Resistance and Voltage Tests

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Updated: 8/22/2024

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.

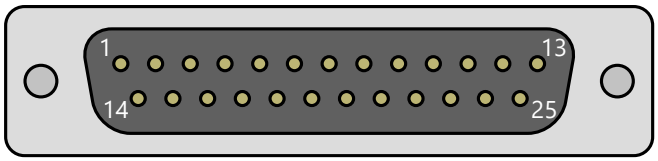

Figure 1: Male DB25 connector pin layout

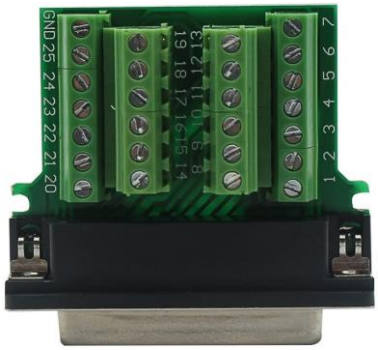

Figure 2: Male DB25 field splice connector pin layout

Resistance Test Procedure

The control cable uses 4 wires per motor (one motor in each element housing unit (EHU)). 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 (disconnected from 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: Begin by turning off your controller, disconnecting power from your controller, and then remove the DB25 control cable connector from the back.

Step 2: Hold the DB25 connector so you are looking at the pins with them pointing at you or open the back shell of the DB25 field splice. If prodding the pins directly, orient the connector so the row with 13 pins is on top, now the upper left-hand pin is pin 1. See **Figure 1** (above) for reference. If you decide to open the case of the connector, reference the pin number marking on the PCB (see **Figure 2** above).

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 15 ohms to 30 ohms depending on cable length between the pins listed below. Record your results in the "Results" column. (100' is about 23 ohms).

Resistance Test Table			
Pin Pair	*Antenna Element*	*Expected Resistance*	*Results (Ohms)*
1-2	Driven	~ 20 Ohms	
3-4		~ 20 Ohms	
5-6	Director 1 or 80/60/40/30m Coil	~ 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 (V1 relay) or ~ 720 Ohms (V2 relay)	
		DB42: ~ 140 Ohms (V1 relay) or ~ 360 Ohms (V2 Relay)	
13-24	Relay 3	**DB11/18/18E/42:** ~ 280 Ohms (V1 relay) or ~ 720 Ohms (V2 relay)	

Table 1: Expected control cable resistances

Step 4: Next make sure there is an open circuit between the following pins. Record your results in the "Results" column. (Any reading < 100 K ohms is bad)

Open Circuit Test Table		
Test Pins	*Expected Resistance*	*Results (Ohms or Open Load (OL))*
Connector metal case to any pin	Open Load (OL)	
Pin 1 to any pin except 2	Open Load (OL)	
Pin 3 to any pin except 4	Open Load (OL)	
Pin 5 to any pin except 6	Open Load (OL)	
Pin 7 to any pin except 8	Open Load (OL)	
Pin 9 to any pin except 10	Open Load (OL)	
Pin 11 to any pin except 12	Open Load (OL)	
Pin 13 to any pin except 22, 23, or 24	Open Load (OL)	
Pin 14 to any pin except 15	Open Load (OL)	
Pin 16 to any pin except 17	Open Load (OL)	
Pin 18 to any pin except 21	Open Load (OL)	
Pin 22 to any pin except pin 13, 23, or 24	Open Load (OL)	
Pin 23 to any pin except pin 13, 22, or 24	Open Load (OL)	
Pin 24 to any pin except pin 13, 22, or 23	Open Load (OL)	
Pin 25 (NOT USED)	NOT USED	NOT USED

Table 2: Expected control cable open circuits

Conclusion

If your antenna passes this test it does not mean it is wired correctly. You could have an intermittent short or a short that requires higher current than what the ohmmeter can supply to reveal itself. You may have also 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.

Motor Voltage Test (Controller Output 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/MODULE.

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/module or driver board failure. You will be measuring the voltage between certain pins of the DB25 connector on the back of your controller. Figure 3 (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 4 (below) shows the layout of the driver board and the Driver Chip/Module naming convention. The naming convention is the same for either driver board using dual inline package (DIP) driver chips or driver modules (small printed circuit board (PCB) with surface mount device (SMD) chips).

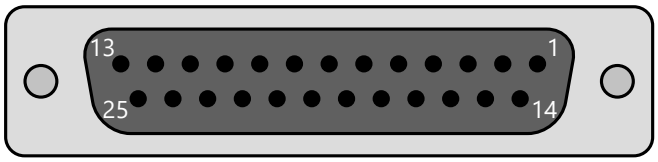

Figure 3: Female DB25 connector pin layout

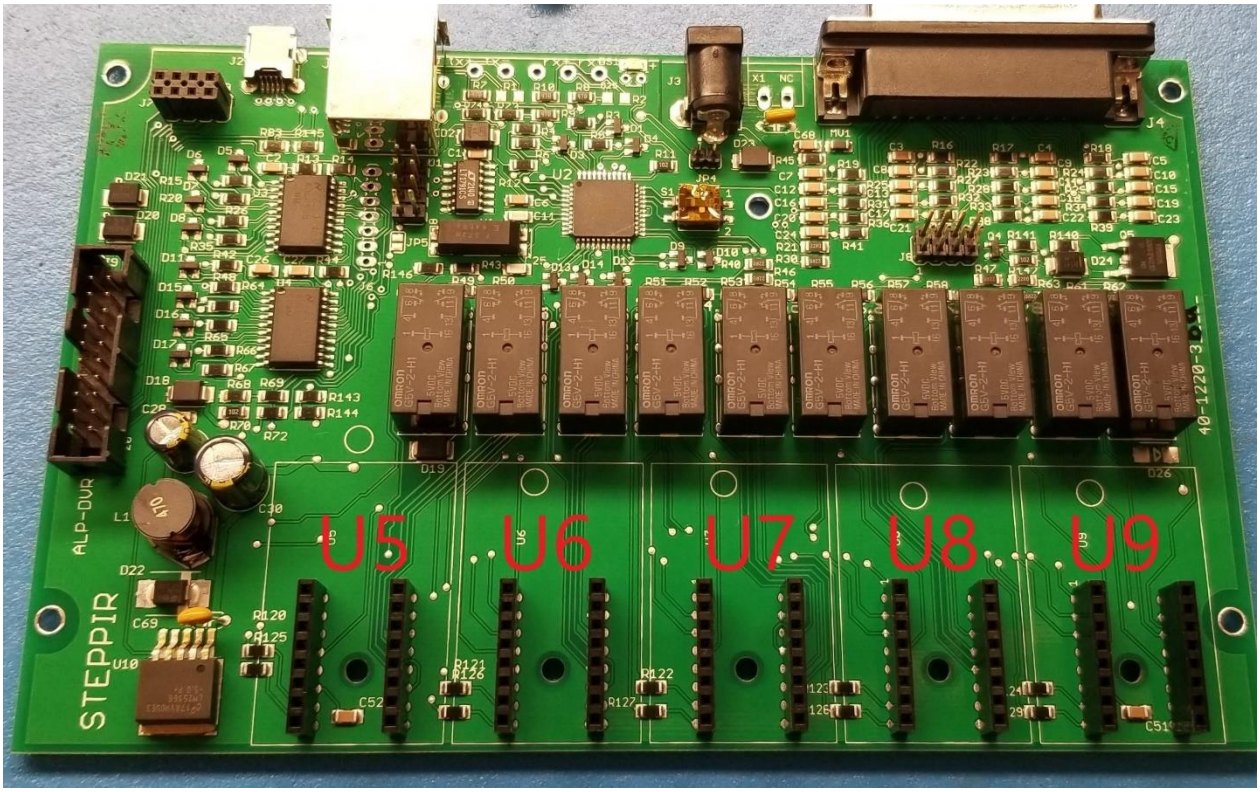

Figure 4: Driver chip/module naming convention

Motor Voltage Test Procedure

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

Table 3: Expected motor voltages

There are two ways to measure voltage from the controller. Either by using a spare DB25 Field Splice with no control cable connected, or by prodding the pins directly on the DB25 connector on the back of the controller.

Figure 5: Spare DB25 field splice voltage measurements

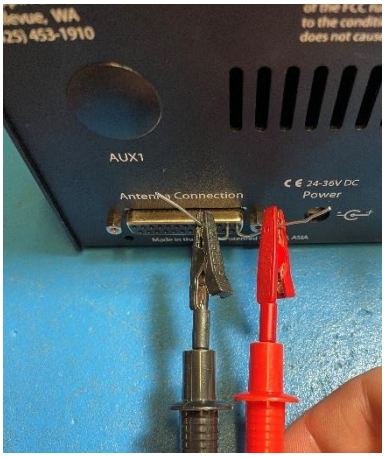

Figure 6: Direct voltage measurements with clips

[1] Your voltage will vary depending on if you are using an OptimizIR or SDA 100 or Fluidmotion controller and whether the control cable is connected.
[2] Your voltage will vary depending on which power supply you are using.
[3] **For Vertical Antenna's with Coil ONLY:** 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: Step 1: Begin by turning off your controller, disconnecting power from your controller, and then remove the DB25 control cable connector from the back. If you have a spare DB25 Field Splice plug it in at this point.

Step 2: Reconnect power and turn the controller on.

Step 3: Using a multimeter, measure the voltage between the pins indicated in **Table 3**, column 1. *Be sure to measure DC voltage during this step rather than AC!* You should be seeing around 1.5-5VDC. You only need to measure the voltages that correspond to the elements on your antenna. Record your results in the "Idle Voltage Results" column. 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!* Record your results in the "Tuning Voltage Results" column.

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 (Controller Output Test)

Relay Voltage Test Procedure

Some SteppIR antennas contain relays to change the active driven element. If you own an antenna with relays you should perform the relay voltage test to ensure that they are working properly. This can be done by either sending the antenna to a specific Ham band or by using the "Relay Test" menu within the “Setup” menu. Erroneous readings indicate a fault with the relay board in your controller. Use the tables 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!* Record your results in the “Results” columns.

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 24-36VDC in the chart.

DB11								
Pin Pair	Relay	Direction	SDA 100			OptimizIR		
			6 - 17m	20m	20m results	6 - 17m	20m	20m results
13-23	R2	NORM	-	24-36VDC	VDC	-	24-36VDC	VDC
		180	-	0VDC	VDC	-	0VDC	VDC
		BI	-	24-36VDC	VDC	-	0VDC	VDC
13-24	R3	NORM	-	0VDC	VDC	-	0VDC	VDC
		180	-	24-36VDC	VDC	-	24-36VDC	VDC
		BI	-	0VDC	VDC	-	24-36VDC	VDC

Table 4: DB11 Relay Voltages

DB18											
Pin Pair	Relay	Direction	SDA 100					OptimizIR				
			6 - 20m	30m	30m results	40m	40m results	6 - 20m	30m	30m results	40m	40m results
13-23	R2	NORM	-	24-36VDC	VDC	24-36VDC	VDC	-	0VDC	VDC	24-36VDC	VDC
		180	-	24-36VDC	VDC	0VDC	VDC	-	24-36VDC	VDC	0VDC	VDC
		BI	-	24-36VDC	VDC	24-36VDC	VDC	-	24-36VDC	VDC	24-36VDC	VDC
13-24	R3	NORM	-	0VDC	VDC	0VDC	VDC	-	24-36VDC	VDC	0VDC	VDC
		180	-	0VDC	VDC	24-36VDC	VDC	-	0VDC	VDC	24-36VDC	VDC
		BI	-	0VDC	VDC	0VDC	VDC	-	0VDC	VDC	0VDC	VDC

Table 5: DB18 Relay Voltages

DB18E												
Pin Pair	Relay	Direction	SDA 100					OptimizIR				
			6 - 20m	30m	30m results	40m	40m results	6 - 20m	30m	30m results	40m	40m results
13-23	R2	NORM	-	0VDC	VDC	24-36VDC	VDC	-	0VDC	VDC	24-36VDC	VDC
		180	-	0VDC	VDC	0VDC	VDC	-	0VDC	VDC	0VDC	VDC
		BI	-	24-36VDC	VDC	24-36VDC	VDC	-	0VDC	VDC	24-36VDC	VDC
13-24	R3	NORM	-	0VDC	VDC	0VDC	VDC	-	0VDC	VDC	0VDC	VDC
		180	-	0VDC	VDC	24-36VDC	VDC	-	0VDC	VDC	24-36VDC	VDC
		BI	-	0VDC	VDC	0VDC	VDC	-	0VDC	VDC	0VDC	VDC

Table 6: DB18E Relay Voltages

DB36 w/80m Dipole					
Pin Pair	Relay	Mode	Band		
			6 - 40m	60/80m	60/80m results
13-22	R1	NORM	-	24-36VDC	VDC
		180	-	-	-
		BI	-	-	-

Table 7: DB36 w/ 80m Dipole Relay Voltages

DB42 w/80m Dipole										
Pin Pair	Relay	Mode	Band							
			6m	6m results	10 - 20m	10 - 20m results	30/40m	30/40m results	60/80m	60/80m results
13-22	R1	NORM	-	-	-	-	-	-	24-36VDC	VDC
		180	-	-	-	-	-	-	-	-
		BI	-	-	-	-	-	-	-	-
13-23	R2	NORM	24-36VDC	VDC	24-36VDC	VDC	-	-	-	-
		180	24-36VDC	VDC	0VDC	VDC	-	-	-	-
		BI	24-36VDC	VDC	24-36VDC	VDC	-	-	-	-
13-24	R3	NORM	-	-	-	-	24-36VDC	VDC	-	-
		180	-	-	-	-	24-36VDC	VDC	-	-
		BI	-	-	-	-	24-36VDC	VDC	-	-

Table 8: DB42 w/ 80m Dipole Relay Voltages

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.

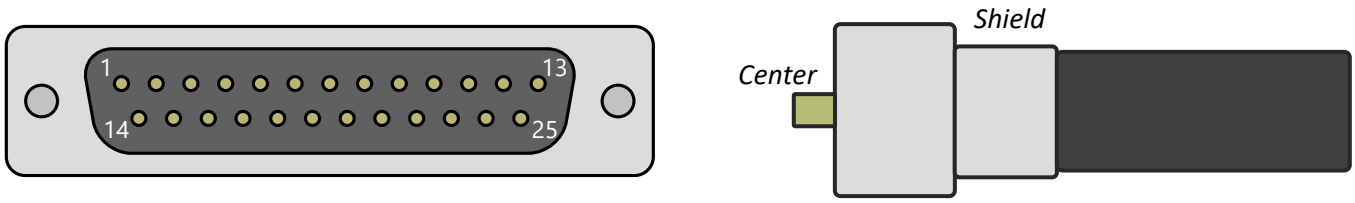

Figure 7: Male DB25 connector pin layout and Coaxial Cable Connector

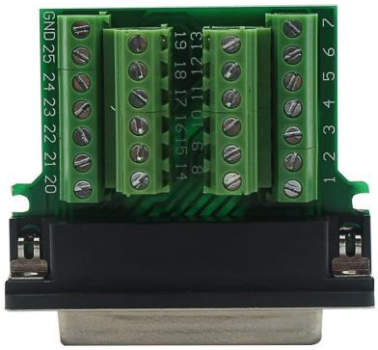

Figure 8: Male DB25 field splice connector pin layout

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: Begin by turning off your controller, disconnecting power from your controller, and then remove the DB25 control cable connector from the back.

Step 2: Hold it so you are looking at the pins with them pointing at you or open the back shell of the DB25 field splice. Orient the connector so the row with 13 pins is on top, now the upper left-hand pin is pin 1. See **Figure 7** (above) for reference. You may also open the case of the connector if using a DB25 Field Splice connector and reference the pin number marking on the PCB (see **Figure 8** above).

Step 4: Make sure there is an open circuit (no connection, OL) between all pins on the DB25 connector and the center conductor of the coaxial cable. (Any reading < 100 K ohms is bad).

Step 5: Make sure there is an open circuit (no connection) between all pins and the shield of the coaxial cable (Any reading < 100 K ohms is bad).

Conclusion

If you see a dead short (Any reading < 100 K ohms is bad) between the coaxial cable and any active pins 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.