

The base station manual.

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Introduction

The base station is necessary for data download from loggers equipped with UHF SRD or LRD link as well as to change loggers' settings. Base station can be hand operated or installed for automatic data download in place visited by the tagged objects., i.e.: in the colony, near the water holes or roost. When base station works continuously, loggers will upload collected data each time when appear in its (the base station) range. Mentioned presence (in the colony, nest, roost) will be also recorded in a programmable interval in base station memory. The base station signal can disable GPS data collection when logger is in range - to save energy.

The distance of bidirectional communication varies between 200m to 6 km and depends on the logger's specification, antenna's version and field conditions.

No computer is needed for unattended operating, only the power source.

For download data stored in base station memory - as well as for sending new settings to the memory - the base station communicates via USB with user's computer and dedicated for this purpose Tracker software.

Versions, models & technical parameters

BS-P5 base station

Strong housing with a led window, USB cable with a waterproof connector. The most common base station model used for a hand operating as well as for a long term & unattended work. It works with external omnidirectional or directional antenna.

Dimensions: 90x35x30mm, weight: 250g, USB Cable length: 2m.

Communication ranges:

- LRD loggers in the line of sight: ground-to-ground ~800m, ground-to-air or air-to-ground >6km;
- SRD loggers in the line of sight: ground-to-ground >100m, ground-to-air or air-to-ground >500m;

BS-P6 base station (discontinued)

Strong housing with a LED window, USB cable with a waterproof connector. Special version of a P5 base station with longer downloading range. Designed for hand operating and also long term & unattended work. It works with external omnidirectional or directional antenna. Model discontinued from January 2021, most of the P6 features and solutions have been transferred to P5 version.

Dimensions: 90x35x30mm, weight: 250g, USB Cable length: 2m.

XS-NS base station

Portable, low power & very short-range base station dedicated for single nests monitoring.

It is equipped with USB cable with waterproof connector which is compatible with Ecotone battery grip. Recommended for projects on birds that nesting in burrows, inside buildings, in caves. In places where the GPS signal might be weak or not present at all it is important to turn off the GPS to save energy; short communication range helps to avoid conflict between multiple base stations in the same area. Works only with a built-in wire antenna.

Dimensions: 65x27x13mm, weight: 80g, USB Cable length: 2m.

Communication ranges: ~10m in the line of sight

XS-UR base station

Portable & lightweight, high sensitivity & long range base station dedicated for data download with the use of drones, as a backup base station, for loggers programming and testing when the main unit is already in use. Can be used also as a stand-alone base station for a single nest, small colonies, water holes or feeders monitoring. Works only with a built-in wire antenna. It is not equipped with the waterproof USB connector.

Dimensions: 65x27x13mm, weight: 12g without battery, 15g with small battery.

Communication ranges: to 500m in the line of sight

P5 base station assembly

Depends on the purpose, the typical base station can be used with the omnidirectional antenna or with the directional Yagi antenna.

Omnidirectional antenna

Attach the omnidirectional antenna and secure gently the hexagonal nut of the SMA connector.



Figure 1 The base station & battery grip.

Yagi antenna

Gain 19dBi, beam width 18°, polarization vertical or horizontal.

- Insert base station into the holder.
- Secure with two butterfly nuts.
- Connect base station and antenna via the antenna cable. Tighten gently but firmly the hexagonal nuts of the SMA connectors.
- Now it's ready for hand operating.

- If you like to attach the base station to the handle or pole, mount the U-Bolt clamp on the outer part of the antenna reflector:



Figure 2 Assembly with directional antenna on mast.

Connectors and plugs protection

- When leaving base station unattended in harsh environment conditions, protect well all plugs and connectors.
- For antenna SMA and USB connectors, we do recommend applying of a drop of grease or lipstick which is good grease substitute and seals well.
- Fix well all cables to the pole with the cable ties or waterproof adhesive tape. Any loose cables can be damaged after weeks of exposition to the wind.
- Protect all cable connectors and the battery grip plug against water with a plastic bag or plastic bottle:

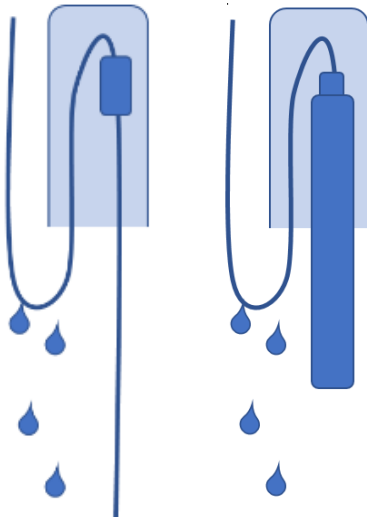


Figure 3 Waterproofing the connectors and plugs.

Powering

Power consumption:

The typical P5, UR, or NS base station power consumption is $\sim 46\text{mA}$, what means that the base station uses daily ~ 1.0 Ah.

Battery grip

All base station models can use dedicated battery grip. It is waterproof and equipped with waterproof USB connector. The battery grip contains 3x D size batteries which can be replaced easily.

Recommended batteries:

3 pcs of not rechargeable (default in set), alkaline D size (LR 20). Such set lasts for 10-15 days of continuous work.

The battery lifetime: depends on the temperature and amount of data received from loggers (total transmission time).

Alternative batteries:

- Any D size not rechargeable, non-alkaline 1.5V battery (cheaper but with shorter lifetime)
- Rechargeable 1.2V-1.5V batteries (the lifetime depends on their capacity and usually will be shorter than from both above models)
- Not rechargeable, lithium D cell 1.5V – very expensive but of the highest capacity. Not recommended for low temperature conditions below 0 Celsius.

Battery change:

Use only D size batteries, do not mix fresh and partially discharged or of different battery models in one set.

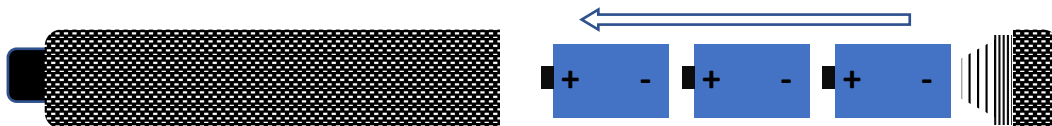


Figure 4 Battery change.

Car battery 12V:

The base station comes with cables with clamps and 12V / USB charger. It enables use of any 12 car battery. Such set combined with a solar charger is often used for long period unattended base station work.

USB wall charger:

When the main power is present, any wall USB charger equipped with USB-A port can be used.

Power bank:

The power banks are generally not recommended. Only a few models in the market which are equipped with “Always On” function can be used. For example <https://voltaicsystems.com/v15/>

Communicating with PC

For communicating with our base station, Tracker application is necessary.

Download it from:

<http://telemetry.ecotone.pl/public/TRACKER/>

Unzip the file and place the Tracker folder in your favourite location.

This application doesn't require installation, we suggest only creating a shortcut to the exe file on Your desktop, for easier further operating.

The Tracker program requires the .NET framework. Most new Windows versions have it already installed, when it is not present, install it from Windows Web site or download it from our server:

http://telemetry.ecotone.pl/public/UPGRADES/BASE_STATION/DRIVERS/

Drivers

The base station can work with any PC operating on Windows XP, 7 & 10. For data download in the field, your old laptop can be used as well.

Connect the USB cable to the PC USB port. **The USB waterproof plug may not fit well to the USB port in your laptop. Use the short USB extension cable which comes with the base station.**

When system cannot recognize the base station - upgrade the drivers:

Upload drivers from:

http://telemetry.ecotone.pl/public/UPGRADES/BASE_STATION/DRIVERS/

save them and unzip to new folder for manual upgrading, or run the [WIN10_CDM21228_Setup.zip](#) which installs all drivers automatically.

When you decide to upgrade drivers manually, follow those steps:

1. Connect the USB cable to the PC USB port. The USB waterproof plug may not fit well to the USB port in your laptop. Use the short USB extension cable which comes with our base station.
2. Open the Device Manager and locate device which appears when connecting base station to the USB port. Usually, it will be not or not properly recognized hardware.

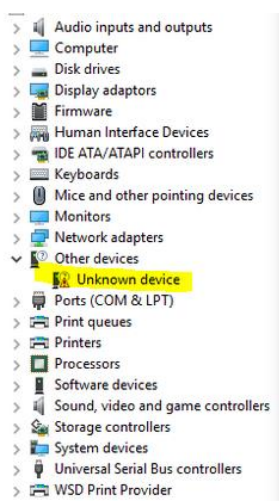
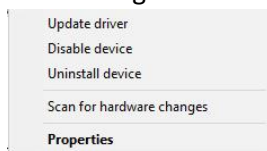
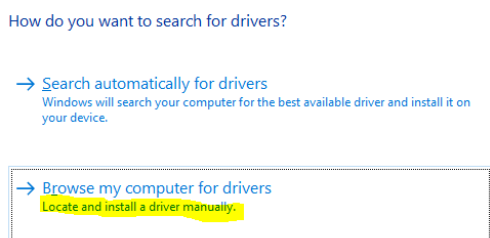


Figure 5 Windows Hardware Manager- not recognised USB.

3. Click the right mouse button to see options. Choose Update driver - or if not present - choose Properties:



4. Click on Locate and install a driver manually:



5. Choose the folder where the drivers have been stored and follow the instructions.
6. After updating the drivers, the base station should install two devices – the USB serial port and USB serial converter:

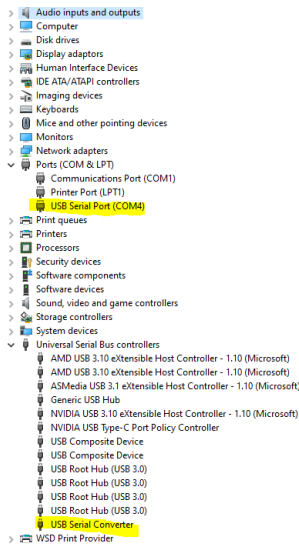


Figure 6 Windows Hardware Manager- properly recognised USB.

7. The COM port number once assigned by Windows to the base station will remain unchanged (each time you connect it).

Operating & functions

LED Indicator lights

- The base station is equipped with yellow, blue and red led indicators, they are visible in the housing window. They show current operating mode of the unit.
- YELLOW blinks 1/s: base station works in typical mode, no data are currently uploaded;
- YELLOW solid light: uploading data from logger or transmits settings to logger. It can be on for 1-2 seconds when the package is small as well for 1-2 hours when downloading huge data file;
- YELLOW solid light followed by 2-3 seconds red light: data transmission interrupted (not completed);
- BLUE solid light: appears for 2-3 seconds every 30-60s – new data are already stored since last data download to the PC. Helps to take decision (especially in harsh weather conditions) whether there is a sense to connect the base station to the laptop.
- RED blinks 1/s – base station works in a telemetry mode, no data are currently uploaded.
- RED solid light: the base station malfunction.

Upgrading firmware

It is very important to always use our base station with the newest firmware. The new generation loggers as well Tracker program could be not fully compatible with older base station firmware.

- Download the firmware from:
http://telemetry.ecotone.pl/public/UPGRADES/BASE_STATION/BASE_P5&P6/
- Unzip the file and run it.
- When asked by the program, connect base station to the USB port.
- After upgrade, which takes about 20 seconds, disconnect base station from the PC.
- Download the newest Tracker program from:
<http://telemetry.ecotone.pl/public/TRACKER/>
- Connect again and run the new Tracker program to check if the base station works well.

Memory, formatting & erasing

The base station uses double 2GB SD memory banks. Data are stored in one bank, the second is used as a backup. Before the field use, format the base station memory from Tracker application, to be sure that it works properly.

When base station works properly, data are downloaded to PC from only one SD memory bank. When the base station detects once any write/read error, from this moment, each time when downloading the data to PC, both memory banks will be downloaded. As a result, doubled sets of data in one file will be saved. In such case formatting the memory is necessary.

The USB download to PC may take a long time when a lot of data are stored in the base station memory. It is recommended to erase the memory regularly to shorten downloading time and to reduce the risk of data corruption when big files are transmitted.

After successful data download, erase the base station memory from Tracker application. From this moment the data will be saved in new, automatically created folder in your PC.

Groups mode

Our base station can communicate with loggers and download data only when they belong to activated GROUPS. Check carefully in Tracker application, if your base station has activated all groups used by your loggers.

Recording logger's presence in range

The base station records in the memory the presence of loggers when they are in its range. Even if loggers don't collect GPS data in the base station range, their presence will be recorded together with the timestamp. Important: only loggers from the valid GROUP activated in the base station will be recorded.

Telemetry mode

Your base station can work in "telemetry mode" activated from the Tracker application. **Never use** this mode for an automatic base station work. It has been designed for very special situations and only when the base station is hand operated. Consult with us each time when you are going to use it.

Radio channels

The base station can work in 5 different radio channels, selectable from Tracker application: White, Red, Green, Blue and Yellow.

The default, and used by all typical loggers, is White channel. Channel used by loggers cannot be changed by the user – any changes in channels are possible during the production and only on the customer's request.

Do not change your base station channel when you haven't order loggers which use channel different than default.

Field installation

Site selection:

The site selection & proper base station installation is crucial to get good results. The base station location depends on the project requirements, terrain configuration, vegetation and animal behaviour.

The general rules about the base station location are:

- Loggers use less energy for communication when are close to the base station, where the signal is strong and packet repetitions are not needed.
- Higher antenna elevation increases communication ranges.

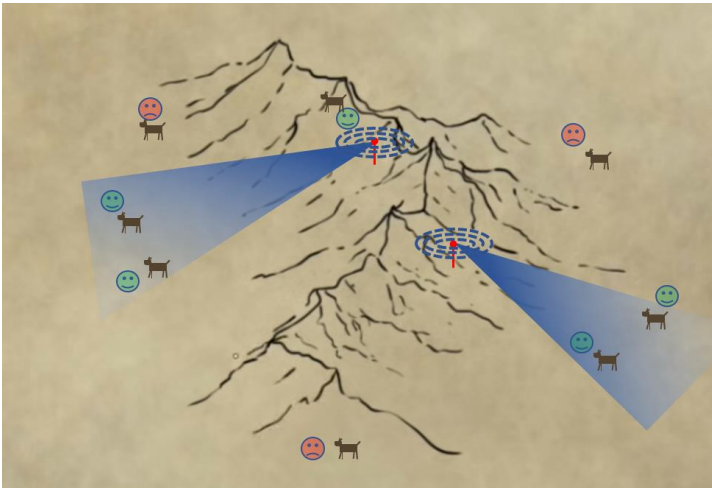


Figure 7 Range reduction by terrain obstacles.

- The vegetation or terrain obstacles may reduce the communication range, or disable the data download at all:

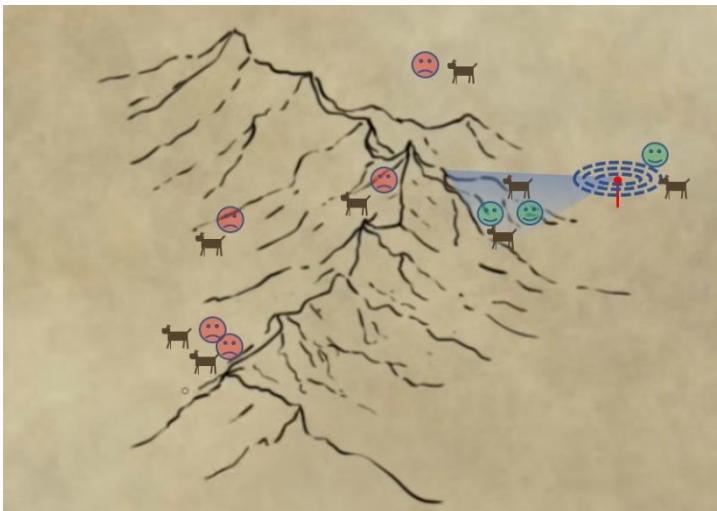


Figure 8 Possible multiple base stations configuration.

- Only one base station can be used in one location (base stations conflict):



Figure 9 Base stations conflict.

- Logger cannot be in the same time in the range of multiple base stations (possible the data lost):



Figure 10 Logger in multiple base stations range.

Scenarios

Colonial animals - place the antenna as close as possible in front of the colony, preferably at the same or higher elevation. Choose birds for tagging only from known nests, which are in one and possible small and compact colony patch, to be sure that all nests will be in a good base station range.

Burrows and caves – it is the most complicated case. Inside the burrow or cave the GPS signal is not present which leads to fast logger's battery discharge due to. Additionally, the base station usually cannot communicate with loggers which are inside and data download is not possible, loggers which cannot detect the base station signal will be not able to use the function "stop GPS in the range". Sometimes antenna location close to and in front of the entrance may help.

Usually use of dedicated base station *XS-NS base station* installed inside of the burrow or in the entrance is recommended and it solves most known problems. When installing the XS-NS base station, keep the minimal distance 10-15m between stations to avoid interferences – check with Tracker application if no conflicts are detected. Installing deep inside the burrows usually prevents any conflicts.

The pass and trails monitoring – when tagged animals are not in reproduction period and data downloading near the nest or the den is not possible, sometimes monitoring the passages, trails, riverbeds,..., is necessary. In this case, the

base station with directional antenna is recommended to increase the detection range. The antenna beam should be focused along the expected animals' path, to extend their time of being in the range.

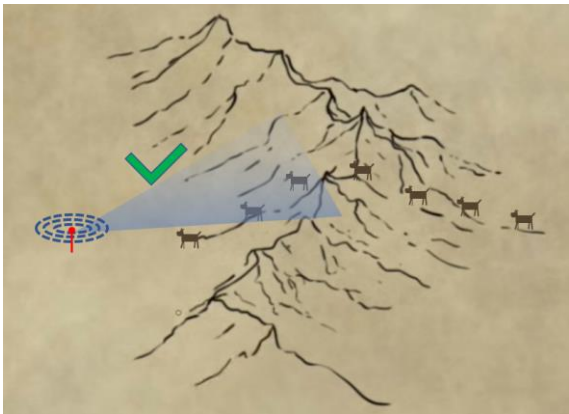


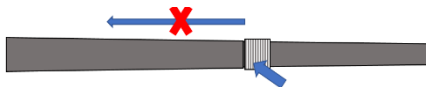
Figure 11 Pass and trails monitoring - proper configuration.



Figure 12 Pass and trails monitoring - not proper configuration.

Installing the base station on the mast

- Attach the antenna to the top of mast with the U-Bolt clamp. When dedicated telescopic pole is used be careful - over-tightening may crush the tube.
- Protect all plugs, connectors and cables (*Connectors and plugs protection*).
- Use the duct tape to protect all section connections of the telescopic pole against accidental folding down.
- Insert the bottom of the mast to the hole in the ground or between stones and use guy wires to stabilize it



well.

- Adjust direction of the antenna.
- Make sure - with laptop and Tracker application - that base station works well, and check communication with loggers placed in expected study area.
- Connect the base station to the power source and protect well against water.
- When the antenna mast is high or there are reasons to place the power source somewhere hidden, use the USB extension cable. Usually it is also possible to download data with 5-10m long extension cable – it helps in a very bad weather conditions, when you have to hide yourself and your laptop in cavity or behind the rock.
- Remember that many species may damage any instruments which are left in the field. Polar foxes, rats, raccoons etc. can chew the cables; polar bear, buffalo, monkey - can damage the installation completely. Try to prevent such problems.

Hand operated base station.

This method is not recommended for animals which come back regularly to the same spots like to the nest, roost places, water holes etc. Continuously working base station saves downloaded data from logger each time the animal is in the range. When downloading the data manually and only occasionally, when the logger will be lost or animal will die, all data since previous download will be lost.

The base station with directional antenna can be hand operated when it is necessary. For easier operating use a short pole as a handle, the battery grip can be used as a handle as well.

The base station can be powered from the battery grip or connected to the laptop. When connected to the laptop it is possible to control the base station work in the Tracker program, *checking if the downloaded data are complete, recognizing which logger was detected,... as well it enables to hear the alert sounds.*

Be prepared for laptop battery recharging when you plan many hours of tracking.

Advices and good practice

Before leaving to the field work, especially before expeditions to remote regions where the internet access will be a problem, prepare and check the equipment very well:

- Check compatibility of PC/Tracker/base station.
- Check all upgrades available for your equipment.
- Make sure that you can use the equipment without any problems or doubts.
- Check downloading ranges, logger's functioning, data download, settings change etc.
- Prepare settings sets for your loggers which you plan to use. When it is your first research season with our GPS telemetry - **contact us to discuss the chosen settings.**
- If possible take a spare base station as a backup, in case damage or lose of the main base station.

Before leaving the base station for unattended operating, check:

- if all plugs are waterproofed and all cables are wind protected;
- the stability of the base station pole;
- if the power source will be sufficient for planned work period;
- the group mode settings - all logger's groups have to be included;
- the downloading distance – make sure that all loggers will be close enough to download data;
- there are no conflicts with another base station which may work nearby.