PRODUCT SUPPORT MANUAL

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Rev. A-Draft

TerraFix™ 406 GPS I PLB

Product No. 2798.2
PLB-201

TerraFix™ 406 GPS I/O PLB

Product No. 2798.4
PLB-200

Personal Locator Beacon
FCC Type Approval
is currently pending

-DRAFT-
Only

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*** * * WARNING * * ***
THIS TRANSMITTER IS AUTHORIZED FOR USE ONLY DURING SITUATIONS OF GRAVE AND IMMINENT DANGER

*** * * DELIBERATE MISUSE MAY INCUR A SEVERE PENALTY * * ***

Forward

Congratulations and thank you for purchasing the ACR **TerraFix™ 406 GPS** Personal Locator Beacon. The combination of superior design, high quality raw materials and quality controlled manufacturing produce a product that will perform for years to come. The Test Facility at ACR can reproduce some of the harshest environmental conditions known to man. This assures that the life saving devices can stand up to the rigors found in any environment on earth. With proper care and maintenance, your PLB will be in service for years to come.

ACR is proud to be certified to the ISO 9001:2000, the International Standard for Quality.

This manual provides operation and maintenance instructions for the **TerraFix™ 406 GPS** PLB, hereinafter referred to as the Beacon. This manual also describes the characteristics and details of the Beacon System.

Table of Contents

SECTION 1 - REGISTRATION OF 406 MHz BEACONS

1.1 Registration Importance

It is **mandatory** that the owner of this 406 MHz Beacon registers it with the National Authorities*. All 406 MHz Beacons transmit a Unique Identifier Number (UIN) when activated. This UIN is programmed in the Beacon based on the country in which the Beacon was purchased. Registration provides the Search and Rescue forces with emergency contact information, and will speed the launch of a rescue operation. The National Authorities use the information to verify if an actual emergency exists. Valuable Search and Rescue resources are wasted every year responding to false alarms. For Beacons that are not registered, SAR forces will not know who you are, or who to contact regarding additional information of your current situation. This will delay the launch of a rescue operation.

**A National Authority is the governmental body that is responsible for PLB Registration Database administration for the country for which the PLB is programmed.*

1.2 Where to register

The owner of a 406 MHz Beacon (PLB) should register it with the National Authority of which the Beacon was programmed, (typically the country where purchased), regardless of where you use your beacon. Each Beacon is programmed with a UIN for the country where the unit is shipped, and will only be accepted for registration in that country. To verify the country, for which a Beacon is programmed, see the label with the UIN on the side of the unit. Units that do not have a country specified on the UIN label are programmed for the United States.

1.3 Registration in the United States

It is the Owner's responsibility and required by law to Register 406 MHz Beacons that are programmed for and purchased in the United States. The National Authority that accepts registrations in the United States is the National Oceanic and Atmospheric Administration (NOAA). The owner should complete the enclosed registration form (Do not confuse this with the ACR Electronics Warranty Card) and mail it with the pre-addressed; postage paid envelope to:

SARSAT Beacon Registration,
E/SP3, RM 3320, FB-4
NOAA/NESDIS
5200 Auth Rd.
Suitland, MD 20746-4304

Beacon registration is also available online at: www.beaconregistration.noaa.gov

The information provided on the Registration Form is used only for rescue purposes. The Registration Form should be filled out and mailed immediately. Registration can be expedited by faxing the registration form or by completing the form online in the event the Beacon is to be placed in immediate service.

Registration forms will be entered in the 406 MHz Beacon Registration Database within 48 hours of receipt. A confirmation letter, a copy of the actual registration and a proof-of-registration decal will be mailed to you within two weeks. When you receive these documents, please check the information carefully and affix the decal to your beacon in the area marked "Beacon Decal here". If you do not receive confirmation, contact NOAA for additional information at: +1-888-212-7283.

1.3.1 Registration in Canada

The national authority in Canada is the NSS (National Search & Rescue Secretariat). Canadian residents can register online at http:beacons.nss.gc.ca. For more information please contact the NSS at (613) 966-1504 or (800) 727-9414.

National Search and Rescue Secretariat
400-275 Slater Street
Ottawa, Ontario K1A 0K2

1.4 Registration Outside of the United States

In countries other than the United States, 406 MHz Beacons are registered with that country's National Authority at the time of Purchase. The Sales agent should assist in filling out the forms and sending to that country's National Authority. To verify that the unit is properly programmed for that country, view the UIN label on the side of the unit. In the event that the Beacon is not programmed for the country in which it has been purchased, the sales agent, (if properly equipped) can reprogram the unit for that country.

1.5 Change of ownership or contact information

It is the owner's responsibility to advise the National Authority of any change in the information on the registration form. If the current owner of the Beacon is transferring the Beacon to a new owner, the current owner is required to inform the National Authority by Letter, Fax or telephone, of the name and address of the new owner. The new owner of the Beacon is required to provide the National Authority with all of the information requested on the Registration form. This obligation transfers to all subsequent owners. Registration forms are available from NOAA, call +1(888) 212-7283 or visit our website at www.acrelectronics.com.

SECTION 2 - OPERATION

2.1 General

The **TerraFix™ 406 GPS** PLB models are designed to be manually deployed and activated. It is only to be activated when all other means of self-rescue have been exhausted. Activation of the

beacon tells Search and Rescue who you are, where you are, and that you are facing a life threatening situation.

2.2 Self Test

PLEASE READ ALL INSTRUCTIONS BEFORE PERFORMING ANY OF THE TESTS.
BE PREPARED TO RECORD DATA FROM THE TEST

Self test is initiated by holding the self test button (see figure 1) for more than half a second and less than five seconds. Your beacon will sound an initial beep and green LED (Light Emitting Diode) flash to signify the test has begun. A green LED will flash a second time to indicate that the self test was successful.

Self tested components: Data Integrity and Memory; Check 406 MHz Synthesizer;
RF Power/Battery; Check GPS header

If your beacon flashes two LED's, the test has been successful. If you encounter only the initial green LED flash alone, your beacon has failed the self test, please contact ACR Electronics or an authorized Battery Replacement Center for servicing of your beacon.

2.2.1 Battery Witness Seal Life

ACR strongly recommend performing the self test on the **TerraFix™ 406 GPS** on a monthly basis. If your beacon flashes an initial Red LED at the beginning of the Self Test, this indicates that your electronic witness has been broken and you have used more than 1 hour of your battery life. While the PLB will still operate normally in an emergency, ACR strongly recommends you have your battery replaced and the electronic witness reset to ensure that you will have 24 hours of battery power should you ever need to activate your unit.

NOTE: The homing beacon at 121.5 MHz is inhibited during self test.

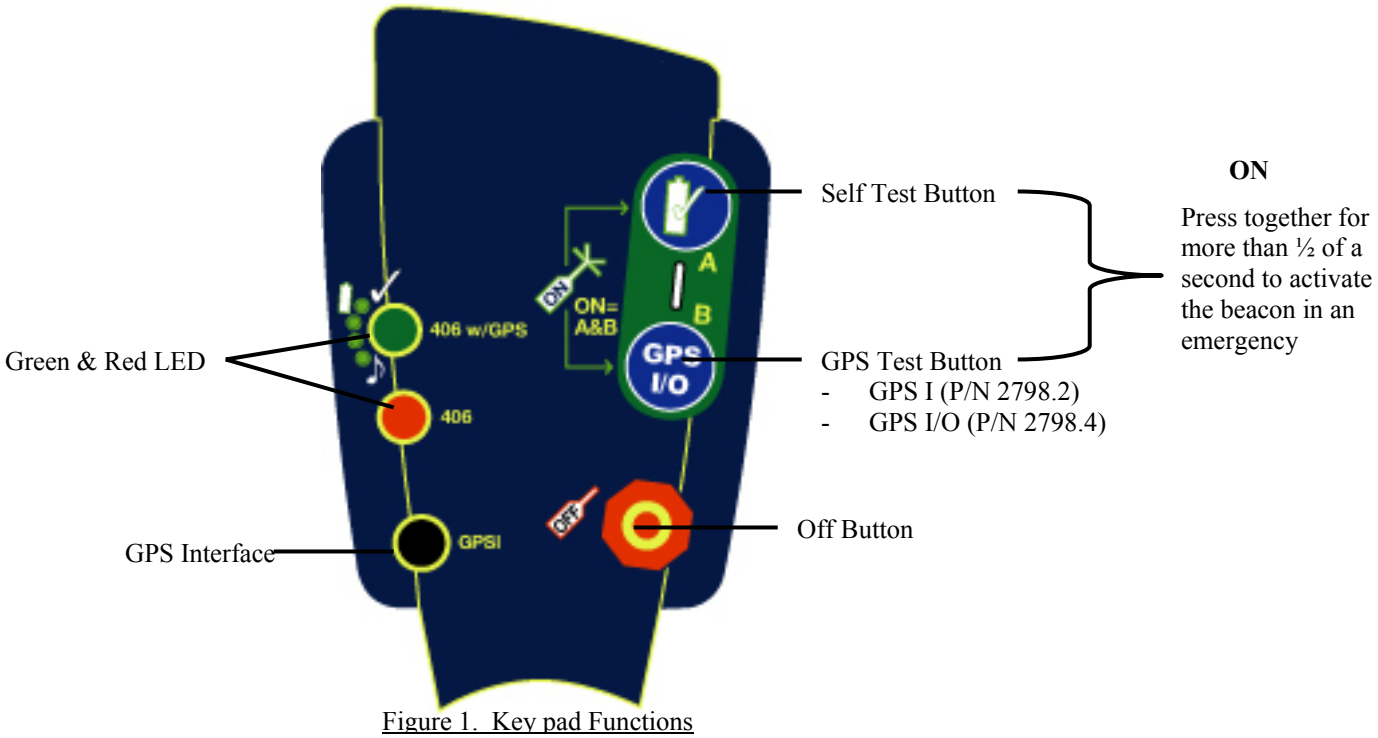


Figure 1. Key pad Functions

2.3 GPS Testing

2.3.1 GPS O (Onboard) Test (P/N 2798.4 only)

Warning: To conserve battery power the following test should not be performed more than once during the five-year life of the battery pack!

The **TerraFix™ 406 GPS** is fitted with an internal Global Positioning System (GPS) receiver that will determine the navigational coordinates, latitude and longitude of its position on the globe. To test the internal GPS you must be outdoors and have a clear view of the sky. **The beacon must remain under observation to witness the results of the test.** When the GPS I/O button is pressed for greater than 5 seconds the buzzer will beep and the red LED will light simultaneously. After approximately 5 seconds, the green LED appears indicating that the GPS has been turned ON and a live test of the internal GPS has begun. The GPS will remain ON until good navigation data has been obtained or until 10 minutes has elapsed. If good navigation data has been obtained, the GPS will be turned OFF and the green LED will light for at least 3 seconds. This navigation data is not saved for use when the beacon is turned ON. The green LED is proof that the GPS is functioning properly and that the beacon is in a location or environment where it can receive the necessary signals from satellites. If the GPS does not acquire good navigation data, the GPS will turn OFF after 10 minutes and there will be **no** successful green LED indication. This test should not be performed more than once during the five-year life of the battery pack to prevent excessive current drain.

2.3.2 Preload external GPS I (Interface)

The **TerraFix™ 406 GPS PLB** (P/N 2798.2 and 2798.4) can interface with a handheld GPS receiver to provide your LAT/LON to SAR forces and narrow your search area to 110 yards (100 meters). The beacon can accept NMEA 0183 version 1.5 and above GPS Data (format GPGGA sentence) through its infra-red interface. The beacon can be forced to update its GPS data by pressing the GPS I or GPS I/O button for 1/2 second and not longer than 5 seconds. The TerraFix PLB will hold the last GPS coordinates in memory for 4 hours before returning to the default. Upon activation, your GPS data will be transmitted to the GEOSAR satellite on the very first burst. TerraFix 406 PLB will interface with most GPS receivers, if you are not sure if your receiver is NMEA 0183 compliant please check the interface settings listed in your GPS manual or you may check our website at www.acrelectronics.com for a list of GPS receivers that will interface with your PLB.

Maximum 500 preloads during the life of the battery.

2.4 TerraFix™ 406 GPS PLB Emergency Activation

2.4.1 Activation

To activate your PLB in an emergency situation, unfasten the antenna from the holster and move it into a vertical position (See figure 1). Next lift the holster cover revealing the PLB keypad. Depress the "self-test and GPS I or GPS I/O buttons simultaneously for more than 1/2 second and less than 5 seconds. Your PLB is now activated. While transmitting your emergency signal, the red LED will flash once every 2 seconds allowing you to see that your beacon is activated. If GPS data is present

in the beacon via the GPS I or GPS O the red LED will turn off and the green LED will take over flashing once every 2 seconds.

The **TerraFix™ 406 GPS** (model 2798.4 only) is equipped with an internal GPS engine. If no external GPS interface receiver is found, upon activation, the **TerraFix™ 406** onboard GPS engine will search to find you're LAT/LON and incorporate it into your 406 MHz signal. In the case when external and internal GPS are present, the internal GPS data will have priority at activation.

When the **TerraFix™ 406 GPS** is turned ON, the GPS engine is also immediately turned ON and will immediately begin acquiring data. Initially the red LED flashes once every 2 seconds to indicate the **TerraFix™ 406 GPS** is turned ON and operating. As soon as the GPS receiver acquires good internal navigational data the red LED stops blinking and the green LED flashes once every 2 seconds. Once good navigational data has been obtained, the GPS receiver waits for 20 minutes before looking for new navigational data again. If for any reason a time period of 4 hours passes without the GPS receiver being able to update the last good set of navigational data, the message transmitted by the **TerraFix™ 406 GPS** will revert to default data. At this point the green LED will stop blinking and the red LED will flash once every 2 seconds. If at any time after this, good navigational data is obtained, this data will be transmitted, the red LED will stop blinking and the green LED will begin flashing again**.**

Figure 2 Antenna Position

Figure 3 Key pad cover
Open the key pad cover for access to Test or activate the beacon

Figure 4 Activation
Press both test buttons simultaneously for more than ½ second and no longer than 5 seconds

2.4.2 Deactivation

To deactivate your PLB depress the "OFF" button for 1 second

SECTION 3 - REPORTING FALSE ALARMS

3.1 Should there be an inadvertent activation or false alarm, it must be reported to the nearest search and rescue authorities. The information that should be reported includes the PLB Unique Identifier Number (UIN), Date, Time, duration and cause of activation, as well as location of beacon at the time of activation.

3.2 **To report false alarms in the United States contact any of the following**:

Atlantic Ocean / Gulf of Mexico
USCG Atlantic Area Command Center
Tel: (757) 398-6390

Pacific Ocean Area \ USCG Atlantic Area Command Center
Tel: (510) 437-3700

USCG HQ Command Center (From any location)
Tel: (800) 323-7233

USAF Langley, Virginia (From any location)
Tel: (XXX) XXX-XXXX

NOAA
Tel: (XXX) XXX-XXXX

SECTION 4 - CARE AND MAINTENANCE

4.1.1 Carefully inspect the PLB case for any visible cracks. Cracks may admit moisture, which could cause a malfunction. Any cracking observed should be immediately referred to ACR for evaluation, (1-800-432-0227)

4.1.2 Batteries may only be replaced at an authorized battery replacement center for the warranty to remain in effect.

4.1.3 The batteries (P/N 1099) must be replaced by the date indicated on the beacon. At each inspection, check the time remaining until replacement is required. Batteries should be replaced if the beacon has been activated for any use other than the self test.

4.1.4 Avoid cleaning your PLB with household cleaners and hydrocarbon materials such as gasoline, benzene, bleach, sanitizers, soaps, etc., simply wipe your PLB down with a damp cloth until clean.

NOTE: There are no user serviceable items inside the PLB. DO NOT OPEN THE PLB UNLESS TO DISABLE IN CASE OF FAULTY ACTIVATION if the OFF button does not stop the transmission.

Power is provided by self contained long life batteries with a five-year recommended replacement cycle. *See Factory Authorized Service Center for replacement.*

Battery replacement includes servicing the PLB by replacing all o-rings, testing the water seal and the electronic diagnostic properties.

Always refer all long life battery replacement and other PLB service to a factory authorized service center.

For the nearest location of an authorized ACR service center, call 1-800-432-0227 (toll free) or visit our website at www.acrelectronics.com

4.2 The **TerraFix™ 406 GPS** contains 2 lithium battery packs that are non-hazardous. They also meet the UN Classification of Lithium Batteries for Shipment as "Non – Dangerous Goods".

SECTION 5 - THE SEARCH AND RESCUE SYSTEM

5.1 General Overview

The **TerraFix™ 406 GPS** Beacon provides distress alerting via radio transmission on 406 MHz to satellites of the COSPAS-SARSAT network and to the GEOSAR network that includes GPS latitude and longitude coordinates when GPS data is present.

The message transmitted by the **TerraFix™ 406 GPS** is unique for each PLB, which provides identification of the transmitter through computer access of registration files maintained by the National Oceanic and Atmospheric Administration or other national authority. **Remember**, if your PLB is **not registered**, SAR Authorities do not know who you are, or how to contact anyone who might know anything about your situation (Refer to section1).

Once the **TerraFix™ 406 GPS** signal (406 MHz) is relayed through the COSPAS-SARSAT and/or GEOSAR network alert, Search and Rescue (SAR) forces determine who is closest, then track the signal using the 121.5 MHz homing frequency which assistant intermediate and short-range location.

5.2 Satellite Detection

5.2.1 The **TerraFix™ 406 GPS** transmits an encoded phase modulated radio signal to the satellite portion of the COSPAS-SARSAT System. The system was developed and implemented by the COSPAS-SARSAT Partners (Russian Federation, Canada, France and the United States).

5.2.2 COSPAS-SARSAT is an international system that uses Russian Federation and United States low altitude, near-polar orbiting satellites (LEOSAR) that assist in detecting and locating activated 121.5/243 MHz PLBs and 406 MHz Satellite PLBs.

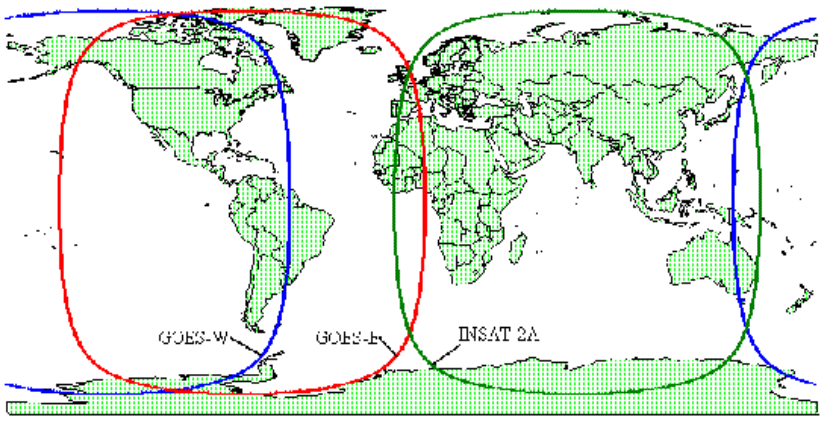
5.2.3 COSPAS and SARSAT satellites receive distress signals from satellite PLBs transmitting on the frequency of 406 MHz. The COSPAS-SARSAT 406 MHz satellite PLB signal consists of a transmission of non-modulated carrier followed by a digital message format that provides identification data. The 406 MHz system uses spacecraft-borne equipment to measure and store the Doppler-shifted frequency along with the satellite PLB digital data message and time of measurement. This information is transmitted in real time to an earth station called the Local User Terminal (LUT), which may be within the view of the satellite, as well as being stored for later transmission to other LUTs.

5.2.4 The LUT processes the Doppler-shifted signal from the LEOSAR and determines the location of the satellite PLB; then the LUT relays the position of the distress to a Mission Control Center (MCC) where the distress alert and location information is immediately forwarded to an appropriate Rescue Coordination Center (RCC). The RCC dispatches Search and Rescue (SAR) forces.

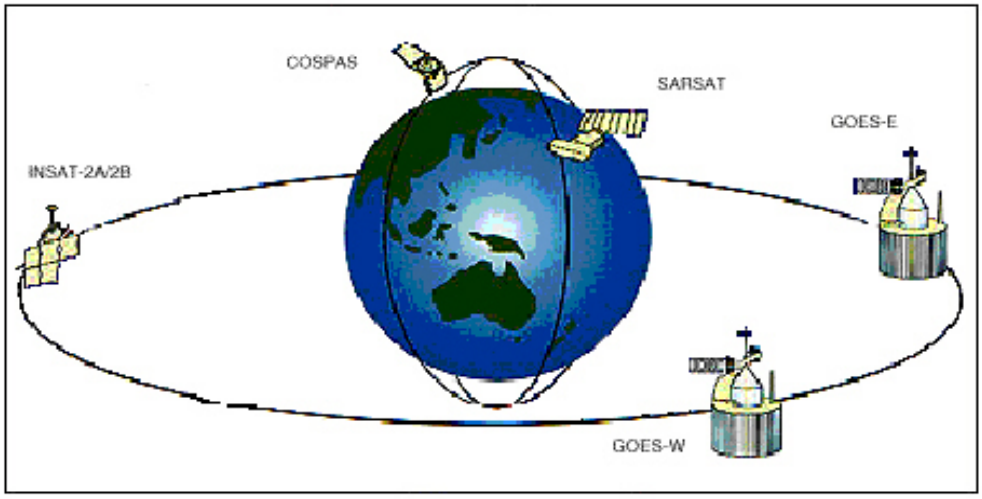
5.2.5 The COSPAS-SARSAT System includes 36 LEOSAR LUT stations, 6 GEOSAR LUT stations and 19 Mission Control Centers that provide real-time as well as global-mode coverage for the Northern Hemisphere, while the Southern Hemisphere is presently served primarily by the global mode. Additional LUTs and MCCs are planned for installation in the near future both in the northern and southern hemispheres.

The addition of the GEOSAR Satellite system greatly improves the reaction time for a SAR event. This satellite system has no Doppler capabilities at 406 but will relay the distress alert to any of the LUT stations. When there is GPS data included in the distress message, SAR authorities instantly know your location to within 110 yards. This speeds up the reaction time by not having to wait for one of the LEOSAR satellite to pass overhead.

5.2.6 Because most of the search and rescue forces presently are not equipped to home in on the 406 MHz Satellite PLB signal, homing must be accomplished at 121.5 MHz.



SATELLITE COVERAGE
Figure 5



GEOSAR SATELLITE ORBIT
Figure 6

SECTION 6 - AUTHORIZATIONS

6.1 The **TerraFix™ 406 GPS** PLB meets the requirements of Federal Communications Commission (FCC) Part 95 Subpart K

5.2 Characteristics

The **TerraFix™ 406 GPS** PLB is a buoyant, battery operated Personal Locator Beacon. The beacon case, with its external antenna, is waterproof. The semiconductor circuits are mounted within the case assembly which also contains the battery power supply. A keypad with "self test," "GPS I or I/O and "Off" buttons are installed on the case, along with an internal beeper and two LEDs. The **TerraFix™ 406 GPS** models accept external GPS data via an I/R interface cable that is included with your PLB. The **TerraFix™ 406 GPS** I/O (P/N 2798.4) also contains an internal GPS engine that will acquire your LAT/LON if an external GPS receiver is not present.

Technical Data - TerraFix™ 406

6.3.1 TECHNICAL DATA

The **TerraFix™ 406 GPS** PLB is available in two combinations. The following product codes define the options available to meet specific operational requirements:

6.3.2 Applicable Documents

NSS PLB01-01	Standard for 406 MHz Satellite PLB's, Canada
COSPAS-SARSAT	Document C/S T.001 & T.007 (spec for 406 MHz distress beacons)
RSS 187	Radio Standards Specification for Emergency Position Indicating Radio Beacons, Emergency Locator Transmitter, and Personal Locator Beacon
FCC	Part 95, Subpart K

6.3.3 Specifications

406 MHz Transmitter

Frequency	406.028 MHz
Frequency Stability	±2 parts per billion/100ms
Output Power	5 watts
Digital Message Format	
Long message / serialized Message protocol	Standard Location (2798.2 – 2798.4)
Duration	520 ms
Rate	400 bps
Encoding	Biphase L
Modulation	±1.1 radians peak

PLB's leave ACR with Serialized code but can be reprogrammed at a service center to other coded formats including nationality of registration.

121.5 MHz Transmitter

Frequency	121.5 MHz
Frequency Tolerance	±50 ppm
Output Power	25 mW PEP
Morse Code "P" ID	every 50 seconds (approximately)
Modulation	
Type	AM (3K20A3N)
Sweep Range	400 to 1200 Hz
Sweep Rate	3 Hz
Duty Cycle	37.5%
Morse P	AM (2K00A2A)
Antenna	
Frequency	406 & 121.500 MHz
Polarization	Vertical
VSWR	Less than 1.5/1

General/Environmental

Battery Life		
Operating Class I		24 hours minimum @ -40°C
Operating Class II		24 hours minimum @ -20°C
Replacement Interval		5 years or after use in an emergency
Batteries meet the UN Classification for Non-dangerous goods		
Size		
PLB less Antenna		1.74 x 5.71 x 3.03 in (4.4 x 14.5 x 7.7 cm)
Material		High impact and UV resistant plastic
Color		ACRtreuse
Weight (less holster)		12 oz (338 grams)
Waterproof		36 feet (11 meters)
Temperature Range		
Operating	Class I	-40°C to +55°C (-40°F to +131°F)
	Class II	-20°C to +55°C (-4°F to +131°F)
Storage	Class I	-50°C to +70°C (-58°F to +158°F)
	Class II	-40°C to +70°C (-40°F to +158°F)

SECTION 7 - GPSI/O Frequently Asked Question

Q. How do I download position data from my GPS to my beacon?

A. You must have a NMEA 0183 version 1.5 or higher output ready GPS unit and a GPS interface cable. The NMEA 0183 optical interface connector supplied with your TerraFix must be connected to the GPS interface cable using a universal serial adapter. Turn on your GPS unit and allow it to acquire the necessary satellites. Make sure the output is set to NMEA 0183 with the GGA sentence configured if necessary. Connect the NMEA 0183 interface cable to the GPS unit and the TerraFix. The TerraFix will initiate a data preload when the GPS I/O button is pressed for more than ½ second and less than 5 seconds.

Q. How long does it take to down load position coordinates from my GPS to my beacon?

A. Upon connection with a properly operating and fully acquired GPS unit, the ACR beacon usually take less than four minutes to synchronize and download coordinates. Subsequent position updates will take from a few seconds to no more than 20 seconds to complete.

Q. How does the GPS data get from my GPS to the beacon?

A. The GPS unit transmits data as electrical energy through the GPS interface cable to the ACR optical interfacing connector. The ACR optical interfacing connector has an infrared LED and sensor located in it. The electrical energy supplied by the GPS unit is converted to infrared light in the ACR optical interfacing plug. Data from the GPS unit is transmitted via infrared light to the beacon through the translucent beacon top cap or lens when the ACR optical interface plug is properly engaged. The beacon has an infrared detector that decodes the light pulses. ACR uses an optical interface design to eliminate the potential for leaks and corrosion common to mechanically interfacing devices. An external LED flashes to confirm that GPS data is being sent from the handheld GPS.

Q. Does my beacon need any special set up to accept GPS data?

A. No. If it is hooked to a valid data source, that has been properly set up to deliver NMEA format with the GPGGA sentence, it will automatically attempt to download the data and form an emergency message that includes the position data when the preload function is initiated.

Q. Does my GPS unit have to be set up in a special way to transmit position coordinates via the NMEA 0183 interface?

A. For the GPS to transmit data, go to GPS setup and make sure the NMEA 0183 output is turned on and the GGA NMEA sentence is selected or turned on. Consult your GPS user's manual for information on configuring the NMEA output.

Q. What is the maximum length my GPS cable can be?

A. ACR Electronics recommends a maximum length of 400 feet using 24 AWG wire. Contact your GPS owner's manual for more detailed information.

Q. What happens if I plug the GPS into the beacon first and press the GPS I or I/O button without waiting for the GPS to acquire satellites?

A. The beacon will function normally, but will not store GPS coordinates. As soon as the GPS has acquired satellites the data will be transferred to the beacon.

Q. How long does the beacon hold data in memory?

A. 4 hours. If new GPS data has not been downloaded, the TerraFix will return to default mode

Q. How much power is needed to run the IR LED on the GPS cable?

The minimum power needed is 3.3V_{DC} and 2mA

7.0 Limited Warranty

7.1 This product is warranted against factory defect in material and workmanship for a period of five years from date of purchase or receipt as a gift. During the warranty period ACR Electronics, Inc. will repair or, at its option, replace at no cost to you for labor, materials or return transportation, provided you obtain a Return Authorization from ACR Electronics, Inc., 5757 Ravenswood Road, Ft. Lauderdale, Fl. 33312-6645. To obtain a Return Authorization, call our Customer Service Department at (800) 432-0227. This warranty does not apply if the product has been damaged by accident or misuse, or as a result of service or modification performed by an unauthorized factory.

Except as otherwise expressly stated in the previous paragraph, the COMPANY MAKES NO REPRESENTATION OR WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, AS TO MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR ANY OTHER MATTER WITH RESPECT TO THIS PRODUCT. The Company shall not be liable for, consequential or special damages.

In order to place the warranty in effect, the accompanying registration card must be returned to ACR Electronics, Inc. within ten days of purchase.