Voltage and Resistance Tests

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Motor Voltage Test

WHEN MAKING THESE CHECKS, BE VERY CAREFUL NOT TO SHORT THE PINS TOGETHER OR TO GROUND! IT ONLY TAKES A MOMENTARY SHORT TO DAMAGE A DRIVER CHIP.

The voltage test will allow you to confirm that your controller is supplying the correct voltages to the stepper motors. Erroneous readings indicate a driver chip or driver board failure. You will be measuring the voltage between certain pins of the DB25 connector on the back of your controller. Figure 1 (below) shows the layout of the DB25 connector on your controller. *Note: If you are using a remote board you will need to perform the voltage tests on the remote driver board rather than on your controller.*

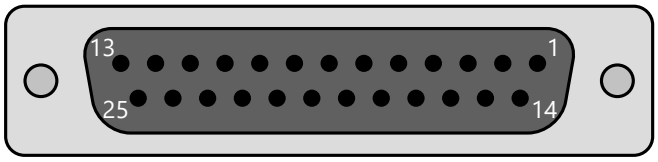

Figure 1: Female DB25 connector pin layout

Motor Voltage Test Procedure

Motor Voltage Table

Pin Pair	Antenna Element	Driver Chip	Expected Voltage (idle)[1]	Expected Voltage (tuning)[2]
1-2	Driven	U5	~1-5VDC	~24-36VAC
3-4			~1-5VDC	~24-36VAC
5-6	Director 1 or 80/60/40/30m Coil[3]	U6	~1-5VDC	~24-36VAC
7-8			~1-5VDC	~24-36VAC
9-10	Reflector	U7	~1-5VDC	~24-36VAC
11-12			~1-5VDC	~24-36VAC
14-15	Director 2	U8	~1-5VDC	~24-36VAC
16-17			~1-5VDC	~24-36VAC
18-19	Director 3	U9	~1-5VDC	~24-36VAC
20-21			~1-5VDC	~24-36VAC

Table 1: Expected motor voltages

[1] Your voltage will vary depending on if you are using an SDA or Fluidmotion controller and whether the control cable is connected.
[2] Your voltage will vary depending on which power supply you are using.
[3] It is recommended to change antenna type to a 2 Element Yagi in the Setup menu as the AC voltage output for the coil occurs for just a few pulses. This short window is not enough time for a multimeter to read the AC voltage.

Step 1: Begin by disconnecting power from your controller and then removing the DB25 connector from the back.

Step 2: Reconnect power and turn the controller on.

Step 3: Using a multimeter, measure the voltage between the pins indicated in table 1, column 1. *Be sure to measure DC voltage during this step rather than AC!* You should be seeing around 5VDC. You only need to measure the voltages that correspond to the elements on your antenna. For example: if you have a 3-element antenna, measure the pin pairs associated with the Driven, Director 1, and Reflector elements.

Step 4: Now, tune the antenna and, while it is tuning, measure the voltage on the pins again. *This time be sure to measure AC voltage!*

Step 5: Retract the elements. Turn off the controller and disconnect power.

Step 6: Plug the DB25 cable back into the controller.

Conclusion

If you have significantly different values at any point in the test process, you can be reasonably certain that you have a damaged driver chip for that element. Be aware that in some cases, we have seen driver chips partially damaged, causing them to work part of the time. This can be confusing in the test process.

Relay Voltage Test

Relay Voltage Test Procedure

Some SteppIR antennas contain relays to change active elements. If you own an antenna with relays you should perform the relay voltage test to ensure that they are working properly. Erroneous readings indicate a fault with the relay board in your controller. Use the table below corresponding to your antenna to check the voltage on the indicated pin pairs in the indicated bands and modes. *Make sure that you are testing DC voltage!*

The " - " symbol in the charts below indicate that you should find zero voltage on the pin pair in that band and mode but you only really need to test the voltage where you see a 0VDC or 33VDC in the chart.

DB11						
Pin Pair	Relay	Direction	SDA 100		OptimizIR	
			6 - 17m	20m	6 - 17m	20m
13-23	R2	NORM	-	33VDC	-	33VDC
		180	-	0VDC	-	0VDC
		BI	-	33VDC	-	0VDC
13-24	R3	NORM	-	0VDC	-	0VDC
		180	-	33VDC	-	33VDC
		BI	-	0VDC	-	33VDC

DB18								
Pin Pair	Relay	Direction	SDA 100			OptimizIR		
			6 - 20m	30m	40m	6 - 20m	30m	40m
13-23	R2	NORM	-	33VDC	33VDC	-	0VDC	33VDC
		180	-	33VDC	0VDC	-	33VDC	0VDC
		BI	-	33VDC	33VDC	-	33VDC	33VDC
13-24	R3	NORM	-	0VDC	0VDC	-	33VDC	0VDC
		180	-	0VDC	33VDC	-	0VDC	33VDC
		BI	-	0VDC	0VDC	-	0VDC	0VDC

DB18E								
Pin Pair	Relay	Direction	SDA 100			OptimizIR		
			6 - 20m	30m	40m	6 - 20m	30m	40m
13-23	R2	NORM	-	0VDC	33VDC	-	0VDC	33VDC
		180	-	0VDC	0VDC	-	0VDC	0VDC
		BI	-	33VDC	33VDC	-	0VDC	33VDC
13-24	R3	NORM	-	0VDC	0VDC	-	0VDC	0VDC
		180	-	0VDC	33VDC	-	0VDC	33VDC
		BI	-	0VDC	0VDC	-	0VDC	0VDC

DB36 w/80m Dipole				
Pin Pair	Relay	Mode	Band	
			6 - 40m	60/80m
13-22	R1	NORM	-	33VDC
		180	-	-
		BI	-	-

DB42 w/80m Dipole						
Pin Pair	Relay	Mode	Band			
			6m	10 - 20m	30/40m	60/80m
13-22	R1	NORM	-	-	-	33VDC
		180	-	-	-	-
		BI	-	-	-	-
13-23	R2	NORM	33VDC	33VDC	-	-
		180	33VDC	0VDC	-	-
		BI	33VDC	33VDC	-	-
13-24	R3	NORM	-	-	33VDC	-
		180	-	-	33VDC	-
		BI	-	-	33VDC	-

Resistance Test (Antenna Wiring Test)

The resistance test will allow you to check the state of your stepper motors and wiring. Erroneous readings indicate faulty wiring or damaged stepper motors.

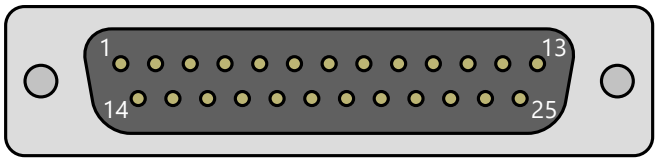

Figure 2: Male DB25 connector pin layout

Resistance Test Procedure

Resistance Table		
Pin Pair	*Antenna Element*	*Expected Resistance*
1-2	Driven	~ 20 Ohms
3-4		~ 20 Ohms
5-6	Director 1	~ 20 Ohms
7-8		~ 20 Ohms
9-10	Reflector	~ 20 Ohms
11-12		~ 20 Ohms
14-15	Director 2	~ 20 Ohms
16-17		~ 20 Ohms
18-19	Director 3	~ 20 Ohms
20-21		~ 20 Ohms
13-22	Relay 1	**DB42/36 w/ 80m dipole:** ~ 550 Ohms or ~700 Ohms (Sept. 2022 or newer)
13-23	Relay 2	**DB11/18/18E:** ~ 280 Ohms (Mechanical relay) or ~ 720 Ohms (Sealed Relay)
		DB42: ~ 140 Ohms (Mechanical relay) or ~ 360 Ohms (Sealed Relay)
13-24	Relay 3	**DB11/18/18E/42:** ~ 280 Ohms (Mechanical relay) or ~ 720 Ohms (Sealed Relay)

Table 2: Expected control cable resistances

The control cable uses 4 wires per motor (one motor in each element housing). Each motor has two wires for each of its two motor windings. This test assumes the antenna is connected to one end of the control cable and the measurements are taken at the 25-pin connector that mates to the controller. You need an ohmmeter capable of measuring 15 – 35 ohms with reasonable resolution or at least one that you can tell the difference between a dead short and 15 ohms.

Step 1: Remove the 25-pin DSUB control cable connector from the controller.

Step 2: Hold it so you are looking at the pins with them pointing at you. Orient the connector so the row with 13 pins is on top, now the upper left-hand pin is pin 1. See figure 2 (above) for reference.

Step 3: Measure the resistance between the pin pairs indicated. You only need to measure the resistance of wires that correspond to the elements on your antenna. For example: if you have a 3-element antenna, measure the pin pairs associated with the Driven, Director 1, and Reflector elements. You should read between about 18 ohms to 30 ohms depending on cable length between the pins listed below. (100' is about 23 ohms)

Step 4: Next make sure there is an open circuit between the following pins. (Any reading < 100 K ohms is bad)

- Connector case to any pin (except pin 13 which is DC ground, will see 100 ohms to chassis ground)
- pin 1 to any pin except pin 2
- pin 3 to any pin except pin 4
- pin 5 to any pin except pin 6
- pin 7 to any pin except pin 8
- pin 9 to any pin except pin 10
- pin 11 to any pin except pin 12
- pin 14 to any pin except pin 15
- pin 16 to any pin except pin 17
- pin 18 to any pin except pin 19
- pin 20 to any pin except pin 21
- pin 22 to any pin except pin 13, 23, or 24
- pin 23 to any pin except pin 13, 22, or 24
- pin 24 to any pin except pin 13, 22, or 23
- pin 25 **(NOT USED)**

Conclusion

If your antenna passes this test it does not mean it is wired correctly. You could have swapped two elements or even wired the whole thing backwards (started at the wrong end of the terminal strip) and it will still measure correctly because each connector pair has a motor winding connected to it, but it is the wrong one. This test just takes you to the next step of trying to determine if the antenna is wired

correctly and then finally determining if the elements are physically moving. This is an open loop system and the controller has no way of knowing if the elements are really moving when commanded to.

Coaxial Cable Short Test

The short test will allow you to check the state of your wiring against the coaxial cable. Erroneous readings indicate a short from the antenna control cable to the ground or center of the coaxial cable.

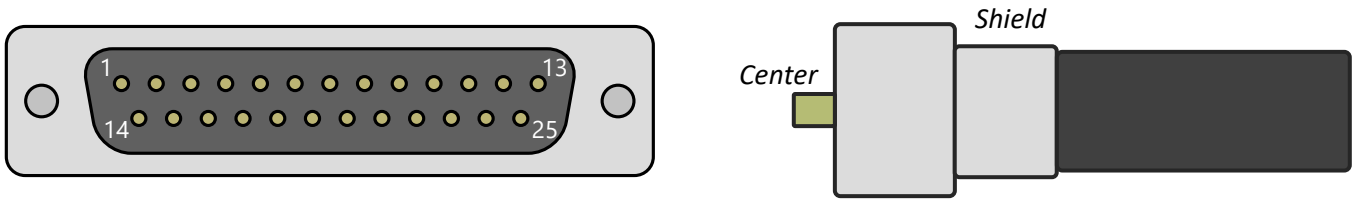

Figure 3: Male DB25 connector pin layout and Coaxial Cable Connector

Short Test Procedure

The control cable uses 4-6 wires per element housing. If there is a short between any of these wires and the shield or center of the coaxial cable it can cause damage to the drive circuitry. This short can occur from damage inside the EHU, or by damaged cable on the tower.

Step 1: Remove the 25-pin DSUB control cable connector from the controller.

Step 2: Hold it so you are looking at the pins with them pointing at you. Orient the connector so the row with 13 pins is on top, now the upper left-hand pin is pin 1. See figure 2 (above) for reference.

Step 4: Make sure there is an open circuit (no connection) between all pins (except 13) on the 25-pin DSUB connector and the center conductor of the coaxial cable. (Any reading < 100 K ohms is bad). Pin 13 will show 100 ohms of resistance to ground and therefore to the center conductor of the coaxial cable (if your controller and radio are grounded together) due to the DC short between the center conductor and shield of the internal balun on Yagi EHU's and the vertical loading coil (Pin 13 will read open if you are measuring on a 20m dipole or BigIR/SmallIR **without** loading coil).

Step 5: Make sure there is an open circuit (no connection) between all pins (except 13) and the shield of the coaxial cable (Any reading < 100 K ohms is bad). Pin 13 will show 100 ohms of resistance to ground and therefore 100 ohms to the shield of the coaxial cable if your controller and radio are grounded together.

Conclusion

If you see a dead short (Any reading < 100 K ohms is bad) between the coaxial cable and any active pins (except pin 13) of the antenna control cable, address that before applying power to either the controller or the coaxial cable. Powering the controller or coaxial cable while a dead short is present can cause an immediate drive circuitry failure.