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CABO/WABO Iridium BEACON

USER'S MANUAL

WARRANTY POLICY

MetOcean warrants products manufactured by **MetOcean** to be free from defects in materials and workmanship under normal use and service for twelve (12) months from date of shipment, unless specified otherwise, subject to the following conditions:

MetOcean's obligation under this warranty is limited to repairing or replacing (at **MetOcean's** option) products that have been returned prepaid to **MetOcean**.

MetOcean will return warranted equipment by surface carrier, prepaid.

This warranty shall not apply to any **MetOcean** product that has been subjected to modification, misuse, neglect, accidents of nature, or shipping.

Batteries are not warranted.

Under no circumstance will **MetOcean** reimburse the claimant for costs incurred in removing and/or reinstalling equipment.

This warranty, and **MetOcean's** obligation there under, is in lieu of all other warranties, expresses or implied, including warranties of suitability and fitness for a particular purpose.

MetOcean is not liable for consequential damages.

REVISION HISTORY

Version	Description of Changes	Author of Change	Date of Change
1.0	Initial version	B. Schandall	20 August 2010
2.0	Editorial changes, technical specifications corrected, battery replacement section updated As per ECP 101130	B. Schandall	06 October 2010

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1 CABO/WABO Iridium Beacon Deployment – Key Points

1. Prior to deploying the beacon, the end user must contact their Iridium satellite service provider to activate the Iridium satellite account. JouBeh Technologies and Iridium VAR may be contacted via sales@joubeh.com or at +1 902 405-4428

The beacons International Mobile Equipment Identity Number (IMEI#) tag can be located on the housings external surface. A second IMEI# tag is located on the inner housing wall of the battery compartment. Refer to section 4.1 Battery Replacement for instructions on how to access the beacon's battery compartment.

2. It is recommended that prior to each deployment the operation of the beacon be tested. This can be done on deck and out of the water. Refer to section 3.1 Activate/Deactivate or table below for activation procedures.
3. Verify operation through confirmation of data transmission and reception.

BEACON ACTIVATION

To activate the beacon place the magnet on the target, located on the beacon label, as shown in Figure 4: Magnet Approaching and On Target. Hold the magnet in this position for 3 seconds until an audible 3 short pulse is heard. Remove the magnet when this pulsing is heard.

To deactivate the beacon place the magnet on the target as shown in Figure 4: Magnet Approaching and On Target. Hold the magnet in this position for 3 seconds until a long pulsing of the internal buzzer is audible. Remove the magnet when the long pulsing is heard.

Beacon status can be verified by holding the magnet on target for 1 second until internal buzzer is audible. A 3 short pulse sequence indicates ON and a long pulse sequence indicates OFF.

2 CABO/WABO Iridium Beacon Introduction

The CABO and WABO Iridium beacons (CABO or WABO) are designed to be used as location monitoring, tracking, and recovery devices. The beacon's primary use is with surface and subsurface ocean equipment, icebergs, and ice floes. The beacon's robust housing allows for long-term and harsh environment deployments.

During surface deployment the beacon acquires and transmits positional information at defined intervals. During subsurface deployment the beacon sits in a stand-by (sleep) mode, for energy efficiency, awaiting activation resulting from surfacing.

The beacon comes in two housing styles, aluminum (CABO) and titanium (WABO), allowing for a range of subsurface deployment depths of up to 6000 meters. Refer to section 2.1 for CABO and WABO specifications.



Figure 1: Iridium Beacon (CABO/WABO)

2.1 Specifications

Table 1: MECHANICAL Specifications

DIMENSIONS	
Hull Diameter	3.50 inch
Overall Height	12.77 inch / 8.73 inch (external power)
Mass (CABO)	AIR 6.7 lbs
	WATER 2.3 lbs (-)
Mass (WABO)	AIR 9.9 lbs
	WATER 5.5 lbs (-)

Iridium Beacon CONSTRUCTION	
Hull Material (CABO)	Aluminum (6061, T6-6061) Anodized (MIL-A-8625C Type III Class 2), Polymer
Hull Material (WABO)	Titanium (Grade 2 and 5), Polymer

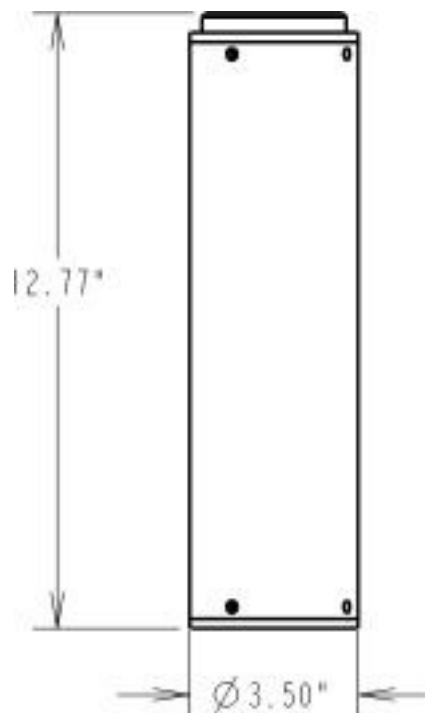


Figure 2: CABO/WABO Internal Power

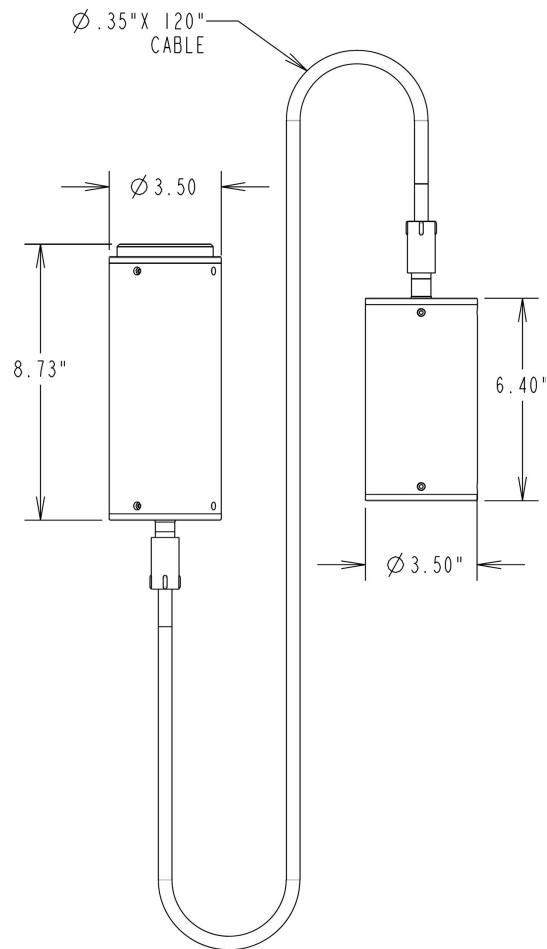


Figure 3: CABO/WABO External Power

Table 2: ELECTRICAL Specifications

ELECTRONICS	
Controller	MetOcean GPT II
Telemetry	Iridium 9602 SBD Modem
GPS	Navman Jupiter 32
Antenna	MetOcean Dual Band Iridium / GPS

POWER SUPPLY	
Alkaline	
Battery	10X C Cell (MDS PI# 015865)
Lifespan	12 months standby with 2000 messages

Table 3: OPERATIONAL Specifications

OPERATION	
Air Temperature	-20 °C to 55 °C
Sea Temperature	-2 °C to 35 °C
Time Reference	UTC and Julian Hour
Sea State	5
Acquisition/Transmission interval (SLEEP MODE)	3 hours
Acquisition/Transmission interval (RAPID MODE)	15 minutes for 6 hours
Acquisition/Transmission interval (STANDARD MODE)	12 hours (messages at 8:00 and 20:00 GMT)
Message Capacity	2000 Messages with 12 Month SLEEP *
Bidirectional Communication	GPS/Transmission Interval
Recommended Maximum Operational Depth	CABO – 2000m
	WABO – 6000m

STORAGE	
Storage Temperature	-20 °C to 40 °C
Storage Life (Alkaline)	24 Months

SURVIVAL	
Temperature	-40C (non-functional)
Sea State	6

* The versatility of the firmware allows for customer defined settings of GPS/transmission interval schemes. Two thousand (2000) messages and twelve (12) month SLEEP is the capacity corresponding to the default acquisition/transmission scheme. This scheme can be customer defined at rates down to 10 minute GPS/transmission intervals. Please contact MetOcean for further details.

3 Iridium Beacon Operation

This section describes the operational functionality of the beacon with Iridium SBD (short burst data) transmission.

3.1 Activate/Deactivate

To activate the beacon place the magnet on the target as shown in Figure 4: Magnet Approaching and On Target. Hold the magnet in this position for 3 seconds until an audible 3 short pulse is heard. Remove the magnet when this pulsing is heard.

To deactivate the beacon place the magnet on the target as shown in Figure 4: Magnet Approaching and On Target. Hold the magnet in this position for 3 seconds until a long pulsing of the internal buzzer is audible. Remove the magnet when the long pulsing is heard.

Beacon status can be verified by holding the magnet on target for 1 second until internal buzzer is audible. A 3 short pulse sequence indicates ON and a long pulse sequence indicates OFF.



Figure 4: Magnet Approaching and On Target

3.2 Default Operational Schedule

3.2.1 Initial Start Mode

Check Iridium signal quality (CSQ) 3 times at 5 minute intervals.

If CSQ return = 0 on all three attempts

- Start **Sleep Mode**

If CSQ return ≥ 1 on any attempt

- Immediately start **Rapid Mode** proceeding directly to data acquisition/transmission

3.2.2 Rapid Mode

Check CSQ 24 times at 15 minute intervals

If CSQ return = 0 on any interval

- Check CSQ a second and third time at 5 minute intervals
 - If CSQ return = 0 on all attempts start **Sleep Mode**
 - If CSQ return ≥ 1 on any attempt proceed with data acquisition/transmission. Continue **Rapid Mode** until **Rapid Mode** period of 6 hours (24 x 15 minute intervals) is complete at which time switch to **Standard Mode**.

If CSQ return ≥ 1

- Proceed with data acquisition/transmission and continue **Rapid Mode** until **Rapid Mode** period of 6 hours (24 x 15 minute intervals) is complete at which time switch to **Standard Mode**.

3.2.3 Standard Mode

Check CSQ on 12 hour intervals at 0800 and 2000 UTC.

If CSQ return = 0

- Check CSQ a second time at 5 minute interval
 - If CSQ return = 0 start **Sleep Mode**
 - If CSQ return ≥ 1 proceed with data acquisition/transmission and continue **Standard Mode** indefinitely.

If CSQ return ≥ 1

- Proceed with data acquisition/transmission and continue **Standard Mode** indefinitely.

3.2.4 Sleep Mode

Check CSQ on 3 hour intervals at 0000, 0300, 0600, etc. UTC

If CSQ return = 0

- Return to **Sleep Mode**

If CSQ return ≥ 1

- Start **Rapid Mode** and proceed directly with data acquisition/transmission.

3.3 GPS acquisition

During **Rapid Mode** GPS data acquisition occurs every 15 minutes for a 6 hour period. During **Standard Mode** GPS data acquisition occurs every 12 hours at 0800 and 2000 UTC. GPS acquisition does not occur during **Sleep Mode**. Once initiated, GPS acquisition continues until a valid fix is acquired or until 150 seconds have elapsed since GPS activation.

Data corresponding to the most recent GPS fix is transmitted in the data set. If a GPS fix is not acquired, data corresponding to the last GPS fix, including lat/long, fix times, signal strength, TTFF and figure of merit are transmitted.

GPSFIX YEAR and GPSFIX DAY, HOUR and MINUTE parameters in FID4028 indicate the year and Julian time corresponding to the most recent GPS fix.

3.4 Iridium Satellite Communication

The buoy uses Iridium Short Burst Data (SBD) mode for transmitting data. During **Rapid Mode** data transmission occurs every 15 minutes for a 6 hour period. During **Standard Mode** data transmission occurs every 12 hours at 0800 and 2000 UTC. Data transmission does not occur during **Sleep Mode**.

During transmission, the modem remains powered until a successful transmission occurs or 200 seconds have elapsed. Should the transmission time-out the data set will remain buffered and sent during the following transmission cycle. The beacon will hold a maximum of 5 buffered messages.

3.5 Data Set

The beacon measures and transmits the following technical data:

- Time of sensor acquisition in year, Julian day, hours and minutes
- GPS fix year and time in Julian day, hours and minutes
- GPS position Lat/Long in GPS decimal format
- Time to First Fix TTFF in seconds
- GPS Figure of Merit
- GPS Signal Strength (signal to noise ratio in dB)

- SBD time in seconds*
- Battery voltage in VDC

*SBD time is the total time the Iridium modem was on for the previous transmission

3.6 Transmission Data Format

Refer to Table 4: FID 4028--Data Transmission Format for the data transmission format used in MetOcean Iridium beacons.

Table 4: FID 4028--Data Transmission Format Iridium Beacon

Data Name	Min	Max	Start Byte	Start Bit	Bit Length	Unit	Decoding Equation/ Comments
Year	2000	2063	1	8	6	year	$y = x + 2000$
Julian Day	0	511	1	2	9	day	$y = x$
Hour of Day	0	31	2	1	5	hour	$y = x$
Minute of Hour	0	63	3	4	6	min	$y = x$
GPS Fix Year	2000	2063	4	6	6	year	$y = x + 2000$
GPS Fix Julian Day	0	511	5	8	9	day	$y = x$
GPS Fix Hour of Day	0	31	6	7	5	hour	$y = x$
GPS Fix Minute of Hour	0	63	6	2	6	min	$y = x$
GPS Latitude	-90	98.7435	7	4	20	deg	$y = 0.00018x - 90$
GPS Longitude	-180	197.48718	10	8	21	deg	$y = 0.00018x - 180$
Time to First Fix	0	254	12	3	7	sec	$y = 2x$
Figure of Merit	0	3	13	4	2	n/a	$y = x$ Fix Accuracy -- 0: <1.5m, 1:<3.5m, 2:<10m, 3:>10m
GPS Maximum DB S/N	0	63	13	2	6	dB	$y = x$
SBD Time	0	255	14	4	8	sec	$y = x$
Battery Voltage	7	17.16	15	4	7	volts	$y = 0.08x + 7$

4 General Care

- Following recovery wash the beacon in fresh water to remove salt, sediment or any biological growth that may have occurred.
- Inspect the unit for indications of damage or corrosion following each deployment.

4.1 Battery Replacement

Table 5 : Material Required for Battery Replacement

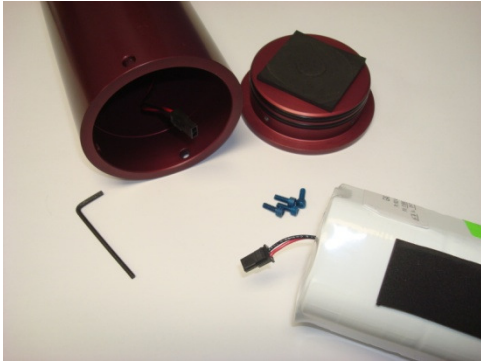
PART / TOOL	QUANTITY	DESCRIPTION	METOCEAN #
Allen Key	1	7/64" Drive	n/a
Battery Pack	1	Alkaline 15V Nominal	015865-100
O-ring	2	Parker 2-231	105271
Socket Cap Screw Fasteners	4	#6-32 x 0.38"	CABO (aluminum) - 105294
			WABO (titanium) - 105278
O-ring lubricant	As required	Silicone grease	100117



1. Remove the four fasteners holding the bottom/battery bulkhead.



2. Remove the bottom/battery bulkhead carefully to ensure that the sealing surface does not get damaged.



3. Remove the battery from the housing and disconnect.



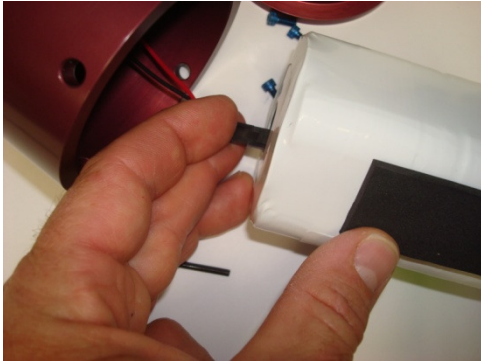
4. Remove and discard o-rings, clean bulkhead and install new, lubricated o-rings.



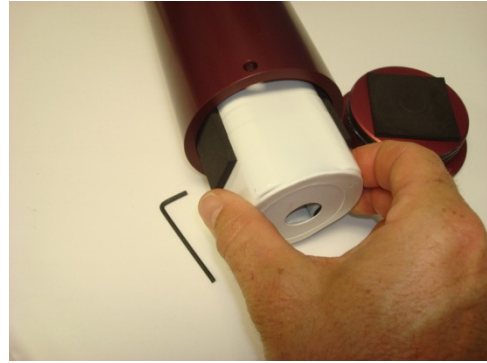
5. Connect the new battery. The connector is polarized to prevent against connecting the battery backwards and damaging the unit.



6. Prior to re-installing the battery into the housing, place the battery connector into the centre of the battery assembly, as shown in this and the following image.



7. Battery connector being placed into the centre of the battery assembly.



8. Re-install the battery into the housing taking care to ensure that the wires do not get pinched.



9. Install the bottom/battery bulkhead carefully to ensure that the sealing surface does not get damaged.



10. Inspect fasteners for indications of damage and replace if required. Reinstall fasteners and hand tighten. It is recommended that you use Loctite MS222 on each fastener.

5 Troubleshooting

Problem	Possible Cause	Solution
No transmission	Low or dead battery	Change battery
	Iridium account not activated	Activate Iridium account
	Signal interference	Ensure beacon has an unobstructed view of sky
No GPS data	Low battery	Change battery
	Signal interference	Ensure beacon has an unobstructed view of sky
Does not start	Low or dead battery	Change battery
	Improperly placed magnet	Ensure appropriate placement and timing
Does not stop	Improperly placed magnet	Ensure appropriate placement and timing