

Troubleshooting

Foreword

When an antenna does not resonate correctly, or it shows an unusual high SWR, in 99% of the cases the problem is due to one or more step motors which do not rotate correctly or are even blocked.

If even a single antenna element does not reach its correct length (even a difference of a few centimeters) the antenna will not resonate correctly on any frequency.

In such cases, changing the band in the attempt to find again the resonance of the antenna, is useless and it will not help you to understand where and what is causing the problem.

The only thing you can try to do (before the tests suggested below) is to "Calibrate" it. This feature brings all the step motors to their start point and is performed only when a step motor has accidentally lost its step, but still continues to move regularl. When for some reason a step motor has stopped, the "Calibrate" function will solve the problem and can only create a useless mechanical stress to the motor. In such a case you must perform the tests described below.

If you can physically see the beryllium copper strip (transparent elements allow this) you will know immediately if a motor is blocked or not, but you will still need to run the tests to figure out the reason of the problem. Although a visual check can only tell if a step motor is stopped or not, it will be rather difficult to visually ascertain a partial or small loss of its steps, especially not when the motor is running but not properly. In such a case the beryllium copper strip will be prevented to reach its correct length in function of the chosen frequency. The noise of the step motors can also give useful information, but a good knowledge or a specific experience is required and in many cases the Ham is not able to distinguish the normal noise of the motor during the cruise speed from that caused by a small and sporadic loss of steps.

There is a small tricky way to check with absolute certainty a partial loss of steps:

Select a frequency and a way to start (eg 14,200 Normal mode).

Now look at the antenna element in transparency and mark with a felt-tip pen or in any other way the exact point on which the end of the beryllium copper strip has stopped (it is sufficient on one single half-element for each motor because both right and left beryllium copper strips are moved out by a single toothed gear, therefore the right length is always equal to the left one).

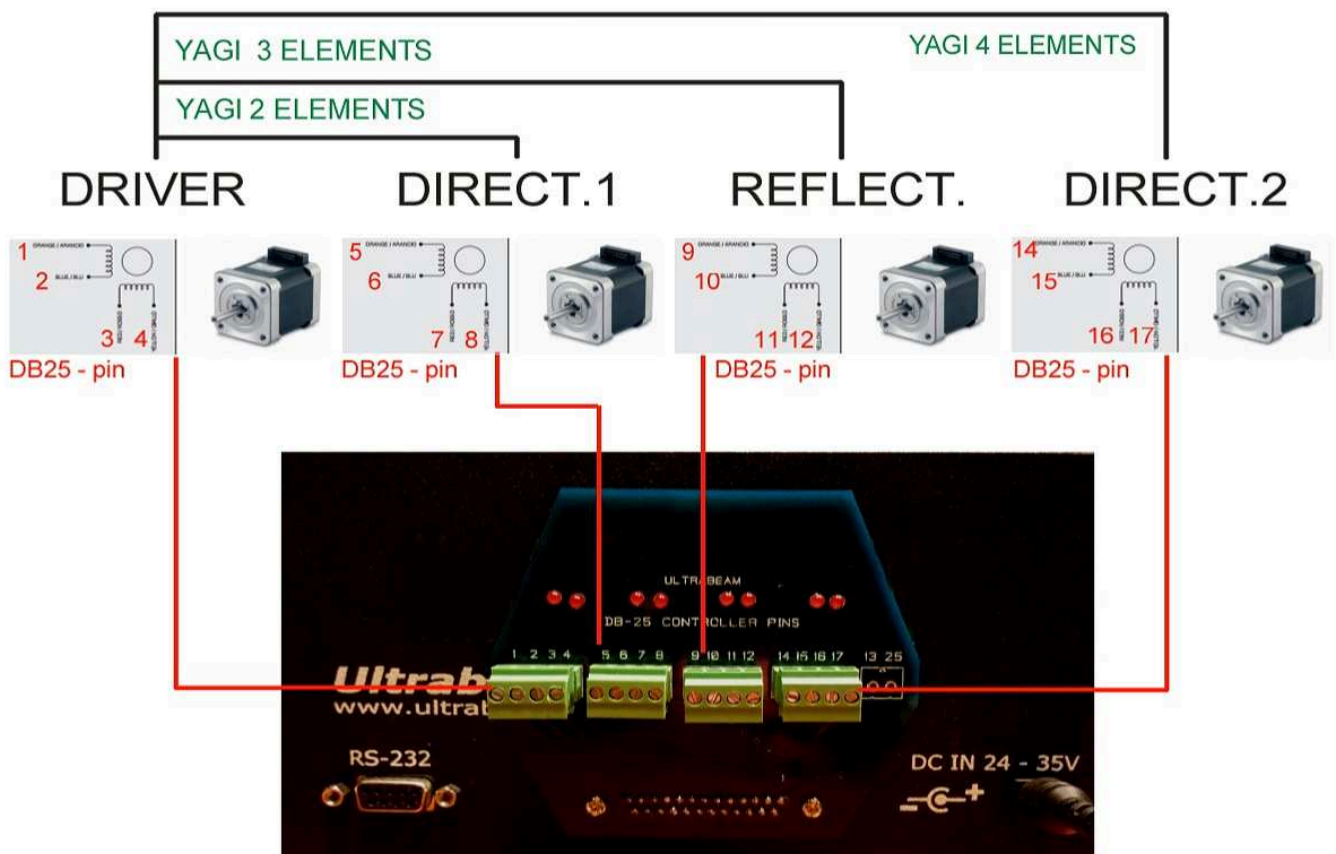
Let the Controller Unit perform several band changes (eg from 20 to 10 meter band and vice versa) and after several cycles, just set it on the starting frequency 14,200 again. If the beryllium copper strip has reached the point marked previously, it means that the step motor moves regularly: If it does not, that means that the step motor loses steps. Since a gap of even a few inches will be repeated at each band change, there will be an error sum and therefore the strip will never stop at the same point.

Since your UltraBeam represents a single circuit composed by Controller, Wiring and Motor Unit, one single problem on one of these elements will inevitably compromise the proper performance of the antenna.

A careful reading of this guidelines will help you to quickly find out a problem and allow you to solve it. In case you should need our technical support, it will allow you to furnish us important information which will allow to offer you an adequate assistance.

As we are not able to physically see your antenna and conduct any verification, our ability to help you at distance is strongly depending on your skill to conduct a reliable diagnosis, otherwise (as often happens) requesting assistance by reporting an high SWR does not help us and even prevents us to assist you properly.

We highly recommend you to carefully read the following pages, which nonetheless will improve your personal knowledge about the technique that characterizes the operations of your antenna.



STEP 1

Test of the Controller Unit voltages.

Check the Vac readings with DB-25 cable disconnected !!

The first thing to check is the Controller Unit and its output voltages. Although the positive result of this test does not necessarily guarantee the 100% functionality of the Controller's electronics, it offers a good opportunity to understand whether or not it is responsible for the incorrect operation of the antenna. For the measurement you simply need a digital volt-meter, even an economical one.

In order to simplify the test and avoid confusion, you only have to check the output voltages of the Controller Unit during the execution of band changes. Any detection of voltages with stopped motors or between pins other than those described, are to be taken as irrelevant.

To facilitate the use of the leads of the Vac meter we highly recommend the insertion of a new DB25 (Fig.2). However, be careful not to create a short circuit between pins. The new card DB-25 controller pins (fig. 1) brings the pin terminals of the DB25 on a series of slide clamps which make readings even easier. As each step-motor has two coils, the Vac voltages can be exclusively detected between pins 1-2 and 3-4 for the Driven Element, 5-6 and 7-8 for the Director and so on so forth for the other motors unit.

As during a band-change the Controller generates the necessary voltage to be supplied to the step-motors, this is the right moment to make a Vac measurement. Choose a band-change that provides you enough time necessary to the measurement.

The normal voltage during movement is approximately 18.8 Vac. No matter the precision of your Vac meter, what is important is to verify that the output voltages are all identical.

If even a single pair of pins relative to a motor coils shows a lower voltage than the reference, then there is certainly a problem on the electronics which either prevents the related step-motor to move properly or it just blocks it.

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Fig.1



Fig.2



If the measured output voltages are all identical, you can assume that the Antenna Controller Unit is working properly and you can proceed with the next step, namely the wiring check.

SPEP 2

Antenna Wiring Check (DB25 unplugged from the Controller)

If the tests on the Controller Unit have shown no problem, it is necessary to check the antenna wiring.

The latter can also be responsible for the malfunction of your antenna.

The reasons that lead to a malfunction or even stop a step motor are:

- An open terminal. Even a single interruption of a wire will inevitably stop the motor.
- Bad contact of one or more terminals (more likely on older antenna models wired by mammoth)
- Partial breakage of strands that make up a cable. This reduces the section of the conductor and creates a drop of voltage which consequently causes a reduction of the motor torque.
- Short circuit between some poles of the cable. This prevents a proper functioning of the step motor and in some cases it may even damage the electronics of the Controller Unit.
- Breakage of the wiring revolving around the mast or the cart.
- Water infiltration in the antenna wiring.

There are two ways to check the antenna wiring:

- 1) Verify that the no wire to the motors (4 wire to each motor) is interrupted.
- 2) Make sure that there is no short circuit in the wires.

You can check for any interruption on the cable by means of the continuity given by the coils of the motors.

By using a digital meter, you can measure the Ohm impedance present on pins 1-2, 3-4 (driven element) and so on so forth for the remaining step motors of your antenna model.

Normally you should measure an impedance between 10-15 Ohm. This value changes as a function of the cable length and its section. Determine whether a pair of wires has a different value. If there is no continuity it means that one of the two wire going to a coil is interrupted. Obviously, if one of the two coils inside the motor is broken, you will have the same results and be unable to know if the problem is only on the cable, but this is a very rare possibility.

As described above you should have:

(values indicative, depends on the length of the cable)

Pin DB25

1-2 = 10 to 15 Ohm
3-4 = 10 to 15 "



5-6 = 10 to 15 "
7-8 = 10 to 15 "



9-10 = 10 to 15 "
11-12 = 10 to 15 "



14-15 = 10 to 15 "
16-17 = 10 to 15 "

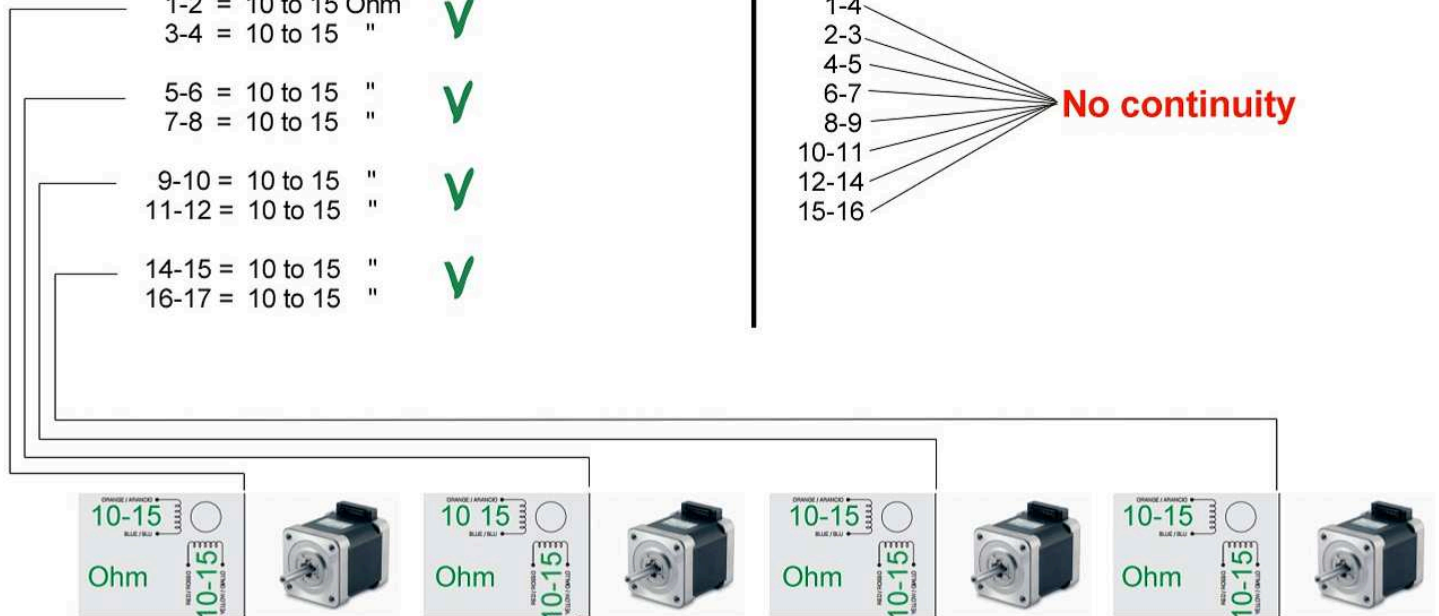


Every other combination should give no continuity

Pin DB25

1-4
2-3
4-5
6-7
8-9
10-11
12-14
15-16

No continuity



If the readings are OK you can exclude the possibility of a problem on the antenna wiring, and the only thing left to be verified is the effective and smooth operation of each motor unit.

STEP 3

Remote movement check of the step motors

DB25 connected to the Controller

If the tests of STEP 1 and STEP 2 have given you a positive result you only have to see whether there is any step-motor which does not move regularly or it is even blocked.

Since a visual inspection is the only way to confirm with absolute certainty the correct function of a motor unit, we indicate you the necessary steps to remotely check with an appreciable approximation whether the step motors are running properly. The following test should be carried out with the DB25 connected by removing the plastic cap.

As mentioned already, you must be careful to avoid short circuits between pins and considering that you must perform some correct measurements, it is advisable to build an additional DB25 connector (male/female) to be placed between the Controller Unit and the antenna wiring, on which you should solder the terminals which will allow you to read more comfortably and avoid risky short circuits. A "DB25-Controller pins" is ideal.

These measures will also be taken by Vac and exclusively on pins relative to the coils of each step motor.

Pin 1-2 and 3-4 for the driven element and so on so forth for the next motor units. Activate a band change and measure the output voltage.

The electric load shown by the motors will give an output voltage lower than the nominal 18.8 Vac (with step motor disconnected) and, depending on the serial number of your Controller Unit, you should read a voltage of 15.4 -17.4 Vac.



We remind you that the voltages you detect may differ from those indicated UltraBeam, due to differences between: Instrumentation, Wiring length, Controller Unit and Voltage.

However, this is not very important because the test will be based on the differences between the resulting output voltages with a blocked step motor and those of a step motor running freely. As in the previous measurements, you have to check out that the output voltage for each coil of every Motor Units is between 15.4 -17.4 Vac.

If a step motor is physically blocked its absorption increases, the measured voltage (while changing band) falls further down and you should read a voltage of about 14 Vac (measurement made with a cable of 50 meters x 0.35).

Due to the vibration of the engine, this reading will be a variable voltage (Vac 13-15) and the longer the motor remains blocked, the more stable will be the Voltage.

To measure the output voltage of your Controller Unit when an engine is actually stopped, it is sufficient to perform a measurement while the motors are performing a "Calibration". Under this condition the step motors are supplied by the Controller even when the motor units are fully retracted. This creates the condition for a voltage reading when the motor is blocked.

At this point you just have to read the output voltages of each step motor while performing a band change. Whenever you read a voltage of about 14 Vac (or the one you have found during the "Calibration") you have a good opportunity to find out if and which of the step motor is blocked.

Summary:

Output voltage (stable reading) without load approximately 18.8 VAC

Output voltage (stable reading) with load about 15.4 -17.4 VAC

Output voltage (reading variable) with engine locked 13-15 VAC

Electronics OK ✓

Motor running regularly ✓

Motor off blocked ✗

NOTE :

In order to carry out a reliable reading, you must select a band change that gives a sufficiently long time to make the measurements (eg 10-20 meters). It is worth remembering that many UltraBeam antenna models use two Driven Elements. By these models the configurations and the number of elements in action do change in relation with the band in use. In order to avoid misdiagnosis, we highly recommend you to select the band on which all Motor Units are active.

Example:

The UB50 works with three elements from 10 to 20 meter-band and with only one element on the 30 and 40 meter-bands (reflector).

The three elements 6-40 meter-band works with three elements from 10 to 20 meter-band as well, and with two elements on the 30 and the 40 meter-band.

When you perform a band-changes in order to determine the Vac voltages, make sure to choose a band where all Motor Units are active.

Final considerations

Now we want to make a last but not less important observation related to the Antenna Controller Unit and its relations with the antenna. The electronics does not know and can not know the actual position of the beryllium copper strip.

The lengths appearing on the Antenna Controller are memorised in its CPU and are only used by the software to send the necessary electrical pulses to the step motors in order to let the beryllium strips reach the appropriate length for the selected frequency or to correct the length of the antenna elements during a correction phase. Therefore, if you have a wiring problem or a mechanical failure on the Motor Units the Controller Unit will always show the same measures.

Trying to check the measurements on the Controller Unit as a confirmation of the actual motion of the Motor Units or as an indication of a malfunction of your antenna, is absolutely useless!

Here is a simple example to make you fully understand the above: perform a sufficiently long band-change and as soon as the step motors begin to move, enter into the Menu and select "Modify Elements". You will notice that although the step motors are moving the indicated lengths are fixed and will be those which the beryllium copper strip will reach when the operation will be completed. This will happen even with the antenna disconnected from the Controller Unit.

This trouble-shooting guide has been prepared to provide you a better technical support in case of a fault or a malfunction in your UltraBeam antenna.

Without a basic knowledge about the technique governing the operation of the antenna, it will be rather difficult for you to make a diagnose which will permit us to offer you any useful information for a correct and quick assistance.

We are confident that by reading this text you will better understand the importance of the above content and the reason of our inability to assist you solely on the basis of a simple and useless value of SWR.

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