

DIVER MAG 1
MARINE MAGNETOMETER
REV 709
OPERATION AND
MAINTENANCE MANUAL

DIVER MAG 1

MARINE MAGNETOMETER

OPERATION AND MAINTENANCE MANUAL



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DO NOT

- Operate the Diver Mag 1 until liquid (charcoal lighter fluid) has been added to the sensor housing; damage can occur to the sensor coils (see page 13).
- Do not let Diver Mag 1 sit in hot sun for prolonged periods.
- Do not use any battery charger other than the one provided with the unit.

DO

- Always operate unit on land before taking in water at a new location (to be sure unit is tuned correctly).
- Operate with fully charged battery.
- Verify readings—by numerous passes—before digging.
- Use only non-ferrous metal on the unit (stainless steel screws, etc.).
- Be careful not to cross-thread the 3/8"-16 buoyancy adjustment bolt when making buoyancy adjustments.
- On the first dive with the Diver Mag 1, allow extra time to make the BUOYANCY ADJUSTMENT before the dive (page 17).

DIVER MAG 1 SPECIFICATIONS

DIMENSIONS/WEIGHTS:

- Diver Mag 1 52"L x 6"Dia 37 lbs.
- Carrying case 59"L x 18"D x 22"H 50 lbs.
- Total Shipping 59"L x 18"D x 22"H 87 lbs.

MATERIALS/COLOR:

- Diver Mag 1 High impact PVC, stainless/yellow

PERFORMANCE/DESCRIPTIONS:

- Sensitivity (switch adjustable) resolves 1 gamma
- Maximum detection distance 1,500 feet
- Cycle time (switch adjustable) 2/5/10 seconds
- Depth rating 200 feet

OPTIONS

- Spare 12v battery pack with underwater housing (belt mounted).
- Dual underwater earphones.
- Land earphones.
- 220 vac charger (Europe).

DIVER MAG 1 DETECTION RANGE CHART

| OBJECT | NEAR RANGE | FAR RANGE |
|--------------------|--------------------|------------------|
| 1 gal can | | 2 gamma 12' |
| 5 gal can | | 2 gamma 18' |
| 55 gal can | | 2 gamma 45' |
| Sm. Plane | 25 gamma at 20' | 2 gamma at 50' |
| 1 ton iron | 40 gamma at 30' | 2 gamma at 80' |
| 6" pipeline | 200 gamma at 20' | 2 gamma at 100' |
| 12' pipeline | 350 gamma at 20' | 2 gamma at 175' |
| Lg. anchor | 500 gamma at 50' | 2 gamma at 200' |
| Med. ship | 1500 gamma at 100' | 2 gamma a 1000' |
| Lg. ship | 2000 gamma at 100' | 2 gamma at 1500' |

The above chart shows the Diver Mag 1 detection range for different targets. The Diver Mag 1 has a sensitivity of one gamma; that is, it will detect a change of one gamma. Each one gamma change will change the digital readout one digit.

CHART EXAMPLE:

As the Diver Mag 1 approaches a small plane, you can expect a one gamma change at 65-75' (the digital readout would change one digit, ie: from 48,240 to 48,239). At 50' distance, another one gamma change would take place (ie: 48,238 on readout). As the fish gets closer, the readout continues to decrement. At 20', you can expect the readout to be at 48,215 (total change of 25 gamma). As the fish passes next to the plane the digital readout could be several hundred digits lower. If the target was 1 ton of iron, the readout could show a change of 2,000. As the fish goes past the target, the readout would walk back to normal (48,240) in reverse of the above sequence.

As a target is approached, the gamma reading can change up (increment) or down (decrement) depending on what is happening to the magnetic field in the area. It is not unusual, when making many passes in different directions over a target, to find some passes incrementing the readout number and other passes decrementing the number. In most cases, when you approach a target, the gamma number will drop as shown in the example above.

The detection ranges given above are standard magnetic deviations for different size targets. You can expect the distances to vary depending on the area you are working. If it is in a noisy area (on land or just off shore) small magnetic changes will be more difficult to discern.

DIVER MAG 1 MAGNETOMETER

INTRODUCTION TO MAGNETOMETERS:

Magnetometers are precision electronic instruments that measure the strength of the earth's magnetic field. Once the magnetometer is set up in an area, it will inform the operator of the strength of the earth's magnetic field in that area (in gammas). More importantly (for our application), if anything is brought into that area that alters the earth's magnetic field, it will change the readout of the magnetometer. For an object to alter the earth's magnetic field, it must be constructed of a ferromagnetic material (iron content). Any material that a magnet is attracted to will alter the earth's magnetic field and therefore can be detected by a magnetometer.

The earth's magnetic field varies in intensity over the surface of the earth (see world map in shipping box). At the poles, the field is concentrated and therefore has a high intensity. A magnetometer would read in the 61,000 gamma area at the poles. At the equator, the field is quite weak. A magnetometer would read in the 24,000 gamma area at the equator. In any given area of the world, the field is fairly even. If an iron object is introduced into the area, the lines of force are disturbed. The amount of disturbance is a function of the mass of the object.



Over the past 45 years, almost every major buried wreck found was done so with a magnetometer. The metal-hulled ships and barges are, of course, easy targets and can be detected from hundreds of feet away. The Spanish galleons laden with gold and silver (metals not detectable by a magnetometer) were found by the magnetometer detecting the ships' anchors or ballast stones (magnetite was often used as ballast). One of the largest finds was a galleon off Florida, found 45 years ago, carrying four hundred million dollars worth of gold and silver. The wreck was found with a proton magnetometer (detected the anchor).

The DIVER MAG 1 is a fourth generation proton magnetometer from JW Fishers. It is a top performing microprocessor driven marine magnetometer detection system with a one gamma sensitivity. Cycle time (how often reading is taken) is switch selectable for 2/5/ or 10 seconds. A two second cycle time gives a strong return signal and is fast enough to detect even small iron/steel targets. The DIVER MAG 1 features a triaxial noise-cancelling sensor that allows omnidirectional operation without heading error or dead zone. The system is fully digitized and displays its output on an easy to read 5 digit LED for murky water or night operations. An audio output allows the diver to operate the system without watching the LED readout. The DIVER MAG 1 is tunable worldwide. The system is easy to maneuver and is operator adjustable for neutral buoyancy.

Power is supplied by an internal 12 vdc rechargeable battery which lasts for two continuous hours at the 5 second cycle time. Extended operation is available by using optional belt mounted spare battery packs. Battery charger operates from 120 vac (220 vac optional).

The DIVER MAG 1 was designed for underwater use, but can be used on land with the same 1 gamma sensitivity. A land handle grip is provided for carrying the unit on land. The unit is quite heavy (35 lbs), so a small wheeled cart is recommended for prolonged land use (use nonferrous metals in cart).

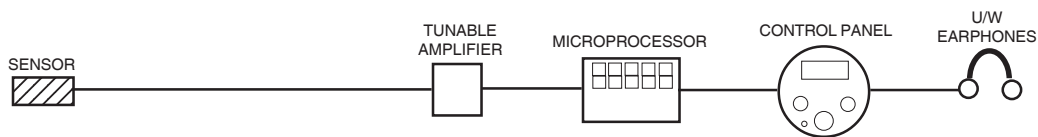
Modular construction allows easy field repair, should it ever be necessary. The DIVER MAG 1 is covered by a full TWO YEAR WARRANTY.

contains charcoal lighter fluid (ships empty from factory, see page 25)

THEORY OF OPERATION

The sensor, located in a housing in the front of the Diver Mag 1, contains charcoal lighter fluid (ships empty from factory, see page 13) which is rich in protons (nuclei of hydrogen atoms). The protons act like small bar magnets and align themselves parallel to the earth's magnetic field (like a compass). Several coils of wire are in the liquid and when a voltage is applied to it (called POLARIZATION or POL TIME), the protons align to this stronger field. After several seconds, the voltage is removed and the protons swing back to align to the earth's magnetic field.

DIVER MAG 1 SIMPLIFIED BLOCK DIAGRAM



The protons “swinging back” induce small voltage pulses in the coils which are amplified and processed by the microprocessor which is on-board. To optimize the amplifier, the amplifier is “tuned” (by a switch) for the frequency (gammas) of the pulses in your area (see world map in shipping box). The tuning is very broad. Once the fish is tuned it will operate over a very large area (+/- 1,500 gamma).

When the microprocessor receives the signal from the amplifier, it filters the signal and counts the pulses. The microprocessor converts the count to gammas, and sends the results to the READOUT. The READOUT stores and displays the count. The process is then repeated (called “cycling”). Two seconds of POL TIME (voltage applied to sensor coils) followed by one quarter second of READ TIME (counting pulses). As long as the count remains the same for each cycle, the READOUT would never change. To inform the operator that a new count is ready to be displayed the READOUT “blinks off” for a very short period prior to the update. If the count changes with each cycle, then the READOUT would change approximately every two and one quarter seconds.

The microprocessor also produces an audio output that shifts in frequency as the gamma numbers change. This shift in frequency can be heard in the underwater earphone.

The Control Panel enables the operator to monitor and control the overall system. Functions such as adjustable cycle times and sensitivity selection are done from the Control Panel.

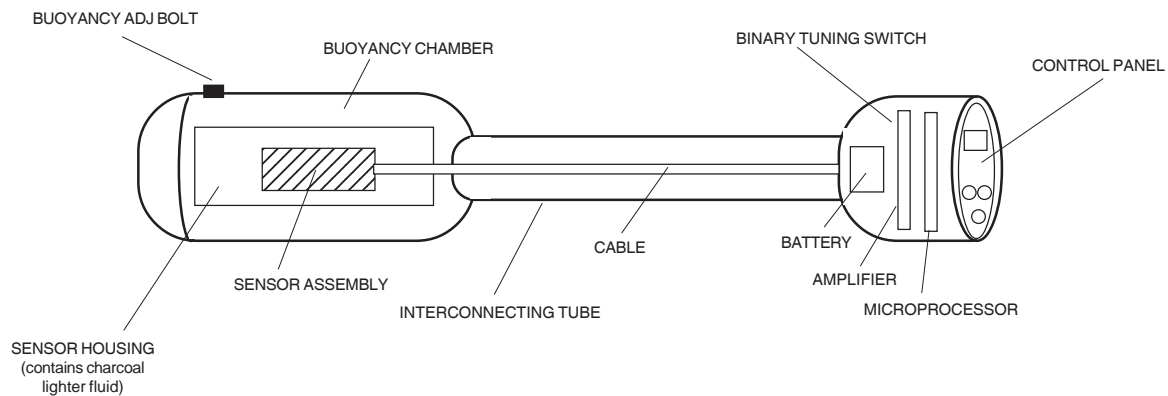
SYSTEM BREAKDOWN

The Diver Mag 1 is a Proton Magnetometer which consists of a sensor bottle assembly, a amplifier board, a microprocessor board, and a control panel. All components are housed in a PVC housing.

The PVC housing consists of a waterproof section in the front which contains the sensor assembly, and a waterproof section in the rear which houses the electronics. The interconnecting tube in the center floods with water. The two waterproof sections are electrically connected by a waterproof cable that travels inside of the interconnecting tube.

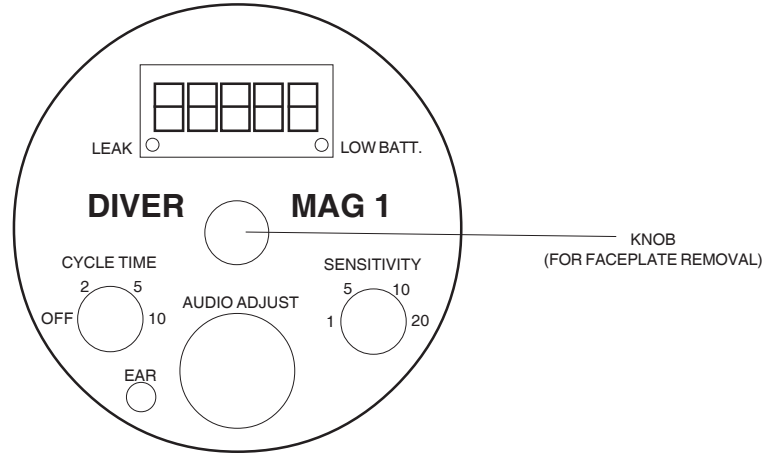
The sensor bottle assembly is quite heavy, so a positive buoyancy chamber is built into the front section of the Diver Mag 1. The buoyancy chamber has an o-ring sealed vent bolt that will allow water into the chamber. This feature allows the operator to adjust the buoyancy of the unit by allowing a controlled amount of water into the buoyancy chamber.

DIVER MAG 1



The Diver Mag 1 must be capable of being tuned from 24,000 to 61,000 gammas (see world map). To optimize tuning, a ten position binary switch (100 different combinations) is used to cover the full range of gammas. Each switch position covers a large area, and the position that covers your area has already been selected at the factory (this will be explained later). For field tuning the Control Panel is removed which gives access to the tuning switch. See P6 on page 19 for more details on tuning.

DIVER MAG 1 CONTROL PANEL



The Control Panel contains the following switches and indicators for overall control of the system:

CYCLE TIME SWITCH - A four position switch that turns the unit on and selects the cycle time.

Pos 1) OFF. In this position all power is removed from the system. When recharging the battery, this switch should be turned off.

Pos 2,3,4) Power is on and the unit cycles (takes a reading) every 2, or 5, or 10 seconds. Battery lasts longest in the 10 second position. In the 2 second position, readings are taken the most often. The 2 second position is recommended when pinpointing a target.

SENSITIVITY SWITCH - A four position switch to allow adjustment of the sensitivity of the unit. In most cases it is desirable to operate at its maximum sensitivity setting of 1 gamma. Once a large target is detected, you may want to turn down the sensitivity to enable you to more easily pinpoint the target.

- G1 - A one digit change indicates a one gamma change. Most sensitive position, used to locate small targets. Best position for general searching.
- G5 - The gamma reading is divided by 5 before it is displayed. A one digit change in the readout indicates a five gamma change. More stable than G1, used for most magging operations if in noisy area.
- G10 - The gamma reading is divided by 10 before it is displayed. A one digit change in the readout indicates a ten gamma change. Used in pinpointing targets or when you are looking for a large target in a small area.
- G20 - The gamma reading is divided by 20 before it is displayed. A one digit change in the readout indicates a twenty gamma change. Used in pinpointing large targets.

If you were in Miami, Florida area, you would get an approximate reading (see map) of:

G1 = 49,138
 G5 = 9,827
 G10 = 4,914
 G20 = 2,457

If you were in the Miami area approaching a large ship:

| <u>SEN Setting</u> | <u>2000' away</u> | <u>1000' away</u> | <u>900' away</u> | <u>800' away</u> | <u>100' away</u> |
|--------------------|-------------------|-------------------|------------------|------------------|------------------|
| G1 | 49,138 | 48,984 | 48,979 | 48,963 | 46,533 |
| G5 | 9,827 | 9,797 | 9,796 | 9,793 | 9,307 |
| G10 | 4,914 | 4,898 | 4,898 | 4,896 | 4,653 |
| G20 | 2,457 | 2,449 | 2,449 | 2,448 | 2,327 |

AUDIO ADJUST - The Diver Mag 1 has both a LED readout and a Audio output (underwater earphones). When a target is detected the frequency of the audio shifts up or down in conjunction with LED readout. The audio adjustment control allows the operator to adjust the frequency (when no target is detected) to a comfortable frequency level. The frequency should not be adjusted to low because the gamma reading will most likely shift lower when a target is detected. If the Zero Adjust knob will not allow full frequency range adjustment (zero to very high frequency), then turn the knob fully counter clockwise. This causes the micro processor to re-center the frequency. After making this adjustment the knob is generally set at mid-range (12 o'clock) position. During READ TIME the audio is turned off.

If a problem occurs with the signal from the sensor the audio will pulsate on and off.

If a water leak occurs in the electronics housing the audio will “wobble”.

READOUT - A five-digit LED READOUT which displays the gamma count. When the magnetic field changes the frequency of the pulses (number of) will change and the READOUT will change. This change can only occur after the one quarter second READ TIME. The readout flashes blank during the one quarter second READ time. The new count is displayed after READ TIME. If a problem occurs with the signal from the sensor the readout will display five dashes (-----) and will retry by cycling again.

LOW BATTERY - The LOW BATTERY LED will illuminate when the battery voltage drops below a factory set voltage reference. A low battery indication begins by the LED blinking on during polarization time. Once this occurs the system will operate for another 15 minutes. The READOUT will start to “jump around” when the battery is low. If a charged external battery is connected, the LED will go out and normal operation will resume. When the external battery runs low, the LED will come back on.

LEAK - The LEAK LED will illuminate if water enters the electronics housing. A leak will also cause the audio output to “wobble”.

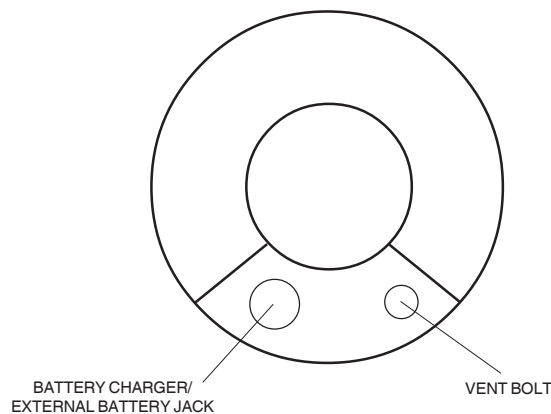
EARPHONE JACK - The underwater earphone, or optional land earphone, connects to this output jack. The design does not require the connection to be waterproof. When the earphone is not attached a cap is not needed.

FACEPLATE KNOB - In the center of the Control Panel faceplate is a Knob that is used when removing the Control Panel faceplate from the electronics housing. The Control Panel is removed to gain access to the tuning switch.

BATTERY CHARGER / EXTERNAL BATTERY JACK - Located at the rear of the electronics housing is a jack that is used to charge the internal 12 volt battery. This same jack is used to connect the optional external battery pack. When not in use, this jack must be capped with the waterproof cap provided.

VENT BOLT - Located at the rear of the electronics housing is an o-ring sealed bolt. This bolt is removed prior to removing the control panel (prevents a vacuum buildup).

DIVER MAG 1
ELECTRONICS COMPARTMENT - REAR VIEW



OPTIONS:

SPARE BATTERY PACK - A belt mounted battery pack in a underwater housing which provides additional power for extended operations. It cables directly into the rear of the Diver Mag 1 electronics housing. This battery is identical to the battery that is inside of the Diver Mag 1. The spare battery pack is disconnected from the Diver Mag 1 for recharging of either batteries.

DUAL UNDERWATER EARPHONES - A dual underwater stereo earphone is available. This dual headset is louder than the standard single earphone that come with the Diver Mag 1.

LAND EARPHONES - For land operation, dual land stereo earphones are available.

220 vac Charger - A transformer for European use.

MAP INSTRUCTIONS:

The purpose of the world map is to inform you of the normal gamma reading in your area. This information is necessary for tuning the Fish so it will operate in your area. The map shows the strength of the earth's magnetic field in your area listed in gammas. These are the numbers you can expect to be displayed in the readout when operating the mag in the G1 position. If your immediate area is located between the purple lines, then your frequency will be less or more than the number on the line. The map gamma numbers are approximate, however the actual readout should be in the area.

Once you have established what the gamma reading should be in your area the Diver Mag 1 amplifier is tuned for that gamma reading (tuning will be covered later).

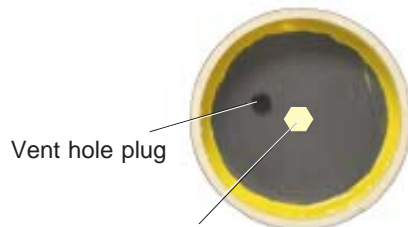
FILLING SENSOR HOUSING WITH FLUID

Do not operate the magnetometer until the sensor housing has been filled with charcoal lighter fluid (or lighter fluid). The unit was shipped without fluid, which must be purchased locally (approximately 1 1/2 quarts of fluid = 1.4 L). If the fluid is in a metal can (plastic container is ideal) then use a coffee filter to filter any possible bits of metal out of the fluid before pouring it in the sensor housing.

The following procedure is best performed by two people:

1. Remove the nose cone by removing the 3 screws. Note that the top screw hole in the cone is marked for proper alignment later; if it is not marked, then mark it.
2. Stand the unit upright with the faceplate end resting on a piece of wood (2x4 works) on the floor. Careful that the knobs are not hitting the wood or the floor.
3. Using a 15/16" wrench, remove the 5/8" fill hole plug (do not lose the o-ring under the head of the bolts).
4. Using a 9/16" wrench, remove the 3/8" black aluminum vent plug (do not lose the o-ring under the head of the bolts).
5. Wear safety glasses.
6. Using a small funnel, Slowly pour the charcoal lighter fluid into the center fill hole in the housing. The second hole is a vent so the air can come out as you are pouring in the fluid. The sensor chamber will hold about 1 1/2 quarts (1.4 L).
7. When the chamber is full, insert the plugs back into the holes finger tight. Shake the mag slightly to get any trapped air to the top of the chamber (you can hear the fluid sloshing around indicating there is air trapped inside.) Remove the plugs and refill leaving a small amount (1 oz or so) of air to allow for fluid expansion.
8. Insert the plugs back into the holes. **Careful not to cross-thread (will damage the threads). Do not over tighten**, just snug will do (once o-ring makes contact, a 1/4 turn will seal the housing. Use a paper towel to clean up any left over fluid around the bolt heads.
9. Reinstall the fish nose cone.

Diver Mag 1 - Nose End View



Insert small funnel
in fill hole and fill
with charcoal lighter fluid



Charcoal Lighter Fluid.....or.....Lighter Fluid



OPERATION AND TUNING

Do not operate the unit until the sensor housing is filled with charcoal lighter fluid (pg 13)

Operation of the Diver Mag 1 is extremely simple. It will operate month after month without any adjustments once the unit is tuned. Once you have tuned for an area, if you change areas (more than 1,500 gammas), the unit should be checked for proper tuning before going in the water (always tune the unit on land, whenever possible, before heading for water). Generally, you would have to travel hundreds of miles (north or south) before tuning would have to be changed, but test it on land to be sure.

Before your unit was shipped from the factory, the fish was tuned to the gamma reading shown on the map for your area. The gamma setting is written on a tag connected to the outside of the fish. Check the map for the expected gamma reading in your present area, and if it agrees with what is written on the tag (+or- 1,500 gamma) then there is no need to change the tuning for your area at this time. Simply checkout the system in the field (see below).

Note: The map gamma reading is the approximate expected gamma reading. If the gamma number is off by more than 1,500 gammas, then tune the unit (page 15) before proceeding with this checkout.

DIVER MAG 1 OPERATION:

Select an area, outside the city, that is free of power lines and buildings (at least 300' away) and away from any large metals (junk cars, dump, etc.). The unit will not work in a city, or in areas saturated with metal. The unit may not work in a park or field that is located in a city.

1. Position the Diver Mag 1 one to two feet above the ground, but parallel to it (use two cardboard boxes — be sure there are no metal staples in the boxes).
2. Set SENSITIVITY switch to G20 (least sensitive position).
3. Set Cycle Time to 2 sec.

When the Cycle Time switch is turned to 2 seconds, power is automatically turned on. The following sequence takes place.

1. The microprocessor is initialized and several test cycles are made. The readout remains blank during this 10 second warm-up period.
2. After the 10 second warm-up the first reading is displayed. While the gamma reading (divided by 20) is displayed the unit goes into polarization (for 2 seconds) getting ready to take the next reading.
3. After the two second polarization time the unit goes into read time for approximately 1/4 second. During read time the readout goes blank. At the end of read time the readout displays the new reading.
4. The unit repeats the sequence (2 sec polarization, 1/4 sec read, 2 sec polarization, etc) until the unit is turned off or the cycle time switch is changed.
5. The readout number should be steady (not constantly changing).

If the readout number is jumping around at this point, see the troubleshooting section and/or call the factory (800) 822-4744.

6. To insure the unit is properly working, have a second person approach the front section (sensor) with a gallon size steel can.

When the can is within 6' of the head of the fish the system should start seeing the can (the numbers in the readout should start down). As the can is moved closer to the head the numbers should continue to go down.

If the readout number does not change, see the troubleshooting section and/or call the factory (800) 822-4744.

Sensitivity Switch:

7. Put the sensitivity switch in the G1 position. This is the most sensitive position, the position you would normally like to operate in. However, due to outside electrical noise, when the unit is out of the water, you may not be able to operate in this position. The other positions (G5, G10, and G20) are used when trying to pinpoint a buried target that is at close range. When in the G1 position:

- a) The readout is displaying gammas and the number should be approximately what the map indicates for your area.
- b) The readout will jump around +/- 1 or 2 due to outside noise. If the numbers jump around excessively (15

DIVER MAG 1 OPERATION (continued):

to 20 gamma) then the fish needs to be tuned or the electrical noise in the area is just too noisy to operate in the G1 position (noise is the most likely problem).

- c) The number in the readout will slowly drift (up or down) while the sensor coils and fluid temperature stabilize.

We are now in the most sensitivity position (G1). Normal operation is in this position.

6. To insure the unit is properly working, have a second person approach the front section (sensor) with a gallon size steel can.

When the can is within 10-12' of the head of the fish the system should start seeing the can (the numbers in the readout should start down). As the can is moved closer to the head the numbers should continue to go down.

Note: When the unit is cycling the frequency displayed in the readout should be "steady". The actual frequency that is displayed may be somewhat different from the map. It is important is that the READOUT is steady so when a change does occur you know a metal object caused it. Once the readout is steady, compare the reading to the reading the tuning switches was set for. If the actual reading is different by more than 500 gammas, then change the tuning to match the displayed readout (see page 15 for tuning).

If you are using the unit on land and in a noisy area (RF noise from CB's, radio stations, power generating plants, etc.) the READOUT may jump around somewhat. Mags always run quieter in the water - no outside interference.

Cycle Time Switch:

The Cycle Time Switch is used to change how often a reading is taken. The 2 second polarization time (the same 2 second length is the same in all positions) is a high current drain on the battery. A battery will last 3-4 times longer in the 10 second cycle time position than in the 2 second cycle time position. When searching for small targets (cannon balls, ship fittings, etc) the 2 second cycle time should be used (so you do not swim or walk past the target). When searching for very large targets, the 10 second cycle time can be used.

7. Change the cycle time switch to 5 seconds and then to 10 seconds. The only difference in the readout between the three Cycle Time settings is how often (readout goes blank) a reading is taken.

Audio Adjust:

The audio output tracks the digital readout. When the gamma number increases, the frequency of the audio increases. When the gamma number decreases the frequency of the audio decreases. The Audio Adjustment control allows the operator to adjust the frequency to a comfortably level for the gamma readout being displayed. If you are unable to adjust the frequency to the desired frequency the scaling is out of range. When the Audio Adjust control is turned completely CCW the microprocessor re-scales the output frequency to cover your gamma readings currently displayed.

8. Screw the earphone into the Earphone jack.
9. Turn the Audio Adjust knob completely CCW, and then to mid-range (12 o'clock).
10. Have a second person approach the front section (sensor) with a gallon size steel can. Watch the readout while you listen to the audio. The audio frequency should shift as the readout changes.

NOTE: If any of the above sequence does not take place, see TROUBLESHOOTING in the back of this manual or call the factory 800-822-4744 or 508-822-7330.

TUNING - CRITICAL!!

Before your unit was shipped from the factory, it was tuned to the gamma reading shown on the map for your area. The factory adjusted gamma setting is written on a tag connected to the outside of the Diver Mag 1. Check the map for the expected approximate gamma reading in your present area and compare it to what is written on the tag. This is a preliminary setting, see note at bottom of page.

The tuning of the mag is very broad. Once tuned for the gamma reading in your area, it will operate over a very wide area (+/- 1,500 gamma). Do not change the factory set tuning (before you test the unit) unless the factory set tuning is not correct for your area (off by 1,000 gamma or more compared to the map). If it is not properly tuned the readout will "jump around".

Note: on land, even a properly tuned fish will not provide a steady readout if it is in an electrically noisy area or if steel/iron is close to the head.

The Diver Mag 1 is tuned by a switch on the amplifier board which is located in the electronics housing in the rear of the fish. The amplifier board, microprocessor board, and control panel are all bolted together. To gain access to the amplifier board, the control panel must be pulled out from the rear of the electronics housing.

To remove the Control Panel:

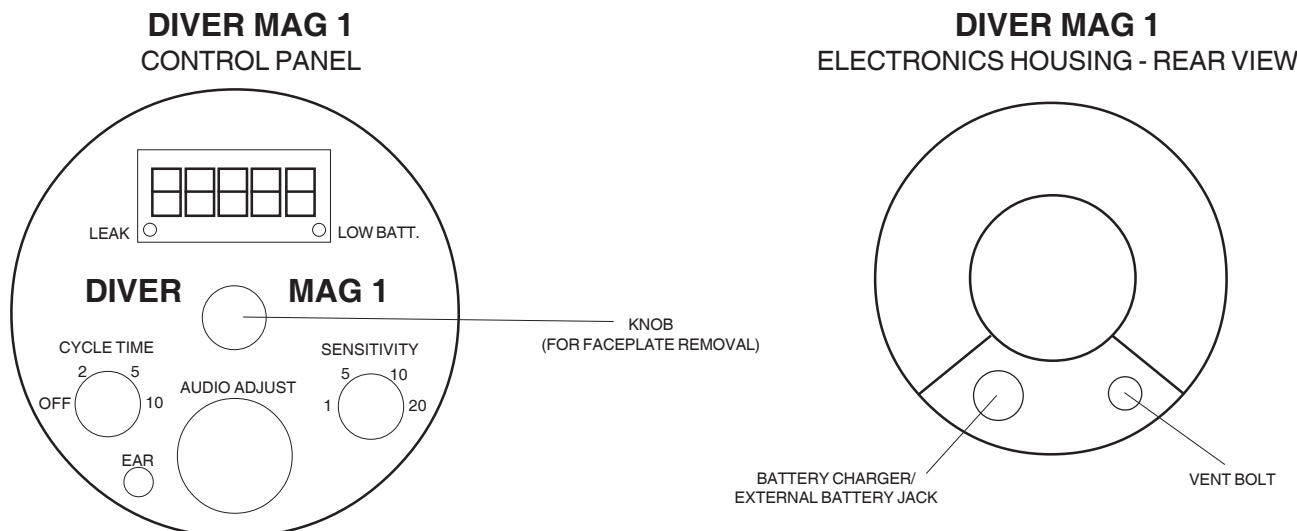
1. Remove the vent bolt (9/16" wrench) from the rear of the electronics housing. Removal of this bolt is essential to prevent a vacuum from being formed when removing the control panel (air pressure may also be required to help with removal).
2. While firmly holding the Diver Mag 1, pull the knob (located in the center of the faceplate) straight out of the housing. Note that wires extend from the control panel to other items in the electronics housing; be careful not to pull the control panel out too far. If you are unable to pull out the control panel, a small amount of air (from a bicycle pump) can be added to the electronics housing. The pressure plug, that is included with the spare parts, is screwed into the vent bolt hole, and a small amount of air pressure is added.

To tune the fish to your area:

3. Refer to the large world map that came with your system and determine the approximate normal gamma reading in your area (ie: Miami, Florida is 47,500 gammas).
4. Locate the 10 position tuning switch and jumper (J1) on the preamp board, and using the chart on the next page tune the preamp board by turning on (1) or off (0) each of the 10 switches and setting jumper (J1) on or off. The switch is on when the lever down towards the board. Take care not to damage the board. This is a preliminary setting, see note below
5. When reassembling the control panel, be sure the control panel is rotated so the readout is at the top. **DO NOT FORGET IT INSTALL THE VENT BOLT** (be sure the o-ring is in place on the vent bolt and tighten until the o-ring is compressed (do not overtighten).

To check out the new tuning position, see Diver Mag 1 Operation on page 13. If the readout jumps around 5 digits or more, refer to the chart on the next page and select first the next higher and then the next lower gamma reading. Change the tuning according, looking for the most stable digital readout.

NOTE: Once the readout is steady (when operating in the field - see page 13), compare the reading to the reading you set the tuning switches for. If the actual reading is different by more than 500 gammas, then change the tuning to match the readout displayed (the map is almost never precisely correct).



INSERT
DIVER MAG 1
FISH TUNING
CHART

Ballast Adjustment:

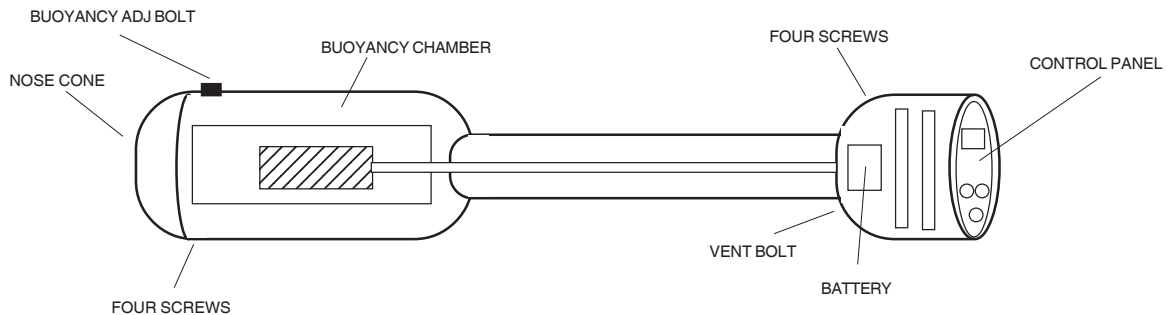
For underwater use, the buoyancy of the Diver Mag 1 is operator adjustable. The unit has a positive buoyancy without any adjustment. The buoyancy is adjusted by allowing a controlled amount of water into the Buoyancy Chamber located in the front of the unit. The Buoyancy Vent Bolt is removed using a 9/16 " wrench and water (fresh or salt) is allowed into the chamber until the desired buoyancy is attained. The plug is then reinserted. **DO NOT OVERTIGHTEN THE BOLT.** The head of the bolt has a o-ring to provide a waterproof seal. When inserting the plug, care should be taken not to cross-thread the bolt into the soft PVC housing. Once the buoyancy is adjusted it will not noticeably vary at changing depths. It is recommended that the buoyancy be adjusted before the dive while the diver is on the surface.

If for any reason, you wish to add weight (other than the water in the buoyancy chamber) a small amount of sheet lead can be added to the front nose cone and a small amount can be taped to the side of the battery in the electronics compartment. Sheet lead (used for flashing in construction) is available at Home Depot or any lumber yard. Lead is nonferrous and will not be detected by the mag.

To add sheet lead to the front end of the Diver Mag 1, remove the four screws that hold the nose cone in-place (mark the top hole of the nose cone for reassembly) and place the piece of sheet lead between the rear of the nose cone and body of the Diver Mag 1 (no need to anchor the lead in-place).

To add sheet lead to the battery compartment area, remove the vent plug from the bottom of the electronics compartment and the four screws that hold the electronics compartment in-place. Carefully separate (pull apart) the electronics compartment. Be careful of the interconnecting wires. Before installing, cover the sheet lead with "duct tape" and tape it to the side of the battery. Don't forget to install the vent plug when you are finished with the reassembly (do not overtighten the vent plug, just enough to compress the o-ring).

DIVER MAG 1



Charging Internal Battery:

Use only the battery charger provided. The charger connects to the jack in the rear of the electronics compartment (see page 11). The jack must be covered, with the waterproof dummy plug, when the mag is in use underwater. The unit should be charged overnight. When fully charged, the battery will last approximately 2 hours in 2 second cycle time, 4 hours in 5 sec cycle time, and 7 hours in 10 sec cycle time. As the battery voltage reaches the point where the battery needs recharging, the Batt LED on the control panel turns on during the 2 sec Pol time. Once the LED starts coming on during Pol time, the system will work for approximately another 15 minutes.

External Belt Mounted Battery Pack:

The external battery pack plugs into the charger jack in the rear of the electronics housing. The battery is identical to the internal battery in the Diver Mag 1. A special jumper cable is provided to connect the charger to the external battery pack.

Troubleshooting

To contact the factory: Phone (800) 822-7330 or (508) 822-7330; Fax (508) 880-8949; email jwfishers@aol.com
Web site www.jwfishers.com ; Mail to JW Fishers Mfg Inc, 1953 County St, E. Taunton, MA 02718

Problem 1 - Audio pulsates on and off and five dashes (- - - -) appear in the readout.

This indicates a problem with the signal coming from the Sensor bottle assembly. The system continues to cycle trying to get a good signal. If its a new unit (never operated in this area before, its possible the tuning (done at the factory) is dramatically off; see page 15 for tuning. If the unit was working ok, but the audio and readout indicates this error, then something in the unit has failed. Contact the factory for instructions.

Problem 2 - Audio “wobbles” and the leak LED (on the control panel) is illuminated.

Water has entered the electronics compartment. Remove the control panel (see page 15) and inspect for water. The tiny leak detector is glued to the inside surface at the bottom of the control panel. Contact the factory.

Problem 3 - Battery LED blinks on during Polarization time (2 sec). The system automatically monitors battery voltage.

When the battery voltage drops below a preset number the LED illuminates. Maximum current draw is during Polarization time, so the LED will turn on during this time. When the LED starts to illuminate recharge the battery overnight. An optional belt mounted spare battery pack is available.

Problem 4 - System stops cycling.

The most likely cause is the battery voltage dropped to low. Recharge the battery overnight. An optional belt mounted spare battery pack is available.

Please contact the factory if any other problems.

LIMITED WARRANTY

The Warranty on the Diver Mag 1 is for two years from date of purchase and is limited to the electronic portion of the unit. The Warranty does not include broken, damaged, or lost equipment. Should service be required, contact us explaining the nature of the problem. Most problems can be isolated over the phone and correct replacement parts sent to you. In some cases, we may have you return an assembly for checkout. In almost all cases, the Diver Mag 1 is field repairable.