**

Start

.....  
.....

Received 2773/121910

Checksums OK

-----  
-----

HZEB>