SAFETY NOTICES

⚠️ CAUTION: False alerts endanger lives and cause expensive disruption to Search and Rescue services, deliberate misuse of the PLB could result in penalty and fine.

⚠️ CAUTION: Spring action antenna deployment; tilt the PLB away from your face when deploying the antenna.

⚠️ CAUTION: Contains lithium batteries. Do not incinerate, puncture, deform, short-circuit or recharge.

⚠️ CAUTION Dispose of a used PLB in accordance with local waste disposal regulations. Refer to End of Life Statement.

⚠️ CAUTION: Avoid using chemical solvents to clean the PLB as some solvents can damage the case material.

Radio Frequency Exposure Warning
⚠️ WARNING: The PLB emits low levels of radio frequency radiation; avoid handling the antenna once activated.
# Table of Contents

Safety notices .................................................................................................................................................. 1

1. Introduction .................................................................................................................................................. 3
   1.1. Scope .................................................................................................................................................. 3
   1.2. Applicability ....................................................................................................................................... 3
   1.3. Servicing equipment .............................................................................................................................. 4
   1.4. Safety notices ....................................................................................................................................... 5
   1.5. False alarms ......................................................................................................................................... 7

2. Assessment .................................................................................................................................................. 8
   2.1. Maintenance tasks ................................................................................................................................. 9
   2.2. Routine testing ..................................................................................................................................... 9
   2.3. Assessment .......................................................................................................................................... 10

3. Maintenance procedures .............................................................................................................................. 12
   3.1. Inspection ........................................................................................................................................... 12
   3.2. Functional test ..................................................................................................................................... 13
   3.3. Message read ...................................................................................................................................... 16
   3.4. Internal inspection ............................................................................................................................... 21
   3.5. Antenna Rewind/Cover Moulding replacement .................................................................................... 22
   3.6. Antenna replacement ............................................................................................................................ 25
   3.7. Base replacement ................................................................................................................................. 27
   3.8. Battery Replacement ............................................................................................................................ 30
   3.9. Leak testing ........................................................................................................................................ 33
   3.10. Reset the Run Time counters on the PCB ......................................................................................... 34
   3.11. Programming ..................................................................................................................................... 35

4. Fault finding ............................................................................................................................................... 37

5. Repair procedures ..................................................................................................................................... 39

6. Spares/Accessories .................................................................................................................................... 40

Appendix 1 : Specification ............................................................................................................................. 41

Appendix 2 : End of life .................................................................................................................................. 41

Appendix 3 : Transportation .......................................................................................................................... 41
1. INTRODUCTION

The XS-4 Personal Location Beacon (PLB) is a device used to alert search and rescue services in the event of an emergency. It contains the following functions:

- **406MHz transmitter**
  A powerful 5 Watt transmission is encoded with a unique serial number. The signal is relayed via satellite to the rescue centre.

- **121.5MHz transmitter**
  A low power transmission is amplitude modulated with a swept audio tone and acts as a homing beacon. Rescue services are able to direction-find on this signal.

- **Flashing light**
  A bright light flashes approx every 2.6 seconds as a visual aid during the last stage of rescue.

- **GPS receiver**
  The GPS module receives and decodes the Global Positioning System signals from a satellite network and computes the position of the PLB. The position data is transmitted in the 406MHz message.

- **Flotation**
  There is an optional flotation pouch/buoyancy pack. Without this the unit will not float.

The flag state and unit serial number is programmed into the PLB as part of the 406MHz transmission, making the PLB unique. Transferring a PLB to another owner either involves re-programming, or re-registration.

1.1. Scope

This manual provides the instructions to enable routine and emergency servicing of the equipment listed below. This manual represents the original equipment manufacturer's (OEM) service documentation applicable to these products.

1.2. Applicability

This manual applies to the following 406MHz PLBs:

- XS-4 110
- XS-4 111
1.3. Servicing equipment

The following tools and equipment will be required to carry out all of the servicing detailed in this procedure.

Equipment:
- Message reader
- Screened box
- Leak testing equipment
- GPS repeater
- Static-safe work area with operator wrist strap
- Multimeter with voltage and resistance scales
- Programming kit:
  - Optical Pen, part no 1202439
  - Software downloaded from www.manageyourbeacon.com
- Battery discharge load (made on-site as required)

Handtools:
- Calibrated torque driver (Up to 75 cNm Ç 0.6ft/lb) with attachments:
  - Small cross-headed screwdriver PZ1

Antistatic precautions

The electronics section of the PLB is sensitive to electrostatic discharge (ESD) which can cause immediate or hidden long term damage. It is important that the PCB is only handled under suitable anti-static conditions.

A fully grounded workstation, which has conductive surfaces to avoid the build up of static charge, should be used.

As a minimum, the operator must be connected to a good earth point through a resistance of 1 MOhm. This is usually achieved by wearing a suitable wrist strap.
1.4. Safety notices

Please read the following information for your safety:

This product has been assessed as presenting negligible hazard in a sealed serviceable state.

Safety analysis

The following table summarises the nature of the hazard which may be present when the unit is opened or serviced; each hazard is discussed at greater length in the detailed sections.

<table>
<thead>
<tr>
<th>Hazard cause</th>
<th>Hazard identification</th>
<th>Precautions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lithium battery</td>
<td>Explosive risk, corrosive fumes, fire, biological hazard</td>
<td>Handle appropriately, avoid contact</td>
</tr>
<tr>
<td>Radio frequency</td>
<td>Physiological hazard</td>
<td>Avoid close or prolonged exposure. Do not touch the antenna during 406MHz transmissions</td>
</tr>
<tr>
<td>radiation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Lithium batteries

The batteries used in these products contain Lithium (Li). Lithium is flammable, reacts violently with water and constitutes a biological hazard. These batteries are hazardous if short-circuited, punctured, incinerated or deformed.

Lithium batteries must not be short circuited.

Lithium batteries must be handled, transported and disposed of using appropriate safety precautions. The use of rubber gloves as a routine precaution is recommended.

In the event of leakage of the battery electrolyte (which can be recognised by a pungent odour), take care to avoid contact, particularly with open wounds; do not ingest the material. Do not attempt to discharge a leaking battery; remove it using appropriate handling materials and seal in a plastic bag, then dispose of it through an approved environmental disposal agent, or in accordance with local regulations.

The PLB contains two battery packs of two cells each. Each pack contains a total of less than 2.0g of Lithium.
Radio frequency radiation
The PLB emits low levels of radio frequency radiation when activated: avoid handling the antenna of an activated unit.

General precautions for chemical agents (adhesives, greases, IPA)
Observe all safety precautions relevant to the country of operation. As a general rule, protective overalls, gloves and goggles should be worn when handling these chemical agents, but different countries may have additional requirements which must be observed.

Ensure that all chemical agents are handled in accordance with the manufacturer's instructions, and that suitable protective clothing is worn.

Make sure that the working area is well ventilated, and that chemical substances are not left exposed. Observe good hygiene practices; do not eat, drink or smoke when handling chemicals.

Read the manufacturer's instructions before using any chemical agent.

- Wear goggles
- Wear overalls
- Wash hands
- Wear gloves
1.5. False alarms

Every care must be taken to avoid the generation of false alarms.

For test purposes the PLB may be operated in the following ways without generating a false alarm:

1. Self test mode (but avoid repetitive self tests)
2. Live mode for less than 50 seconds (after 50s a live transmission is made)
3. Live mode in a screened enclosure

If for any reason the PLB is activated outside a screened enclosure (other than as a self test) for more than 50 seconds, it must be assumed that a false alarm has been generated. If this occurs:

1. Deactivate the PLB (see below).
2. The rescue services must be informed that there has been a false alarm. Use any means available to contact the coastguard or the nearest Maritime Rescue Coordination Centre (MRCC); state that there has probably been a false alarm, identify the location of the PLB and if possible give the unique ID.

De-activating a live PLB

If the PLB will not switch off when the TEST/OFF button is held for over 2 seconds and it continues to transmit, the PLB may have a fault. To prevent further transmissions it is recommended that the unit is allowed to exhaust its battery whilst the alarm signals are suppressed. The recommended procedure is:

1. If possible stow the antenna and place the PLB in a metal enclosure or wrap it in metal foil.
2. Leave until the battery is exhausted.

If it is absolutely necessary to fully disable the PLB (by unplugging the battery) then please see the relevant section of this manual.

NOTE: All PLBs (even unprogrammed ones) will transmit.
2. **ASSESSMENT**

![PLB device diagram]

**White indicator Light**
Flashes every 3 seconds once PLB active
Long flash every 50 seconds means satellite transmission OK
Flashes each second when GPS is searching
3 rapid flashes means GPS location sent

**Red pull handle**
Pull to expose antenna
Only pull in an emergency
Pulling breaks the plastic anti-tamper seal that can not be reset by the user.

**Programming Point**
Press once to activate PLB.
When the PLB is on, push the ON button again to make the indicator light flash a SOS signal pattern.

**Antenna**
Unwraps and stands vertical once the anti-tamper cover is removed

**GPS antenna zone**
Do not obstruct
Needs a clear view of the sky for best operation

**ON button**
Press once to activate PLB.

**TEST / OFF button**
Push and hold to start the self test feature,
flash of white light indicates that the self test is successful.
Once PLB active:
Hold TEST to turn PLB off
2.1. Maintenance tasks
Service providers are reminded that it is their responsibility to ensure that the procedures herein are followed, that only manufacturers approved parts are fitted and that good common practice is observed.

False alarms caused by inadvertent activation must be avoided. We recommend that PLB testing is only done in self-test mode where possible to avoid false alarms.

The functions which can be performed by service providers are:

- Routine testing
- Reprogramming
- Message reading and verification
- Battery replacement
- GPS test
- Leak testing
- Fault diagnosis and repair
- Battery life/GPS Test reset
- Antenna replacement
- Base moulding replacement
- Antenna rewind

2.2. Routine testing
A PLB should be tested monthly by its owner to ensure functionality. The PLB should be inspected for mechanical damage at the same time as carrying out self test.

Whatever the reason for the return the PLB must be subjected to a full assessment before any other action is taken. The agent has a responsibility to ensure the PLB is completely serviceable and is fit for its purpose.

Included in the user handbook are full details on activating the PLB in an emergency, LED operation, end of life statement and product specification: therefore these items are not repeated in this manual.
2.3. **Assessment**

Every PLB returned for servicing, of whatever nature, must be fully assessed to determine its operational status. The diagram shows the tasks which must be carried out for each servicing situation.

If the PLB is opened for any reason, it is recommended a new seal is fitted.

**Assessment form**

The assessment form, shown on the next page, is an essential tool in performing diagnosis. It may be used to support customer billing, and must accompany any warranty return to the manufacturer.

The first section of the form records the customer, the PLB and the reason for return (as ‘Customer comments’). It is essential to record the identity details from the PLB identification label, as these will be necessary for comparison with the transmitted data. The battery expiry date must be noted; if less than 6 months life remains, a battery change should be recommended to the customer.

Opening the PLB for internal inspection is only required if a problem is found.
# Kannad Aviation XS-4 Service Record

## Ref No | Date
---|---

### Customer

### Type | Man. Serial No | Battery expiry date
---|---|---

### Flag State | Programmed Serial Number

### Customer comments

### Warranty claim | YES/NO

## PRE REPAIR INSPECTION/TEST

<table>
<thead>
<tr>
<th>Tamper intact</th>
<th>Plastic acceptable</th>
<th>Labelled correctly</th>
<th>Self Test</th>
<th>GPS Test</th>
<th>Message read</th>
<th>Antenna OK (optional)</th>
<th>Battery expiry OK</th>
</tr>
</thead>
</table>

### Comments

## INTERNAL INSPECTION (optional)

<table>
<thead>
<tr>
<th>Battery OK</th>
<th>Battery voltage</th>
<th>Water ingress</th>
<th>Plastic damage</th>
<th>PCB OK</th>
</tr>
</thead>
</table>

### Comments

## POST REPAIR CHECK

### FUNCTIONAL TEST

<table>
<thead>
<tr>
<th>Self test</th>
<th>Live mode</th>
<th>GPS Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>LED 3 flashes</td>
<td>LED on</td>
<td>Pass</td>
</tr>
<tr>
<td>Light consistent</td>
<td>Switches off</td>
<td></td>
</tr>
</tbody>
</table>

### Comments

## MESSAGE READ

### ID OK | Country | Serial no | 406 frequency OK | Man Serial No |
|---|---|---|---|---|

### Comments

## New Parts

<table>
<thead>
<tr>
<th>Battery kit</th>
<th>Lid kit</th>
<th>Antenna kit</th>
<th>Base kit</th>
<th>PCB</th>
</tr>
</thead>
</table>

### Action taken and Conclusions

<table>
<thead>
<tr>
<th>Assessed by</th>
<th>Signed</th>
<th>Date</th>
<th>FINAL LEAK TEST</th>
<th>RESET COUNTERS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pass/Fail</td>
<td></td>
</tr>
</tbody>
</table>
3. MAINTENANCE PROCEDURES

3.1. Inspection

Antenna lid  Check antenna lid is intact. If Anti-tamper cover is damaged or is non-standard in any respect, battery capacity must be considered suspect. Contact customer to confirm any history of PLB activation.

Battery expiry  If there is less than 6 months left to run, contact customer and recommend battery replacement.

Lanyard  Lanyard is an option. If fitted inspect to ensure it is in good condition.

Plastic damage  Check plastic body for signs of cracking or wear.

Water ingress  Can only be checked by disassembly. Not recommended for routine returns.

Antenna damage  The antenna material is marine grade stainless and so is resistant to corrosion. It is recommended that the antenna is replaced if it shows any signs of deterioration. Antenna should not show signs of being creased at any time.

Identity  Ensure that the Identity information is clear Ç replace (using programming facility) if necessary.

If the PLB needs cleaning then this should be done using warm soapy water and a damp (not wet) cloth. Do not use strong detergents or solvents.

<table>
<thead>
<tr>
<th>Do not paint the PLB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do not clean with detergents or solvents</td>
</tr>
</tbody>
</table>
3.2. Functional test

Self Test
Self-test verifies operation of the PLB by checking all key features including battery and alert transmitters.

Push and hold the SELF TEST button for a minimum of 2 seconds, the indicator light will flash once to indicate the start of the self test sequence.

After a few seconds, a successful self-test will result in the indicator light flashing a number of times in quick succession depending on past battery usage;

- fresh battery: self test pass 0-2 hours use
- minimum usage: self test pass 2-4 hours use
- medium usage: self test pass >4 hours use
- No flash: self test fail

The PLB will switch off automatically when the self-test has completed.

Important
Each self-test draws small amounts of energy from the battery pack. Unnecessary testing of the PLB may subsequently reduce the run time of the PLB in an emergency. On average, the PLB should only be self tested 12 times per year, or a total of 60 times across the 5 year battery lifetime.
If the self test reaches the 2 flashes it is recommended that the battery is replaced.

Note:
The 121.5MHz transmission made during self test is unmodulated. Therefore it will not be picked up by some message readers or by an air band radio receiver. The self test inherently checks the 121.5 and 406 power as part of the test. However if the 121.5MHz must be checked then a Spectrum Analyser (121.5MHz transmits for 10mS) or a suitable EPIRB/PLB message reader/tester will be required to record the transmission.

Self test failure: See Section 4 Fault finding
GPS Test
This test proves that the XS-4 internal GPS receiver can acquire a position fix.
Take the PLB outside into an open space with a clear view of the surrounding sky.
Push and continue to hold down the TEST button for 2 seconds, the PLB will run a standard self-test (see above). Immediately after the indicator lights stops flashing, hold down the TEST button for around 30 seconds. While the GPS is being tested the indicator light will flash regularly. The test may take up to 5 minutes Ç you should continue watching the PLB during this period. A successful GPS test is signaled by the indicator light flashing a number of longer flashes as below:

- GPS self test pass 10 Ç 4 GPS tests remaining
- GPS self test pass 3 Ç 1 GPS tests remaining
- GPS self test pass No GPS tests remaining

The GPS position can be confirmed at the end of the test: The unit will transmit an RF self test message with the GPS position encoded onto it. In addition the unit will transmit via the IR port (see [Reading message from IR USB pen]).

Important
To preserve battery life, GPS testing is restricted to a maximum of 10 tests throughout the 5 year battery life. Once used up, further GPS tests are disabled.
Live test:

Note: The PLB will transmit 50 seconds after being switched on. It will then continue to transmit on 406MHz every 50s.

Do not allow the unit to transmit unless it is in a screened box/room.

1. Confirmation of activation:
   In order to confirm that the unit will operate in an emergency the unit may be switched on by pulling off/removing the antenna cover and pressing the ON button. Confirm that the indicator light flashes regularly. Press and hold the TEST button until the unit stops. Do not allow the unit to operate for more than 50 seconds.

2. Live message read:
   In order to confirm that the unit will transmit during an emergency the unit should be switched on and then placed inside a screened box. Connect the screened box to a message reader using a suitable 50Ohm BNC co-axial cable.
   a. Switch the unit ON and immediately place inside a screened box. Close lid.
   b. After 50 seconds the unit will transmit. Confirm that the 406 Message is received by the reader. Confirm the unique ID.
   c. Reset reader (if required) and confirm that 121.5MHz signal is present.
   d. Wait until the unit has just transmitted a 406MHz message and then quickly remove the unit from the screened box. Press and hold TEST to switch unit off.
3.3. Message read

A. Message read using 406MHz transmission
To confirm that the PLB is programmed in accordance with the identification label it is necessary to carry out a message read. A typical message reader is the ARG5410 MK2. This model will be used to describe the process. Operation of the reader is detailed in its handbook and will not be repeated here. The procedure is as follows:

1. On the reader select receiver mode
2. Position the PLB at the distance from the reader as required (every type of reader will be different and so distances may vary). If the antenna is still wound on the PLB then position the reader closer to the top of the PLB with some adjustment to the position may be required to obtain the consistent results. This is because the output with the antenna wound is very low power.
3. On the PLB press the TEST button to run the Self Test
4. After a few seconds the message reader should receive and decode the message.
5. Confirm the frequency was correct (406.037MHz)
   This proves the 406MHz transmitter is radiating within the correct frequency band. If the ARG5410 Reader is not used, then another facility for measuring the 406MHz frequency must be provided (a spectrum analyser for example).
6. Confirm the 15 digit ID agrees with PLB identity label UIN
   This proves the 406MHz transmitter is modulating correctly and the PLB is programmed with the correct identity. If the ARG5410 is not used then another facility for message decoding must be provided (other message readers).
7. Confirm the Flag state and the Serial No agrees

<table>
<thead>
<tr>
<th>Typical screen</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:25</td>
</tr>
<tr>
<td>Test #11</td>
</tr>
<tr>
<td>S TEST OK</td>
</tr>
<tr>
<td>ID: 9D0D071D3B00013</td>
</tr>
<tr>
<td>406.0257 MHz</td>
</tr>
<tr>
<td>PASS</td>
</tr>
</tbody>
</table>

Common problems

<table>
<thead>
<tr>
<th>Audio tone</th>
<th>Will not be heard with the XS-4 series product.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>If outside limits, repeat self test a number of times. (Provides a warm up time). Repeat test.</td>
</tr>
<tr>
<td>Bad frame</td>
<td>This error message occurs if the Reader fails to synchronize. This occurs approx. 10% of the time. Repeat test multiple times. Move location of PLB/reader. Also note that an exhausted reader battery causes bad frames.</td>
</tr>
</tbody>
</table>

Normal mode
It is possible to message read in live mode provided the PLB is in a screened enclosure. In this case the Reader reports NORMAL OK and the first 3 bytes of the full hex message are FF FE 2F instead of the usual FF FE D0 for self test mode.

GPS messages
The transmitted message will change once the GPS location has been confirmed. On some older message readers this will result in a HEX ID which does not correspond to the one given for the PLB under test.
B. Message verification using the IR USB Pen

The XS-4 series support read back of diagnostic data over the programming infra red port. By using this facility it is possible decode the HEX ID (UIN) which is useful when confirming the identity of the PLB. To use this facility you need a Orolia Ltd USB I/R programming pen and a Windows PC running the Windows communication utility program Hyper Terminal.

Also Internet access to the online Cospas Sarsat beacon decode page will be required.

These instructions assume that you already have the USB I/R light pen installed on your computer and have installed Kannad e-Prog & ManageYourBeacon software.

1/ Locate the Windows Hyper Terminal program on your PC and set up a new connection.

2/ Select the COM port allocated to the USB I/R light pen.
(same as e-Prog and in the range COM 1 - COM15)

3/ Set COM PORT settings (normally default values)

Bits Per Second = 2400
8 data bits
Parity = none
1 stop bit
Flow control = hardware
4/ Note the 'Connected' status of the new Hyper Terminal session, this indicates that it is now ready to receive PLB diagnostic data.

5/ Place the programming USB I/R Pen against the programming window on the beacon.

6/ Push and hold down the test button to enable a Beacon Self Test

7/ On completion of the self test, the green RX LED located on the USB pen will flash for a few seconds to indicate that the diagnostic data is being transferred.
8/ The self test diagnostic data is captured and displayed as raw text.

9/ Use your mouse to highlight and copy the relevant part of the hexadecimal string. Start point of the Beacon identity data is after the second line 0D01 bits.

End point is after 22 bits
10/ Access the online web page; [http://www.cospas-sarsat.org/](http://www.cospas-sarsat.org/) Click on Beacons, then Beacon Message Decode Program.

11/ Paste the previously captured 22 bit hexadecimal string into the decode Window and select 22 Hexadecimal format and click on process.

12/ Read the PLBs programmed 15 digit HEX ID, this should be identical to that shown on the rear label of the PLB.

If required print a copy of this report as a customer record.
3.4. Internal inspection

- If there is a pungent smell, then suspect that one of the Lithium battery packs have leaked. See section 1.4 for advice. Wear rubber gloves. Damaged lithium batteries may be unstable and pose a serious safety hazard. Leakage usually damages circuit boards, so it is often necessary to scrap the PLB without further investigation.

- Check circuit board for white salt deposits, dull grey corrosion or wetness. If any corrosion is evident the PCB should be replaced.

- Check plastic parts for signs of cracking.
3.5. Antenna Rewind/Cover Moulding replacement

If the customer has activated the unit by pulling the cover off then it will be possible to rewind the antenna and replace the cover (a new cover is required as the cover is designed to break when pulled).

1. Remove and discard the Pozidriv screw that is left in the top of the unit.

2. If existing cover is still in place, lift the red lever moulding to remove the screw.
3. Inspect the antenna and then rewind the antenna and clip it into position. Try to keep the antenna held with a small amount of tension as it is wound.

4. Carefully fit the new cover moulding into position. Do not trap the antenna.
5. Hold and refit the retaining screw. Do not overtighten – this is a self tapping screw into plastic. Tighten to 75cNm.

6. Finally close lever moulding.
3.6. Antenna replacement

1202410 Replacement Antenna Kit

1. Remove the cover moulding as per section 3.5 and unwind the antenna.

2. Remove the 2 off screws retaining the antenna assembly.

3. The antenna assembly should now lift off.
Reassembly

4. Ensure that a new sealing gasket, supplied in the battery service kit, is fitted to the new top moulding. Ensure that it is pushed into position and not twisted.

5. Fit the new top moulding into position on top of the PCB and secure using 2 off screws (99-182) tightened to 45cNm.

6. Carry out an ON/OFF cycle to ensure that the switches are working.
   ie:     Switch unit ON, Led should flash.
           Turn unit OFF by pressing and holding TEST button.
           Ensure unit is switched off before 50 seconds.

7. Carry out a leak test as per section 3.9

8. It is recommended that a message read is carried out at this stage.

9. Rewind the antenna and fit a new cover moulding as per section 3.5

10. Self test the unit.
3.7. Base replacement

1202414 Replacement base kit
1202442 Replacement base kit (buoyant))

1. Remove the cover moulding as per section 3.5

2. Remove the antenna assembly as per 3.6.
3. Remove the battery/PCB assembly from the base moulding by pulling gently on the top of the PCB. Take care not to disturb the screening/batteries.

Use Anti-static precautions
4. Fit the battery/PCB assembly into the new base moulding in the slot as shown. Take care not to damage any components which may obstruct fitting.

Arrange the battery wires as shown to prevent trapping. Keep highlighted area clear of wires.

Take care to ensure that the assembly is fully seated.
11. Carry out an ON/OFF cycle to ensure that the switches are working.
   ie: Switch unit ON. LED should flash.
       Turn unit OFF by pressing and holding TEST button.
       Ensure unit is switched off before 50 seconds.

5. Fit a new gasket to the top moulding as per section 3.6.
6. Refit the top moulding/antenna assembly as per 3.6
7. Carry out another ON/OFF cycle to ensure that the switches are working.
   ie: Switch unit ON. LED should flash.
       Turn unit OFF by pressing and holding TEST button.
       Ensure unit is switched off before 50 seconds.
8. Carry out a leak test as per section 3.8
9. It is recommended that a message read is carried out at this stage.
10. Rewind the antenna and refit the cover moulding as per 3.5
11. Carry out a self test
12. At this point you will need to ensure that a new rear label is printed to identify the
    unit (this should be the same as is printed on the removed/old base moulding).
13. Fit the new rear label and cover with the overstick label.
3.8. Battery Replacement

1202408 Battery replacement kit

When the battery expiry date is reached the battery needs to be replaced. Ensure that there is at least 5 years life on the replacement battery before fitting. Replacement batteries are supplied as a kit (see spares list). The kit includes a new seal and expiry date labels. The expiry date is marked on the rear label of the PLB.

1. Lift the red lever moulding and remove the posi-drive screw retaining the cover moulding. Lift off the cover moulding assembly as per section 3.5.
2. Unwind the antenna and remove the 2 off posi-drive screws and lift off the antenna/top moulding as per section 3.6. Discard the old gasket.
3. Pull out the PCB and battery together.
4. Remove the foam spacer from the end of the batteries then - pull the 2 batteries out from the shield.

Use Anti-static precautions
5. Disconnect the battery and dispose. See end of life statement Appendix 2.

6. Measure the new battery voltage and confirm that each cell is 6V minimum.
7. Note the expiry date on the batteries and ensure that the label provided with the kit is correct.
8. Plug both batteries into the PCB. Position batteries into shielding as shown.
9. Refit the PCB and Battery into the base moulding in the position shown.

10. Carry out an ON/OFF cycle (this check that the switch is lined up correctly).
11. Fit a new gasket to the antenna moulding as per section 3.6.
12. Refit the antenna and secure using 2 off screws to 45cNm.
13. Carry out an ON/OFF cycle to ensure that the switches are working.
   i.e.: Switch unit ON. LED should flash.
        Turn unit OFF by pressing and holding TEST button.
        Ensure unit is switched off before 50 seconds.
14. Test the unit in a screened box in live mode (if available).
15. Carry out a leak test as per section 3.9
16. Rewind the antenna, clip into position and refit cover moulding as per section 3.5.
17. Carry out a self test.
18. Reset the run time counters as per section 3.10
3.9. Leak testing

The leak test described here raises the air pressure inside the PLB. Check that no air bubbles escape when the PLB is submerged in water. The standard PLB is not buoyant - it will not need to be held under the water.

Gross leak test

Use hot water at +60º ±5ºC (140F ± 9F).

Cooler water will not raise the air pressure enough.

Hotter water will damage the PLB.

1. Remove lanyard (if one is fitted).
2. It is advisable to deploy antenna - this will reduce trapped air and make a leak more visible.
3. Immerse PLB in the hot water.
4. Dislodge ALL trapped air.
5. For the next 5 minutes check for any escaping bubbles.
6. If there is any sign of water ingress, remove PLB quickly.
7. Remove PLB from water, wipe thoroughly dry. Note that there will still be water under the antenna cover if fitted.
8. Rewind the antenna and refit the lanyard as applicable.

Any escape of bubbles must be corrected.

Disassemble, rebuild and re-test. A new sealing kit may be needed.

Drying times

A gross leak may still lead to water inside the PLB. If this occurs, then disassemble the PLB and dry its component parts in an oven at +40ºC to +60ºC. Most parts will dry in a few hours, however the battery pack traps water and should be left in the oven for at least 16 hours. The oven is necessary; the battery will not dry out if left at room temperature.
3.10. Reset the Run Time counters on the PCB

The PLB PCB records the following during the life of the unit:

1. Number of long GPS tests carried out
2. Run time of 406MHz transmissions.
3. Run time of unit including self test.

These counters must only be reset after a battery change.

The Counter Reset must be performed with e-Prog software.
Note: Carrying out this reset does not alter any of the other programmed information.

Procedure:
1. Plug the USB pen into the USB port of the computer.
2. Open e-Prog software
3. Select McM Optical Pen/2400bps, from the Configuration menu.
4. Select Menu, Personal Locator Beacon Ç PLBô Miscellaneousô Reset McMurdo beacon counters
5. Ensure Tx LED flashes on side of pen.
6. Place the pen over the programming IR LED on the top of the PLB.
7. Press and release the TEST button on the PLB.
8. The red Reset in progress and yellow IR link active indicators will light.
9. The PLB will flash the lamp a number of times to indicate reset in progress.
10. The green Factory reset complete indicator will light to indicate successful reset.
3.11. Programming

Programming is the process of transferring information into the PLB so that when activated it will transmit a unique code. This code will then be linked to the owner through the registration process. To ensure a quick rescue response it is important that the identity inside the PLB is correctly selected.

The identity is a country number (to be precise, the ITU MID code) plus a serial number, which may be either the manufacturer's serial number, or a national serial number issued by the authorities in the country of registration.

The identity is stored in non-volatile memory (EEPROM) on the circuit board. Disconnecting the battery will not affect it, however fitting a new circuit board will.

When to reprogram

The PLB should always be reprogrammed if it is transferred to a new owner with a different country code, or if the PCB is replaced.

Exceptions

PLBs do not need to be re-programmed when transferred to a new owner with the same flag state (normally country of residence). This is because they are programmed with a serialised number. Simply complete another registration form to inform the authorities of the transfer.
Programming the PLB

The programming utility e-Prog must be used with the USB pen 1202439 to program the XS-4 PLB. A personal computer (PC) with the Windows XP/2000 operating system or later is required.

The e-Prog software user instructions are available and therefore these instructions are not repeated here.

IMPORTANT

It is recommended that the following must be carried out after a PLB is programmed:

1. Verify correct programming using a message reader or the message verification process. See section 3.3.
2. Print a new registration form (at the PC) and pass it to the PLB owner.
3. If applicable, fit new identity labels to the PLB.
4. Print warranty form if the PLB is new.
4. FAULT FINDING

The Self test carries out a predetermined sequence of tests. If the unit fails self test then it should be possible to determine what the fault is.

1. Self test start – check for IR pen signal. If signal is present then the unit will be programmed. If no signal is present then the unit will continue with self test.

2. A test transmission will be made at 121.5MHz (unmodulated). The software monitors the output detector to ensure that a signal is being transmitted.
   
   Use a message reader to confirm if the unit is transmitting on 121.5MHz.

3. A single test transmission at 406MHz is made. The software monitors the output detector to ensure that a signal is transmitted and it also monitors the PLL in lock detector to ensure that the correct frequency is transmitted. The internal checksum is also checked to ensure that the message is valid.
   
   Use a message reader to confirm if the unit is transmitting on 406MHz.

4. The GPS will be powered up and monitored to ensure that it starts. A valid position will NOT be obtained during self test.

5. See next page for Self test diagnosis
After the self-test sequence has been completed the software will transmit a short burst of data to the IR-Link (please refer to section 3.3B for details of how to set up Hyperterminal). This data will be in a machine readable format as follows -

<SOH>ST;SER;BTH;BTM;BTS;PL4;FL4;PL1;FL1;STC<STX>FLAGS<ETX>CSUM<EOT>

Where -

<SOH> is an ASCII 'Start of Header', character 0x01
SER is an ASCII character sequence which indicates the following beacon generated data contains the result of a self-test sequence
BTH is the accumulated run-time hours in decimal ASCII, e.g. 01, 02 etc.
BTM is the accumulate run-time minutes in decimal ASCII, e.g. 01, 09 etc.
BTS is the accumulate run-time seconds in decimal ASCII, e.g. 01, 09 etc.
PL4 is the 406 power detector level if self-test passed, in decimal ASCII, i.e. 0 to 1023 etc.
FL4 is the 406 power detector level if self-test failed, in decimal ASCII, i.e. 0 to 1023 etc.
PL1 is the 121 power detector level if self-test passed, in decimal ASCII, i.e. 0 to 1023 etc.
FL1 is the 121 power detector level if self-test failed, in decimal ASCII, i.e. 0 to 1023 etc.
STC is the number of long GPS self-tests that remain, in decimal ASCII, i.e. 1 to 10 etc.
<STX> is an ASCII 'Start of Text', character 0x02
FLAGS is a 16-bit ASCII decimal number indicating the result of the test, i.e. 041F. The high 8-bits are used to indicate which sections of the E²PROM memory were tested (details not given here), and the low 8-bits indicate the tested hardware status as follows -

Bit 0  1 = 406 PLL in lock, 0 = PLL lock failed
Bit 1  1 = 406 Output detected, 0 = 406 output failed
Bit 2  1 = 121.5 Output detected, 0 = 121.5 output failed
Bit 3  1 = E²PROM Checksum ok, 0 = E²PROM checksum failed
Bit 4  1 = Battery life indicator ok, 0 = battery life exceeds set limit
Bit 5  Used by GPS enabled beacons only, 0 for non-GPS beacons
Bit 6  Used by GPS enabled beacons only, 0 for non-GPS beacons
Bit 7  Not used, always 0
<ETX> is an ASCII 'End of Text', character 0x03
Checksum is the 16-bit sum of all data from <SOH>, up to and including <ETX> calculated using 16-bit modulo 65536 addition. The checksum is transmitted as ASCII hex, e.g. F6A3.
<EOT> is an ASCII 'End of Transmission', character 0x04

A typical self test pass message is:

ST;210500003;0;18;11;340;0;189;0;5853F082A8CMFFFED08E3080047FDFF8880B707200

This can be decoded as follows:

ST  Self test
210500003  Serial number
0;18;11  Run time
340;0  406 Power level (expected to be over 300)
189;0  121.5 Power level (expected to be over 150)
5  Number of GPS self tests remaining
853F  Self test report code
3F (0011 1111) = PASS

Other useful examples are:

39 (0011 1001) Low 121 and 406
1F (0001 1111) No NMEA data
3D (0011 1101) Low 406
3C (0011 1100) PLL failure
3B (0011 1011) Low 121
5. REPAIR PROCEDURES

Repair policy for this PLB is repair by replacement of major sub-assemblies. Component level diagnosis and repair is not supported.

Spare parts for these purposes are listed in section 6.
6. SPARES/ACCESSORIES

The following spares are available:

<table>
<thead>
<tr>
<th>Item</th>
<th>Part number</th>
<th>Variant</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery service kit</td>
<td>1202408</td>
<td>All</td>
<td>Sealing gasket, battery pack, expiry label</td>
</tr>
<tr>
<td>Programming label kit</td>
<td>1202409</td>
<td>All</td>
<td>Rear label (x5), Overstick label (x50), Label set (50)</td>
</tr>
<tr>
<td>Replacement cover kit</td>
<td>1202411</td>
<td></td>
<td>Cover moulding (printed) and screw</td>
</tr>
<tr>
<td>Replacement Antenna kit</td>
<td>1202410</td>
<td>All</td>
<td>Sealing gasket, antenna assembly (including plastic moulding) + 2 screws.</td>
</tr>
<tr>
<td>Display box (packaging)</td>
<td>1202412</td>
<td>Standard</td>
<td>Packing box + insert</td>
</tr>
<tr>
<td>Display box (packaging)</td>
<td>1202440</td>
<td>Australian</td>
<td>Packing box + insert</td>
</tr>
<tr>
<td>Replacement Base kit</td>
<td>1202414</td>
<td>Standard</td>
<td>Base moulding (including keypad and rear label), and programming overstick label</td>
</tr>
<tr>
<td>Replacement Base kit</td>
<td>1202442</td>
<td>Australian</td>
<td>Base moulding (including keypad and rear label), and programming overstick label and flotation pouch</td>
</tr>
<tr>
<td>Document Pack</td>
<td>1202413</td>
<td>Standard</td>
<td>Instruction card, warranty form, registration document, Declaration of conformity</td>
</tr>
<tr>
<td>Document Pack</td>
<td>1202441</td>
<td>Australian</td>
<td>Instruction card, warranty form, registration document, Declaration of conformity</td>
</tr>
</tbody>
</table>

A range of accessories (including lanyards, pouches and dive canisters) are available. Details can be found on the Kannad website and in our product brochures.
APPENDIX 1 : SPECIFICATION

Please see product user manual as delivered with unit or see website.

APPENDIX 2 : END OF LIFE

At the end of the products useful life, it is vital that the battery is removed from the main body of the PLB to prevent false alerts. False alerts cause expensive disruption to Search and Rescue services and may endanger lives as a consequence.

Safe disposal
Contains traces of Lithium, may contain Lead and Brominated flame retardants (BFRs), both in the housing material and circuit boards.

DO NOT INCINERATE

Kannad Aviation strongly recommends that this PLB product is disposed of in a sensible and considerate manner. For example, do not simply discard the product in the domestic waste. Instead take it to a civil recycling facility, or contact Kannad Aviation for advice.

APPENDIX 3 : TRANSPORTATION

The latest advice (January 2009) is:

Passenger Aircraft:
These products contain non-hazardous ‘primary lithium batteries’. They can normally be carried on board passenger aircraft as a personal item in carry-on baggage. Kannad always recommends declaring the PLB to airline staff at check in, in the same way you would for a laptop PC or video camera.

As air cargo:
These products contain small lithium metal batteries. Due to the low level of lithium content this product is classed as not restricted as air cargo under IATA SP188 Ç PI 970, always check with the carrier concerned for any additional restrictions that could apply.