Ground Station – tracking antenna servo calibration

for Pitlab&Zbig 180/180 degree tracking antenna

Pitlab antenna

Figure 1 Tracking antenna pointing north and 45 degree up.

Pitlab&Zbig tracking antenna uses two 180 degree rotation servos to cover all directions above ground level. For antenna we recommend standard size servos with metal gear and ball bearing.

Note: not all servos are capable of 180 degree rotation. Some servos marked by manufacturer as "180 degree" can achieve this range with standard PPM pulse range from 1 to 2 miliseconds. Some other servos are marked by manufacturer as standard 120 degree (+/- 60 degree), but they can reach 180 degree with extended PPM pulse length, e.g. HK12K or MG966R servos.

Other servos need some modification - usually soldering two additional resistors inside servo (e.g. BlueBird 660MG+BB http://www.bigaj.com.pl/fpvsystem/?page_id=159)

NOTE: Ground station do not provide power supply for servos, and external UBEC for servos is necessary. It must be switching regulator, capable of delivering at least 2A current (3-5A for heavy antennas).

External UBEC should be mounted close to servos. It is especially important when tracking antenna is connected to ground station with long wires.

Video receiver (VRx) is usually mounted close to tracking antenna. In this case it is important to provide separate ground wires and power supply for servos and for video receiver. There wires cannot be tied together on antenna side to avoid noises and stripes on video signal (these wires may be tied together only on Ground Station side)

Good for servo/receiver connection purposes is VGA cable (for PC monitors), cheap and available in various length. It has two D-Sub connectors and internally 3 shielded wires e.g. for audio/video signals and several unshielded wires for supply and servo PPM signals.

Heave antennas may have counterweight which reduces servo payload, current consumption and internal servo heating.

Selecting 180/180 degree antenna type

Ground station with firmware v2.60 or later supports two types of antenna:

-Pitlab&Zbig 180/180 degree antenna (described in this tutorial)

-Third party 360/90 degree antenna

To choose/verify proper antenna type open setting page and check text on [type ….] button, showing current selection. It may be [Type 180/180] or [Type 360/90]. To change type just press button and its text changes according to current settings.
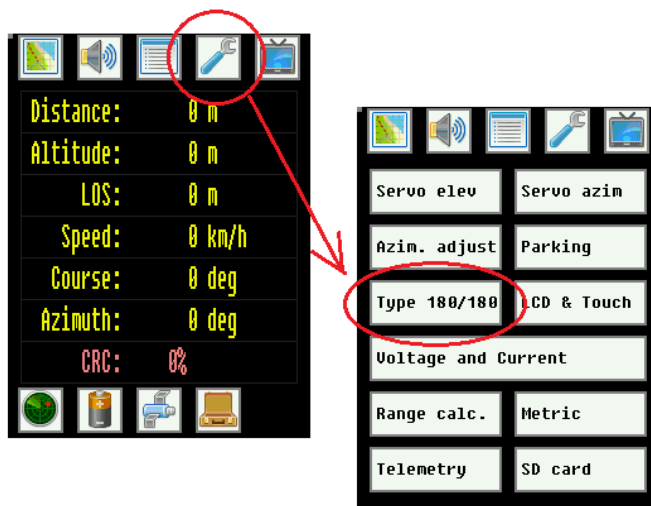

Figure 2 Setting antenna type

Azimuth servo

Azimuth servo controls antenna direction by rotating it left or right. Proper servo calibration includes:

-setting proper leftmost (west, counter clockwise CCW or -90 degree) position

-setting proper rightmost (east, clockwise CW or +90 degree) position

-adjusting zero (north, 0 degree) position

Note: during azimuth servo adjustment, elevation servo is set to its neutral position (antenna points up), but until elevation servo is not properly adjusted, its position may be different (random)

Position left-west

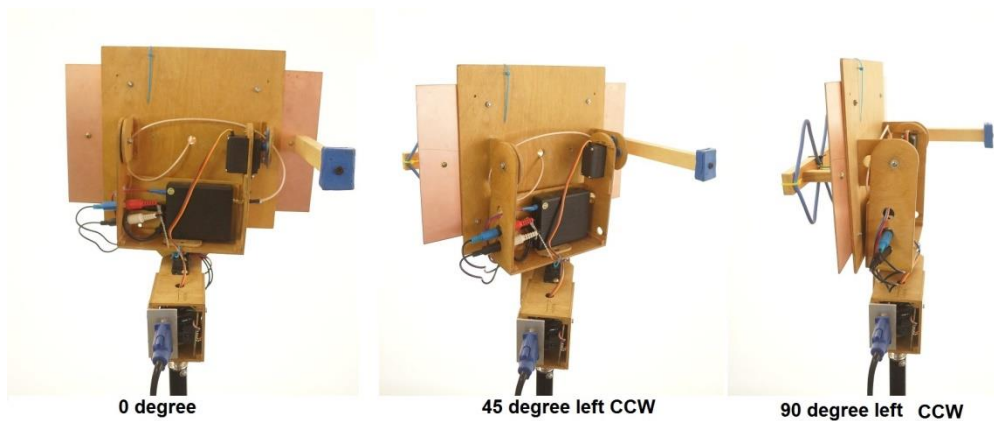In this position azimuth servo rotates 90 degree to the left or counter clockwise.

0 degree   45 degree left CCW   90 degree left CCW

Figure 3 Azimuth servo in different positions

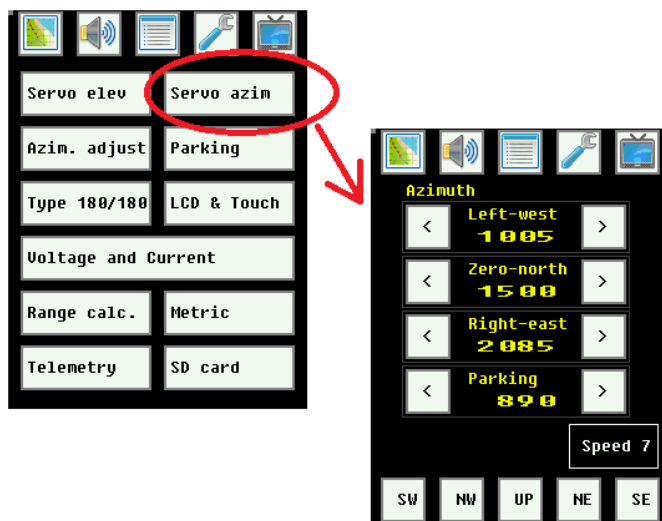To adjust this position open [Servo azim] settings

Figure 4 azimuth servo adjust page

Use buttons < or > in "Left-west" row, to adjust leftmost (90 degree CCW) servo position.

Figure 5 Adjust azimuth servo 90 deg CCW position

NOTE: if servo starts shaking in leftmost position you may need to change servo arm position.

Position right-east

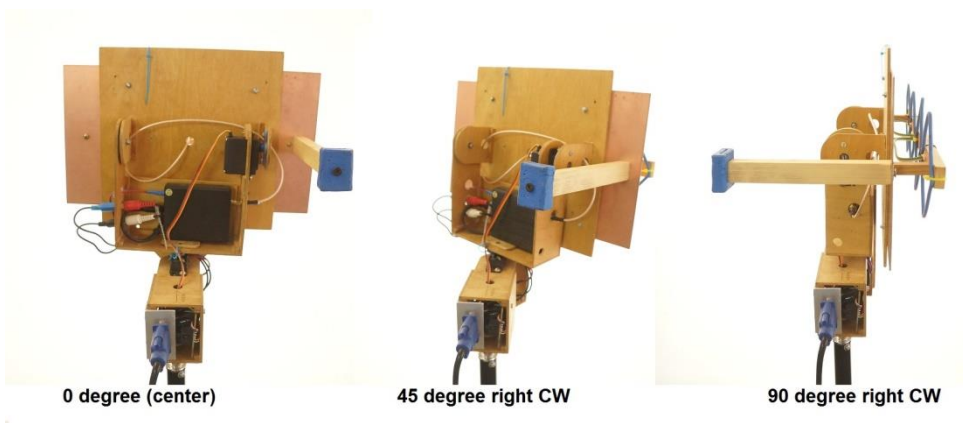In this position azimuth servo rotates 90 degree to the right or clockwise.

0 degree (center)   45 degree right CW   90 degree right CW

Figure 6 Different azimuth servo positions

To adjust adjust rightmost (90 degree CW) position open [Servo azim] settings and use buttons

< or **>** in "Right-east" row.

Figure 7 Adjust azimuth servo 90 deg CW position

NOTE: if servo starts shaking in leftmost position you may need to change servo arm position.

Azimuth center position

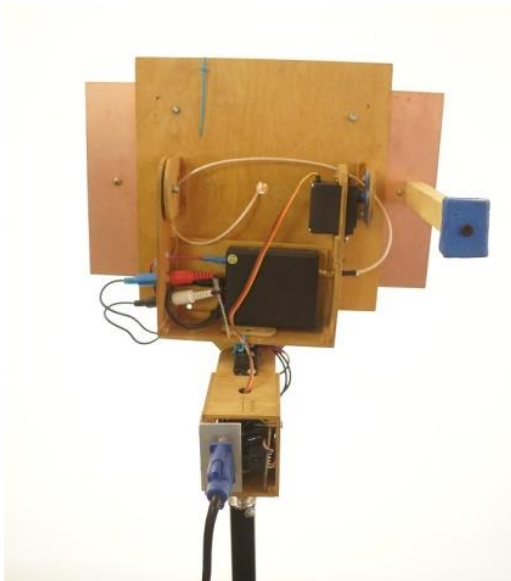This option sets (adjusts) servo center position to increase antenna positioning accuracy.

Figure 8 Azimuth servo in center (zero) position

To adjust center (zero) position open [Servo azim] settings and use buttons **<** or **>** in "Zero-north" row.

Figure 9 Azimuth servo zero adjustment

Elevation servo

Elevation servo controls antenna direction by moving it up and down. Proper servo calibration includes:

-setting proper forward (north) position

-setting proper backward (south) position

-adjusting zero (up) position

Note: during elevation servo adjustment, azimuth servo is set to its neutral position, but until elevation servo is not properly adjusted, its position may be different (random). We recommend to adjust azimuth servo first.

Position "forward"

In this position azimuth servo rotates 90 degree clockwise and points antenna horizontally and to the north (if azimuth servo is neutral).
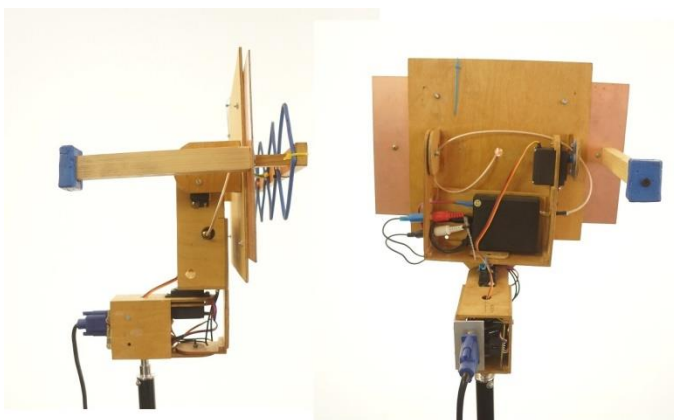

Figure 10 Elevation servo in forward position

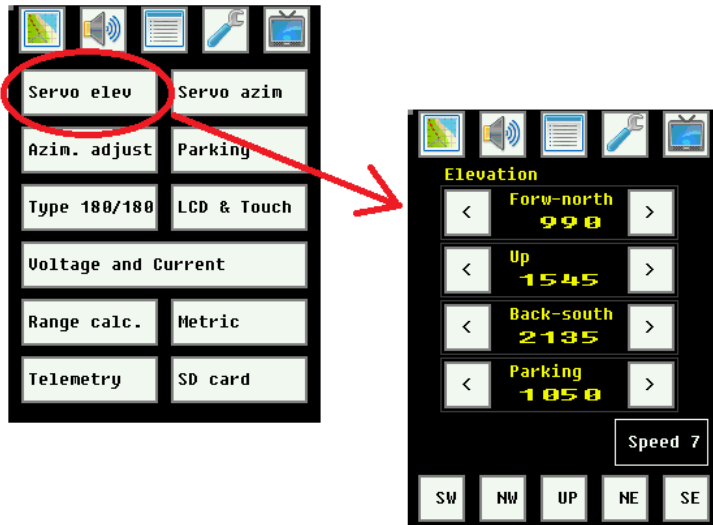To adjust this position open [Servo elev] settings

Figure 11 Elevation servo adjust page

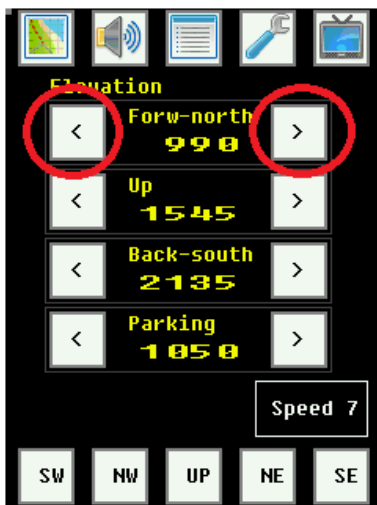Use buttons **<** or **>** in "Forw-north" row, to adjust forward (90 degree CW) servo position.

Figure 11 Adjust elevation servo forward position

NOTE: if servo starts shaking in forward position you may need to change servo arm position.

Position "backward"

In this position azimuth servo rotates 90 degree counter clockwise and points antenna horizontally and south (if azimuth servo is centered).

Figure 12 Elevation servo backward position

To adjust backward (90 degree CCW) position open [Servo elev] settings and use buttons **<**   or **>** in "Right-back-south" row.

Figure 13 Adjust elevation backward position

NOTE: if servo starts shaking in backward position you may need to change servo arm position.

elevation center position

This option sets (adjusts) servo center position (up) to increase antenna positioning accuracy.

Figure 14 Elevation servo in center (up) position

To adjust center (zero or up) position open [Servo elev] settings and use buttons **<** or **>** in "Zero" row.
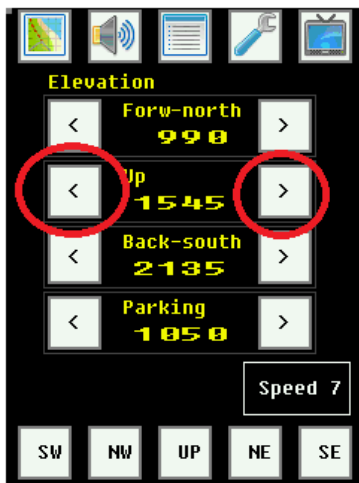

Figure 15 Elevation servo zero adjustment

Setting parking position

Parking position is a special azimuth and elevation servo position, safe for transportation. Defining this position may be useful for long or heavy antennas and when manual rotating servo to proper position is difficult or impossible.

To adjust parking position open [Servo elev] or [servo azim] settings and use buttons **<** or **>** in "Parking" row.

Setting servo speed

When tracking antenna is carrying heavy directional antenna (e.g. Yagi or grid) full servo speed may cause unexpected shaking of antenna mount (tripod) and produces high forces on servo gears. Ground station allows to set reduced servo speed. Special algorithm not only reduces speed but also implements accelerating – servo starts with low speed and then gradually increases speed. This same applies at the end of movement, when GS gradually decreases speed when servo ends movement.

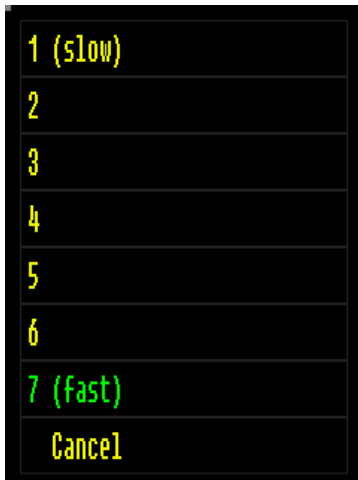Speed setting is common for both servos (azimuth and elevation).

Figure 106 Servo speed settings

Testing antenna

After both elevation and azimuth servos are properly calibrated you may test antenna positioning. At the bottom on both azimuth and elevation settings page there are five buttons which sets antenna to predefined positions:

[SW] – antenna is pointing south-west and 45 degree up

[NW] – antenna is pointing north-west and 45 degree up

[SW] – antenna is pointing south-west and 45 degree up

[UP] – antenna is pointing up.

[NE] – antenna is pointing north-east and 45 degree up

[SE] – antenna is pointing south-east and 45 degree up