

BLACK BOX ELECTRONIC FISHING TECHNOLOGY

The most comprehensive book on Black Box technology ever assembled. Learn how and why fish are attracted to a downrigger cable that gives off a small electric charge. The book also gives a step by step procedure you can use to determine if your boat attracts or repels fish. Learn the principles of the Black Box and how to optimize your boat's charge for each species of fish.

Chapter I Catching Fish with Electricity - The Concept

Ever wondered why some boats consistently out fish all the others? Every experienced fisherman has seen it. Two boats using the same lures, same gear, same depth and one will catch most of the fish. The answer may not be as mysterious as it seems. Research in recent years has shown that positive voltage on your downrigger cable can have a major influence on fishing results. As a boat sits in the water, very small electrical currents are generated as the minerals in the water react with the different metals on the boat. If the boat is outfitted correctly, a very slight positive electrical charge will surround the hull. Fish are attracted to this positive charge. If the boat is set up wrong, an incorrect charge surrounds the hull and fish will be repelled. Fishermen who learn how to take advantage of this will significantly improve their catch.

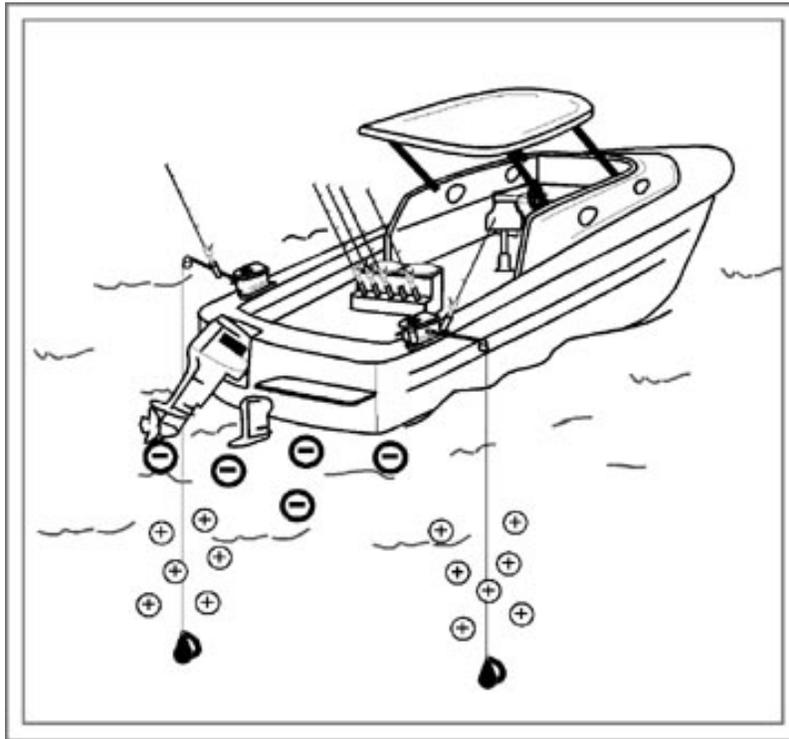
Nearly one hundred years ago, Russian scientists studying fish behavior learned that most fish have reactions to weak positive and negative electrical charges in the water. Some fish, like sharks, will react strongly to the tiniest of electrical fields. Fish are attracted to a positive charge and are repelled by a negative charge.



Different species will show varying degrees of electrical reaction. Some of the fish showing the most sensitivity include salmon, kokanee and trout. Natural electrolysis causes electricity to flow from the metal hull parts of your boat to your downrigger wire. If the boat and downrigger are set up right, this will place a positive charge on the downrigger wire which attracts fish. A black box will stabilize this charge at the ideal voltage.

Modern downriggers offer fishermen a big advantage in getting the correct positive electrical charge around their boats. If the downrigger is insulated, natural electrolysis between the stainless steel downrigger wire and the metals of the boat will create a

positive charge. The fisherman can then control and stabilize this charge to the ideal voltage by using the Black Box.



Every boat takes on a natural electric charge in the water because of the different metals reacting with the minerals in the water. The zincs on the motor will be positive in charge. This drives the other metal parts on the boat to a negative charge. Any unconnected metals like downrigger cable will take on a positive charge.

Commercial salmon trollers have used the Black Box technique to increase their profits many thousands of dollars each year by imposing a voltage on their stainless steel cables. By using multiple cables all connected to the Black Box, they can create a complete zone of positive electricity around the boat hull. Downrigger fishermen can create this same field with the Black Box.

The Black Box will significantly improve results when trolling. It can also be effective in mooching, jigging and still fishing applications. In these instances, the downrigger or wire fishing line is connected to the Black Box and is lowered to the fishing zone.

Recommended steps in evaluating how much a Black Box will improve your fishing.

1. Read the first few chapters of this write-up so you understand the principles of how your boat generates electricity in the water.
2. Follow the steps in Chapter III and run the simple test to see how much natural voltage your boat is producing. This will tell you if you are attracting or repelling fish and will

tell you if the boat needs some cleaning up to correct base problems. This is half the battle and should be done to improve your fishing even if you never purchase a Black Box.

3. Once you know your natural voltage, you can see how much voltage correction you need and evaluate how much a Black Box will help you.

Chapter II

Factors that Effect Your Boat's Electrical Condition

To take advantage of an electrical charge to catch fish, there are several criteria which must be observed. Even without a Black Box there is “natural” voltage generated in a downrigger wire that can significantly assist the downrigger owner in improving his catch. With or without a Black Box, the following steps should be observed.

1. The downrigger spool and wire line must be insulated from the boat hull. This allows a natural voltage to be generated on the wire. Most downriggers with plastic spools are insulated by the manufacturer. Some manufacturers intentionally connect the downrigger wire to the boat’s electrical system as a means of stopping the retrieve when the downrigger weight breaks the water surface. This does the opposite of what you want. A high voltage is placed on the downrigger wire which repels fish.

2. Check the zinc sacrificial anodes on the boat and on your outboard or outdrive. If they are more than 50% dissolved, they should be replaced. If they have a coating of slime or growth, this should be cleaned off. Use a stainless steel brush or a non-metallic scrubber so that the zinc is not contaminated with a foreign material. New zinc anodes should meet MIL-SPEC MIL-18001. (Zinc, -0.1% cadmium and -.025 aluminum)

3. Bare lead downrigger weights usually produce a harmful charge. Impurities that are present in the lead cause the problem. Scrap lead from auto wheel weights can be particularly bad because it contains antimony (tin). The best practice is to use only coated weights. Vinyl or powder coated weights are readily available on the market, or you can paint or vinyl dip them yourself to insulate them.



A bare lead weight will react with the stainless steel wire and create a problem voltage right in your fishing zone. To be safe, always use coated weights.

4. Do not use a metal snap to connect the downrigger cable to an uncoated downrigger weight. Use a nylon snap hook or connect the weight with a short piece of monofilament to insulate the weight from the wire. If the lead weight is hooked directly to the steel downrigger wire, a separate and often harmful electric field will be set up.
5. If your downrigger cable is more than 2 years old and has been operated heavily in saltwater, it may have become etched from galvanic action. This means it has been worn out both electrically and physically and should be replaced.
6. Some fishermen attempt to create the correct voltage by crimping zincs on their downrigger wire or by placing copper or other metals near their lures. This is not advisable. Often, a zone of harmful voltage will be set up somewhere in the system. It's best to keep your wires and weights as "clean" as possible and then get the correct voltage from the Black Box.

Chapter III

How to Test Your Boat's Electrical Charge

The effects of underwater electrolysis and the corrosion damage it can cause to metallic boat parts have concerned boaters for many years. Only in more recent years has it been learned that these same factors can have a significant role in how a boat fishes. This chapter describes a step-by-step procedure that you can follow to see if your boat is

adequately protected from galvanic corrosion (electrolysis) and is set up to maximize the positive effects of a positive voltage on fish.



A voltmeter with a scale of zero to one volt will measure the natural voltage of your wire. Here the natural voltage reading is .782 volts. Note the positive lead is touching the downrigger wire. The negative lead is connected to the engine or the negative pole on the boat battery.

Even if you may never intend to purchase a Black Box, you should carefully follow these steps. You can save yourself a lot of grief from corroded boat parts and may considerably enhance your fishing results.

Whenever a boat is in water, the different underwater metal parts interact with each other to form a weak battery. Electrical currents flow from one metal part to another depending on the type and placement of the metals involved as well as the mineral content of the water. Typical metals used on boats include aluminum, copper, steel, brass, stainless steel and zinc as sacrificial anodes. If a boat is set up properly all the corrosion is channeled so it dissipates harmlessly in the zinc sacrificial anodes. As it does so, it creates a positive field around the vessel which can be helpful in attracting fish.

The Pro-Troll Quick Boat Check Procedure.

1. Use a voltmeter that has a DC scale that will read zero to one volt. If you already have the Cabela's Black Box you can use it as your voltmeter in the natural voltage mode.
2. With the boat in the water, lower a downrigger wire into the water five or six feet. It is best to do this away from marinas or docks where a number of boats are moored. Stray electrical currents from battery chargers or electrical systems can distort your readings. It is also best to have a vinyl-covered downrigger weight and an insulated end snap connecting your weight to the wire.

3. Turn off everything electrical on the boat. Turn off the master battery switches if you have them. Then connect the negative lead from your volt meter to the negative battery terminal, the engine or to some other grounded metal on the boat. Touch the positive lead to your downrigger wire near the spool or along the arm. You should get a natural voltage reading of between .7 volts and .8 volts. If the reading is significantly outside this range, you have a problem (see later problem section).

4. One by one, turn on the boat's different electrical systems and watch the voltmeter. Start first with the battery switches. Next, turn on the bilge pump. Start the engine and then each of the other electrical devices. If your natural voltage reading changes by more than .05 volts from its starting point with any of these steps, you have an electrical leakage problem. These are quite common in battery switches and accessories like bilge pump connections where a slight amount of positive electricity can leak into the water in the bilge.

If your boat fails test 3 or 4, you are probably repelling fish rather than attracting them. You need to find the problem on the boat and clean it up.

Initial things to check if your readings are not normal

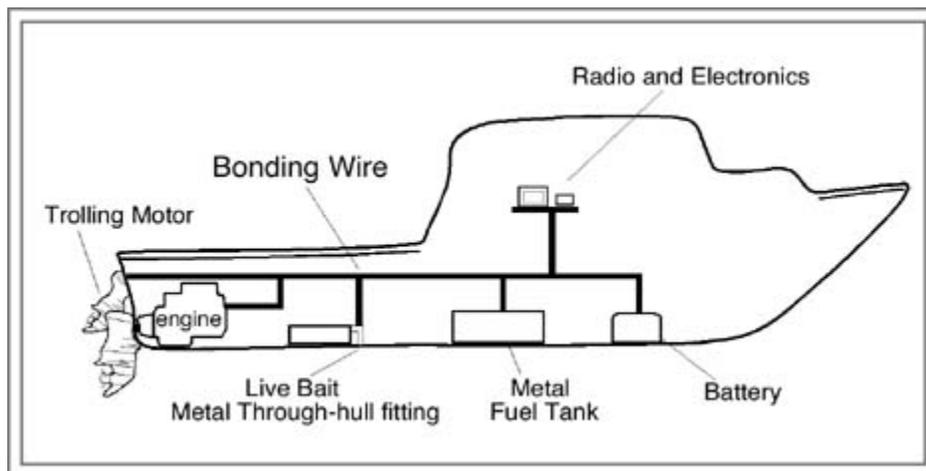
If your readings are low (below .500) most of the time the problem is either your zinc not making good contact with the water or your downrigger cables are not making good contact with the water. Boats that are kept on trailers out of the water, often get oxidation on the zinc and it will become covered with a white powder. This insulates the zinc from the water and causes a low voltage reading. The solution is to clean the zinc with a stainless steel brush.

Downrigger wires also get corrosion and don't make good contact with the water. The older the downrigger wire, the more likely it is covered with scum or corrosion. It will give you a low reading even with a good zinc. For testing purposes you can scrape or clean a section of the wire with steel wool. If the wire has broken strands it's probably time to replace it. Otherwise the best answer is to install a Black Box which will bring the voltage back where you want it. Different downriggers on the same boat will frequently show different natural voltage readings because the wire on one will be older or more corroded than the other. The Black Box will correct the voltage on up to six downriggers.

Boat bonding could be a problem. Inspect the inside of the hull. If the boat is fiber glass or wood, there should be a copper bonding wire running along the bottom of the hull connecting all the underwater metal fittings together. For example, it should run from the engine or outdrive to the metal fuel tanks, metal water tanks, thru hulls, trim tabs and motor shaft and stuffing box. Be sure the bonding wire is not broken and that the connection to each fitting is clean and tight. The connections are easy to check with a volt/ohm meter. With the boat in the water, touch the positive lead from the volt meter to each fitting and the negative lead to the bonding wire. If the meter shows a reading of .010 volts or higher, clean the connection and recheck. If its below .010 volts, check the

same connection with an ohm meter to insure continuity of less than one ohm. If the boat is out of the water on a trailer, you can use the ohm part of this test by itself.

If your outboard engine is an electric start, it is automatically grounded and nothing further needs to be done. If it is not an electric start it must be grounded (bonded) to the boat ground system. This can be done by running a wire from the metal on the motor to a ground point on the boat hull. If you are not sure the motor is grounded, you can use a volt/ohm meter to check. To test for bonding, connect the negative meter lead to the negative terminal of the battery and test for continuity to the boat hull or bonding strap as well as the outboard motor. If there is no continuity, install a bonding wire (#10) from the negative terminal to the hull and to the outboard.



All metal parts in contact with the water should be connected together by a heavy bonding wire

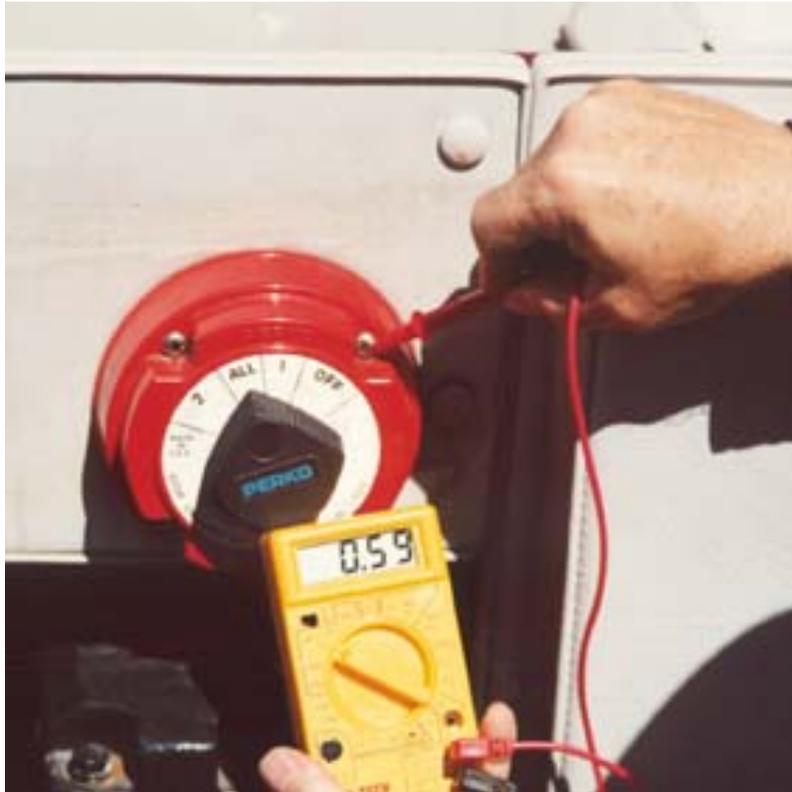


A common problem occurs with kicker outboards that are not electric start. Unless this motor is bonded (connected) to the ground part of the boat, the zinc on the kicker will create a strong positive field around the boat ("hot boat"). This can severely impact your fishing results. Run a ground wire from the kicker to your main engine ground or some other ground point on the boat.

Another common problem is separate batteries in the boat that are not grounded to the main battery. Many fishermen will install a separate battery to run accessories like electric trolling motors, depthsounders and radios. The negative ground terminal on this battery must be connected to the negative terminal of the main boat battery or you may be creating significant fish problems.

Electrical leakage of positive voltage from a battery switch or, bilge pump or another positive terminal can also cause a major problem and a "hot boat". Positive leakage will cause a higher than normal natural voltage reading in your boat test. If your reading was more than about .750 volts, you probably have leakage. For each volt of electrical leakage you will read approximately .120 volts of higher natural reading on your downrigger cable. For example, in step 4 of the Quick Boat Test Procedure, if you read

.200 volts more on your downrigger cable when you turn all the boats electrical systems on, this means you are leaking approximately .200/.120 or 1.67 volts into the water. You need to find and correct the leak.



Leakage of electricity from the plus side of a boat's power system creates "hot spots" and will ruin a boat's fishing ability. Here an isolated screw on a battery switch shows a leakage reading of .59 volts. This charge will pass along the fiberglass, through the bilge and directly into the water around the boat. This switch needs to be removed and all surfaces cleaned free of the dirt and crust that are allowing the electricity to pass.

Chapter IV

Black Box Operation and Recommended Voltages



1. 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).
2. Be sure the metal contact sleeve is in place on the downrigger wire and connected to the Black Box.
3. Drop the downrigger to fishing depth or at least a few feet under the surface.
4. Turn the knob to the “on” position. Put the mode lever in the Natural Voltage position. If you get a normal voltage reading (.7 to .8), you will know all wires and connections are functioning correctly. If for example, you get a zero reading, you will know something is wrong. To apply a selected voltage to the downrigger wire, flip the switch to the Applied Voltage position. You can then turn the dial to set any reading you want from zero to one volt.

RECOMMENDED VOLTAGES

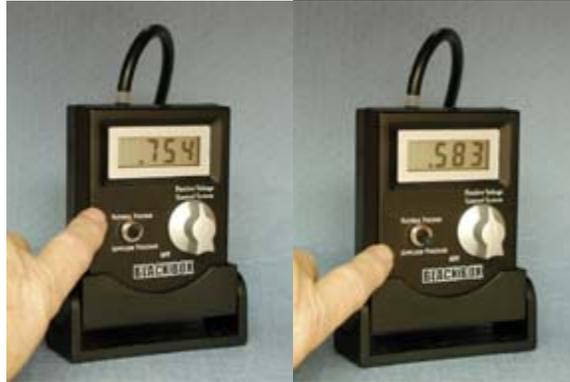
There has been a great deal of work done on the correct downrigger wire voltages for salmon, trout, kokanee, bass, laketrout and other species. The following table should be used as a suggested starting point. You may find other voltages that work better.

SPECIES 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 *
Sharks .400 volts *

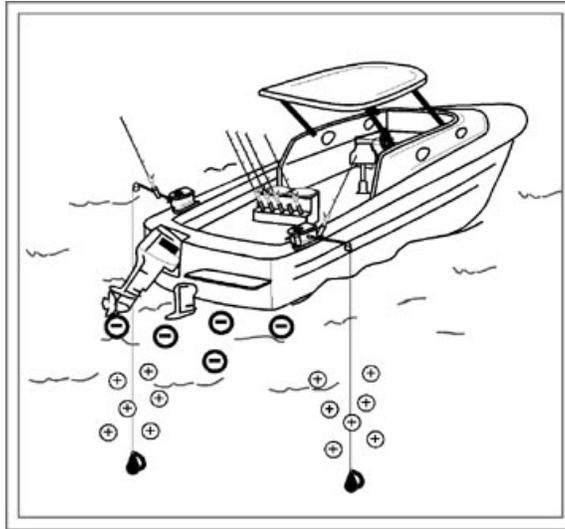
Striped Bass .650 volts *
Sturgeon .500 volts *
Catfish .500 volts *

* Further research may change this recommendation.



These photos show the Black Box in a typical “Natural” voltage position and an “Imposed” position. In the left photo the lever is in the “up” position and the Box shows a natural reading of .754 volts. In the right photo the lever has been moved to the “down” position and the dial has been adjusted to an imposed setting of .583 volts. In most instances you will be lowering the natural voltage to get the reading you want. From time to time while you are fishing, it is a good practice to switch the mode switch to the natural reading position. If you get a normal natural reading, this tells you that all your connections are working. If you are running multiple downriggers on one Black Box, you should make this test on each downrigger with one in the water at a time. If you get a zero natural reading, the first thing to check is the contact sleeve riding on the downrigger cable. Sometimes scum will insulate the contact. You can usually get it working by wiggling or sliding it back and forth on the cable.

The Black Box is very effective in improving results when trolling. It should be connected to all the downriggers on the boat so it provides a uniform positive charge completely around the hull. There is a zone of fish attraction created at the downrigger wires. The fish will come to the wire. Often, results will be best by using a very short drop back leader between the downrigger release and the lure or bait.



When you are trolling with the Black Box, the electric attraction zone is set up between the positively charged downrigger cable and the negatively charged outdrive and other metal boat parts in contact with the water..

Chapter V

Tips on Adjusting the Black Box

1. If you are not catching fish, the natural inclination is to turn the Black Box up to a higher voltage. Often this is the wrong way. Most of the time you want to reduce the natural electrolysis voltage for best results. Sometimes you can tell if you have the Black Box voltage too high by watching hooked fish as you reel them near the boat. If your voltage is too high, they will fight violently and will try to swim under the boat and into the prop wash where the voltage is lower.
2. Larger fish need less voltage than smaller fish. Their large body size makes them more sensitive to the electric charge. For very large fish (over 20 or 30 pounds) you may want to turn the voltage down about .1 volt. You should also lower the voltage for extra sensitive fish like sharks. Note: As you dial the Black Box, it will show readings down to zero.
3. As you are searching for the best voltage, make very small adjustments. Often, a small change is all that is needed to attract the fish you are after.
4. If you are running more than one downrigger, it is best to hook all of them to the Black Box to avoid having different voltages on each downrigger. By connecting all of the downriggers together, it creates a uniform positive charge around the entire hull which is highly desirable. The Black Box has the power to run up to six downriggers.



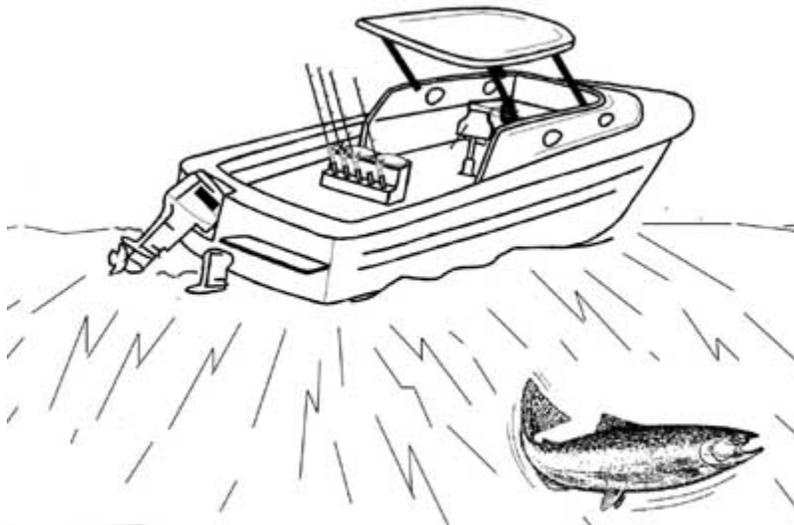
Zinc anodes are installed on outdrives or motor shafts to protect from electrolytic corrosion. Note the heavily corroded condition of this zinc. When the zinc is more than 50% corroded, it should be replaced.

A number of questions arise on how to adjust the Black Box as you fish deeper. There is less loss than you might suspect as you go 50, 100 or even 200 feet down. Each section of downrigger wire is reacting separately with the boat's hull and its zinc, thereby creating its own natural voltage through the process of electrolysis. Using insulated wire, we have measured this voltage as deep as 400 feet and found very little change in the charge generated. The Black Box is adjusting and controlling your rate of natural electrolysis to the setting you desire. This will carry right down the wire in both fresh and saltwater.

Chapter VI

Using the Black Box Without Downriggers

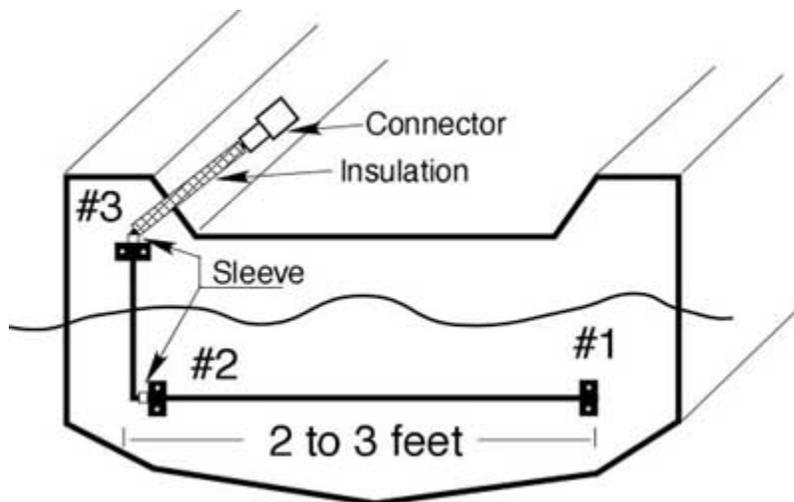
Many fishermen would like to have the advantage of a Black Box but they do not use downriggers. River fishing for salmon or shallow water fishing for bass are two examples. Shallow water jigging is another example. Pro-Troll developed a transom mounted wire system that works just as well in attracting fish as downriggers. A piece of downrigger cable is stretched across the transom of a boat and connected to the Black Box. The field around the boat can then be adjusted to the optimum voltage



In shallow water, the electrical field around a boat will either attract or repel fish below the boat. If the boat is "hot" fish will

be repelled. A Pro-Troll transom mount kit allows a Black Box to correct the charge so that fish are attracted.

The transom mount system is composed of a piece of stainless steel downrigger cable stretched between two insulators on the transom of your boat. It is positioned so it is underwater. An insulated wire runs from the cable up into the boat and connects to the Black Box. The Pro-Troll transom mounting kit contains the parts needed for this installation. (1) A piece of downrigger cable, (2) three insulator pad mounts to hold the cable away from the boat, (3) a piece of insulated tubing and (4) the necessary hardware to go to the Black Box. The three insulators can be fixed to the transom with the self sticking adhesive included or they can be mounted with screws. The Pro-Troll Transom Mount Kit #1505 can be purchased from Pro-Troll retailers. In many cases fishermen are able to find local materials and construct their own transom mount.



Before installing the transom kit, thoroughly clean the locations for the insulated mounting pads. Clean off all grease, dirt and foreign materials. The pads can be secured to the boat using the adhesive tape on the back of the pads. For maximum bonding it is recommended that the six stainless steel screws also be used to attach the pads. It is not necessary that the #1 and #2 pads be mounted in the center of the transom as shown in the drawing. They can also be mounted to one side. (1) mount the three pads as shown. (2) Feed the stainless steel wire through the small hole in the #1 pad and then through the #2 pad. At this point slide one of the small wire sleeves down next to the #2 pad. Pull the wire taut (if using only the tape mounting don't over pull as you might break the tape bond on the #1 pad). Crimp the sleeve with a pair of pliers or crimping tool. This will secure the wire in place. Run the wire through the #3 pad and then through the last sleeve. Crimp the sleeve to prevent the wire from coming out. Cut a piece of insulation

(supplied) the length of the remaining wire less one inch and feed it over the wire. Place the connector on the end of the wire and securely crimp it in place. Plug the connector on a white wire coming from the Black Box distribution post into this connector. Make sure the bare part of the stainless steel cable does not touch any metal parts on the boat.

Other Fish

The Black Box can also be used effectively with bottom feeding fish like sturgeon and catfish. In this instance, it is best to use a rod and reel with insulated wire line. Peel off the insulation to leave a short bare section near your bait. You will also have to leave a bare piece of wire somewhere in your reel. You can then clip an alligator clip from the Black Box to your wire line. Both catfish and sturgeon use electro sensor cells to find prey. The transom mount will also help catch these fish by neutralizing the boat.

Chapter VII Electrical Sensitivity of Fish

Research into the behavior of fish in the presence of electricity started over one hundred years ago. Scientists and biologists have long been fascinated by the ability of some fish to use electricity and magnetism to navigate and find prey. Even though a lot has been learned, in many ways the field is still in its infancy. It is known that all fish have some reaction to electric stimulus in the water; but exactly how fishermen should take advantage of this, remains a mystery with most species. Lets start with a summary of what is known.

Fish use electricity in varying ways.

As early as 1917 scientific studys had revealed that a number of animals including fish, demonstrated responses to the presence of tiny electric fields in their environment. Some of the earliest work was done on catfish which turned out to be very electrically sensitive. Scientists, PARKER and VAN HEUSEN, tested blindfolded catfish in an aquarium. When glass or inert rods were inserted into the tank, there were no reactions. However, when metal rods were inserted, there were immediate reactions. With some metals, the catfish would swim to the rods and with other metals they would swim away. The reactions came from galvanic reactions between the metals and the water. Later the same scientists created the same reactions with induced electricity instead of the rods.

By the 1950's hundreds of fish were classified and ranked by their degree of response to an anode (electrical) reaction. It was learned that many fish have the capability to sense the electrical impulses given off by other fish and some can even sense the tiny voltage gradients created by ocean currents and river water movements in the presence of the earth's magnetic field. All fish have a reaction to an electrical field but it differs. Some fish are attracted to the field, some are frightened by it and attempt to hide and a third group appears to be immobilized by it. Interestingly, however, all of these groups react

towards the positive charge and away from the negative. Even fish that are frightened and attempt to hide, will move in the direction of the positive anode.

In 1982 a study by Mr. L. A. Balayev of the Moscow All-Union Research Institute for Sea Fisheries concluded in part:

- Fish are divided into three groups: those with an anode reaction, those without and those in the intermediate group.
- Irrespective of the presence or absence of anode reaction, all species of fish distinguish the anode (+) from the cathode (-) and prefer the anode.
- The anode reaction occurs in two stages: (1) distinction by the fish of the polarity of the current, (2) movement towards the anode or absence of movement depending on the ecological stereotype of behavior of the fish.

The presence of an anode reaction is characteristic of active and agile species. Fish that are not very active respond to the action of the (electric) current by hiding.

Some fish are unique in that they have special cells on their body surface that are electro receptors. These nerve cells have the specific capability of reading electric signals. Sharks, rays, sturgeon and catfish are some of the better known species of this type. Not only are they attracted by an anode reaction but they will use their electro receptors to find prey hidden or buried in the mud or sand. They can sense the electrical nerve discharges of their target.

Following are some of the scientific conclusions relating to game fish.

SHARKS

In the rankings of electro sensor capabilities of all fish, sharks and rays are at the absolute top of the list. Dr. Theodore Bullock of the Scripps Institute of Oceanography, is one of the foremost world experts on Electro reception. His book "Electro reception" was published in 1986. Bullock ranks sharks as probably 1000 times more sensitive than any other fish. He indicates that sharks and rays have the documented capability to navigate solely using the earth's magnetic field as their guide. In the June 1991 issue of National Geographic, researcher Adrian Kalmijn noted that a "shark recognizes an electric field in the order of five— billionth of a volt per centimeter." Kalmijn offers this perspective. "Plant electrodes 2000 miles apart on the ocean floor and power them with a 1.5 volt flashlight battery. That is a very weak electric field. But every shark in between those electrodes will know what you are up to."

An interesting series of tests on sharks were run by a scientist named KALMIJN in 1971. He successfully demonstrated that sharks and rays use electro sensors to find prey buried in sand. He buried live flatfish. When sharks were stimulated to feed, they would go to the exact spot in the sand and dig out the flatfish. Kalmijn then substituted a charged wire

electrode for the flatfish. The sharks would tenaciously dig to the electrode and return time and time again even though they found no prey.

SALMON

Salmon do not have electro sensor cells like sharks but they have been found to be one of the species strongly attracted to an anode reaction. Research at the University of British Columbia demonstrated that salmon can distinguish the earth's magnetic field. When baby salmon in test tanks were subject to magnetic fields imposed outside the tanks, the majority of the fish would orient themselves to one side of the tank. It is believed salmon use this sense in their migration patterns. Many years ago the U.S. Fish and Wildlife Service learned that they have to be very careful with galvanic reactions (electrolysis) around salmon hatcheries.

In many instances salmon must swim through culverts or other metal structures in their upstream migration. If the dissimilar metals are used such that a negative galvanic reaction is present, the salmon will refuse to enter the culvert or structure. The Fish and Wildlife service carefully neutralizes these structures to ensure salmon passage.



Salmon, trout and many other fish have what is called a lateral line down their sides. In this line there are hairlike nerve cells that can detect vibrations and weak electric fields. The same kind of cells appear on the head of the fish.

In 1979 Daniel Kenichi Nomura completed his masters thesis at the University of B.C. by running controlled voltage tests aboard boats of commercial salmon trollers. For King salmon, Normura demonstrated that troll success “was higher for the positive 0.5 volts condition and not significantly different for the positive 1.0 volts condition, with respect to the paired control conditions of zero volts.” The same tests for sockeye salmon showed the best attraction voltage for this fish was 1.0 volts. Nomura also attempted to prove or disprove the theory that optimum voltage has a bearing on the size of salmon caught but his results were inconclusive.

CATFISH

Catfish also possess electro receptor cells. Like sturgeon and sharks they use this capability to find prey in the muddy murky waters they habitate. Many cat fishermen know the old trick of throwing flashlight batteries into the water to catch catfish. The electrical charge attracts them.

STURGEON

Sturgeon are another species that possess special electro receptor cells. There is a row of these cells along the sturgeons snout. They use this capability to detect tiny electrical discharges from clams, mussels and other invertebrates buried in the mud or sand. Fishermen who can duplicate these nerve discharges in their bait using the Black Box technology have a fishing advantage.

KOKANEE

Kokanee are one of the most sensitive salmon to electric voltage. Kokanee are the landlocked cousins of the sockeye salmon. With a voltage of usually .600 volts, kokanee will congregate around a downrigger wire and will follow along as you troll. Most kokanee experts rely on the Black Box to improve their catch.

TROUT

Studies on trout have linked their response to electrical fields to metabolism. Active fish like trout have a higher rate of metabolism and demonstrate more electrical sensitivity. Research has shown that the best Black Box setting for most trout is .65 volts.

Chapter VIII

The Chemistry of The Electric Charge on Your Boat

Electrolysis or galvanic action as it is sometimes called is the generation of electricity through a chemical reaction. Any time dissimilar metals are present in an electrolytic solution a battery will be created and electricity will flow. The amount of electricity generated depends on the metals involved and the nature of the electrolytic solution. Sulfuric acid is a strong electrolytic solution. It is used in your car battery to generate enough electricity to start the car and power your electric systems. Water containing minerals is a weak electrolytic solution but it will still generate electricity.



Most outboard motors have a small zinc anode fastened to the motor shaft. It is very important that this be present and that the motor be bonded to the hull or other metals on the boat.

There is a table ranking all metals by what is called nobility. When a metal of high nobility is coupled with a metal of low nobility, more electricity will be generated. Zinc is very low in nobility and will react strongly with almost all other metals. This is why zinc anodes are placed on boats. Downrigger wire, which is stainless steel, is relatively high on the metal nobility table. The reaction between stainless steel wire and zinc will normally generate about .8 volts of electricity in saltwater.

If any two of these metals are connected in an electrolyte, the one standing higher on the table will be anodic, lower one cathodic. The further apart they are in the series, the greater will be the galvanic (electrical) potential between them. For example, if the stainless steel reading of .24 (downrigger wire) is subtracted from the zinc reading of 1.04 (boat anode) the result shows a voltage potential of .80 volts being generated. This is what we would expect to read if we tested the boat's natural voltage.

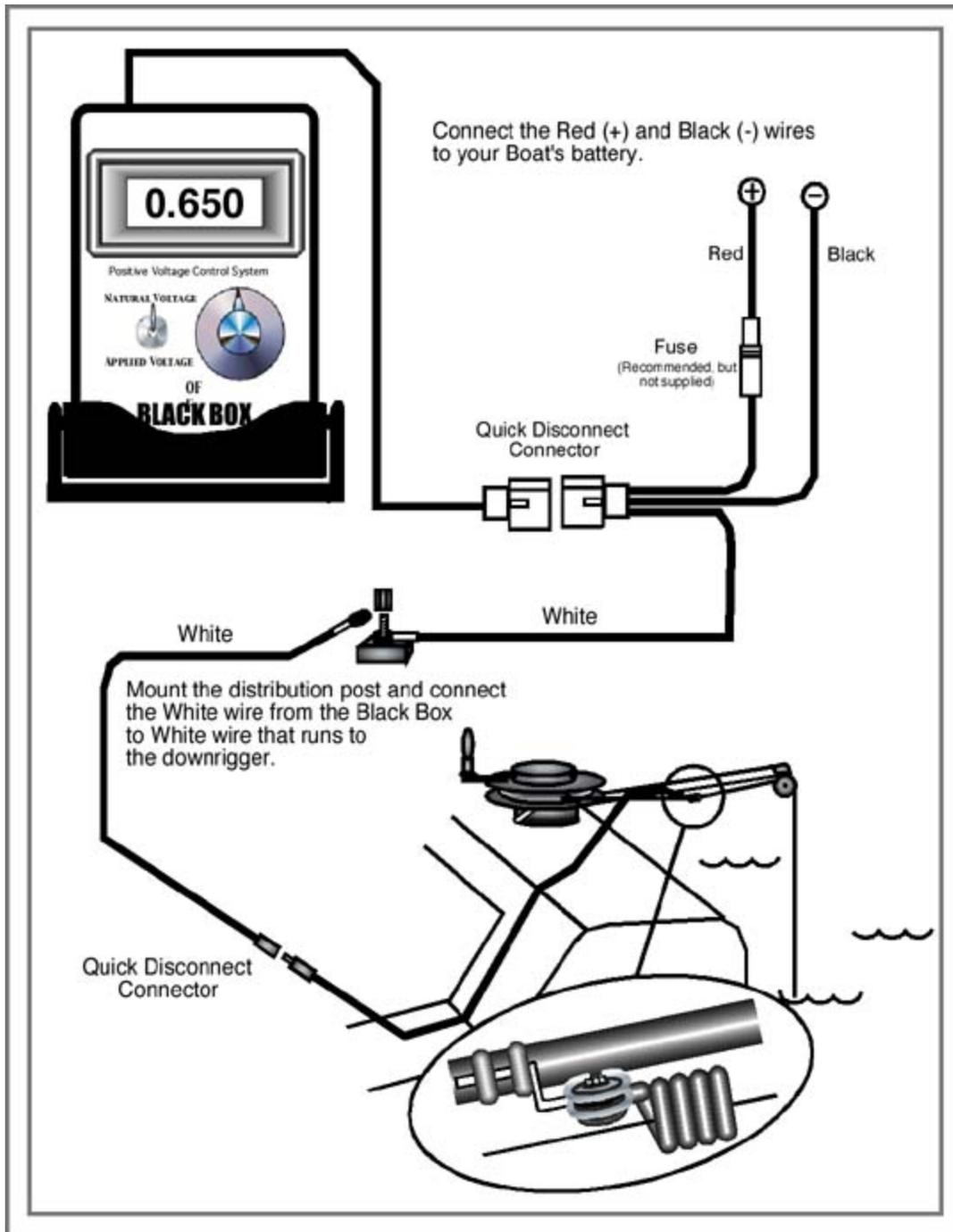
NOBILITY OF METAL IN SALTWATER	
	Volts
Magnesium	1.58
Zinc	1.04
Cadmium	.88
Mild Steel	.79
Aluminum alloyed	.71
Lead	.52
Tin	.50
Brass	.31
Stainless Steel	.24
Monel	.12
Silver	.08
Gold	.00
Platinum	.00

Data taken in saltwater @75° F. Voltage will vary with temperature, salinity, velocity, oxygen content and different metal alloys

Chapter IX

Black Box Installation

This schematic shows the layout of the Black Box installation. Run the wires in out-of-the way places on the boat and connect them as shown.



The Black Box can be mounted on any vertical or horizontal surface. It should be mounted in a dry location. It is water resistant but not water proof.

1. Run positive and negative power leads from an electrical source that is connected to the boat battery to the location where you will mount your Black Box. Connect these leads to the female quick disconnect socket. Be sure to connect the positive lead to the terminal matching the red wire on the plug on the Black Box. If this line is not fused, it is recommended that you do so to protect against shorts. A three amp fuse will be adequate.

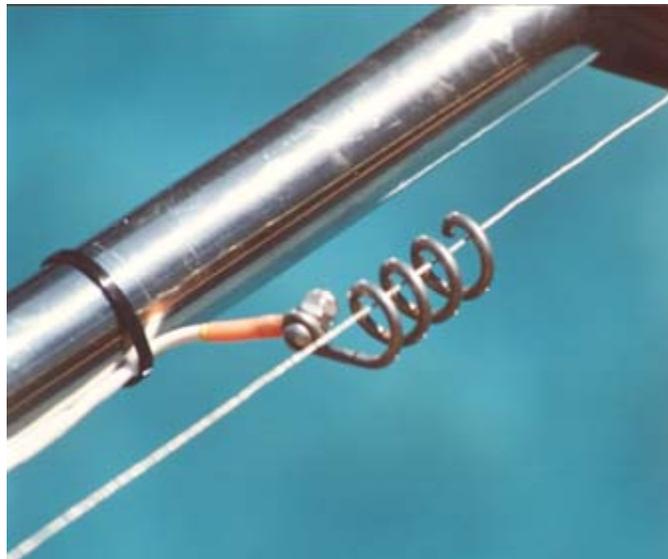
Do not run the Black Box from positive or negative terminals that are heavily loaded with other equipment like radios, fish finders etc. Overloaded circuits can cause distortions in the voltage the Black Box places on your downrigger. If you have heavily loaded circuits, you need to run a new positive and negative lead from your boat battery to the Black Box.

2. If you are going to run multiple downriggers on the Black Box, you should locate the distribution post near the stern of the boat. Thread the white wire coming out of the quick disconnect plug to the distribution post. Try to locate this wire where it is protected and you won't trip over it. Most boats have wire bundles running down the side gunnels.

3. Run a connecting wire from the distribution post to the vicinity of each downrigger location.

4. Thread the contact sleeve onto your downrigger cable and connect it to the white plug in wire. Secure the contact sleeve wire lead to the downrigger boom with the two cable ties included with the kit. Place the contact sleeve far enough out on the boom to avoid interfering with the downrigger operation, usually about 12 inches. You should attach the cable ties approximately 1 inch apart and positioned on the boom so that the contact sleeve does not interfere with the normal lead-in of the cable into the downrigger spool. The heads of the cable ties should be on the opposite side of the boom from the white wire so that they can be pulled tight. Plug the wire on the downrigger wire into the lead coming from the distribution post.

Note: The Black Box should be mounted where it can be unplugged and removed when not in use. It is moisture resistant, but not water proof. It should be removed and stored in a dry area.



The contact sleeve should be mounted so it rides the wire but does not pull the wire out of its normal track.

Using the Black Box with the internal 9 volt battery

1. Open the compartment on the back of the Black Box and install a 9-volt battery. With a quality battery the Black Box will normally operate for up to 70 hours. If 12 volt power is available, it is best to run the Black Box from boat power rather than the 9 volt battery. If the 9 volt battery is weak, your voltage readings can be distorted.
2. The Black Box can have the 9 volt battery installed and be connected to the boat battery at the same time. If you have the 9-volt battery installed, you can use the Black Box to check your natural downrigger readings and your connections. See Chapter 3 on testing your boat.
3. To use the Black Box with only the internal 9 volt battery, you must have the negative wire (black) coming from the Black Box connected to your motor or another grounded part on the boat.

Chapter X Troubleshooting

Problem: When the Black Box is first turned on, there is no natural voltage reading.

- a. The unit may not be turned on. Turn the knob clockwise until the unit is turned on. Be sure the mode switch is in the “up” natural voltage position.
- b. The downrigger contact sleeve is not plugged in or is not making proper contact with the stainless steel wire.
- c. The downrigger wire is not in the water.
- d. The zincs on the boat are worn out or are not functioning therefore resulting in a low reading below the minimum of .5 volts.
- e. If you are in extremely pure freshwater, there may not be enough dissolved minerals present to create a normal voltage. Most bodies of freshwater will show readings very close to salt water but you may have found an exception.

Problem: Your natural voltage reading is too low (.1 to .5 volts)

- a. Your boat zincs are worn out or may be covered with scum or white oxide powder. If so, the zincs will not work properly. They should be cleaned or replaced.
- b. The boat does not have enough zinc to protect the vessel. If you have cleaned the zincs and still get a low reading, more zincs may be needed.

c. The sacrificial anode on the outdrive or outboard is an alloy of aluminum and not zinc. Some manufacturers have replaced zinc anodes with alloys of aluminum. Because of the higher nobility of aluminum, you will get a lower natural voltage reading. Your natural reading could drop by as much as .2 to .3 volts.

d. The boat is not properly bonded. Check the bonding connections and be sure all metal parts touching the water are bonded together with a wire connected to the battery ground. A kicker motor that is not bonded to the ground system of the boat will cause this problem.

e. Your downrigger wire may be corroded or partially insulated. Older downrigger wire often can become coated with scum or corrosion. This has the effect of partially insulating the wire and will cause a low natural voltage reading. You can usually scrape off a short section of the wire and retest to see if this brings the voltage up. Some downrigger manufacturers paint or coat their wire to remove the shine. This can have the same effect. The wire is partially insulated and will show a low reading. The Black Box will correct both of these problems and bring the voltage to the correct level.

Problem: Your natural voltage reading is near zero or negative.

a. You have the voltmeter connected backwards.

b. The downrigger wire or spool is grounded to the boat. Find the source of grounding and insulate the downrigger from the hull.

c. There is insufficient or pacified zinc on the boat. The zinc should be cleaned or new zinc should be installed. (Clean zincs with a stainless steel wire or bristle brush. Do not use a common mild steel wire brush).

d. The hull is not bonded. An aluminum boat that does not have the hull bonded to the engine can cause a negative downrigger wire reading. Run a bonding wire from the motor to the battery ground post and be sure the hull is also connected to the negative battery terminal. If you use two batteries in the boat, the ground terminals of both must be connected together and grounded to the boat hull.

Problem: Your natural voltage reading is too high (more than .800 volts)

a. There is electrical leakage in the hull. A positive connection is leaking some electricity across your hull and into the water. This is quite common particularly with battery switches or bilge wire connections. Try to find the source of the leak by using the Quick Boat Check Procedure in Chapter III. You can disconnect one circuit at a time (removing the fuse is a good way) and watch for a change in the natural voltage reading. This problem is called a "hot boat". It is a very common and the boat will have a very hard time catching fish. You can test the whole boat at once by disconnecting the positive terminal from the battery. If your reading on the downrigger cable changes, you have leakage somewhere.

- b. Your downrigger spool and wire are not insulated from the boat's electrical system. Some downrigger manufacturers impose a strong positive charge on the downrigger wires as a means of controlling weight retrieval (short stop system).
- c. Your downrigger wire has been changed to a metal with higher nobility than stainless steel. Monel wire will show higher readings than stainless.
- d. The water where you are doing your testing is high in acid content. Heavy concentrations of certain algae in freshwater can cause overly high natural readings on your Black Box. If you are testing in a heavy algae concentration, this may be the only problem. Before you assume something is wrong, test in clearer water.

Problem: Separate downriggers on the boat do not show the same natural voltage reading when they are tested individually.

- a. This often happens. If the wire on one downrigger is older than another one or has had more use, there will be more corrosion on the older one and it will show a lower natural voltage reading. The Black Box will correct this difference.

Problem: When the boat is first put in the water there is a low natural voltage reading but after an hour or two the natural voltage will be much higher.

- a. The natural voltage is driven by the cleanliness of the boat's zinc. A boat that has been out of the water will frequently have some oxidation on the surface of the zinc which insulates it and causes a low reading. After an hour or two the chemical reaction on the zinc will clean off the oxidation and the natural voltage will go up.

Problem: When you test the voltage on your downrigger wire with a separate voltmeter, the voltage shows lower than the reading on the Black Box.

- a. This is generally caused by the ground wire that comes from the Black Box to the negative side of the battery being overloaded. If there are several pieces of equipment like radios, fish finders and lights all hooked to a common ground wire, it can become overloaded and have a voltage drop. If the Black Box is hooked to this same wire, it will read a false ground level and send out an incorrect differential voltage.
- b. Turn off all the auxiliary equipment on the boat and take new voltage readings. If this corrects the voltage error, the Black Box should be set up with a separate ground wire back to the battery.
- c. Check the connections on the ground wire to be sure they are clean and making good contact. A corroded connection can cause the same problem as an overloaded wire.
- d. The voltmeter in the Black Box is extremely accurate. This is rarely the problem.

Chapter XI

Common Black Box Questions

Does it really work?

With many species, absolutely yes. It has been well proven that certain fish are attracted to a very slight positive voltage and will swim to the source of the voltage if it is in the range that attracts them.

How can I determine how much the Black Box will improve the catch on my boat? Are some boats naturally better than others?

The impact a Black Box will have on each boat differs. Some boats may have all factors favorable. The bonding is good, there is no electrical leakage and the natural voltage is just about the ideal level. In this instance, the Black Box would add very little to the catch results. Many other boats have poor bonding, "hot spot" voltage leaks, bad zincs or natural electrolysis levels that are way too high or too low. In these instances, a boat tune-up and the Black Box would help considerably. If a boat has electrical leakage or a problem which results in a high or low charge on its downrigger wires, it will have a very difficult time catching fish. The only way to know for sure if you have a problem is to go through three steps: 1) Check the bonding, 2) Find and correct any electrical leakage and 3) Measure the natural voltage. See the Chapter on testing your boat. Another factor that enters the equation is the water. A boat that measures just the right voltage in saltwater may be a little low in some freshwater. The Black Box will properly compensate for all these variables.

The fish species I am after is not listed in the book. How can I find out if it works on these fish and what setting to use?

All fish have sensitivity to electricity but some species are particularly sensitive. Most of the commercial work with Black Boxes has been done on salmon where sensitivities are well known. Some fish are known to have special electro sensor cells the fish uses to find prey. Some of these are sharks, rays, sturgeon and catfish. There is simply no data on many species of fish. As experimental test results come in, we will publish them.

Will the Black Box work in freshwater?

It may actually be more effective in freshwater than in saltwater. Because of its high salinity, saltwater creates more natural voltage. Freshwater is much more variable in salinity and mineral content. The Black Box voltage control circuit will provide the correct voltage in freshwater regardless of salinity.

The book indicates you should have an "insulated downrigger wheel". How can I determine if my wheel is insulated?

Insulated wheel means the downrigger spool is not in electric contact with the boat hull. Most downriggers are constructed with plastic spools and are automatically insulated. An

all metal downrigger mounted on an aluminum boat would not be insulated. Some electric downriggers are intentionally connected to a boat's electric system (Cannon Mag series). They use an electric circuit through the downrigger wire as a means of stopping the weight when it gets to the surface. This applied voltage spooks fish. Most electric downriggers are insulated by design.

Will the Black Box work on aluminum boats?

Yes. An aluminum boat actually has an advantage over fiberglass as long as it is properly bonded and equipped with zinc anodes. The metal hull serves as the minus side of the electrolysis circuit and your downrigger wires are the positive side. With the large aluminum hull area, a wide electric field is set up in the water below the boat. With the broader electric zone, fish are attracted from a broader area. All metal hull boats have a large negative "footprint" and can have a fishing advantage.

When using the Black Box, what is the effect of my leader length or the distance between my downrigger release and my lure? If I use long leaders will it reduce the effect of the Black Box?

The electric field that attracts fish surrounds your metal downrigger wire. The further away from this wire you get, the weaker the field. Therefore for best results, you do not want to use leaders that are too long. Fish will actually swim to the wire where they sense the electric field. Leader lengths of ten to twenty feet are best. However, you must balance the affect of the Black Box with other factors that dictate leader length. In some cases (very clear water for example) leader lengths of 50 to 100 feet are often needed to catch fish. In these instances the Black Box will be much less effective.

I have a Cannon or other electric downrigger that uses the short stop feature. Can I use this with the Black Box?

The Cannon short stop feature is a system where the electric downrigger automatically stops when the weight breaks the surface of the water. This is accomplished by using the downrigger wire as part of the electric control circuit. When the Cannon downrigger is turned on, a strong positive charge of up to 7 volts is imposed on the wire. When the weight breaks the surface, the circuit is broken and the downrigger stops. The Black Box is going to impose a steady voltage of whatever you dial onto the wire (.5 volts .6 volts etc.). If a downrigger with a short stop is turned on with the Black Box running, the Black Box voltage control circuit will not let the voltage on the wire rise above your setting. The result is normally the short stop feature will be over ridden and the weight will not stop until it jams into your downrigger pulley. If the Black Box switch is turned to natural voltage position prior to turning on the downrigger, the automatic stop will work. Note: When voltage as high as 7 volts is imposed in the water, most fish will be repelled from the area. When commercial trollers are being bothered by hake or other trash fish continuing to hit their lures, they will "blow off" the trash fish by turning the commercial Black Box up to 2.0 volts.

Will the Black Box work in conjunction with the Cannon positive ion control?

The Cannon positive ion control is designed to perform the same function as the Black Box. The voltage on the downrigger wire can be adjusted up or down. The differences are that the Black Box controls all downriggers at once and the positive ion control runs on each downrigger separately. The positive ion system does not have a voltage readout meter like the Black Box. The Black Box control system is better. For optimum results, all downriggers should be controlled to the same exact voltage. If the Black Box and the positive ion control are run at the same time, interference can result particularly if several positive ion downriggers are running at the same time. It is best to turn off the positive ion control and run only with the Black Box.

How much power does the Black Box take? Will it interfere with my loran, VHF radio or fish finder?

The Black Box takes very little power. At full load it uses only one tenth of one amp (.1 amp). This is an insignificant amount of power relative to the other electrical devices on the boat. It puts out a small steady current of DC electricity and will have no effect on radios, lorans, etc.

Do I need to increase the Black Box voltage for extra deep operation?

If your boat has a base natural voltage reading in the range of .7 to .9 volts, most of the time you need not be concerned with depth up to 100 feet or so. Your Black Box will bring the entire wire into the range you set at the surface. If you are fishing more than 100 feet down, there can be a slight drop in voltage on the deep section of the wire. The Black Box voltage can be raised by .1 or .15 volts to compensate for this.

How does the Black Box actually increase or decrease the voltage all the way up and down the wire?

This answer is complex even for those with a good understanding of electricity. The Black Box is not actually adding or subtracting voltage from the wire. If it attempted to do so, the charge would be quickly dissipated by the electrical conductivity of the water. The Black Box works by altering the rate or level of natural voltage that your boat and downrigger wires generate. Because of this, the same voltage is being generated by the chemical reaction at all points along the wire. You will therefore have the same voltage 50 or 75 feet down that you read at the surface.

Can the Black Box be used on boats without a 12 volt battery?

Yes. The Model 1500 Black Box is designed to operate from a standard 9-volt battery, when installed. The Black Box installation is the same except the wire going to the 12-volt boat battery is not connected. The Black Box technology is available to all downrigger fishermen. It will work on any boat large or small; with or without an

external 12-volt battery. If 12 volt boat power is available it is recommended that it be used so as not to run down the internal battery.



Kokanee are very sensitive to an electric charge. A Black Box works very well on this species.

For ordering the black box contact Tackle By Dy

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