

SubSurface

Instruments



# MUL-1

Magnetic Underwater Locator  
Instruction Manual

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# Features

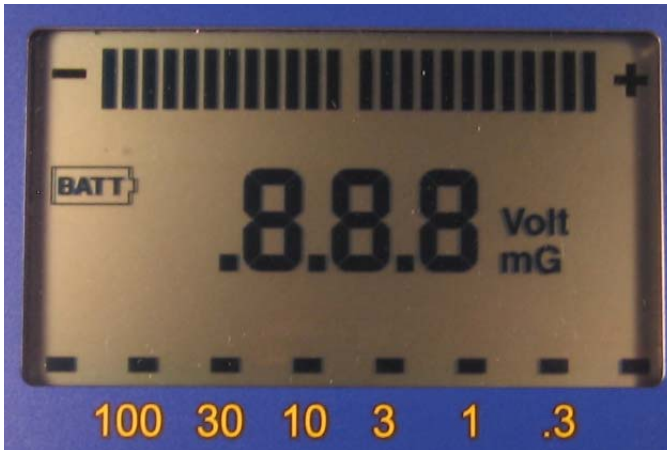
- ◇ Standard unit with internal battery housed in a high impact ABS case.
- ◇ Included accessories:
  - Manual
  - 120 Volt AC charging cord
  - Rechargeable sealed lead acid battery (internal)
  - 12 Volt auxiliary power cable
  - RS-232 Cable
  - Sensor cable-end mating connector (included on cable if optional cable supplied)
- ◇ Accessories store in compartment in lid
- ◇ Electronic control unit
- ◇ Titanium encased waterproof Sensor
- ◇ Waterproof optional cables available: 50', 100'  
Other lengths special order
- ◇ Commonly used for deep water search up to 1000 feet or more by towing on sleds detecting pipelines, ordnance, steel/ironclad ships, chests cannon, anchors, etc.
- ◇ Can be used in shallow water, streams, and ponds searching for discarded weapons, cannon, ships, anchors, and other forms of ferrous metal objects.
- ◇ Low Battery indicator on LCD display.

## Controls Description



1. **ON**..... Power ON
2. **OFF**..... Power OFF
3. **Volume** ..... Raise or lower volume
4. **Gain** ..... Increase or decrease gain from .3mG to 100mG
5. **Zero** ..... Manual adjustment of zero offset
6. **Auto Zero** ..... Automatic adjustment to “NULL” output
7. **Battery Check**..... Press to check battery voltage

## Display Description



1. **Bar Graph (top)**.....Shows signal strength and polarity
2. **BATT Icon** ..... Flashes when battery needs charging
3. **Numeric output** ..... Indicates signal value in Milligauss  
..... dependent upon range setting,  
..... or battery voltage when BATT  
..... CHECK button is pressed.
4. **Bar Graph (bottom)**..... Indicates current Range selected  
..... by the GAIN buttons.
5. **Numbers across bottom**.....100, 30, 10, 3, 1, .3 are ranges  
..... in Milligauss.

# Function

The Magnetic Underwater Locator (MUL) responds when the magnetic field strength measured at the two sensor elements inside the Sensor housing are different. This difference is measured in “Differential Milligauss” and is reported to the user via the LCD display and the audio speaker.

A headset may be used in noisy environments and will disable the speaker when connected.

The RS-232 interface allows control and recording using a personal computer with a serial COM port.



The LCD Bar graph fills to the left or the right side of the display depending on signal polarity. Left is Negative and right is Positive. As the signal increases in strength, the audio pitch increases in frequency.

# Operation

Connect the sensor to the electronics using the sensor cable before turning the system on. Press the green ON button to turn on the MUL . To turn OFF press the red OFF button. The RS-232 interface cannot be used to turn the MUL on or off.

To check battery condition press the BATT CHECK button and the battery voltage will display on the LCD.

Place the sensor in the water using your towing arrangement.

As the sensor is towed across a target the audio output will increase in pitch relative to the strength of the target. The bar graph at the top of the display will also darken the bars to the left for a negative polarity and to the right for a positive polarity.

Adjust the GAIN up or down as needed to maintain proper sensitivity.

Towing the sensor horizontally will produce two peaks as the sensor passes over a target. Towing vertically will produce one peak over the same target.

When attaching the sensor to a tow rig, keep the sensor away from ferrous metals. Although the sensor cable can be used to tow the sensor, it is not recommended using it to tow a sled rig.

The sensor can be held by a diver to locate objects but will need communication between the diver and the topside operator.

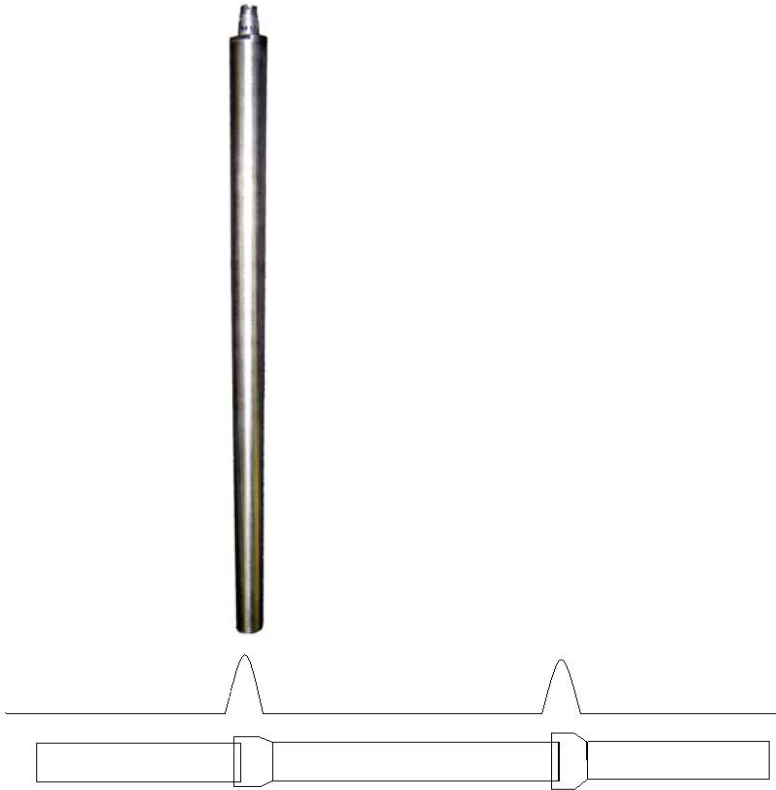
Although the electronics is water proof<sup>\*</sup>, it is recommended that it be kept out of the elements as much as possible. Water damage to the internal parts is not covered under warranty.

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\*(The phone jack lid seal must be closed to maintain watertight integrity.)

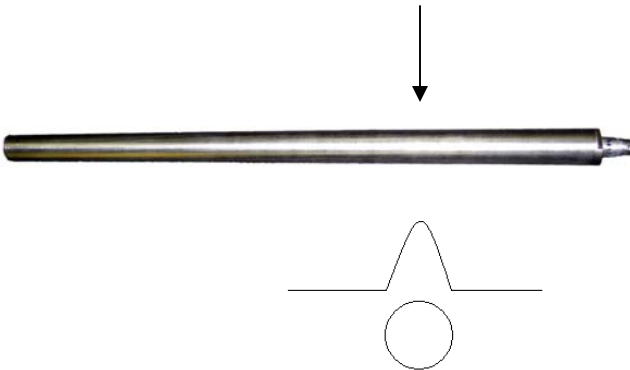
When sensor is directly over a target, the output will be at maximum. The joints of a pipeline will provide the strongest signal.



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*(Continued from page 8)*

Crossing the pipeline perpendicular to its' direction will provide a maximum signal when each individual sensor is directly over the pipe.



## Connections

The headphone jack has a water resistant cover. Lift open to plug in a stereo phone plug to listen with a headset in noisy environments.

Replace a blown fuse with a 1/4 amp fast blow.

Use the included RS-232 cable to connect the MUL to a computer.

To run on external power or to charge the battery in the field, connect the external DC power cable to the POWER connector. Connect the other end clips to a 12 to 15 Volt DC power source. Red to positive and Black to negative.

The sensor cable is connected to the SENSOR connector. A cable-end mating connector is supplied on units purchased without a cable.



# Connector Wiring

## Sensor connector

### Electronics - PT06A-12-4P:

A - 12 VDC  
B - Power ground  
C - Signal +  
D - Signal -

### Sensor - SEACON MSXJJ-4-BCR:

1 - 12 VDC (large pin)  
2 - Power Ground  
3 - Signal +  
4 - Signal -

## RS-232 Connector

### PT06A-12-3P:

A - (YEL)  
B - (ORG)  
C - (BLU) Power Ground

### DB-9:

2  
3  
5

## Power Connector

### PT06A-12-3S:

A - 12 VDC  
B - Power Ground  
C - NC

Red Clip  
Black Clip

## Charging Connector

AC Power cord Type C-8

## Headphone Connector

Standard 1/4 inch stereo

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The optional stainless steel  
**SEACON** connector with  
adapter plate.



# RS-232 Interface

## COM Port settings:

Baud rate	9600
Bits	8
Parity	NO
Stop bit	1
Flow Control	None

## Program:

Use Hyper Terminal or custom software to communicate. Turn off echo. The unit will echo any character it receives to verify communication.

## Commands:

v	Lowers volume
V	Raises volume
g	Increases range (lower gain)
G	Decreases range (raise gain)
b, B	Check battery voltage
r	Turns OFF status report
R	Turns ON status report
?	Causes a status report to be sent
l	Specifies short status report
L	Specifies long status report
d	Turns off debug mode
D	Turns on debug mode
z	Zero + 1 step per command
Z	Zero - 1 step per command
a, A	Initiate auto zero
s, S	Toggle sample rate

## Report String Description:

Long version using send character = "L", Total characters = 58

`$$SIG= _±XXXE-X, _GAIN= _X, _BAT= _XXXE-1, _VOL= _X, _Z= _XXX, _A= _X!`

Short version using send character "l" (lower case L), Total characters=22

`$$SIG= _±XXXE-X, _GAIN= _X`

Underscore in string represents a SPACE character. It is not output as an underscore but as a space.

**Example:** `$$SIG= ±XXXE-X, GAIN= X, BAT= XXXE-1, VOL= X, Z= XXX, A= X!`

## Maintenance

Keep the unit as clean as possible, especially the Electronics keypad panel. Do not use an abrasive cleaner on the keypad overlay or the LCD lens.

Be sure to wire your cables correctly if you are not using factory supplied cabling. See **Connector Wiring** in the manual for pin outs.

The Titanium encased sensor has no user serviceable parts. In the event of a failure, the sensor should be returned to the factory at the address listed at the end of this manual.

The battery and charging circuit are located inside the electronics unit and should not need servicing for quite some time. In the event that the battery weakens or fails, return the unit to the factory for replacement.

### **Battery Charging:**

Connect the AC Power cord to the CHARGE connector located on the lower right of the electronics panel. The Red LED will illuminate during charging and will extinguish when the battery is fully charged. While plugged in it will provide a trickle charge but the LED will be off.



### **Repair Service:**

Should you need to return the system to the factory for service, send it to the address listed on the last page of this manual. Pack the unit properly to protect it during shipping. No authorization is necessary. Please include all your company information for returning the unit.

# Specifications

## Controls:

ON, OFF  
Volume UP and DOWN  
Range setting (Gain or Sensitivity) UP and DOWN  
Zero, Plus and Minus  
Auto Zero - Automatic self-adjusting  
Battery Check

## Outputs:

Audio Frequency pitch (Speaker & jack for headset)  
Visual LCD Display  
Bar graph - Range GAIN setting - Milligauss  
RS-232 PC connection (cable included)  
Control all keypad functions  
Data log range, keypad & signal settings  
Works with hyper terminal or equivalent

## Power Options:

Internal battery: 12 volt, 7.2Ah sealed lead acid  
Battery Life: 72 Hours continuous use  
Charges to full overnight  
External Power 12 to 15 volt, cable included  
Internal battery charging circuit is enabled when external power or AC charging cable is connected .

## Operating temperature range:

-20F to 150F (-29C to 66C)

## Dimensions:

Electronics: 16.9" X 10" X 6.5"  
Sensor: 1.625" X 34.375" (4.13cm X 87.3CM)

## Included Accessories



Serial Port Cable



AC Power/Charge  
Cable



12 Volt Power Cable

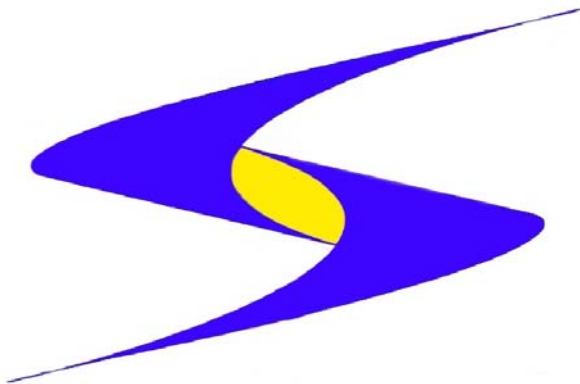
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## Warranty Statement

SubSurface Instruments, Inc. warrants the MUL-1 to be free from defects in material and workmanship for a period of twelve (12) months from date of shipment to original purchaser, subject to the following conditions.

Our obligation under this warranty is limited to servicing or adjusting any product returned to the factory for this purpose, and to replace any defective part thereof. Such product must be returned by the original purchaser with proof in writing, to our satisfaction, of the defect. Serial numbers must be intact. Abuse and/or batteries or battery damage is excluded from the warranty.

SubSurface Instruments, Inc. shall not be liable for any injury to persons, or any other special or consequential damages sustained or expenses incurred by persons from the use of any product or repair.



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MUL—Magnetic Underwater Locator/Gradiometer  
(Long Sensor, for underwater sled or diver)