

NovaTech Beacons & Flashers



Mini-Beacon 1000



VHF Radio Beacon

Operation & Maintenance Manual

TD 12-024

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1 Safety Information


1.1 Pressure Case

As with any sealed pressure case, the contents could be under pressure due to a battery or seal failure. This could expel the batteries when the device's lens cap is removed. To be safe, always point the antenna end cap away from you during opening. The antenna end cap is designed to vent internal pressure as it is removed. If venting is heard during the caps removal, stop removal until venting has stopped. If a battery is trapped in the case take extreme care, there could be a pressure buildup behind it and the battery could be expelled at any time.

1.2 Unauthorised Modifications

Any changes or modifications made to this device or any of its accessories, which have not been expressly approved by MetOcean Data Systems, may result in the user voiding their authority to operate said equipment.

1.3 RF Exposure

	<p>WARNING: To satisfy FCC RF exposure requirements for mobile transmitting devices, a separation distance of 20 cm or more should be maintained between the antenna of this device and persons during the device operation. To ensure compliance, operations at closed that this distance are not recommended. The antenna used for this transmitter must not be co-located in conjunction with any other antenna or transmitter.</p>
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1.4 Class B Digital Device Compliance

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer for help

2 Introduction

The Mini-Beacon 1000 is a self-contained submersible Radio Beacon designed to assist in the location and recovery of surface and subsurface oceanographic equipment. The Mini-Beacon 1000 may be submerged to depths of 1,000 meters (3,280 feet).

The Mini-Beacon 1000 has 2 variants – 1000 and 1000A. MMB1000 provides 4 frequencies and 1000A provides 2 additional frequencies, for a total of 6 frequencies available. These frequencies are in the range of 154 MHz to 161 MHz. In standard configuration, the Mini-Beacon 1000 has the following preset frequencies.

Channel A: 154.585 MHz

Channel B: 159.480 MHz

Channel C: 160.725 MHz

Channel D: 160.785 MHz

In the 1000A configuration, the following preset frequencies are available.

Channel A: 159.150 MHz

Channel B: 159.200 MHz

Channel C: Not Configured

Channel D: Not Configured

For the remainder of this manual, unless otherwise specified, the term 1000 will refer to both 1000 and 1000A.

The Mini-Beacon 1000 offers multiple user configurable options including daylight off option. Please refer to section 7 for unit configuration details.

In standard configuration the Mini-Beacon 1000 produces a 2 second transmission on a 17% duty cycle. The device will produce a pulsing, 17 dBm maximum, 154.585 MHz RF signal for approximately 25 days. The device can be turned ON or OFF by triggering the internal magnetic reed switch.

3 Quick Start

1. The Mini-Beacon 1000 is shipped with batteries installed.
2. Open the device by disconnecting between pressure case and knurled feature on the antenna cap to expose the Mini-Beacon 1000 PCB. Please refer to section 7 for assembly and disassembly details.
3. Position switch #1 on the 8 position DIP switch to the on position to apply power to the PCB.
4. Close the unit. The unit will default to the ON state following reassembly.
5. Turn on DF-500N Receiver or other receiver tuned to the correct frequency and check that there is a pulsing signal.
6. The standard configuration Mini-Beacon 1000 is ready to be deployed. In standard configuration the unit can be turned ON or OFF by triggering the internal magnetic reed switch. Please refer to section 6.1. Should you require configuration other than standard please refer to section 7 for unit configuration details.

4 Installation

Various installation factors can affect the performance of the Mini-Beacon 1000. Install the unit in a location that will ensure that when the beacon is at the sea surface the antenna will be vertical and well out of the water. Keep the antenna well clear of metal obstructions. Nearby metal can absorb some of the R.F. energy, reducing the range.

4.1 Antenna

The Mini-Beacon 1000 is supplied with one $\frac{1}{4}$ wave low profile antenna, part number K00172. Install the antenna on the stud located on the top of the antenna cap and secure finger tight only – do not use a wrench.

4.2 Pressure Case

When mounting the pressure case take care to prevent any side loading on the antenna cap. Side loading on this cap could cause damage resulting in reduced performance or leakage.

To minimize possibility of corrosion or wear, NEVER mount the pressure case directly to metal. Isolate the pressure case by wrapping it with vinyl tape, or similar, at the contact points.

5 Operating Instructions

5.1 On/Off

Power to the Mini-Beacon 1000 PCB can be controlled by placing switch #1 on the 8 position DIP switch in the on or off positions. See **Table 2: 8 Position DIP Switch** and **Figure 3: PCB Showing DIP Switch Locations**.

The device may be turned ON or OFF by actuating the magnetic reed switch, located within the pressure case, with an externally placed magnet.

The magnet must be held in position until you have confirmation of state change. The target for magnet placement is approximately 2.0 inches down from the bottom of the knurled feature. See **Figure 1: Magnet Approaching and On Target** for magnet positioning. One long flash of internal LED indicates device is turning ON. Two quick flashes of internal LED indicate the device is turning OFF.



Figure 1: Magnet Approaching and On Target

5.2 Batteries

The Mini-Beacon 1000 uses 7 x CR123A Lithium cells for approximately 20 days of continuous operation. Install batteries with the positive terminal towards the PCB. The circuit is reverse polarity protected. Rechargeable batteries are not recommended. Always remove batteries when the Mini-Beacon 1000 is not in use. Please refer to section 8.2 for battery change details.

PLEASE NOTE: Following any disconnection of PCB from batteries, wait for a period of two minutes before reconnecting. This period of time is required to let the circuit fully discharge and ensures that the device will function optimally.

5.3 Test Operation

The following quick test verifies the Mini-Beacon 1000 in standard configuration is functioning properly:

1. Turn device ON using magnet.
2. Turn on DF-500N DF Receiver or other receiver tuned to the correct frequency and check that there is pulsing signal.
3. Mini-Beacon 1000 is ready to be deployed.

5.4 Direction Finding Receiver

Any Direction Finding (DF) Receiver that tunes to the preset frequencies may be used to locate the Mini-Beacon 1000. MetOcean Data Systems manufactures the hand-held DF-500N receiver.

When selecting a receiver or when ordering the Mini-Beacon 1000, one factor must be considered. Any DF Receiver requires a certain amount of time to lock onto a signal, the DF-500N needs less than ¼ second, while some older shipboard DF Receivers need almost 2 seconds.

The Mini-Beacon 1000 is normally shipped with a duty cycle (D/C) of 2 seconds ON and 4 seconds OFF. This duty cycle will work with virtually all DF Receivers.

If you plan to use the ships DF Receiver, be sure to check that it is operating properly.

5.5 Range

Range of the beacon is essentially “line of sight”. To maximize range the beacon and DF Receiver should be as high as possible.

One can expect a minimum range of 2 nautical miles working to a Zodiac and 2 to 4 nautical mile range if you are on the deck of a vessel 25 feet off the water.

The following formula can be used as an approximate guide for range: (beacon at surface)

$$\text{RANGE (Nautical Miles)} = \sqrt{H \times 2}$$

Where H = height of DF Receiver antenna in feet above the water’s surface.

6 Configuration Details

To gain access to the electronic PCB board for unit configuration remove the antenna cap on the pressure case by rotating the cap counterclockwise by hand.

PLEASE NOTE: When removing or installing lens cap apply hand pressure to the knurled portion of the cap only. Hand-tighten the lens cap only when reinstalling.

Removal of the PCB from the case will cycle power. Following a power cycle on the board the unit will default to the ON state.

PLEASE NOTE: Following any disconnection of PCB from batteries, wait for a period of two minutes before reconnecting. This period of time is required to let the circuit fully discharge and ensures that the device will function optimally.



Figure 2: PCB Removed From Pressure Case

6.1 On/Off

Power to the Mini-Beacon 1000 PCB can be controlled by placing switch #1 on the 8 position DIP switch in the on or off positions. See **Table 2: 8 Position DIP Switch** and **Figure 3: PCB Showing DIP Switch Locations**.

To enable magnetic reed switch functionality switch #1 on the 4 position DIP switch must be in the on position. See **Table 1: 4 Position DIP Switch** and **Figure 3: PCB Showing DIP Switch Locations**.

6.2 Daylight Off

The Mini-Beacon 1000 is equipped with a light sensor to allow for the daylight off functionality. To enable this option, switch #2 on the 4 position DIP switch must be in the on position. See **Table 1: 4 Position DIP Switch** and **Figure 3: PCB Showing DIP Switch Locations**.

Table 1: 4 Position DIP Switch

4 POSITION DIP SWITCH			
SWITCH #	CONTROLS	POSITION	FUNCTION
1	REED SWITCH	ON	ENABLE
		OFF	DISABLE
2	LIGHT SENSOR	ON	ENABLE
		OFF	DISABLE
3	RESERVED – PLEASE KEEP IN OFF POSITION	OFF	N/A
4	RESERVED – PLEASE KEEP IN OFF POSITION	OFF	N/A

6.3 RF Frequency

The Mini-Beacon 1000 can be configured to transmit on any of the preset frequencies. RF transmission frequency configuration is accomplished using switches #2 and #3 on the 8 position DIP switch. See **Table 2: 8 Position DIP Switch**, **Table 3: RF Frequency** and **Figure 3: PCB Showing DIP Switch Locations**.

6.4 RF Pulse Duration

Transmission pulse duration can be configured for 1, 2, 3, and 4 seconds. Pulse duration configuration is accomplished using switches #4, and #5 on the 8 position DIP switch. See **Table 2: 8 Position DIP Switch**, **Table 4: RF Pulse Duration** and **Figure 3: PCB Showing DIP Switch Locations**.

Table 2: 8 Position DIP Switch

8 POSITION DIP SWITCH			
SWITCH #	CONTROLS	POSITION	FUNCTION
1	POWER TO PCB	ON	ON
		OFF	OFF
2	RF FREQUENCY	*SEE TABLE RF FREQUENCY	
3			
4	RF PULSE DURATION	* SEE TABLE RF PULSE DURATION	
5			
6	DUTY CYCLE	* SEE TABLE DUTY CYCLE	
7			
8	RESERVED – PLEASE KEEP IN OFF POSITION	OFF	N/A

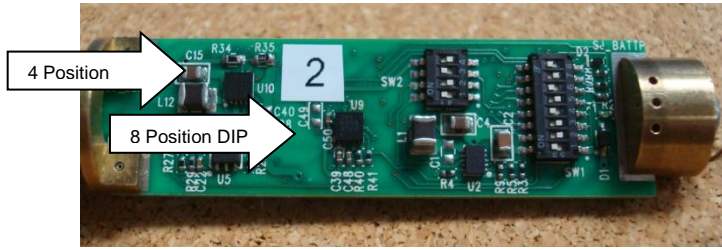


Figure 3: PCB Showing DIP Switch Locations

Table 3: RF Frequency

SWITCH #	RF FREQUENCY			
	A	B	C	D
2	OFF	ON	OFF	ON
3	OFF	OFF	ON	ON

Table 4: RF Frequency (1000A)

SWITCH #	RF FREQUENCY			
	A	B	C	D
2	OFF	ON	N/A	N/A
3	OFF	OFF	N/A	N/A

Table 5: RF Pulse Duration

SWITCH #	RF PULSE DURATION (SECONDS)			
	1	2	3	4
4	OFF	ON	OFF	ON
5	OFF	OFF	ON	ON

Table 6: Duty Cycle

SWITCH #	DUTY CYCLE			
	RESERVED: Do NOT USE	RESERVED: Do NOT USE	17%	10%
6	OFF	ON	OFF	ON
7	OFF	OFF	ON	ON

6.5 Duty Cycle

Duty cycle is the percentage of transmission time in a complete transmission cycle (i.e. transmission and non-transmission combined).

$$\text{Duty Cycle (\%)} = (\text{transmission time}/\text{complete cycle time}) \times 100$$

The Mini-Beacon 1000 can be configured for 10% or 17% duty cycle. Duty cycle configuration is accomplished using switches #6, #7 on the 8 position DIP switch. **Table 2: 8 Position DIP Switch**, **Table 5: Duty Cycle** and **Figure 3: PCB Showing DIP Switch Locations**.

Increasing duty cycle for a given pulse duration will decrease battery life.

7 Maintenance

There are no user repairable parts in the Mini-Beacon 1000. Return the unit to the factory for repairs.

7.1 Regular Maintenance

- Rinse thoroughly with fresh water after every use
- Protect lens from damage, scratching or impact
- Always remove batteries when not in use
- Always use fresh batteries
- Protect “O” ring surface from damage
- Replace worn or damaged “O” rings
- Keep batteries and electronics dry

7.2 Battery Change

The Mini-Beacon 1000 uses 7 x CR123A Lithium cells. Install fresh batteries with the positive terminal towards the PCB. See **Figure 4: PCB Removed for Battery Change**. Please ensure that the insulating plastic tube remains within the pressure case during battery change.

PLEASE NOTE: Following any disconnection of PCB from batteries, wait for a period of two minutes before reconnecting. This period of time is required to let the circuit fully discharge and ensures that the device will function optimally.

PLEASE NOTE: Cycling power to the PCB will result in the device defaulting to the ON state.



Figure 4: PCB removed for battery change

7.3 “O” Ring Facts

A conservative estimate is that “O” rings will last for two to five years.

The main problem with “O” rings is that over time they can take a “set”. They lose their original round shape and they become slightly flattened resulting in less compressibility. Reduced compressibility can lead to a water leak near the surface. The best way to prevent a problem is to service the “O” rings before every deployment.

Some of the main factors that can cause a “set” are:

- High storage temperature (exceeding 40°C) over time will cause the rubber to harden.
- Exposure to sunlight and ozone will cause the “O” ring to deteriorate and stiffen.
- Temperature does not have to be that cold for an “O” ring to lose a great deal of its flexibility. At 4°C, an “O” ring has stiffened significantly.
- “O” rings must be lightly lubricated with silicone-based grease. We recommend “Parker Super O Lube”.
- A typical seal failure results in a very small amount of water, not a flooded case. Most seal failures occur near the surface.
- The “O” ring becomes less flexible as the rubber ages.
- If you are operating or storing at low temperature, it makes it even more important to service the “O” ring regularly.

7.4 “O” Ring Maintenance

MetOcean strongly recommends that “O” rings be serviced on a regular basis to ensure a reliable seal. **Remove and lubricate at least once a year, preferably more often, and replace every two years or sooner.** With regular maintenance, “O” rings will be very reliable and trouble free. It has been, however, our observation that most “O” rings are neglected for years and expected to perform at the extremes of their design limits.

There is one “O” ring that requires service on this device. The “O” ring is located on the lens cap. Replace the “O” ring with 2 – 116 – N70, available from MetOcean or your local “O” ring supplier. Lubricate lightly with a silicone grease, we recommend Parker Super O Lube.

7.5 Corrosion Prevention

Corrosion is a problem common to all metals used in the ocean. To help minimize corrosion the Mini-Beacon 1000 is protected with a chromate conversion followed by powder coating process.

Do not mount the beacon directly against metal. Isolate the pressure case by wrapping it with vinyl tape or similar at the contact points.

8 Specifications

Transmitter Output	50 mW max, pulse FSK
Transmitter Duty Cycle	17%, 1 sec. on, 5 sec. off
Harmonics	-40 dB minimum
Battery Life @ 4°C	Approximately 25 days
Batteries	7 x CR123A Lithium
Operating & Storage Temperature	-40°C to +60°C (-40°F to +140°F) ¹
Ocean Depth Rating	1,000 meters (3,280 feet) – maximum
Frequency Range (1000)	Channel A: 154.585 MHz Channel B: 159.480 MHz Channel C: 160.725 MHz Channel D: 160.785 MHz
Frequency Range (1000A)	Channel A: 159.150 MHz Channel B: 159.200 MHz
FCC Identification	Pending
Canadian Identification	Pending
Range	2-4 nautical miles
Antenna	Field replaceable ¼ wave low profile
Weight with Batteries	In air 1.00 lb (0.45 kg) In water 0.63 lb (0.29 kg)
Dimensions (exclusive of antenna)	14.60" long (370 mm), 1.13" diameter (28.7 mm)

¹Operating temperature range dependant on battery temperature specifications

9 Warranty

MetOcean Data Systems guarantees this product to be free from defective materials and workmanship and agrees to remedy any such defects for a period of one year commencing from the date of purchase.

This warranty does not apply if the equipment has been subject to misuse, neglect, accident or improper installation, or altered outside our factory, or to damage caused by defective batteries. MetOcean Data Systems neither assumes nor authorizes any person to assume for it any other obligation or liability in connection with this product, including damage resulting from design or equipment failure.