PRIMALUCE LAB

SPIDER 230C



INSTALLATION & MAINTENANCE MANUAL

Version 2.0 - update 26/11/2024

This instrument is made by PrimaLuceLab SpA, via Roveredo 20/b, 33170 Pordenone (Italy). For any questions concerning product use, support and warranty information, please refer to the addresses given in the relevant documents.

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CAUTION

To avoid the danger of electric shock and malfunction, do not expose the radio telescope (in particular the mount and the receiver) to rain, snow or moisture. The electronics are not waterproof so in the possibility of bad weather conditions with rain, snow or similar, it is required to keep the instrument closed and covered with a special waterproof cover.

Do not use the radio telescope in case of strong winds (above 25 km/h - 15mph) to prevent unwanted movement of the antenna, damage to support system, handling equipment and antenna. If the wind speed exceeds 25 km/h - 15mph, please keep the radio telescope pointed towards the vertical (zenith) and enclosed in a special protective structure.

WARNINGS

If handled improperly, the radio telescope can be damaged, then please follow the instructions below:

- Do not disassemble the closed radio telescope components such as equatorial mount or receiver
- Do not open or subject to damage shock or excessive shock any electronic parts. For example, do not drop the receiver or other elements.
- Do not short circuit the electronic elements
- Do not expose the instrument to extreme temperatures, above 50°C
- Do not incinerate or dispose in fire any component of the radio telescope
- Do not allow any electrical or electronic part of the radio telescope to get wet
- Do not bend, change or force any mechanical part of the radio telescope

POWER SUPPLY: The SPIDER 230C radio telescope has components that require an external power supply: mount and receiver. Do not get wet, open or modify the power supply supplied with the instrument. Immediately unplug the power supply if there is any malfunction.

DO NOT PROCEED WITHOUT READING THIS:

1) **SPIDER 230C radio telescope is designed to be used under the sky and it can't be used inside (for example inside a building) since radio waves can't pass through metal or other materials used in building construction.**
2) **SPIDER 230C radio telescope is a large and heavy instrument: if improperly handled it may hurt you during use or installation. Please perform the installation with the help of at least 2 persons (3 persons in total are requested for the installation). If you feel uncomfortable with any step of the installation or the use of the radio telescope, please do not proceed and contact us to ask for an help.**
3) **Take care during radio telescope operation. Do not stay close to the radio telescope and/or do not use the radio telescope when people are close to it (less than 2 meters - 6.5 feet). During the movement of the antenna, the radio telescope may touch people if they're too close to the radio telescope.**
4) **Note on Radio Frequency Interferences: SPIDER is designed to record frequencies from 1395 MHz to 1445 MHz. In order to allow proper capture radio waves of natural origin coming from space, the installation location must be free of any radio frequency interferences. PrimaLuceLab cannot be held responsible of any radio interference that may be captured by the SPIDER radio telescope.**
5) **SPIDER radio telescope is composed by many metal parts, also large and/or heavy: please take care during installation and use if you have to use/install/move parts. We suggest you to wear protective gloves.**

Parts identification

The numbers indicate the name of the component listed below.



Verification of components supplied

Check for the presence of all the components required from the order. The included accessories and parts may vary depending on the order.

1



4 quarters of parabolic antenna

Support device for equatorial mounts 2



3 Receiver

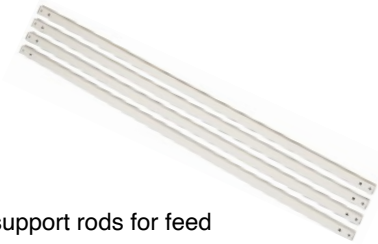


4



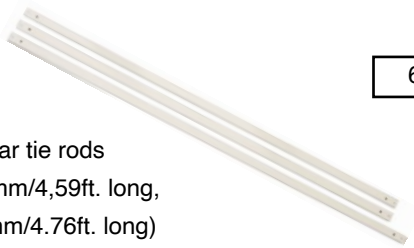
2 x 10 Kg counterweights for Declination axis

5



4 support rods for feed (1214mm/3,98ft. long)

6



3 rear tie rods (2x1379mm/4,59ft. long, 1x1452mm/4.76ft. long)

7



3 pairs of support plates with 5 holes each

8



1 pair of support plates with 3 holes each

9



Feed with support

LNA protective case with coax cables (length varies based on order)

10



11



4 spacers



12

LNA units

13



Equatorial mount with tripod (if ordered)



14

2 x 10 Kg counterweights for Right Ascension axis (only if also the mount is ordered)

15

Front support disk



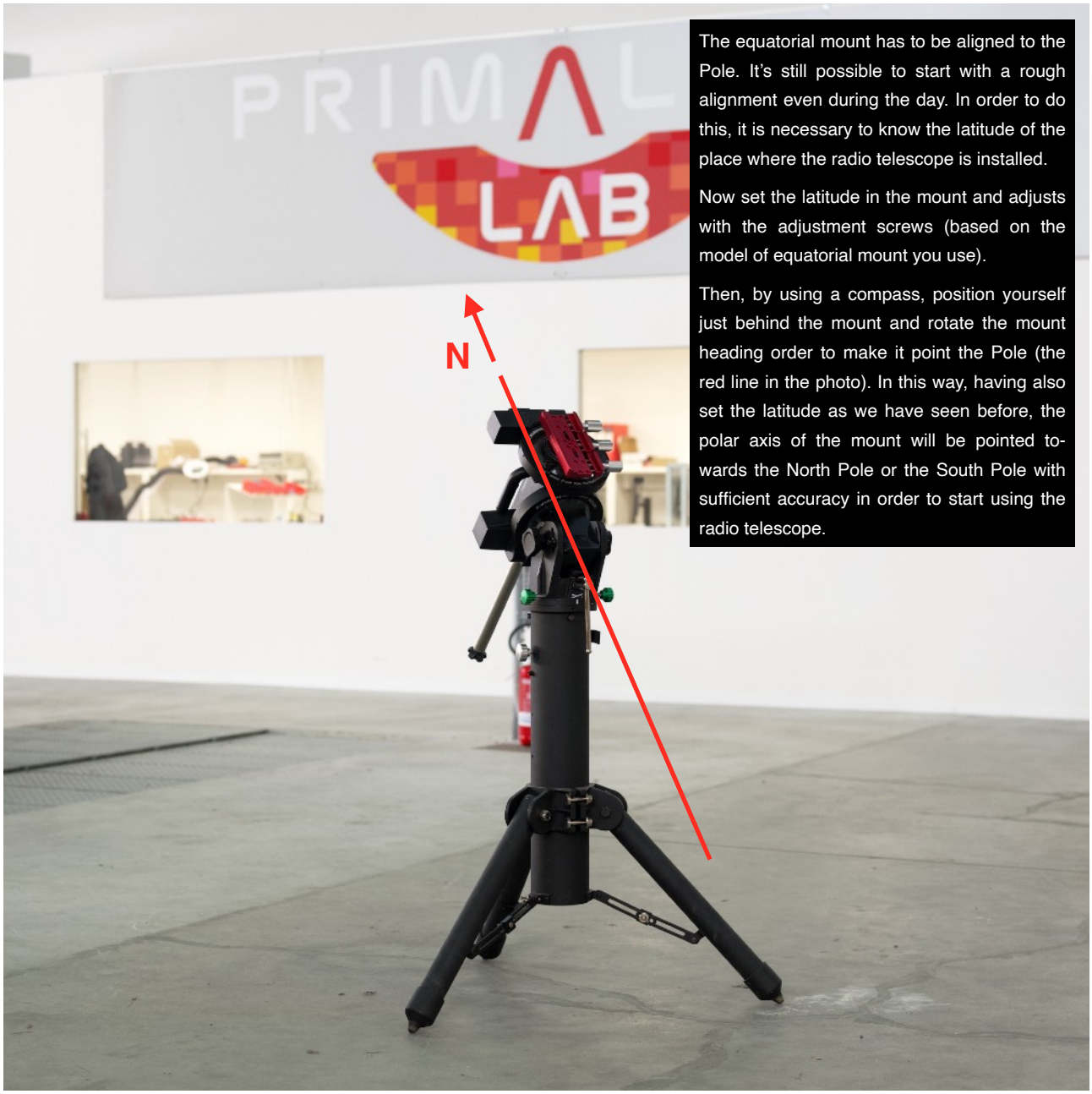
16

Various screws with washers and nuts:

- n.20 M6x55
- n.28 M6x45
- n.8 M6x35
- n.4 M8x25
- n.4 plastic cable ties

First use: prepare the mount

SPIDER 230C is the 2.3 meter diameter radio telescope designed to let you use an equatorial-type mount (that usually are used with optical telescopes) that must have at least 50kg (110 pounds) of payload capacity, a Losmandy style dovetail clamp, 2 10kg (22 pounds) counterweights, an ASCOM 6 driver for computer connection and a field tripod with a central pier. Based on the equatorial mount you have, please follow the instructions provided by mount manufacturer in order to install the mount in the field and have it aligned to the North Pole if you're in the Northern hemisphere (like in the example picture below) or to the South Pole if you're in the Southern hemisphere.



The equatorial mount has to be aligned to the Pole. It's still possible to start with a rough alignment even during the day. In order to do this, it is necessary to know the latitude of the place where the radio telescope is installed.

Now set the latitude in the mount and adjusts with the adjustment screws (based on the model of equatorial mount you use).

Then, by using a compass, position yourself just behind the mount and rotate the mount heading order to make it point the Pole (the red line in the photo). In this way, having also set the latitude as we have seen before, the polar axis of the mount will be pointed towards the North Pole or the South Pole with sufficient accuracy in order to start using the radio telescope.

At this stage, the mount has to have the counterweight bar installed and it has to be set in the so-called *HOME* position (with counterweight bar pointing down) and the dovetail clamp pointing the Pole.



Please make sure that the 2 clutches (the one for Right Ascension and the one for Declination) are closed and that the axis are no longer free to move.

Install the two 10Kg counterweights (**14**) onto the counterweight shaft of the mount and lock them into position with the proper locking screws (note: make sure they are locked and they do not move when you leave the counterweights).

NOTE

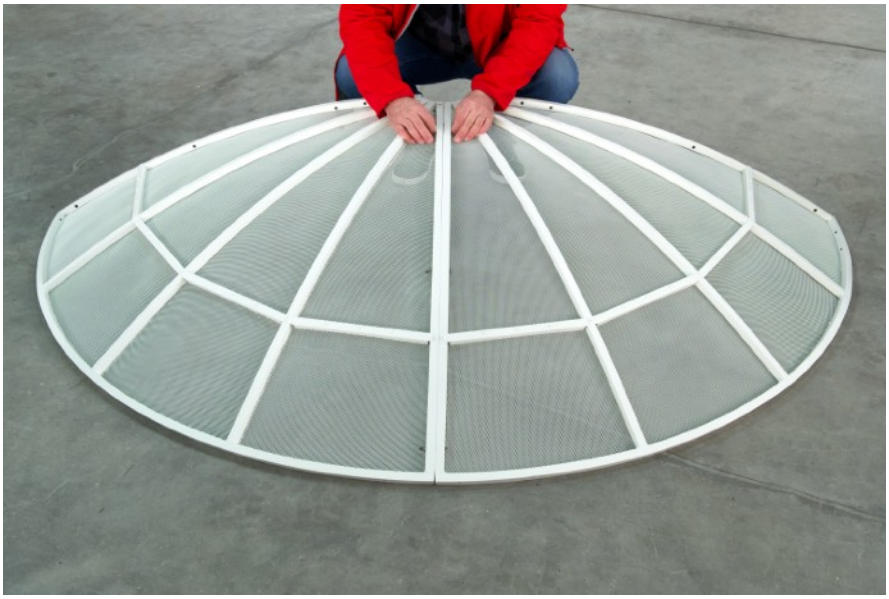
Please note that, when the antenna will be installed, the Support device for equatorial mounts (**2**) may touch the tripod when the antenna will be pointed towards the Zenith. In order to avoid this, your mount has to have an extension (like the one you see in the picture) in order to have the mount head more distant from the bottom tripod. Since there are many tripods in the market, you may have different solutions. We suggest you a tripod like the one you see in the picture or a pier for concrete base.

Installation: install the antenna

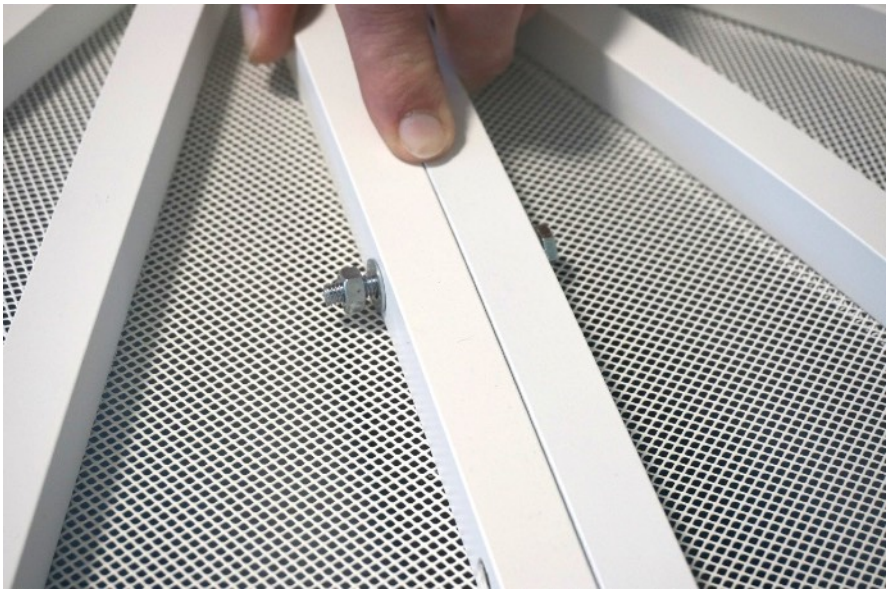
SPIDER 230C comes with a parabolic antenna that consists of 4 sections (quarter of parabola - **1**). First of all you need to build the reflector (primary reflector): put on a plane the four quarters and push them together two by two, as in the photo below.



Then use the 16 M6x55 screws with 1 nut and 2 washers each to tie together two quarters of the parabolic antenna, inserting them into the holes (4 on each side of the ray). Cap the bolts with nuts but do not tighten them all the way, you will need to do this later.



WIth the fasteners somewhat loose, make sure that the two coupled quarters mate/align as closely as possible, avoiding small steps between one and the other in the forward facing part of parabolic antenna (to allow for a better parabolic shape).



Next, join the two halves of the parabolic antenna.





Tighten first the two top screws for each half (the outer ones - photo below). As before, use the screws with bolts but do not tighten completely, it will be necessary to tighten them later.



Next, raise the parabolic antenna and insert and tighten the screws in the two holes for each ray to the center of the antenna.

Now take the support device for equatorial mounts (**2**) of the parabolic antenna. It's already preassembled with the connecting plate for the antenna. Unscrew the two screws on the bottom plate by removing the end of the bar.

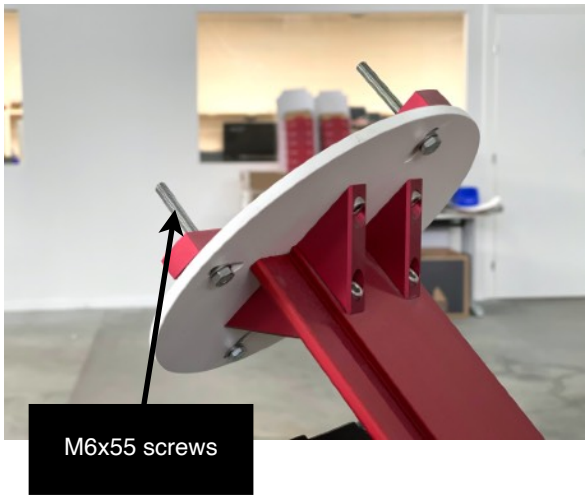


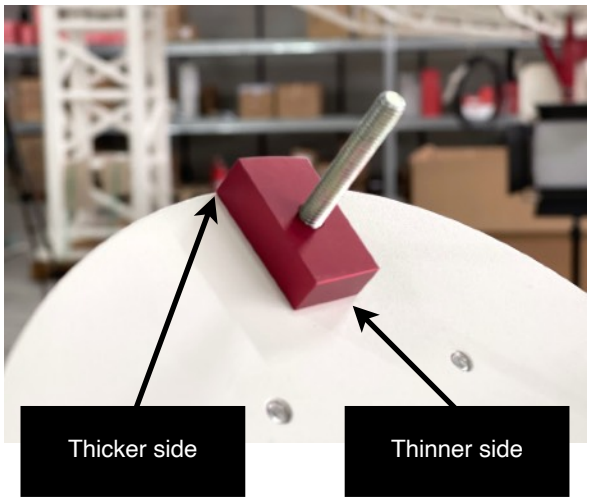


The *support device for equatorial mounts* has to be set at a precise height among the mount's dovetail clamp. It has to be as low as possible but, at the same time, it needs to not touch any part of the mount head if you loose the Declination movement clutch and you rotate the support device for equatorial mounts.

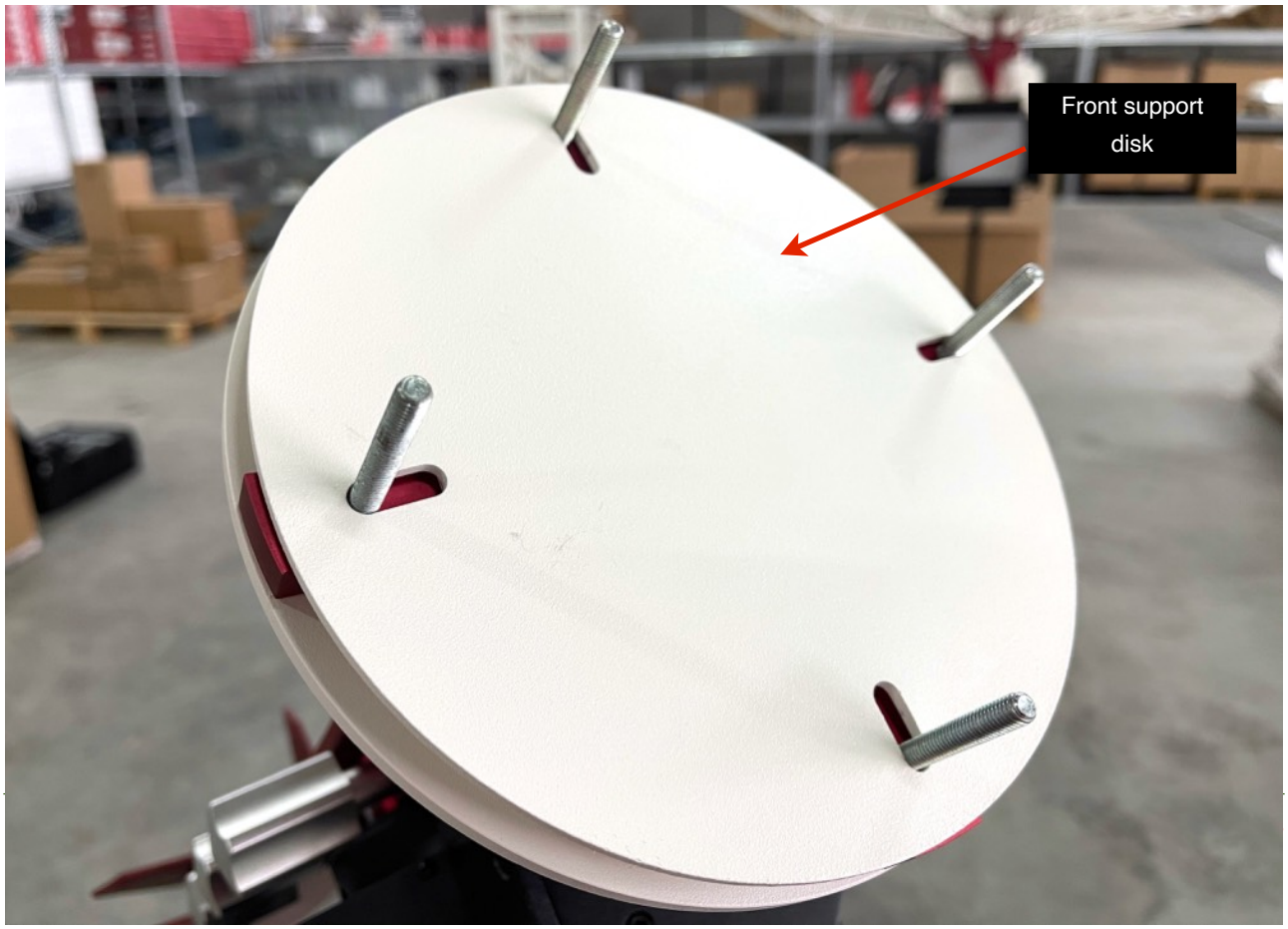
Next, place the support device for equatorial mounts onto the upper part of mount head and affix it to the mount with the locking knob(s).

Insert the 4 M6x55 screws into the front disc and attach by screwing, as in the image below, the 4 spacers (**11** - one for each screw). The spacers have a variable thickness with one side less thick than the other; this thin edge goes toward the center of the support disc (fitting the shape of the parabolic reflector). Do not tighten all the screws of the spacers but leave them slightly loose to allow you to move the screw along the slot of the circular plate (used to attach the plate to the antenna more easily).





To help adjust the position of the 4 screws just inserted (to affix the spacers) sliding them in the slot, you can insert the front support disk (**15**) onto the screws until they pass through the holes of the disc. Then remove the front support disk.





Now proceed with the parabolic reflector installation. This procedure must be done at least by 2 people. Carefully lift the entire reflector, making sure not to damage the parabolic dish itself, place it right in front of 4 spacers that you have previously installed. Match the 4 central holes (90° apart) with the 4 screws and pull down until the reflector touches the 4 spacers. **Due to the large size of the parabolic antenna, this step may be difficult: execute it carefully helping the insertion of the reflector impressing small vibrations.**





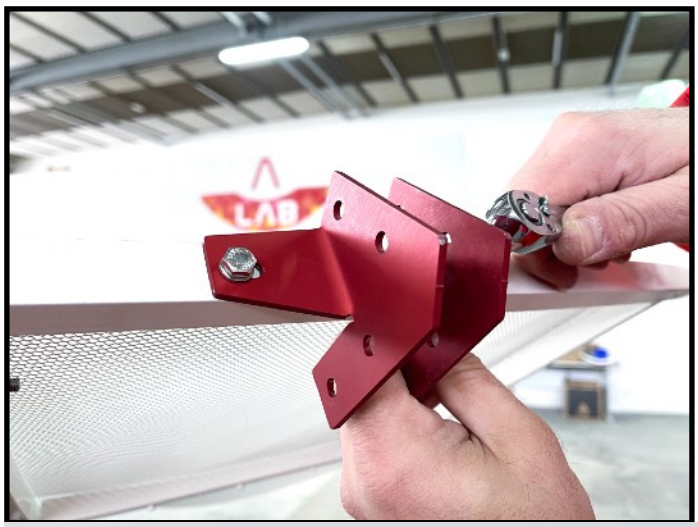
Next, loosen the declination clutches and rotate the antenna 90 degrees (taking care because at this moment the antenna is not fixed on the mount support so avoid it coming free from the screws) until it gently touches the ground.



Take the front support disk (**15**) and put it on the 4 screws fixing it with 4 bolts (1 for each screw) and 4 washers (one for each screw). The antenna is now fixed on the support.



Loosen the two mount clutches (the ones of Right Ascension and Declination) and point the antenna to the vertical (the parabolic antenna will "look" upwards). **Attention: at this point of installation, the radio telescope is not balanced, so when you open the clutches it tends to move by itself. Proceed with caution and avoid slides moving by itself. Close the clutches making sure that the antenna is stationary.** Now move down the counterweights of Right Ascension axis to better counterbalance the weight of the antenna (no need to be precise, unscrew the locking screw of each counterweight, slide along the counterweight bar and lock towards the end of the bar itself by closing the same screw lock).



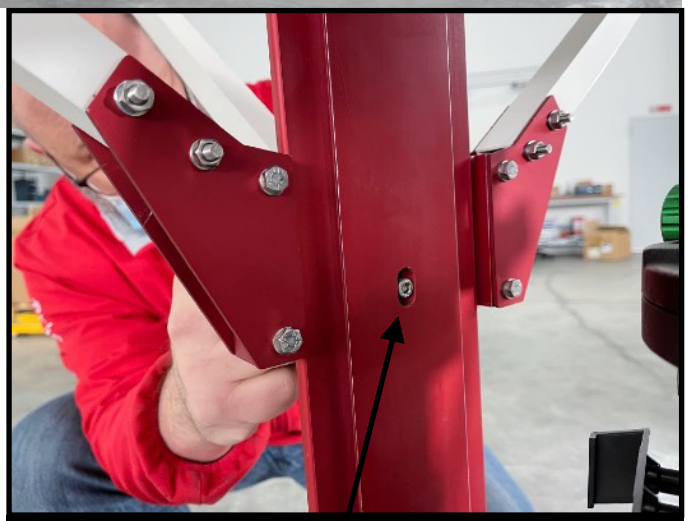
Next, take the 4 support plate pairs: 3 of these have 5 holes each (**7**) and one has 3 holes (**8**). The plates must be fixed on the edge of the reflector, in correspondence of the pairs of holes (there are 4 pairs of holes spaced 10 cm), using for each hole a M6x35 screw with two washers and one nut. The smaller plate is inserted into the holes in correspondence with mount's counterweight shaft.



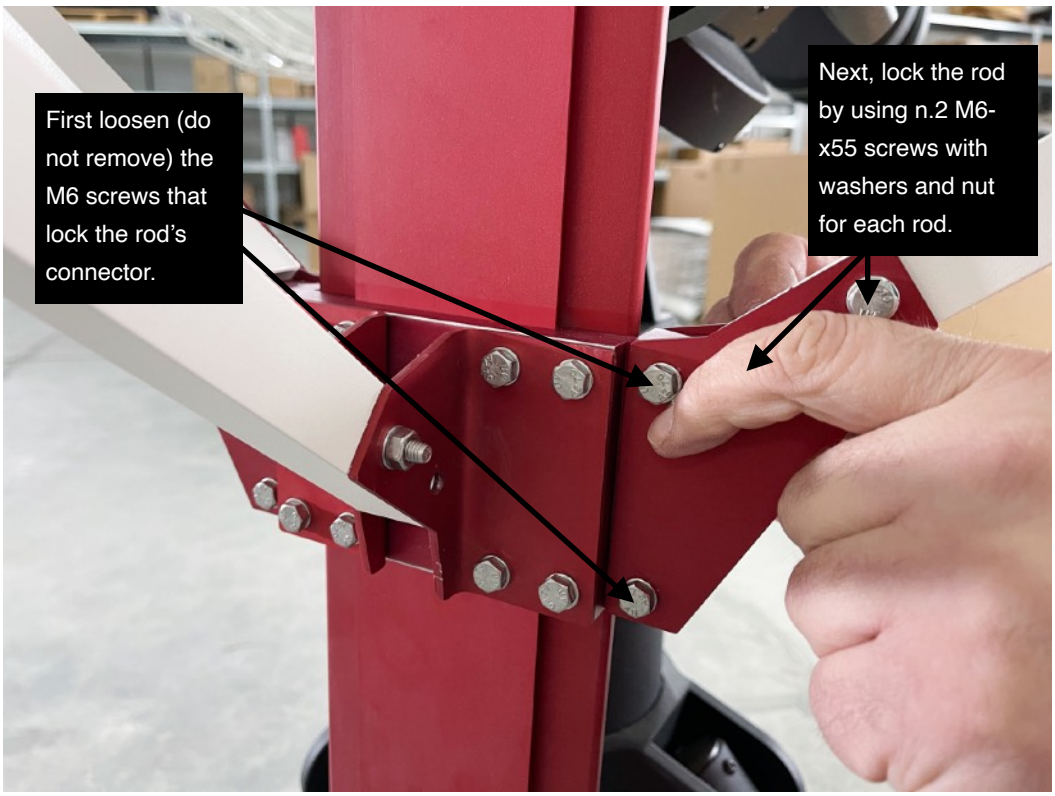


Now take the 3 rear tie rods (**6**) that are used to create the rear support system of the antenna: two are 1379mm/4,59ft long and one is 1452mm/4.76ft. long. The longer rod must be used on the side opposite the counterweight bar, just above the support device for equatorial mounts. The two short rods are to be installed laterally (one to the left and one to the right of the first rod).

Before installing the 3 rods, loose the screw that you can find in the bottom part of the antenna support.



Loosen (and do not remove) the screw that you can find in the bottom part of the antenna support.



In order to correctly insert the rods for the antenna's rear support, first loosen (do not remove) the M6 screws that lock the rod's connector on the antenna support device, then lock the rod by using n.2 M6x45 screws with washers and nut for each rod. Then fix the rod to the support plates with n.2 M6x45 screws.



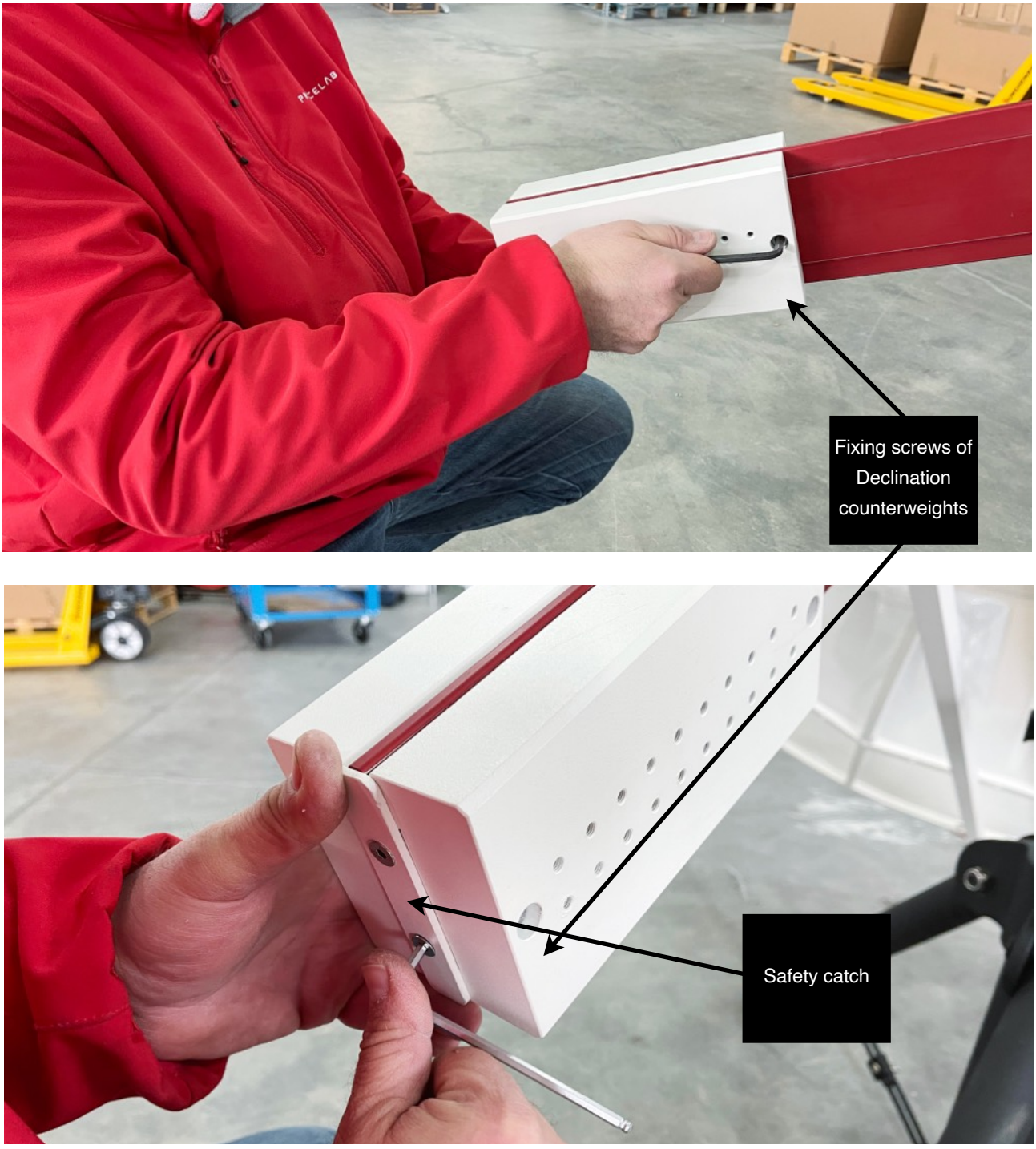


Now take the four support rods for the feed (**5** - all of the same length, 1214mm/3,98ft.) and, using 2 M6x45 screws for each, secure them in front of the parabolic antenna, one for each of the four plates. Tightening the locking screws, 4 rods will remain in place.

Please take care when you install the four feed support rods because, if you let them fall when you're installing them at this stage, they will damage the main antenna reflector.



Now loosen only the clutch knob for the mount's declination axis and point the antenna toward the north. **The reflector will be forward weight-biased because you have not yet installed the counterweights for the declination axis, so be careful when moving. Once in position, close the clutch to hold the reflector in place.** Take the counterweights for Declination axis (**4**) and insert it into the support device for equatorial mounts, as shown in the image. Place it towards the end of the plate, then fix it by using the two M8x25 fixing screws and make sure it does not move.



Then take the safety catch and affix it to the end of the support device for equatorial mounts using two M6-x12 screws.



Now bring the antenna back to the home position and close the clutches to prevent unwanted movements.

In order to fix the dovetail bar in the the correct position in respect to the clamp, fix it as low as possible but, by doing so, please also check that the antenna won't touch the mount when it will move.

Caution: When unscrew the knobs on the mount to shift the dovetail bar, hold firmly the antenna preventing it from falling!



The antenna has to be set in order not to touch the mount when the antenna moves in all the possible directions.



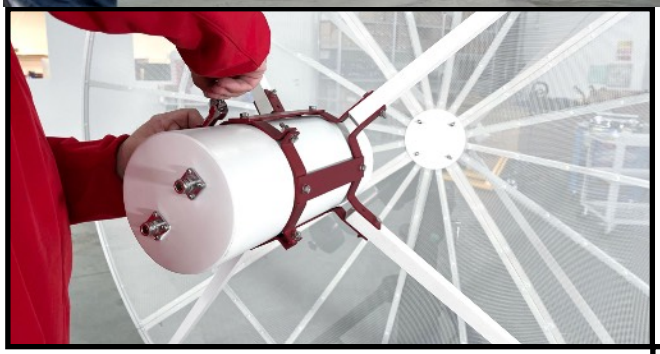
Release the couch of Declination axis and manually rotate Declination 90 degrees until the antenna gently touches the ground, like you see in the picture.

NOTE

When you move the antenna, please keep it firmly because it's still unbalanced. Please take care or the antenna may touch and hurt you it you moves it or it moves itself too at high speed.

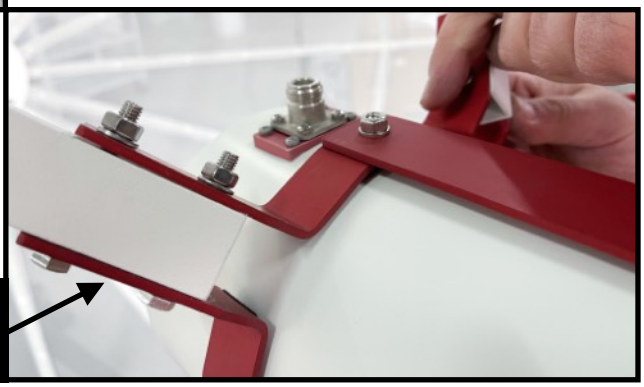


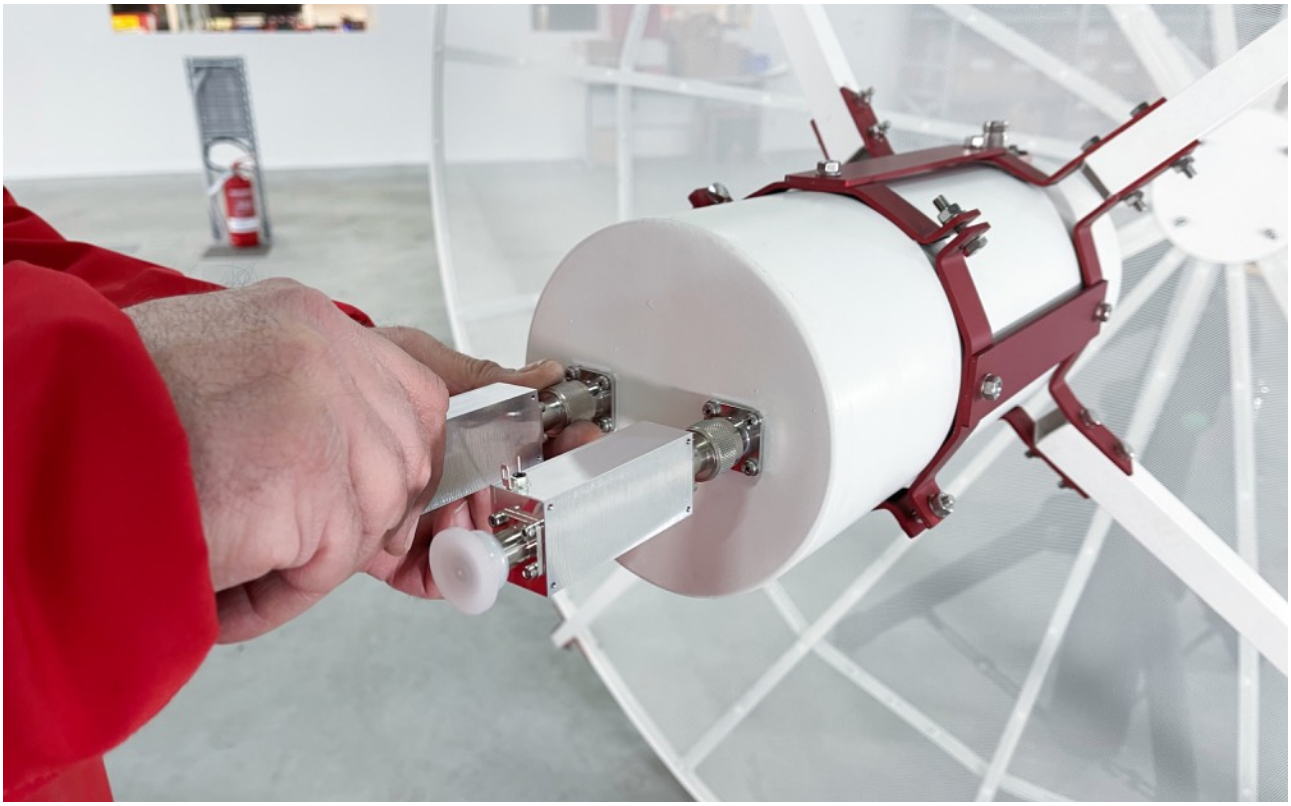
When you install feed in front of antenna, please make sure it's 80cm (31.5 inches) from the "Front support disk" (15).



Now install the feed (**9**) just in front of the antenna. The feed comes with a proper support system that has 4 connectors that allows the connection to the 4 support rods you previously installed.

In order to fix the feed, use n.2 M6x45 screws to connect every connector of the feed support to the 4 support rods.



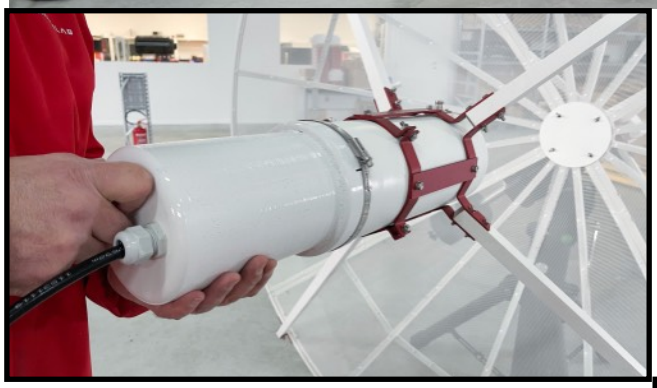


Now connect both LNA units (**12**) to the feed. To do this, connect the female RF IN connector of each LNA to to the male threaded connector of the feed.



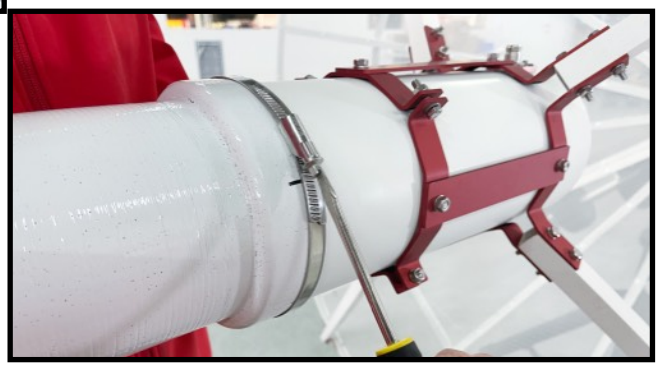
Next, take the LNA protective cap (**10**) that comes pre-installed with the coaxial cables. Connect the female connector of the coaxial cable to the male thread in the RF OUT connector of the LNA units.





By taking care not to pull too much on the connectors or to bend the coaxial cables, affix the LNA protective cap to the feed and close the external protective connectors.

Next, use the metal hose clamp in to attach the LNA protective cap to the feed. Use a screw driver in order to lock the metal hose clamp in position.





Use plastic cable ties to attach the coaxial cable by sliding it along one of the feed horn support rods parallel to the counterweights bar of the mount.

With a pair of scissors you can trim the excess portion of the band that sticks out. Warning: clamp the coaxial cable straight along the rod without kinks or loops.



Fix the coaxial cable along the support rod parallel to counterweights bar.

First use: install RadioUniversePRO software

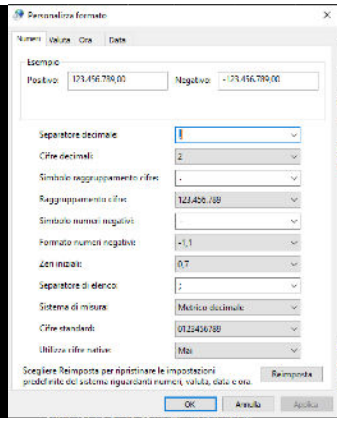
RadioUniversePRO is the software we specifically designed to control SPIDER radio telescopes and acquire radio astronomy data. In order to run RadioUniversePRO, you have to install it on a computer (not provided with the radio telescope) that has to have these minimum specifications:

- Operating system: Windows 10 (suggested: 64 bit version)
- Screen resolution: at least 1920 x 1080
- RAM memory: 4 GB (suggested: 8 GB)
- Processor: i3 (suggested: i5 or i7)

In order to install RadioUniversePRO, double-click on the setup.exe file included with the installation files and follow the guide on the screen in order to complete the installation.

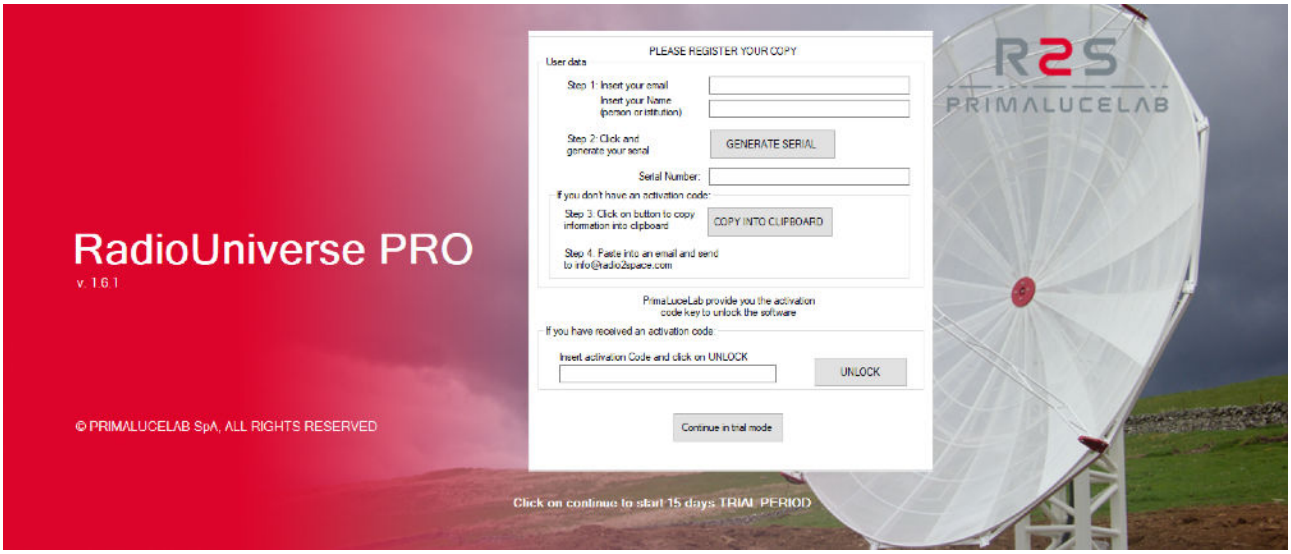
VERY IMPORTANT

When the installation is completed, please use Windows File Manager to access to the installation directory (usually C:\Program Files\RadioUniversePRO), select RadioUniversePRO.exe file, make a mouse right click and check that, under “Compatibility” tab the “Execute as administrator” option is selected
Check for international settings: go to Control Panel, Region and click on Additional Settings. Here check that the “Decimal symbol” is the , (comma) and that the Digit Grouping Symbol is the . (point). Then click OK to confirm.

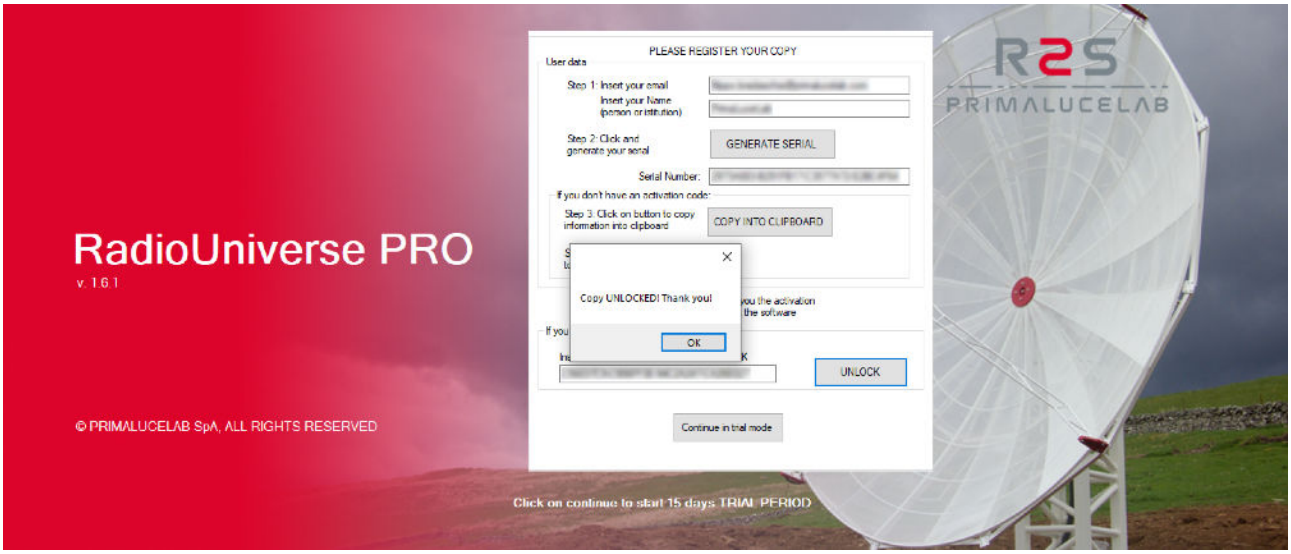


Now you can start RadioUniversePRO software by double clicking on the RadioUniversePRO icon in your computer desktop (or by selecting RadioUniversePRO in Windows START menu), this will open RadioUniversePRO software. When you install RadioUniversePRO software for the first time on a new computer, you will be requested to register the software. Otherwise a trial period will expire in 15 days.

In order to to this, type your email and name in the proper fields (step 1), then click on the GENERATE SERIAL button, this will generate a long code shown in the “Serial Number” field. Please send an email to us at info@radio2space.com with the following information:

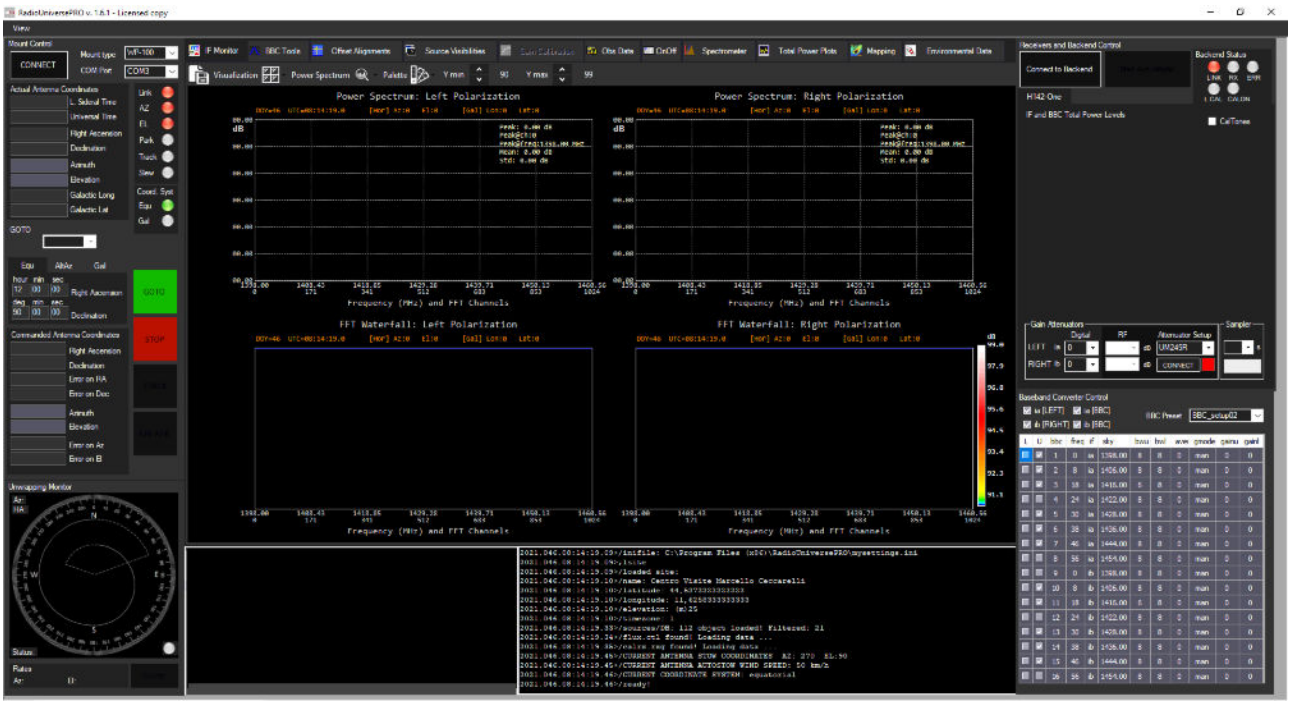


1. email address
2. name
3. serial number



and we will reply to you with the activation code.

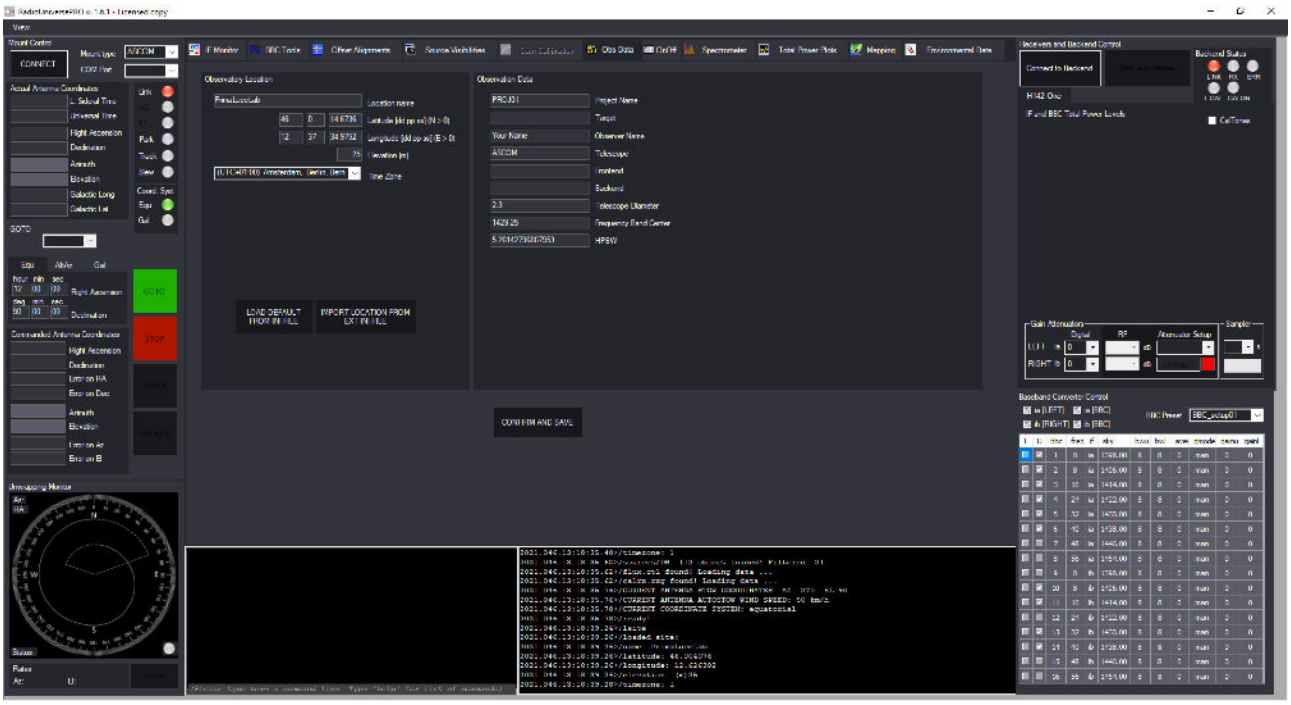
Copy the code into the Activation Code field and press the UNLOCK button. If the code is correct, you will see a notification that confirms the successful activation. Please click on OK button to close the notification and then the CONTINUE button to start RadioUniversePRO software.



Now select the “Obs Data” tab and, in the Observatory Location field, please enter:

- Location name
- Latitude (in dd pp ss format, insert negative value is you’re in Southern hemisphere)
- Longitude (in dd pp ss format, insert negative value if you’re located W instead of E)
- Elevation (in meters)
- Time Zone

To confirm, please click on the button CONFIRM AND SAVE.



First use: connect mount to control room and start remote control

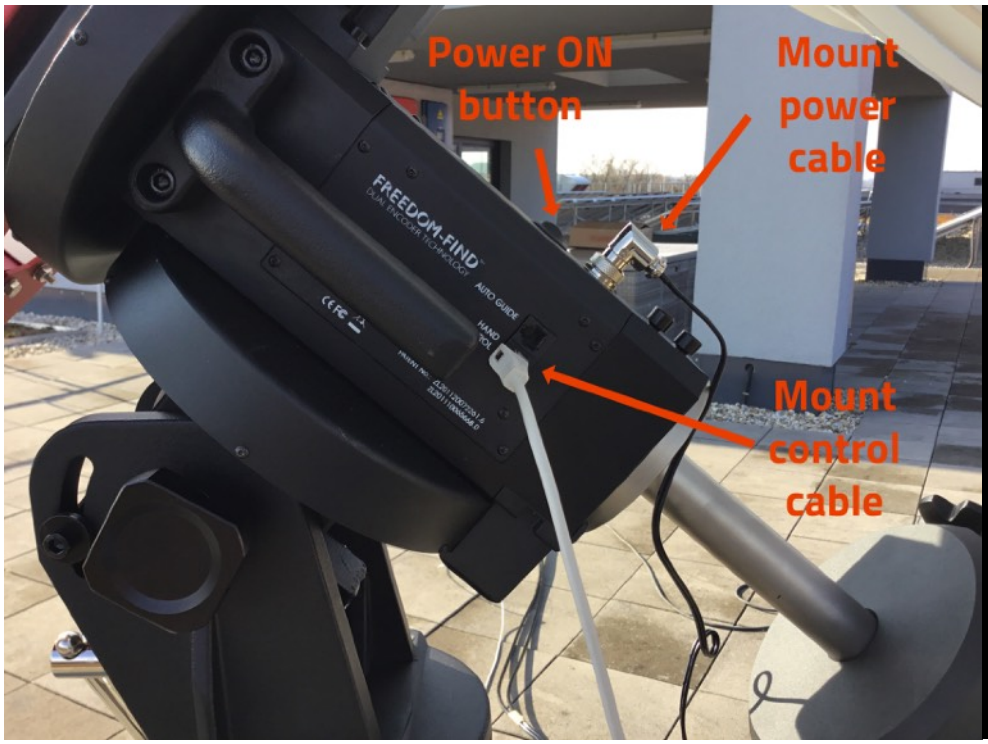
SPIDER 230C radio telescope is designed to use equatorial mounts normally used with optical telescopes. **The following guide has been written by using a SkyWatcher EQ8 mount and, if you have a different mount, this guide may be slightly different but the general concepts of use are the same.**

1) Install the antenna on the mount and, having the mount counterweight shaft pointed to the ground (please refer to the user manual for your mount if you want to know more about counterweights and counterweights shaft), point the antenna to the North direction as precise as possible. If you perform this operation at night time, you can point towards the North Star (if you live in North Hemisphere); if you perform the alignment during day time, you can use the aid of a compass.



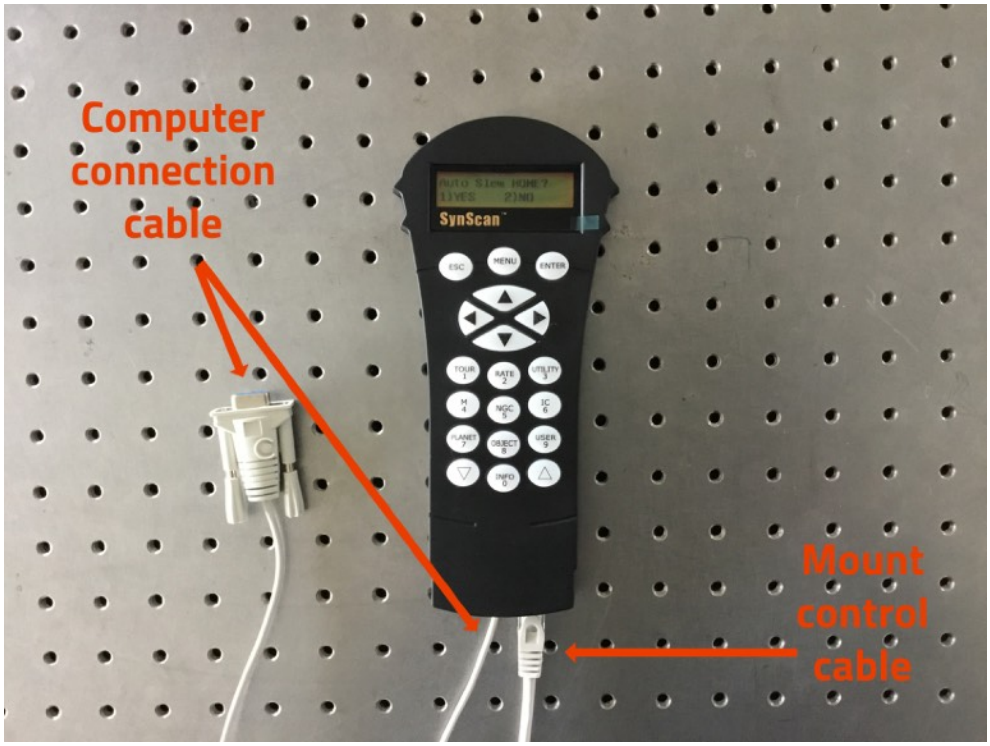
2) Set the mount elevation based on the Latitude of your location. Please use the proper Latitude regulation knob (please refer to the mount user manual if you don't know what is the Latitude regulation knob).

3) Connect the mount to the power cable and then the mount control cable in the proper ports of the mount head, as you can see in the picture below.



Since it's useful to have the mount's hand pad in the control room, close to the control computer, and since the cable connecting hand pad to mount head is usually very short, if you have the SkyWatcher mount (like the one shown in the images) you can replace the standard cable with a longer ethernet cable (that will connect the hand pad to the "Hand control" port in the mount's head.

4) The mount comes with a hand pad that has to be set in the control room, close to the H142-One receiver and the control computer (where you installed RadioUniversePRO control software). Please connect the other side connector of the Mount Control Cable to the rightmost port in the bottom part of the hand pad. Then connect the Computer connection cable to the other port of the hand pad on one side: the same cable has to be connected to a serial RS232 port of your control computer (if you haven't a serial RS232 port, you can use a RS232-to-USB converter, not included standard with the radio telescope).



5) Press the ON button on the mount head.

6) On the hand pad you will read the message "Initializing". If your mount comes with Encoders, after a few seconds, "Auto slew home?", please press button 1 and SPIDER 230C mount will automatically move the antenna until it reaches the HOME position. You see the message "HOME position established", then press ENTER to confirm.

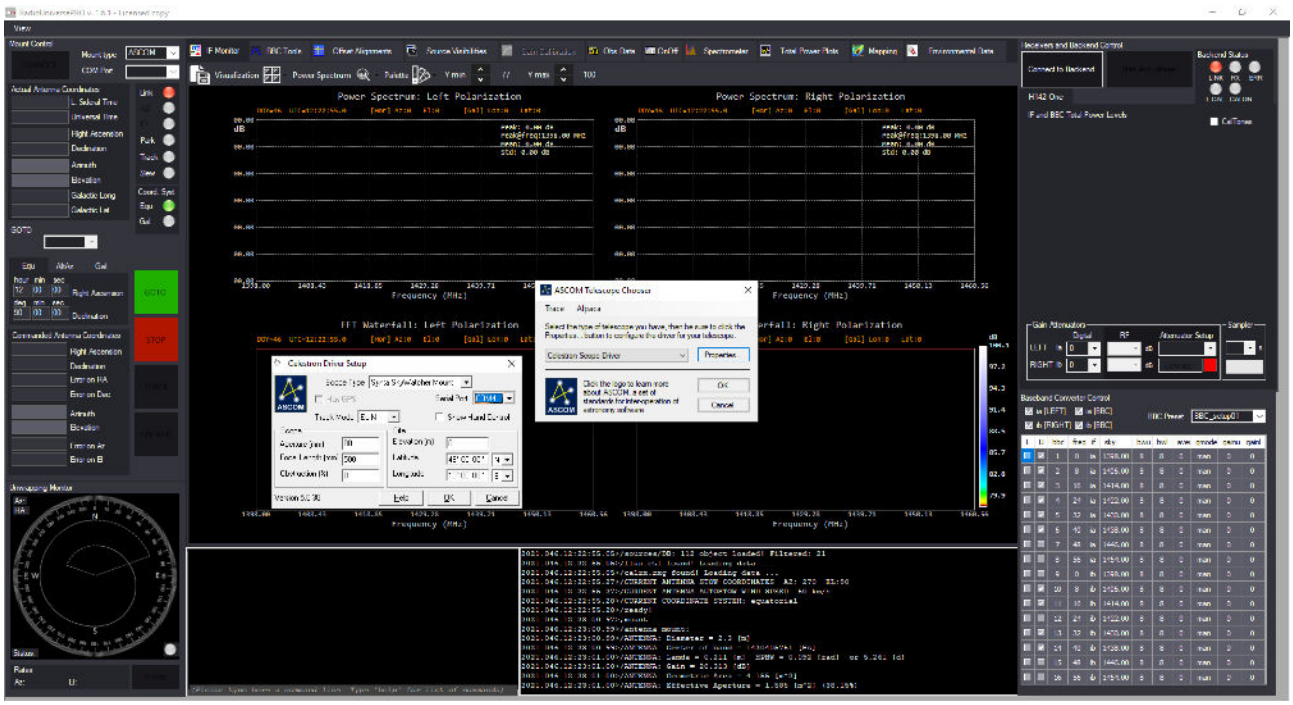
NOTE: what is the Home Position**?**
The equatorial mount that comes with the SPIDER 230C radio telescope needs to be aligned to the North Polar Axis (a point in the sky very close to the North Star) if the observer is in North Hemisphere. If the observer is in the Southern Hemisphere you need to align to the south. When you align the mount to the polar axis, the mount is able to track the objects with a single movement. Polar alignment is a critical factor for an optical telescope but it's less sensitive in case of a radio telescope because of the less precision requested for a radio telescope tracking and goto. But it's always important to align SPIDER 230C mount as close as possible to the North (or South) Pole.

7) A message "Add DEC offset" will appear, press the butt on 2 (NO).

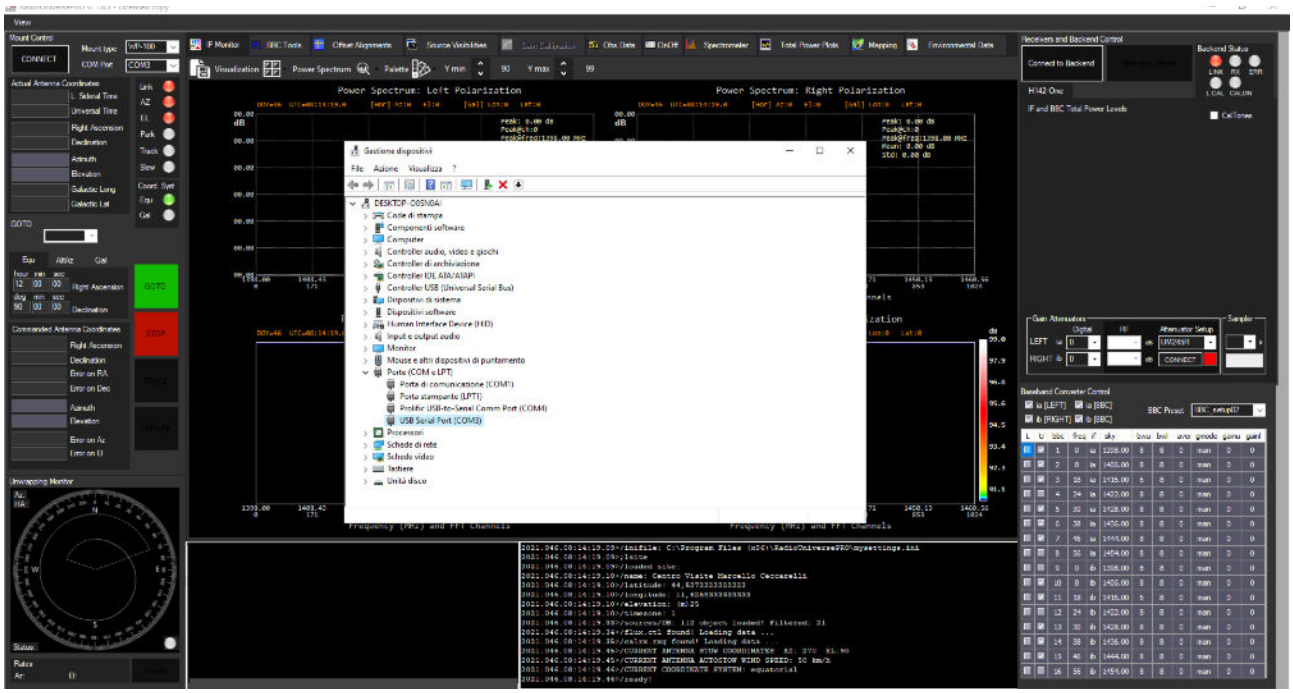
8) The hand pad will request you to insert date (USA format, MM/DD/YEAR) and time. Please enter the requested data and press ENTER to proceed step by step. At the end you will be asked "Begin alignment?", please select "NO" and you will see the "Choose Menu".

9) Now we have to deselect the use of the internal mount encoders (encoders are not needed for the use of the radio telescope). Press the ARROW UP (the lower right button) in hand pad 5 times up to “Auxiliary Encoders” menu, then press ENTER button. With arrow UP or DOWN buttons please select DISABLE, then press ENTER. NOTE: before switching off the radio telescope when you finish using the radio telescope, please remember to activate encoders again or the radio telescope won’t be able to use the AUTO HOME function (and you will have to manually set the radio telescope antenna in HOME position).

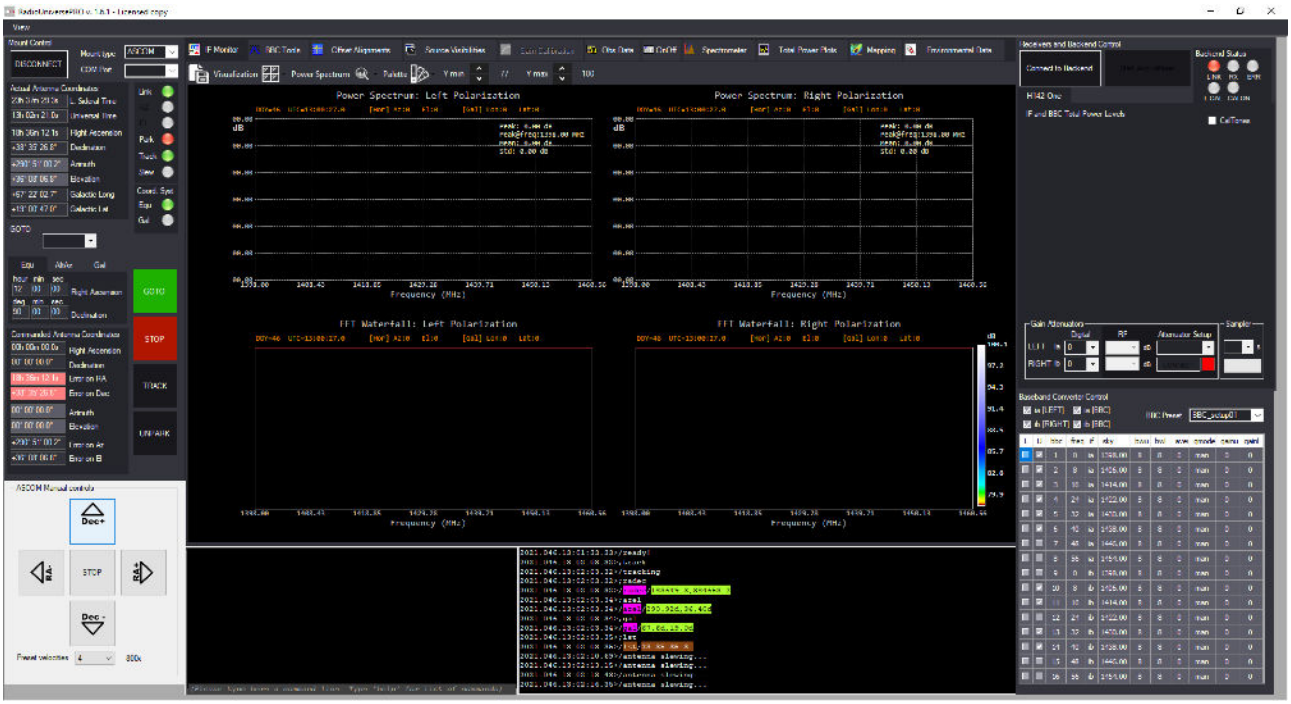
10) SPIDER 230C has to be used with a computerized equatorial mount connected to RadioUniversePRO software by using the ASCOM platform (please remember that, in order to control your EQ mount from RadioUniversePRO software, you have to have “ASCOM Platform” at least version 6.3 installed - https://ascom-standards.org - and the ASCOM driver of your equatorial mount). Select ASCOM in the Mount Type window and then press the Select button. This will open the “ASCOM Telescope Chooser” window, select “SkyWatcher” option, then press Properties button to continue.



11) A new window “ASCOM configuration” will open. Here it’s important to correctly set ASCOM connection parameters to allow RadioUniversePRO to control your EQ mount (please note, at this time your EQ mount has to be powered ON). In Port option, select the proper COM port the connection cable created when you connected the mount cable to the control computer. If you don’t know what is the port number, please go to Windows “Device Manager” and search for “Ports (COM & LPT)” in the list as you can see in the picture below. By plugging and unplugging the mount cable of to the control computer, you will be able to see the device appear and disappear, and you will be able to determine the COM port number created by your computer. This is the COM port number you have to select in “Port” option in “ASCOM configuration” window. Next insert the Latitude and Longitude parameters (based on your location) and press the OK button of “ASCOM configuration” window when done. Finally, press OK button of “ASCOM telescope chooser” window to confirm.

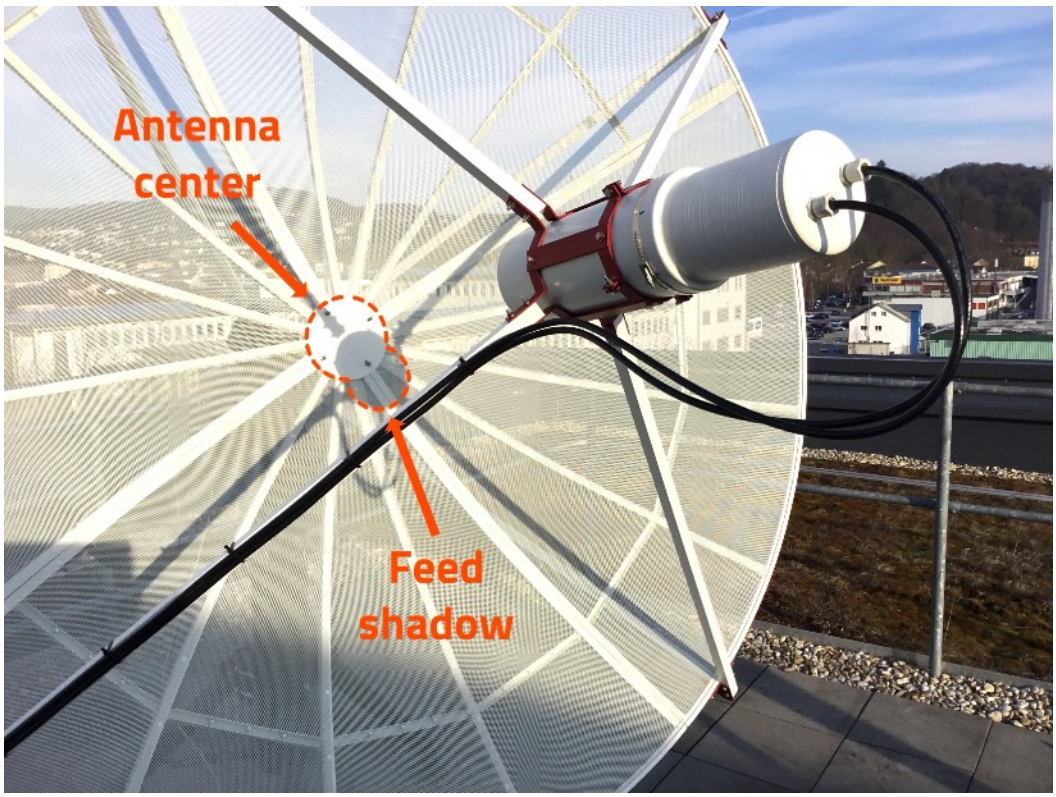


12) Now press the “Connect” button in the upper-left portion of the mount control area of RadioUniversePRO and the connection to the mount will be stablished (a new window will pop-up, you can hide it because you will have all t**he mount controls also in the main RadioUniversePRO window). On the left column you now see all the antenna position related data with the controls of the mount itself.**

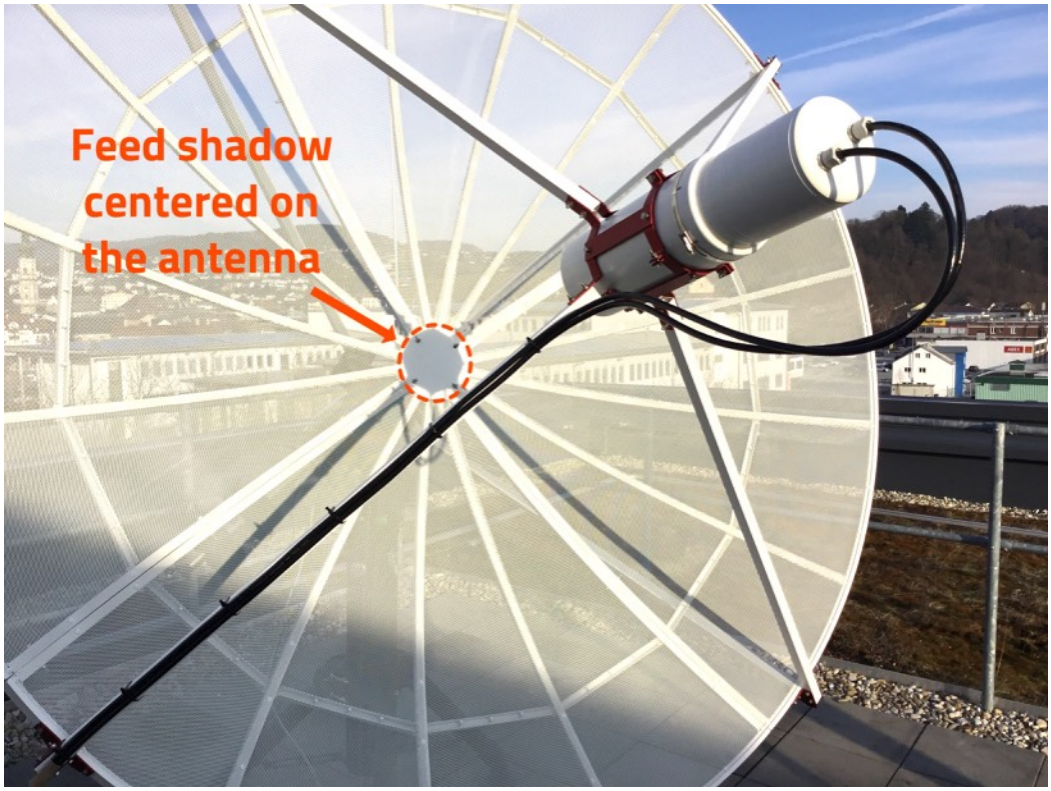


13) Now we have to better align the radio telescope to the sky object position, this procedure is done during day time with the Sun at least at 15 degrees from the horizon. Please go to “Source Visibilities” and double click on the “Sun”. The radio telescope will move the antenna close to the Sun. Take a look at the shadow of the feed on the antenna. If it’s on the center, it means that the SPIDER 230C mount already has a proper polar alignment.

14) If you see (such as in the picture below) that it’s not in the center, please use the elevation and azimuth controls (shown in the picture below) of the mount to bring the Sun shade in the center of the antenna.

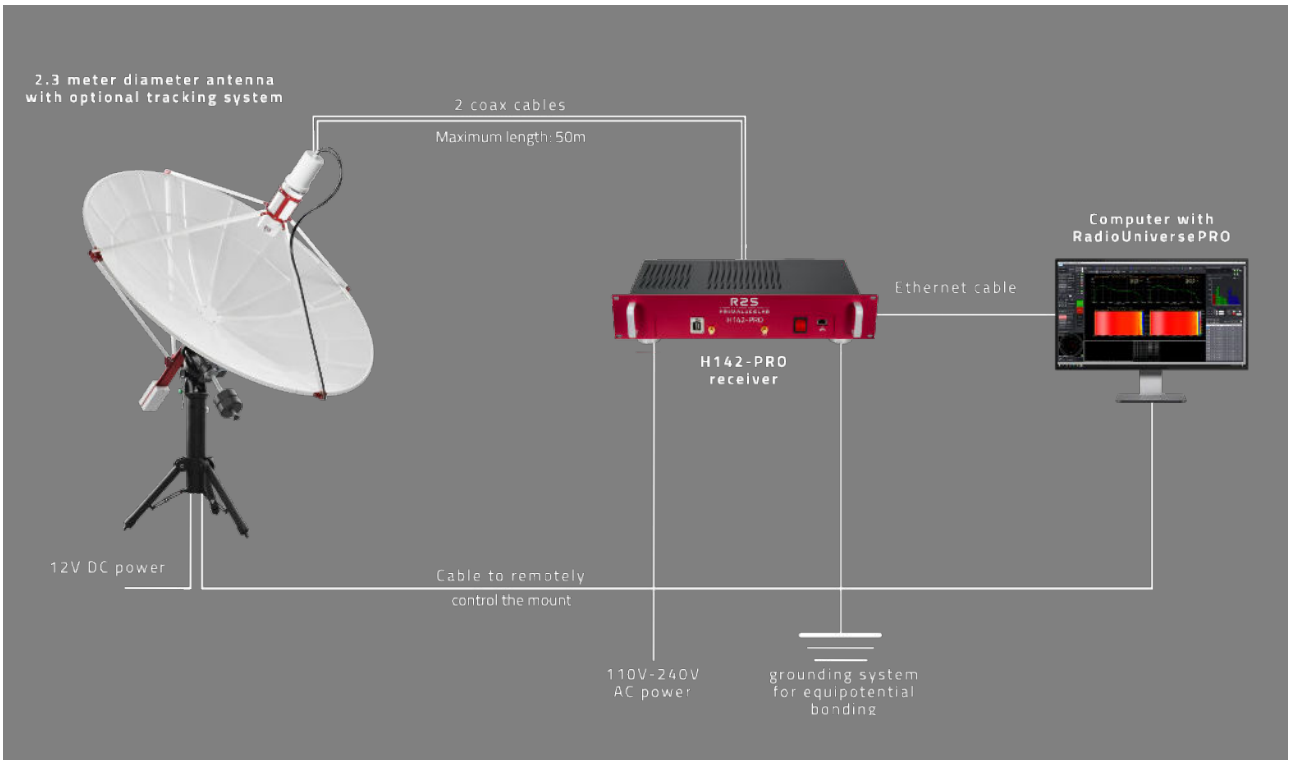


The radio telescope mount is now aligned to the sky and you can proceed with the next paragraph (you will be able to refine the radio telescope alignment to the radio sources in the sky by using the “Offset Alignment” tool of RadioUniversePRO as described in the next paragraphs).



First use: connect the receiver in the control room

SPIDER 230C comes with the H142-PRO receiver for radio astronomy at 1420 MHz frequency. The receiver has to be installed in a control room together with a Windows 10 computer (not provided with the radio telescope). The receiver can be set on a table or can be installed in a 19" rack. The receiver connects to the antenna with the coaxial cables and it's connected to the control computer with an Ethernet cable.



Before turning on the receiver, connect the coaxial cables to the RF1 & RF2 IN ports to the back of the receiver. Finally connect the power cable.

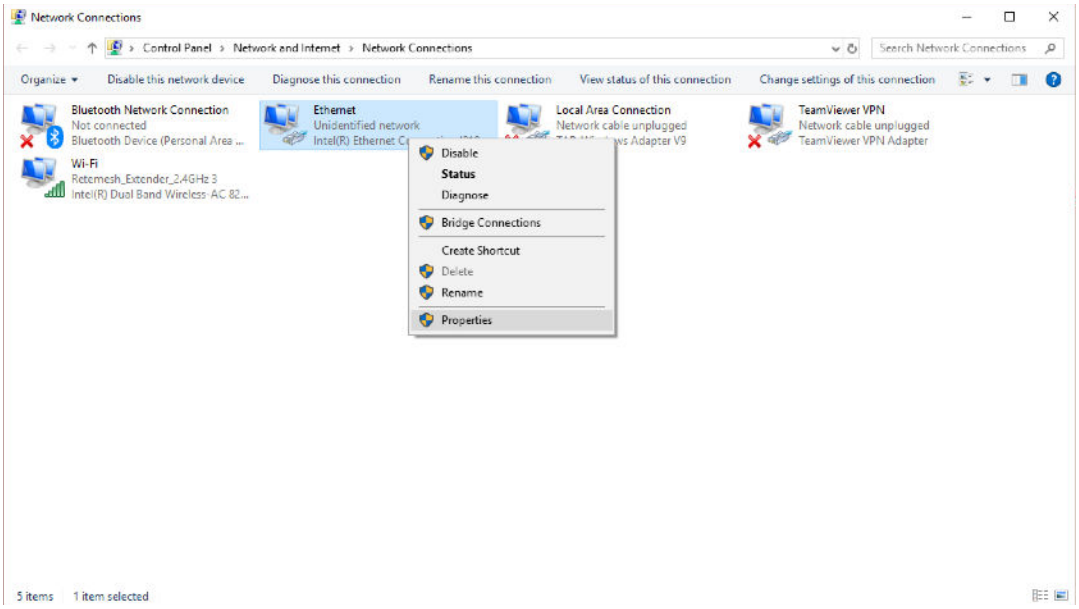


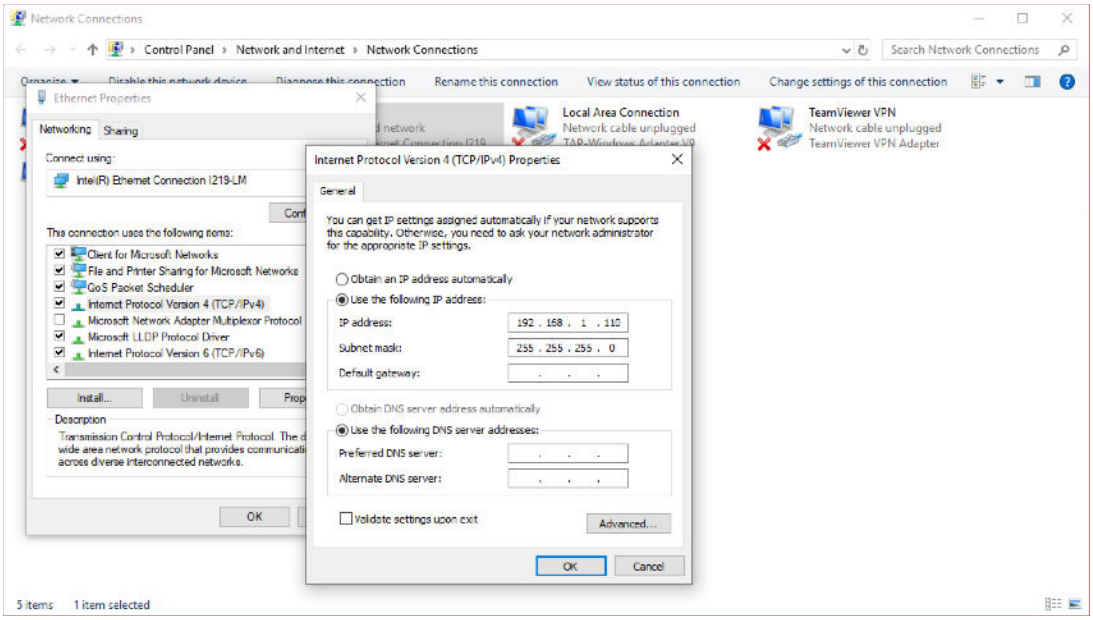
Please remember to connect the receiver's power cable AFTER you connected the coaxial cables to the proper ports in the back part of the receiver.

Now connect the Ethernet cable to the Ethernet port of the receiver and to the Ethernet port of the computer where you previously installed RadioUniversePRO software.



In order to connect to the receiver, the ethernet port on the host computer has to be correctly set with the same class of IP address as the receiver (which is set to 192.168.1.150). In order to do this, in your computer where you installed RadioUniversePRO software please select START, enter in the Control Panel, then select “Network and sharing center” and press “Change adapter settings”. Make a mouse right-click on your Ethernet connection and select Properties.



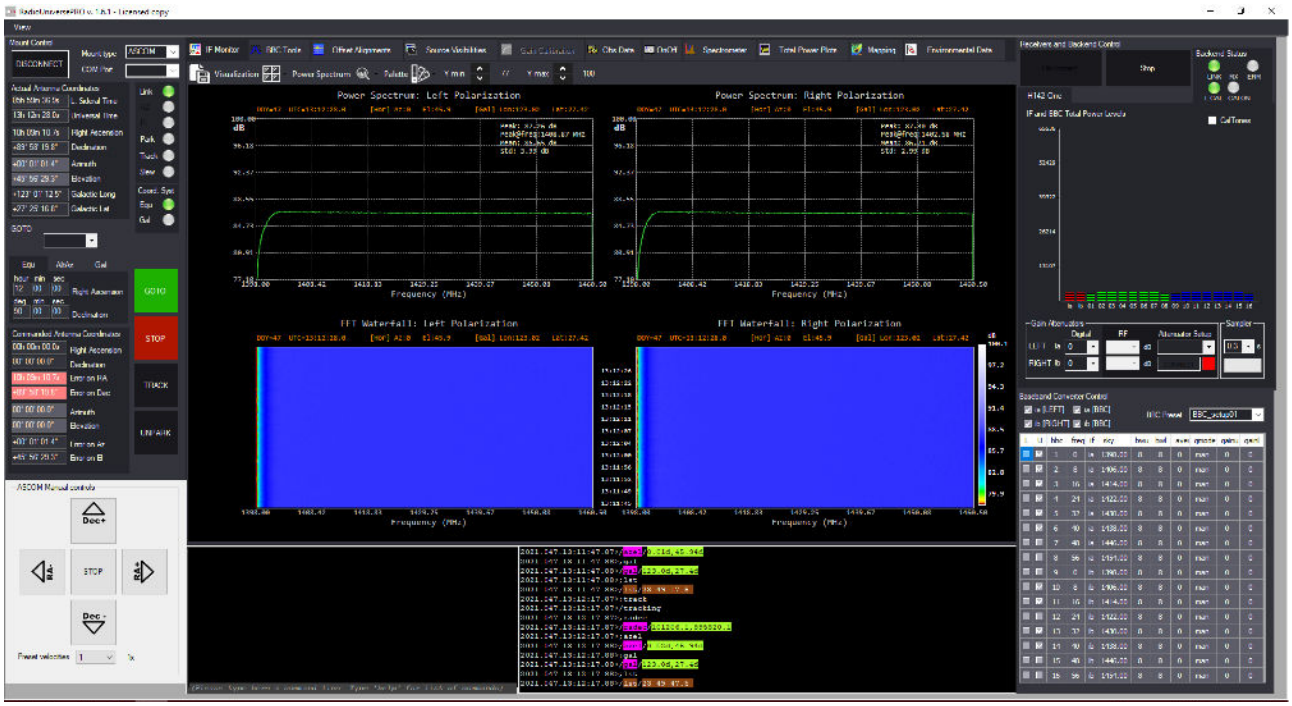


A new windows “Ethernet Properties” will appear, please double click on “Internet Protocol Version 4 (TCP/IPv4)” and this will open a new window. Here please select “Use the following IP address” and use these values:

IP address: 192.168.1.110

Subnet mask: 255.255.255.0

Now, click on the OK button to confirm. Launch the RadioUniversePRO software, click on the “Connect” button in the upper part of the right column. Please wait a few seconds for RadioUniversePRO to connect to the receiver and press “Start Acquisition”. You’re now ready to start using your SPIDER 230C radio telescope! Please proceed by reading the “RadioUniversePRO user manual” to learn how to use the software and acquire radio astronomy data with your radio telescope



SPIDER 230C radio telescope maintenance

Since SPIDER 230C radio telescopes may be exposed to environmental phenomena that are variable depending on the geographic location where the radio telescope is installed, the following information must be followed:

- **Mechanical periodic control**: the user is required to periodically (we advise checking every time the radio telescope is used) inspect the locking status of all the screws that are used in the antenna and mount. If necessary the user is requested is tighten the screws.

- **Radio telescope storage:** when the SPIDER 230C radio telescope is not in use, the user is requested to store the radio telescope in a place protected from environmental effects like wind, rain, snow, etc. The SPIDER 230C radio telescope can be used only if wind is lower than 25 km/h - 15 mph - and if it's not raining or snowing. If the user is using the SPIDER 230C radio telescope and wind increase and/or it starts raining and/or it starts snowing, the user must move the radio telescope to a protected storage location (for example inside the house). In case of hail, the parabolic antenna could be damaged by the hail itself which could ruin the parabolic shape of the mesh dish. Do not use the SPIDER 230C also in case of hail.

- **Animals**: check that no animals may interfere with radio telescope operation. For example (but not restricted to this) birds could be on the antenna (especially when parked in Stow Position) or rodents that could bite through the cables. The user is requested to check that no animal has created problems for the radio telescope and, if a problem is detected, avoid the use of the radio telescope until the problem is fixed.

- **Ice**: in very cold conditions a layer of ice may form on the parabolic antenna and/or on the mount. In normal cases this does not preclude the operation of the radio telescope but, if allowed to accumulate in large quantities, it may interfere with the handling of the antenna. In these cases the user is required to remove the ice before using the radio telescope, paying attention not to damage the radio telescope during the ice removal process. If it is not possible to remove the ice and it blocks (or tends to block) the movement of the radio telescope, the user shall melt the ice (eg using an air dryer or waiting for the solar irradiation melt down the ice layer).

- **Intense hot/cold**: the radio telescope is designed for operation at temperatures between -10°C/14°F and +50°C/122°F. If you experience temperatures outside of this range, you are required to avoid using the radio telescope until conditions return to the correct range.

Warning: If hail (or other atmospheric phenomena) cause deformation or breakage of the parabolic antenna (or part of it), the user may order parabolic antenna (or part of it) replacement part.

Note: meteorological events described in this paragraph are to be considered as exceptions, so any damage that may result from these phenomena is not covered by the product warranty, even though they occur during the warranty coverage period.

Troubleshooting

In order to check that the radio telescope works correctly, you can follow this very simple procedure:

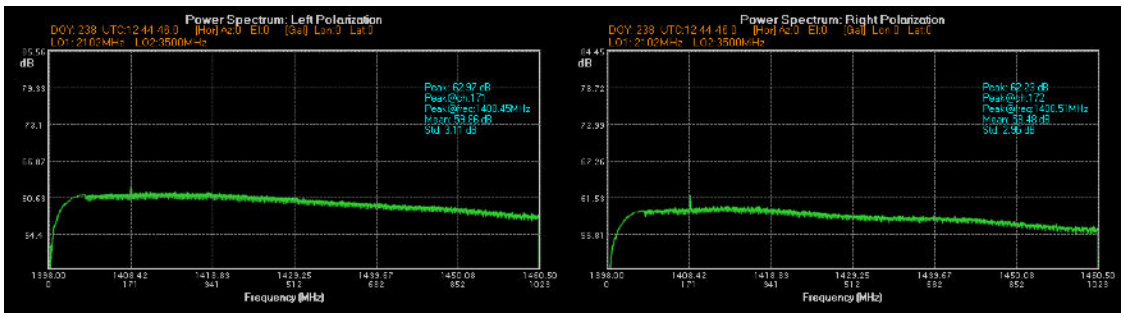
1) ***check mount functionality***: during daytime, please point to the Sun and, once the pointing is confirmed, check the shadow of the feed.

    I. *if you see the shadow in the center of the parabolic antenna* (or very close to it): it means that the SPIDER's mount is working properly, the antenna is moving as requested and you may start an "Offset Alignment" procedure in order to even improve antenna alignment on the sky.

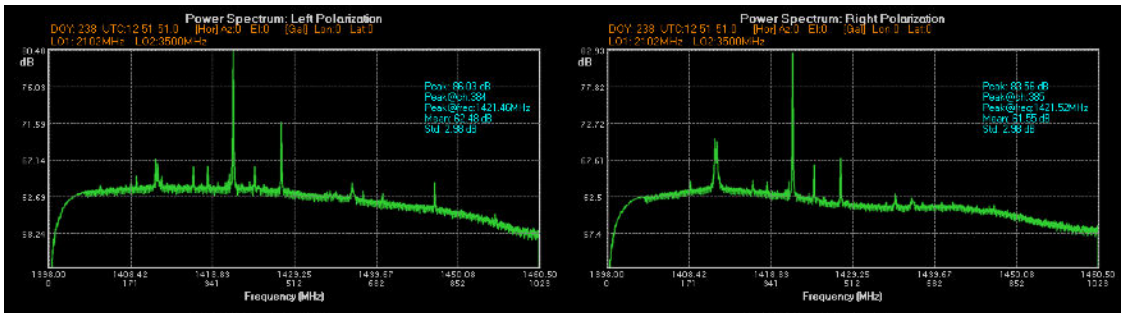
    II. *if you see the shadow not in the center of the antenna*: the mount is working but it needs to be aligned to the sky. First of all please check that all the data in "Obs Data" tab of RadioUniversePRO are correct. Then check the time and verify that it corresponds to the clock of your computer where you installed RadioUniversePRO software. If you find a setting error, fix it, disconnect from the mount, restart RadioUniversePRO, make a goto to the Sun (now the shadow should be closer to the center) and proceed with an "Offset Alignment" again.

    III. *if you see the shadow far from the antenna* (it means that the radio telescope is pointing a sky position far away from the Sun or it's not moving at all), first of all please check that the mount is correctly connected to the software as described in the previous paragraphs. If it's correctly connected to the control computer, you have to read the mount position under "Actual Antenna Coordinate" left column in RadioUniversePRO. If you're reading all 00000000 values, it means that the mount is not connected to the control computer with RadioUniversePRO software. In this case please check all the connection cables (from the radio telescope to the mount), check that you selected the correct COM port number and the correct mount model in the upper part of the left column of RadioUniversePRO.

2) ***check receiver functionality***: Once you are sure that the mount is working and aligned to the sky, during daytime point to the Sun and, once the pointing is confirmed, check the signal in Power Spectrum, for both left and right polarizations. The Sun signal is so strong that it has to be visible in realtime even with very low digital gains (for example +6dB) set in the right column of RadioUniversePRO. In order to check it, with the radio telescope on and connected, please select the Sun in the sources lists and press the GOTO button. You should see the signal increase both in the Power Spectrum and in the FFT windows. Once the source is acquired, you can test the signal by using the command azeloff=5,5 that will move the radio telescope away from the Sun by 5 degrees both in azimuth and in elevation and you should see a decrease of the signal. Then use the command azeloff=0,0 and this will point the radio telescope again to the Sun and you will see again the increase of the signal in both the polarizations. If you see this, everything is fine and your radio telescope is working perfectly. If you can't see signal increase (and you're sure your radio telescope is actually pointing at the Sun), please point the radio telescope to an empty area of the sky (the Zenith should be ok, just check that you're not pointing at the Sun), go to IF Monitor tab of RadioUniversePRO and take a look at the dB scale (you may have to activate the dB scale feature by pressing the "dB scale" option). Take a look at the dB value of the Power Spectrum graphs: if you read values around 60dB - 65dB (like in the picture below), some element is not working and we need to identify the element with the problem. Please follow this guide in order to check all the parts of the receiving system of your SPIDER radio telescope:



I. *Check the LNA units*: if you can't see signal in one polarization but you can in the other polarization, or if you can't see signal in either polarization, the first thing to check are the LNA units. If you can't see signal in one polarization but you can see it in the other polarization, the first thing to do is to identify which LNA unit is not working. In order to do this, please disconnect the receiver and mount from the RadioUniversePRO software, turn off all the power units and then invert RF cables in the rear ports of the receiver. Then turn on again all the power units and connect to the RadioUniversePRO software. Repeat the pointing to the Sun and check the power spectrum and FFT windows. If now you see that the signal is coming from the other polarization (and it's not coming from the polarization that before it was working), it means that one of the LNA is not working. You need to check cables connections to the LNA in the radio telescope (you need to move the radio telescope as close as possible to the horizon with the command source=azel,270,15 then disconnect from the RadioUniversePRO software, turn off all the power units, open the cap the protects the LNA units on top of the feed and check that the cables are perfectly connected to the LNA units). If the cables are correctly connected to the LNA you can also remove the LNA units from the feed and directly connect the RF cables to the feed. Then turn on again all the power units of the radio telescope, connect to the RadioUniversePRO software and, without pointing at the Sun, please check the IF monitor. You should have slightly higher values than before (a few dB more), like in the picture below (note: in this picture you see many peaks because it has been recorded indoor and the receiver was recording many RF interferences).



Now please point to the Sun. Without the LNA units the signal will be lower but it has still to be visible (you can increase the digital gain in right column of RadioUniversePRO software). If now you see the signal, it means that everything is working except for the LNA unit (one or both) and you have to ship to us to fix the LNA (one or both, based on what unit you see it's not working). If you don't see the signal, please proceed to the next step and

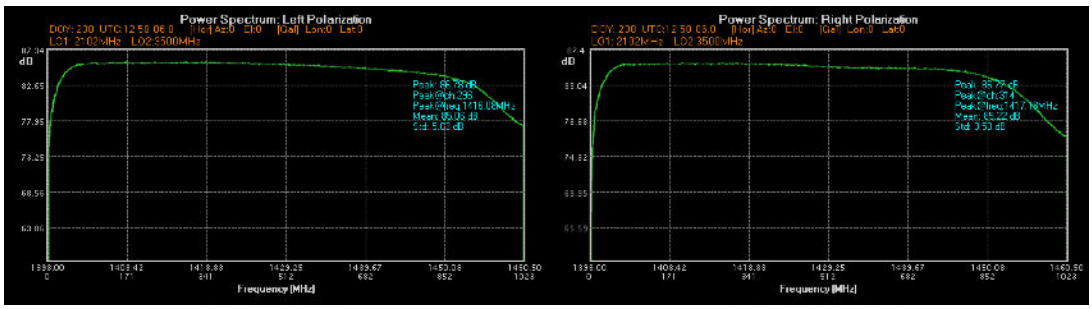
check cables.
Before checking the cables, let's double check the LNA units you disconnected from the radio telescope. Please use the double N connector accessory that comes with the radio telescope and connect to one of the end of the LNA units (as you can see in the picture below). Connect the resistor load to the other side of the LNA unit. Finally, with the receiver turned off and the RF cables disconnected, connect the LNA units directly to the receiver.
Start again RadioUniversePRO and start the connection to the receiver. In

Resistor load connected to the "RF IN" connector of the LNA



Double N connector connected to the "RF OUT" connector of the LNA

the IF monitor tab you Should read a value between 80dB and 85 dB. If it's not, your LNA is not working and you have to ship us back. Indeed, if you read a value between 80dB and 85 dB, if means that your LNA units are working but, since you can't read signal from the radio telescope, you need to check cables so let's move to the next paragraph.



II. *Check the RF cables*: every SPIDER radio telescope uses N type connectors for the RF cables, both male and female types. Male connectors are used for receiver con-

nection, in the radio telescope pier and for LNA connection. Female connectors are used in the pier. In order to verify the cables, you have to check that the connector is properly connected to the cable itself since, for example during the insertion in the pipe connecting the radio telescope antenna to the control room, it could be disconnected.

Check male connector: by using a 17 wrench, unscrew the rear cap of the connector.



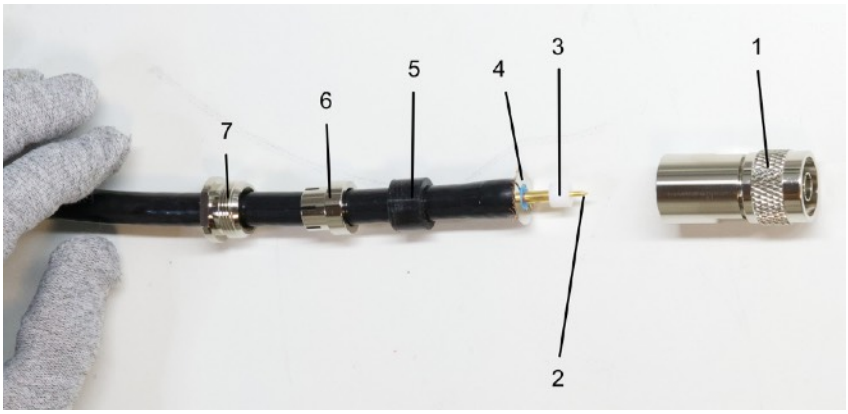
Then remove the rear element



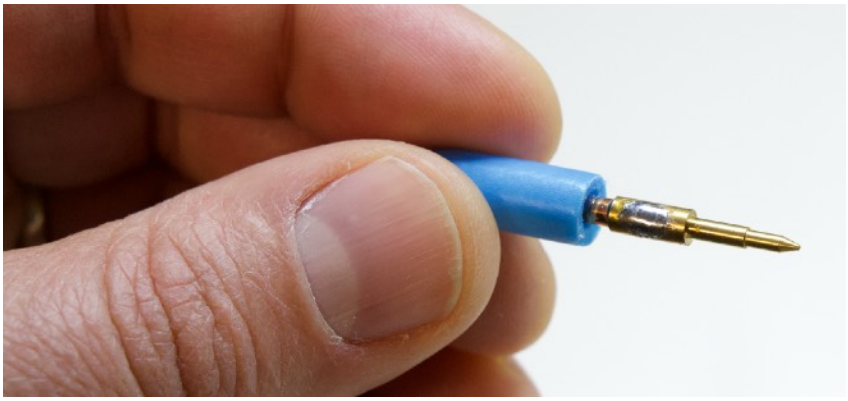
and open the connector as shown in the image below.



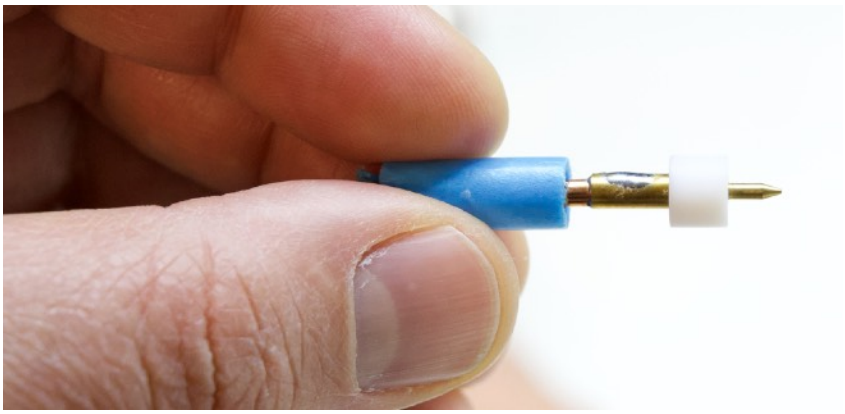
Check that the element 4 is clean, without residues of metallic shield (copper color) or



foil (the copper sheet more internal to the metallic shield, adhering to the internal insulating material). There must be no traces of moisture or water, or any other element that could lead to a short. Check that the metallic shield does not directly touch the element 2. By using a magnifying glass, look at the element 2 and the relative soldering that fixes it on the central conductor of the RF cable.
By applying a slight effort, check that the tip is fixed with respect to the central conductor (for example, holding it between two fingers and checking that it does not



move). If everything is ok, insert again the element 3 on the tip (element 2) and close all the elements making sure that the element 2 is in the central position with respect to the terminal N.



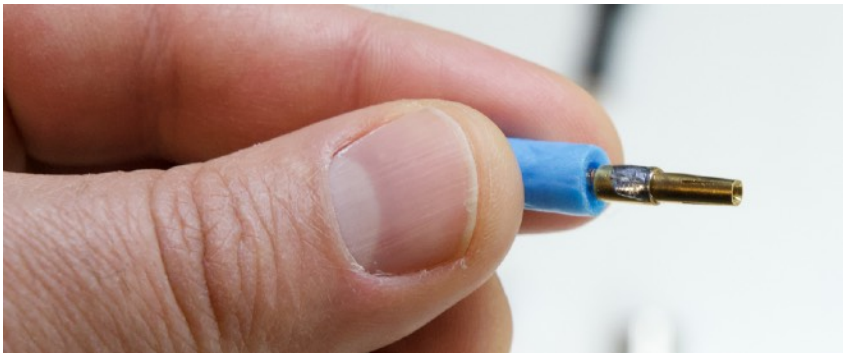
Check female connector: by using a 17 wrench, unscrew the rear cap of the connector.
Then remove the rear element and open the connector as shown in the image below.



Check that the element 4 is clean, without residues of metallic shield (copper color) or foil (the copper sheet more internal to the metallic shield, adhering to the internal insulating material). There must be no traces of moisture or water, or any other element that could lead to a short. Check that the metallic shield does not directly touch the element 2.



By using a magnifying glass, look at the element 2 and the relative soldering that fixes it on the central conductor of the RF cable. By applying a slight effort, check that the tip is fixed with respect to the central conductor (for example, holding it between two fingers and checking that it does not move).



If everything is ok, insert again the element 3 on the tip (element 2) and close all the elements making sure that the element 2 is in the central position with respect to the terminal N.

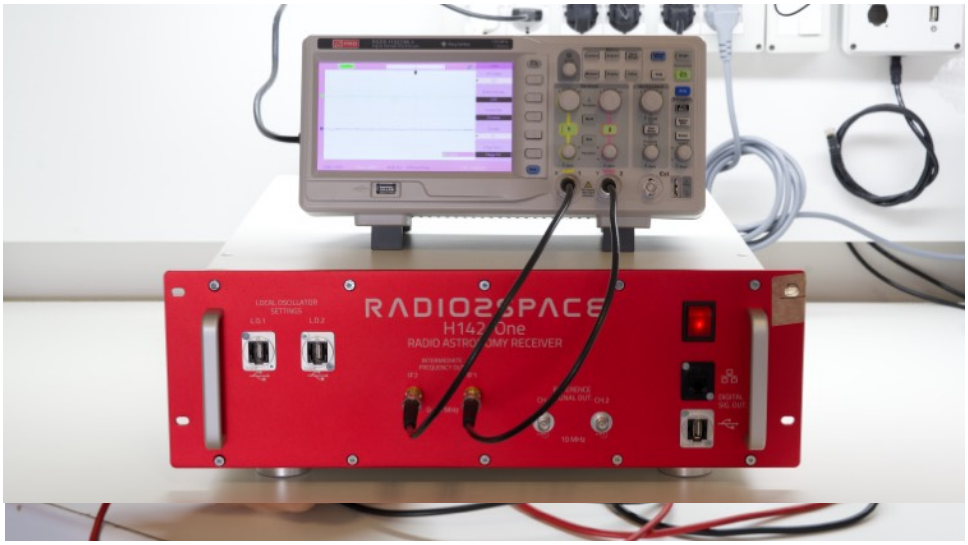


After having checked that the connectors are properly set, by using a multimeter, check that there is not a short circuit between the tip (element 2) and the outside part of the N connector, for both male and female connectors.



III. *Check the receiver*: if you checked that LNA units and RF cables are ok but you still have one or two polarizations not showing the signal increase when you point to the Sun, you must now check the receiver. With the receiver turned off, disconnect the RF cables from the back side of the receiver and then turn it on again. By using a tester, please check that the voltage from the central pin to the external part of the connector is around 12V, for both the RF1 and RF2 ports. If you read around 12V, the receiver sends correctly the power to the LNA units.
If one of the two RF1 or RF2 channels (or both) doesn't provide power, you have to send us back the receiver for assistance. If both the channels provide power, proceed to the next step.

By using an oscilloscope connected to the 2 IF exit on the front panel of the receiver, please check you can read an analog signal.
If you see a signal it means that the receiver is sending data to the integrated spectrometer module and, but you can't see the signal in RadioUniversePRO, it means that the spectrometer module is not working. If you can't read any signal, it means



that the internal analog receiver is not working. In both cases you have to send us back the receiver for assistance.

INFORMATION TO USERS



According to art. 26 of Decreto Legislativo 14 marzo 2014, n. 49 "Attuazione della Direttiva 2012/19/UE sui rifiuti di apparecchiature elettriche ed elettroniche", the symbol of the barrel placed on the equipment or its packaging indicates that the product at the end of its useful life must be collected separately from other waste.

The user will therefore have to give the end-of-life equipment to the appropriate separate collection centers for electronic and electrotechnical waste or to return it to the reseller upon the purchase of a new type of equivalent equipment, one by one.

Properly differentiated collection for the subsequent start of dismantled equipment for recycling, treatment and environmentally compatible disposal helps to avoid possible adverse effects on the environment and health and favors the reuse and / or recycling of the materials contained in the equipment.

The abusive disposal of the product by the user implies the application of the administrative sanctions as per D.Lgs. 152/2006.

Compliance with the RAEE legislation (D.Lgs. 49/2014)
PrimaLuceLab is registered to AEE Register with number IT17030000009790
PrimaLuceLab adheres to Sistema Collettivo ERP Italia for the compliance to RAEE legislation.

European Recycling Platform

WARRANTY

1) The PrimaLuceLab product warranty is effective from the date of purchase and is valid only if it is with the invoice (or receipt) of purchase.

2) The warranty covers the product against defects in workmanship and includes the cost of the replaced material and labor.

3) The warranty does not cover any damage caused to the product or defects or failures that occur due to improper installation , improper use and/or deterioration due to normal wear.

4) THE GUARANTEE DOES NOT APPLY IN THE FOLLOWING CASES:

    - Repair by anyone not authorised by PrimaLuceLab .
    - Invasive interventions or tampering with internal and/or external parts.
    - Missing of the invoice (or receipt) of purchase.

TERMS OF SERVICE
Technical assistance is performed exclusively by PrimaLuceLab or its authorised resellers. All returns must be received with our permission (to be asked writing an email to support@primalucelab.com) . YOU HAVE TO add to the shipping the invoice (or receipt) of purchase and the detailed description of the defect. For products without the invoice (or receipt) of purchase, repair and shipping costs are always paid by the customer.