



BLACK BOX

"Positive Voltage Control"



The Scotty Black Box - How & Why

There has been much research into the concept of using electricity to catch fish. Commercial fishing vessels have been using Black Box technology for years and now recreational fishermen are tapping into this resource. The Black Box has proven to be very effective in trolling, mooching, jigging and more. The purpose of this publication is to explain why.



No. 1201
Black Box

20 foot Load
Line &
Connector
Sleeve



Fish & Electricity

Russian scientists first discovered that bony and cartilaginous fish respond to the presence of electricity in the water. Many species use electric signals to communicate, some repel predators with it and others use electricity to navigate. Salmon, among others, are attracted to a positive charge and repelled by a negative charge. By maintaining a steady and appropriate positive charge on your downrigger wire, it is possible to attract fish and keep them interested in your lures. The Black Box does this in both salt and fresh water.

Electrolysis

To understand the Black Box, one must first understand the principle of electrolysis. This process is also known as galvanic action. Metals are ranked according to how strongly they react with other metals. The lower they are on the galvanic scale (or the less "noble") the more strongly they react. When dissimilar metals are placed in an electrolytic solution, electricity flows between them (basically: a battery) and corrosion occurs. The difference in nobility, or ranking, of metals determines how much electricity will be generated. Zinc, which is very low in nobility, is used in sacrificial anodes on boats to prevent corrosion of metal parts because it will corrode long before other metals.

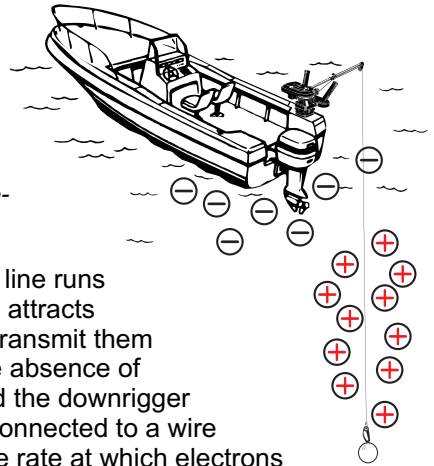
The Black Box

The electricity generated in electrolysis puts a natural charge on your vessel. When using a downrigger, the reaction between your wire and your zinc anodes will normally generate about .8 volts (in saltwater). This positive charge on your downrigger wire has been known to attract fish. However, fish are extremely sensitive to changes in this charge. The Black Box is designed to regulate and monitor that charge through a metal contact sleeve over the downrigger wire. It also has a pulse mode which can be used to trigger strikes during slow times.

Electrons flow from the boat metals, typically the less noble zincs, across the electrolytic solution (fresh or saltwater) to the downrigger cable. They then migrate into the Black Box drawn by the red battery post (anode). The black post (cathode) donates electrons to power the Black Box and is connected by a bonding wire to all metal parts in contact with the electrolytic solution.

The downrigger cable maintains a fish-attracting positive electric potential because the Black Box draws electrons from the downrigger line faster than electrons are donated through the water from boat metals.

D.C.Reid, BC Outdoors Sport Fishing, June-August 2002.



The charge from the zinc to the downrigger line runs negative to positive because stainless steel attracts and sheds electrons faster than water can transmit them from the boat's zinc. This creates a relative absence of electrons, or relative positive charge around the downrigger line. A sleeve over the downrigger wire is connected to a wire which runs to the Black Box. By altering the rate at which electrons are transmitted from the surface of the downrigger line to the Box, the Black Box modifies the charge around the entire length of the cable. The circuit is completed as electricity is attracted by the positive or red battery terminal, passes through the battery to the negative post whereupon one lead powers the black box and the other connects through the bonding wire to the engine or outdrive. At this point, the circle begins again with the electrons being attracted back toward the downrigger line.

The Black Box is most effective when connected to all the downriggers on the boat, providing a uniform positive charge around the hull. Up to 6 downriggers can be connected to one Black Box. A short drop back leader length is recommended in order to keep the lure within the electric field. Longer drop back leader lengths tend to put the lure into the weaker part of the field. Leaders of 10-20 feet work well. Depth can also alter the effectiveness of the Black Box. You may need to increase the charge slightly on your Black Box to compensate for deeper fishing (100' or more). Do not forget to turn it back down when fishing nearer the surface. The Black Box is also very effective when drift fishing, as fish have longer to react to the positive voltage effect and it can attract fish from as much as 300 feet away. The Black Box has also been used successfully for ice fishing. A Black Box is effective on all types of boat hull, provided it is properly bonded and equipped with zinc anodes. Aluminum hulls actually act as the negative side of the electrolysis circuit, creating a wider electric field and attracting fish from a broader area. Some vessels may be so well bonded that the natural electrolysis is ideal. These boats may not benefit from the use of a Black Box. A Black Box draws very little power (about .1 amp at full load). It has no effect on other electronics on board.

Natural Electrolysis

"Natural" electrolysis occurs on most boats even without a Black Box. There are several factors which will affect your boat's electrical condition. Your downrigger spool and wire line should be insulated from the boat hull in order to allow natural electrolysis to occur. All models of Scotty downriggers are fully insulated. The sacrificial zinc anodes on your boat should not be more than 50% dissolved. They should be clean and unpainted. If you trailer your boat often, you should

scrub your zincs with plastic scrubber or stainless steel brush to remove the film which develops. This film will reduce the effectiveness of your zincs drastically.

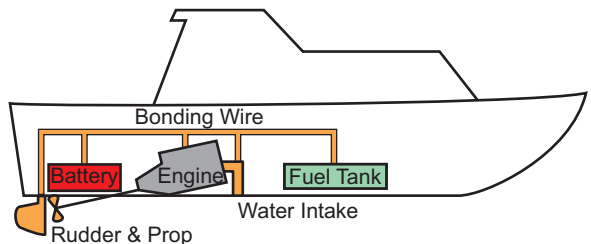


- Do not use a brush or scrubber made of any other metal as it will contaminate your zincs.
- Your downrigger weights should be pure lead, as impurities can produce a negative charge.
- Use a nylon snap to connect the downrigger cable to the downrigger weight or use a short piece of monofilament to insulate the weight from the wire. This breaks a harmful electrolysis field which might occur.
- Replace your downrigger cable at least every 2 years if it has been used often in saltwater, as the galvanic action will etch it over time.
- Do not use zincs on your downrigger wire. This may cause a negative voltage zone to occur.

Controlling Electrolysis

It is important to guard against the effects of electrolysis on your boat. Careful testing of your boat's electrolysis condition will prevent corrosion damage and perhaps enhance your fishing results. Ideally, your boat should be set up so that the corrosion is controlled and dissipated in the sacrificial anodes. It is recommended to measure the levels of electrolysis around your boat to ensure proper protection. Here's how: Inspect the inside your hull. Look for a copper bonding wire running along the bottom of the hull, connecting all the underwater metal fittings—engine, fuel tanks, thru hulls, etc. Check that this wire is unbroken and has clean, tight connections. Check the connections with a voltmeter, by touching the positive lead to the fitting and the negative lead to the bonding wire. The meter should show a reading of .010 volts.

Aluminum boats with an outboard should be properly electrically grounded to the metal hull or bonding strap. An electric start outboard should also be grounded (connect the negative terminal of the battery to the boat hull). Also test for continuity to the boat hull or bonding strap as well as the outboard motor. A #10 bonding wire should be installed from the negative terminal to the hull and to the outboard if there is no continuity. With the boat in the water, lower a downrigger wire into the water a few feet. Do this away from marinas or docks to avoid stray electrical currents. Now test the voltage on your downrigger wire. With your downrigger weight and wire in the water, turn off everything electrical on your boat. Turn the master connect battery switches off. Connect the negative lead from your volt meter to the negative battery terminal, the engine or to one of the bonded metal fittings on the hull. Connect the positive lead to your downrigger wire near the spool or along the arm. You should get a natural electrolysis reading of between .7 and .9 volts. If your reading is much outside this range, you have a problem. Turn each of the boat's electrical systems on one at a time, starting with the battery switches, then the bilge pump, engine and then each of the other electrical devices. If your natural electrolysis voltage reading changes by



more than .05 volts you have an electrical leakage problem or a problem in the negative battery circuit. If you have electric downriggers, be sure to turn them on as part of your checkout. To test them, you will have to lower them deeper and then hold your positive lead against the moving wire as it rewinds.

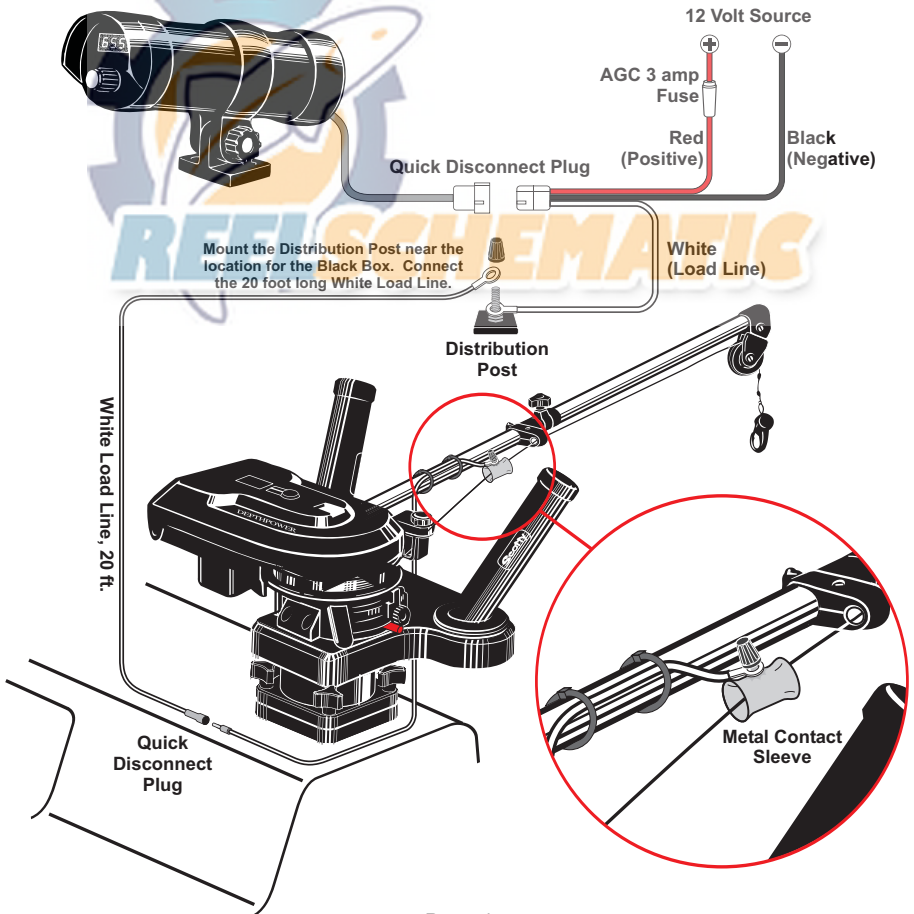
Base Readings: If your electrolysis reading is too low (.1 to .5 volts), your zincs may need cleaning or replacing, or your boat may not have enough zinc. You should also check the bonding connections for improper bonding.

If your reading is zero or negative, your downrigger may not be insulated from the hull, your zincs may need cleaning or replacing, there may be electrical leakage from a positive connection somewhere, or your hull may not be properly bonded.

If your reading is too high (over 1 volt), your downrigger may not be insulated from the hull or your downrigger wire may have been replaced with something other than stainless steel (ie monel)

Installing Your Black Box

Your Black Box should be mounted in a dry location, as it is water resistant but not waterproof. You can mount it either a vertical or horizontal surface and can



be mounted away from the downriggers as monitoring is not required after installation. Disconnect your cannonball snap and feed the downrigger cable through the contact sleeve. Connect the contact sleeve wire lead to the downrigger boom with cable ties, leaving the last several inches of sleeve wire and sleeve loose so that the sleeve doesn't interfere with the spooling of the wire. Clean your plug and socket regularly with an emery cloth and spray electrical connections periodically with a moisture displacing lubricating spray.

Turn on your Black Box. The initial reading is the boat's charge. After 10 seconds, the reading will change to reflect the charge exerted on the downrigger line. This usually reads about .050 volts. The dial can then be tuned to the desired level to suit your target fish.

Fish Species	Recommended Voltage
Chinook (King) Salmon	.600 volts
Coho (Silver) Salmon	.650 volts
Sockeye Salmon	.750 volts
Kokanee Salmon	.650 volts
Halibut	.450 volts
Laketrout (Mackinaw)	.650 volts
Rainbow & Brown Trout	.650 volts
Cutthroat Trout	.650 volts
Black Bass	.750 volts
Shark	.400 volts
Striped Bass	.650 volts
Sturgeon	.500 volts
Catfish	.500 volts

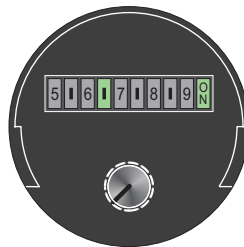
Operating Your Black Box

There are two models of Black Box. They operate slightly differently and have different start up sequences.

Light Bar Model

Connect the power to the Black Box. Be sure the Black Box switch is turned to the off position (all the way counter clockwise). Be sure the metal contact sleeve is in place on the downrigger wire and connected to the Black Box.

Drop the downrigger to fishing depth or at least a few feet under the surface. With the knob still in the off position, read the green marker on the Black Box to get the line's natural voltage. If the natural voltage is not what you want, turn the



- 5 | 6 | 7 | 8 | 9 | 0 N .600 Volt
- 5 | 6 | 7 | 8 | 9 | 0 N .625 Volt
- 5 | 6 | 7 | 8 | 9 | 0 N .650 Volt
- 5 | 6 | 7 | 8 | 9 | 0 N .675 Volt

Black Box on by turning the dial clockwise. Note the "on" light at the right end of the scale. It shows you are now imposing the voltage with the Black Box. You can then dial and maintain the desired line voltage.

If the natural voltage is .9 volts or higher, the green bar graph will show .9. If the bar graph does not show a natural reading when everything is connected, this means your boat's natural reading is below .5 volts. By turning the Black Box on, you can increase or decrease your voltage to the desired level. When the Black Box is turned on and connected to 3 or 4 downriggers, the amperage draw averages about .1 amp.

Note: As you dial the Black Box (light bar model only) below .5 volts, the reading does not show on the scale but you are progressively reducing the voltage until you turn the unit off. The digital model shows the reading all the way down to zero.

Digital Model

Plug in the power to the Black Box. Be sure the Black Box switch is turned to the off position (all the way counter clockwise).

Be sure the metal contact sleeve is in place on the downrigger wire and connected to the Black Box.

Drop the downrigger to fishing depth or at least a few feet under the surface.

Turn the knob to the on position. Watch the digital readout. For the first ten seconds, it will show the natural electrolysis reading of the wire. The readout will then automatically go into the dial mode. You can then turn the dial to whatever reading you want from zero to .9 volts.

Pulse mode. This model Black Box can be set to the pulse mode where the Black Box pulses the voltage between the boat's natural electrolysis and the desired dial reading. To enter the pulse mode, turn the unit on and wait 10 seconds until it shows the dialed readout. Then turn the dial off and quickly turn it back on. You will note the reading will change back and forth. Turn the knob to the desired set point.

To get the digital Black Box out of the pulsing mode, turn it off entirely for at least ten seconds. When you turn it back on, it will go into the normal operating mode.

Digital Diagram



In the non pulsing mode, if the natural voltage is .9 volts or higher, the digital display will show .9. By turning the dial, you can increase or decrease your voltage to the desired level. When the Black Box is turned on and connected to 3 or 4 downriggers, the amperage draw averages about .1 amp. The pulse mode can be very effective in triggering a strike, particularly when fishing is slow. Some change in conditions can often trigger a strike.

Installation Troubleshooting

"When the light bar model Black Box is plugged in but not turned on the green light does not show any natural electrolysis reading. Or, when the digital model is first turned on, there is no natural electrolysis reading"

- The unit may not be getting power or the power leads may be reversed. Turn the knob to the "on" position and see if the green light comes on.

- The downrigger contact sleeve is not plugged or is not making proper contact with the stainless steel wire.
- The downrigger wire is not in the water.
- The zincs on the boat are worn out or are not functioning resulting in a low reading which is below the light bar model minimum of .5 volts.
- If you are in freshwater there may not be enough dissolved minerals present to cause significant natural electrolysis. Most bodies of freshwater will show readings very close to salt water but you may have found an exception.

"When the light bar Black Box is plugged in but not turned on, the green light stays at .9 volts"

- This means the natural electrolysis is .9 or above. This is abnormally high and usually indicates some other higher nobility metal like monel wire.

"When the voltage on the downrigger wire is tested with a separate volt meter, the reading is not the same as the natural electrolysis reading shown on the Black Box"

- This usually indicates there is too much load on the negative ground wire where the negative lead of the Black Box is connected. If several devices like radios, radar, electric downriggers, blowers and fish finders are all attached to the same ground terminal strip, often there is not enough capacity in the wire going back to the battery. This throws the Black Box off. A separate negative lead should be run from the Black Box black wire back to the engine or battery ground.

Black Box Fishing Tips

- Resist the temptation to turn the Black Box up to a higher voltage if you are not getting strikes. It is actually better to reduce the natural electrolysis voltage. You have the Black Box too high if hooked fish fight violently or try to swim under the boat when brought near the hull.
- Larger fish are more sensitive to positive charge. Lower the voltage of your Black Box to attract them.
- Make small adjustments with your Black Box. Often this is all that is needed.
- A boat that has good natural electrolysis levels may change when you repower or change any electronics on board. Test your boat any time you make a change to be sure you are not repelling fish unknowingly. A boat that fishes well without a Black Box may require one after a change of engine.

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