

# RMD-1

Remote Metal Detector

## OPERATION MANUAL

012511



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# RMD-1 System



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## MAINTENANCE

Your RMD-1 was designed to be maintenance free. It is constructed of corrosive resistant materials. It is recommended the coil be rinsed in fresh water after use. It is recommended the control box be kept out of direct sunlight and away from moisture. Close the lid when not in use, control box is not water proof. Keep cable connectors dry. Please write/phone the factory at (508) 822-7330, (800) 822-4744, or E-mail [jwfishers@aol.com](mailto:jwfishers@aol.com) if any problems.

## LIMITED WARRANTY

Your detector underwent constant inspection during assembly to insure many years of trouble free performance. The RMD-1 has a TWO FULL YEAR warranty from the date of purchase. During this period, your detector will be repaired free of charge should a failure occur due to materials or workmanship. The Warranty does not cover broken cables or coils, or damage due to dropping or general misuse.

Should service be required, write/phone us explaining the nature of the problem, and we will supply shipping instructions. All repairs are made at our factory. Repairs by unauthorized persons may void the Warranty.

## SPECIFICATIONS

SENSITIVITY (switch selectable):

<b>Sensitivity (in water or air):</b>	<b>High Position</b>
• Piece of eight .....	10 in.
• Shotgun .....	28 in.
• 4" diameter pipe .....	34 in.
• One gallon can .....	36 in.
• 2' x 4' sheet metal .....	50 in.
• Maximum range .....	62 in.

PERFORMANCE/DESCRIPTION:

- Detection area (standard coil) ..... 62 in. deep, 52 in. wide
- Input voltage ..... 9 -36 vdc, or 120 vac, or 220 vac
- Power consumption ..... 8 w
- Readout ..... Meter, Audio

DIMENSIONS/WEIGHT:

- Coil set ..... 10" x 16" x 5" H ..... 32/2 oz.
- U/W Housing & elect. .... 9 1/2" L x 2 1/2" Dia .. 1.4 lbs/4 oz pos electronics alone ..... 1 7/8" x 7" x 1 1/2" H ..... 5 oz.
- Surface Control Box ..... 13"L x 13"W x 6"H ..... 7.6 lbs.
- Cable ..... 1/4" Dia x 150-1000' ..... 4-25 lbs.
- Shipping Box ..... 29"L x 25"D x 15"H ..... 25-61 lbs.

MATERIALS/COLOR:

- Underwater housing ..... High impact PVC/yellow
- Control Box . High impact Underwater Kinetics case, PVC/black
- Cable ..... 4 conductor PVC/chrome
- Coil set ..... High impact urethane/black

## OPTIONS

- Up to 1000 ft. cable.
- RS232 computer output on downstairs electronics.
- Analog output on downstairs electronics (0 to 2.5 or 0 to 5 vdc).
- RS232 computer output with GPS on surface control box.
- Analog output on surface control box (0 to 2.5 or 0 to 5 vdc).
- Input voltage for control box 220 vac and 9-36vdc.
- Different coil sizes (special build).

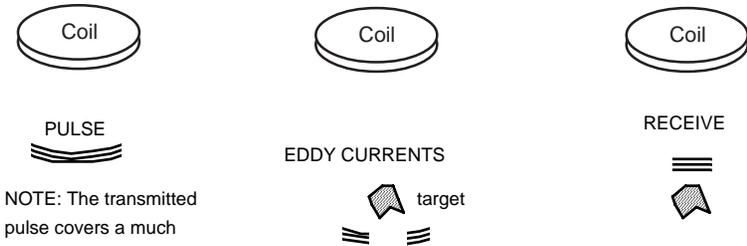
## INTRODUCTION

The RMD-1 is a high performance Pulse Induction metal detector which can be attached to almost any ROV or towed underwater system. Pulse induction technology allows the RMD-1 to detect both ferrous and non-ferrous metal objects under the ocean floor while ignoring mineralization in the salt water and seabed. The ROV metal detector locates and tracks underwater pipelines, finds missing tools and dredge parts, locates weapons and unexploded ordnance, and finds lost treasure.

Pulse detectors have had a major impact on the salvage business. Their major claim to fame is that they are very sensitive and do not detect minerals (extreme concentrations of iron ore may give a modest reading). This lack of mineral detection is an answered prayer for salt water divers who have to contend with heavy mineralized deposits on the ocean floor which produce false readings on conventional detectors. Pulse detectors ignore these mineral deposits and respond only to metal targets (ferrous and non-ferrous metal).

## HOW PULSE DETECTORS WORK

Pulse detectors operate by transmitting a continuous stream of high energy magnetic pulses (one hundred per second), from the Coil. After each pulse is transmitted, the unit then "listens" using the Coil as the receiving antenna.



When a transmitted pulse hits a metal object, a magnetic field is induced in the object. This causes eddy currents to flow in the metal, which in turn generates a second magnetic field. This field is picked up by the Coil, amplified, and then displayed by the meter and heard in the speaker/earphone.

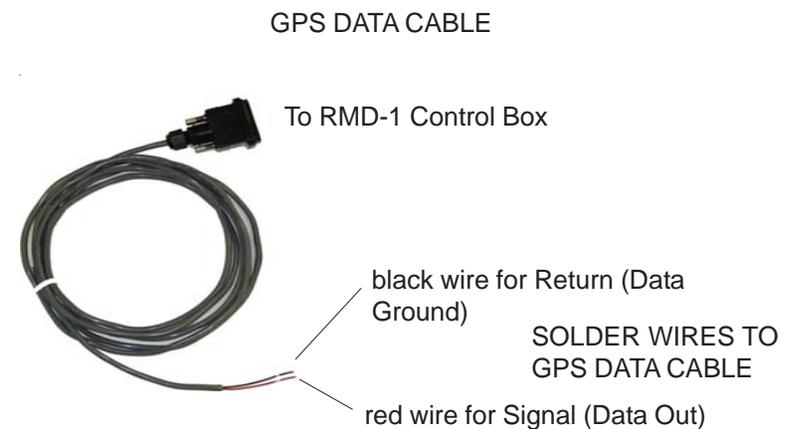
## GPS OPTION (used with RS232 Control Box option)

The GPS option allows the boat's GPS to be connected to the Control Box. This option is used with the RS232 Control Box option which will then output the boat's GPS and the RMD's output signal to a computer.

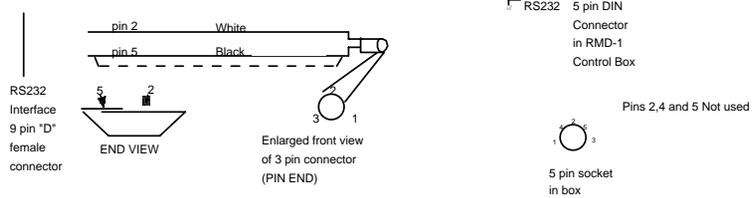
Attach the output cable from the GPS system to the RMD-1 Control Box.

NOTE: The GPS system must have a serial output, not USB. There is no adaptor to connect a GPS with USB output to a serial port.

If the data cable for your GPS has a 9 pin "D" connector on the end (for a PC serial port), it will connect directly to the "GPS INPUT" jack on the Control Box. If the data cable for your GPS has bare wire leads on the end, you will need to splice the appropriate wires to the cable shown below. If your GPS did not come with a data cable, one can be obtained from the GPS retailer or manufacturer. There are usually a variety of cables available, many also include connections for an external power source for the GPS. We recommend using an external power source as using the GPS with the data output consumes a set of small batteries in a few hours.



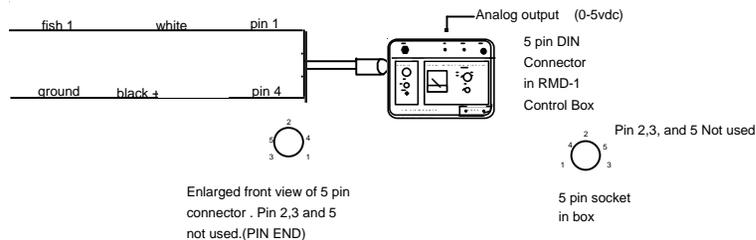
## RS232 WIRING



## ANALOG OUTPUT OPTION

The analog output option allows the RMD-1 to be connected to an external device such as a strip chart recorder or data logger. The output is 0 to +5.00vdc. The voltage is a representation of the detection signal strength.

The analog output uses 2 wires and is wired to a 5 pin DIN connector on the RMD-1 as Follows:



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## REMOTE METAL DETECTOR DESCRIPTION

The RMD-1 system employs two coils molded into rugged ABS shells and firmly attached to the underwater vehicle with a corrosive-proof tubular PVC frame. The frame provides a sturdy mount and keeps the coils far enough away from the ROV so as not to be affected by the metal parts. The oval coils produce a detection envelope which extends 3 to 5 feet into the bottom. The sleek, low profile coil design minimizes drag and weight on the ROV.

When the coil senses metal it sends a signal to the RMD-1 "downstairs" electronics unit attached to the underwater vehicle. This downstairs electronics unit can produce RS232 output, 0-5 vdc output, or a proprietary signal used by the JWF topside control/readout unit. The output from the downstairs electronics unit can be transmitted through the ROV's umbilical or a separate cable.

The standard RMD-1 has a topside Control Box which displays the readout with both a meter and audio alarm. The closer the proximity of the metal target, the stronger the reading. The topside unit can use the underwater vehicle's umbilical cable to supply voltage to the downstairs electronics unit and to receive the output signal from the downstairs unit. The RMD-1 can be powered from 120 vac (standard) or 220 vac, or 9 - 36 vdc.

The RMD-1 is easy to operate and readily attaches to most any underwater vehicle.

## COIL SIZES

The detection range of a pulse metal detector is determined to some degree by the coil size. Larger coils will detect large targets deeper, but have less sensitivity to the smaller targets. The 10 in x 16 in x 5 in coil, which is standard on the RMD-1, is an ideal size for detecting both small targets, such as individual coin size objects, and larger targets to 5 ft deep. Special coil sizes can be built for special applications.

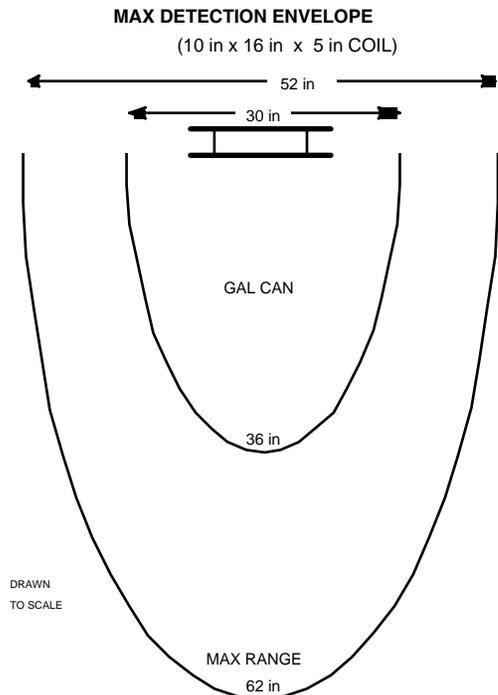
**RMD-1 SENSITIVITY**

The sensitivity of the RMD-1 is switch selectable. Normal operation is in the Hi position. If you are trying to pinpoint a target but the meter goes to full scale, switch to Low or Med sensitivity. The target is directly below the center of the coil when the meter is at its highest point (but not full scale). When operating in Low sensitivity, you can expect detection ranges about one half of Hi. You can expect these detection ranges whether the target is buried under mud, coral, sand, or rocks.

Sensitivity (in water or air):	Hi Position
• Piece of eight .....	10 in.
• Shotgun .....	28 in.
• 4" diameter pipe .....	34 in.
• One gallon can .....	36 in.
• 2' x 4' sheet metal .....	50 in.
• Maximum range .....	62 in.

**RMD-1 DETECTION ENVELOPE**

The detection envelope for the RMD-1 is very large - much larger than the coil width/length. The drawing below shows the detection envelopes (Hi position) for a one gallon can and for the maximum detection envelope (a very large object).



When using the RMD-1 with a GPS receiver the following connection and power-up sequence must be followed for proper operation.

1. Cable up entire system including GPS/Loran C to RMD-1, RMD-1 to the computer (RS232 interface), and RMD-1 downstairs to RMD-1 control box. Also connect all components to their proper power sources.
2. Power-up GPS/Loran C and obtain current position fix.
3. Power-up computer.
4. Power-up RMD-1
5. Initiate data collection program on computer.

If the RMD-1 is powered up before the GPS has obtained the current position or the GPS interface cable is disconnected, the RS232 interface will default to the "No Position Available" message as shown above.

If the GPS/Loran C loses its position fix during operation, the RMD-1 will default to the "No Position Available" message".

If either of these conditions occur correct the fault (re-initialize the GPS, check connections, check battery condition). Once the GPS/Loran C is again functioning properly, power down the RMD-1, wait five seconds and power up the RMD-1. The position information should now be present.

**RS232 ON DOWNSTAIRS ELECTRONICS OPTION**

With the RS-232 option, the downstairs electronics can be connected to any computer or data recorder equipped with an RS-232 input. The specification of the interface is as follows: 8 bit ASCII data, 4800 baud rate (custom baud rates are available), 1 stop bit and no parity bit.

The message relays the signal strength from the RMD expressed from 0 to 5,000 millivolt (0 to 5.000 volts). The complete message is repeated continuously with no delay between messages.

The message sent on the RS-232 output is as follows:

(Note: The message length can vary as shown)

RMD=95mv<cr><lf>

RMD=3270mv<cr><lf>

RMD=5000mv<cr><lf>

•The baseline reading (no metal present) is approximately 100mv.

See page 9 for connection information.

## RS232 /GPS OPTION

With the RS232 option the RMD-1 Control Box can be connected to any computer or data recorder equipped with an RS232 input. The specification of the interface is as follows: 8 bit, 4800 baud rate, 1 stop bit, and no parity bit.

The GPS/Loran C interface allows the ships position information to be input into the RMD-1. The RMD-1 then reformats the information, combines it with the signal strength reading from the search coil, and sends it to an external computer via the RS232 interface.

Any GPS or Loran C receiver equipped with a NMEA 0183 output can be used with the RMD-1. If you are not sure if your receiver has NMEA 0183 output, check its manual or call the manufacturer. You may find that you have to tell your GPS receiver to send out the 0183 information (refer to your GPS manual). If given a choice, select 0183A or 0183C format. Both versions include the latitude/longitude message format called GLL. The RMD-1 can also receive the message format called GGA, if the message GLL is not available. The RMD-1 automatically checks for the presence of either message on power-up.

The sample message sent on the RS232 interface is as follows:

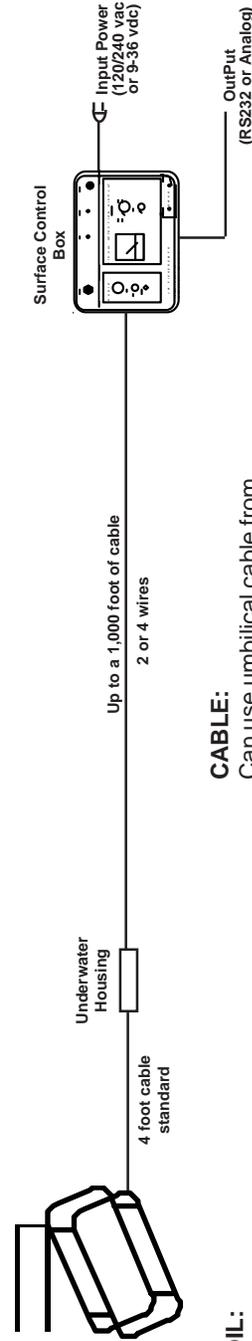
```
Position 4151.745353, N, 07102.394576, W <cr>
RMD= 3270mv <cr> <cr>.
```

Where the "Position" is the latitude and longitude coordinates from the GPS or Loran C receiver and "RMD" is the detection signal strengths expressed from 0 to 5,000 millivolts (0 to 5.000 volts). The complete message is repeated once per second.

If a GPS or Loran C is not being used, or if the GPS or Loran C message is not being properly received by the RMD-1, the message will be as follows:

```
NO POSITION AVAILABLE <cr>
RMD = 3270mv <cr> <cr>.
```

## RMD-1 SYSTEM CONFIGURATION



### COIL:

High noise immunity coil set. Standard coil set is 10" x 16" x 5". Larger coils are available by special order. Full ocean depth coils are also available.

### CABLE:

Can use umbilical cable from ROV or a separate cable. A 4 wire cable is required if power to the U/W housing electronics is from the surface; 2 wires if power is from ROV.

### UNDERWATER HOUSING:

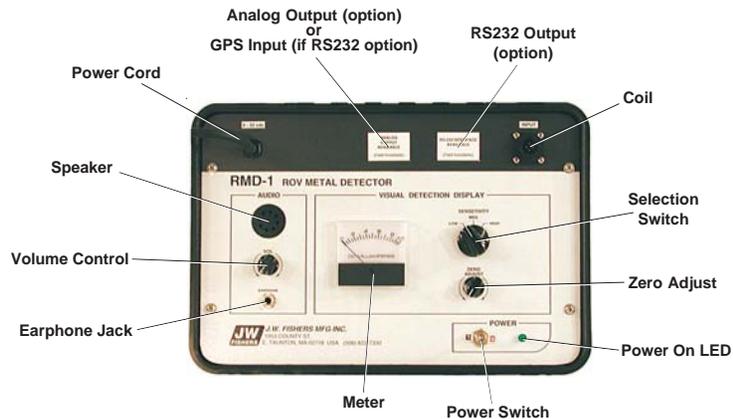
Contains downstairs electronics board. Can be powered from surface Control Box (standard) or from local ROV power (9-36 vdc at 8 w). Electronics board can be removed from housing and mounted in ROV. Electronics board output is RS232, or analog, or a proprietary signal to surface Control Box (standard).

### SURFACE CONTROL BOX:

Contains switches and controls for operating the system. When metal is detected by the coil, the meter in the Control Box swings up and the audio alarm sounds off. Control Box also has an optional RS232 and analog output for computer or chart recorder connection. System can be operated without the Control Box by applying power directly to the underwater housing.

## RMD-1 CONTROL BOX

The heart of the system is the control box which contains all controls and indicators for the system:



- **Meter** Indicates the presence of metal by swinging to the right. The closer the metal is to the coil, the further it will go to the right.
- **Speaker** When the meter moves past .2 , the speaker sounds off. The higher the meter goes, the higher the pitch (frequency) out of the speaker.
- **Volume Control** Adjusts the volume out of the speaker or earphone.
- **Earphone Jack** Accepts a standard 1/4" earphone plug (stereo or mono). Speaker output is silenced when earphones are plugged in.
- **RS232 Output** With this option the RMD-1 can be connected to any computer or data recorder with a RS232 input.

## MOUNTING AND CALIBRATION

The RMD-1 has been factory calibrated for proper operation when mounted on a JW Fishers ROV or other non-metallic host platform. In other applications, the search coils should be mounted as far from metallic components as possible. Only nylon or 316 stainless steel fasteners may be used near the search coils.

Before permanently mounting the search coils, test the RMD system to insure that it will operate properly with the search coils in the chosen location. When testing, the host platform and search coils must be clear of other metals (at least 6 ft from the search coils). To check for proper operation, test each sensitivity setting (low, medium, and high). In each setting, the zero adjust knob should be able to set the meter between 1 and 2, the normal operating range. If using the RS232 output, the reading should be close to +0.1vdc (+100mv dc).

If the above condition can not be met, try repositioning the search coils for the lowest meter reading. Once the best location is found, secure the search coils in the chosen position. Retest the system. If the zero adjust knob cannot zero the meter in each sensitivity setting, complete the following procedure to calibrate the downstairs board.

Equipment needed: Phillips screw driver, small flat blade screwdriver, DC volt meter able to read down to 0.1 vdc. If the RS 232 output will be used, the readings from this test may be observed on the PC display instead of the dc volt meter.

- 1) Remove the (2) 4-40 x 3/8" flat head screws from the underwater housing.
- 2) Slide the cable end out of the housing.
- 3) Rest the circuit board on a non-metallic surface. Do not unplug any cables.
- 4) Turn on the RMD system.
- 5) Measure the voltage on the right pad of J2. Connect the (-) lead of the meter to pin 2 of JP6 (green wire).
- 6) Turn the trimpot R37 with the small flat blade screwdriver. Turn in the direction that causes the voltmeter reading to decrease. **DO NOT ADJUST ANY OTHER TRIMPOTS**
- 7) Adjust R37 until the voltmeter or PC display reads +0.10vdc (+100mv).
- 8) Test the RMD system again. The zero adjust knob should be able to zero the meter in all sensitivity switch positions. Slowly approach the search coils from below the 'Bottom Coil' with a metal object. The voltage should begin to increase as the object is brought closer to the 'Bottom Coil'. Please note that the detection envelope is non-linear. The voltage change will be very small (50-100mv) when the object is at the outer edge of the detection envelope. The voltage change will be greater as the object is brought closer to the search coils.
- 9) Reinstall the underwater housing and o-ring. Be sure the o-ring and its seats are clean. Reinstall the (2) 4-40 x 3/8" flat head screws. Do not overtighten.



## OPERATION/CHECKOUT

- Position the coil outside and 5-6' away from any metal.
- Plug the cable from the underwater electronics board into the control box.
- Connect power to the system.
- Turn the control box Power Switch on and note that the POWER ON LED is illuminated.
- Turn the Sensitivity Switch to HI position.
- Turn the ZERO ADJUST knob until meter reads approximately .1.
- The system is ready to go. Periodic adjustment of the Zero Adjust knob may be necessary.

## DETECTING METAL

As metal passes below the lower Coil, the needle swings up. At about a .2 meter reading the audio sounds off and increases in pitch (frequency) as the needle swings higher. Maximum meter swing occurs when the target is directly below the center of the Coil. As you go past the target, the needle returns to .1 and the audio stops.

Run some tests out of the water with a metal target (gal can is fine) to get the feel of the detection pattern. There is no need to move the coil, simply move the target around (below) the coil set.

The upper coil is the noise cancellation coil. As metal is brought above this coil it causes the meter to go down. If metal is brought from the side of the coil set, the top coil cancels out the detection of the bottom coil. This feature allows the coil set to be located near a metal object with out detecting it. However, if the metal is too close to the side of the coil it will reduce sensitivity to other targets. It is when a metal object passes below the plane of the lower coil that the target is detected.

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