Tideland Signal Mfg.

Featuring Aids to Navigation Products

INSTALLATION AND OPERATION MANUAL

SeaBeacon® 2 *System 6* Racon IECEx

011.1292-00

Alfredo Dominguez	Andrew Zeller	Hernando Ramirez
Engineering Mgr.	**Project Engr.**	**Checker**

REV	ECO	Description	Date	By
F		Updated Company Info	05APR21	LTD
E	0531	Updated Figure 5	12SEP19	RBT
D	0631	Change Pressure Switch Range	27JUN19	RBT
C	0249	Updated Table 4: Control Box Connections	28NOV16	RBT
B	0248	Revised Ex Label	01APR16	AZ
A	6569	Released for Production	18JAN16	AD

TIDELAND SIGNAL
(Houston, TX)
TEL + 1 713-681-6101
FAX + 1 713-681-6233
EMAIL sales@tidelandsignal.com

WEBSITE: www.tidelandsignal.com

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. OVERVIEW

A marine radar displays a picture of all objects that reflect pulses within the service range of the radar. The objects displayed usually represent either hazards to navigation or guidance devices that have been deployed to assist in course determination. When there are many returns from individual target, the exact identity and location of the displayed radar targets helps to reduce the risk of disastrous navigation errors. The SeaBeacon® 2 *System 6* racon provides the mariner with precise navigation information in the form of a coded trace on the radar screen that can readily be identified as specific to a particular racon. The coded trace identifies and fixes the position of the racon with respect to other targets. When used in conjunction with navigation charts showing the identity and location of the racon, this trace aids in the correlation of other targets with their chart markings.
Thus oriented, the mariner is able to achieve precise vessel positioning in all weather and visibility conditions.
Marine radar beacons “racons” are designed to respond to marine shipborne X and S band radars. Due to similarities between marine and aviation radars, aviation radar may receive responses from marine racons but there are no established international standards for this type of application and our equipment is not designed to operate under these conditions. Tideland does not recommend using our SeaBeacon®racon product line as a radar beacon for aviation traffic.

1.1 FUNCTIONS OF THE SEABEACON® 2 SYSTEM 6

The SeaBeacon® 2 *System 6* racon is an all-weather aid to marine navigation that responds to radar pulses. The racon is a transponder that receives a radar pulse from an interrogating radar transmits a coded response. The presence of that response on the radar display provides the mariner precise information regarding the identity and location of the racon because each racon can be set to produce a specific Morse code character. The racon can be used to provide range and bearing information.

The SeaBeacon® 2 *System 6* racon is frequency agile, which means that it responds at the same frequency as the pulse from the interrogating radar. Moreover, the length of the coded racon response of the radar display is scaled to be proportional to the interrogating radar pulsewidth. One can alternatively select the SeaBeacon® 2 *System 6* racon to provide a fixed length response. Digital signal processing techniques and high speed circuitry employed in the SeaBeacon® 2 *System 6* racon enable it to reply to several hundred vessels in its service area.

The ideal marine radar would have a narrow, well defined beam (main lobe) with energy radiating only from the main lobe. In practice, radar antennas radiate a small amount of energy in directions outside the main lobe. These secondary beams are called side lobes and, if responded to, are a possible source of confusion when the racon is close to the interrogating radar. Should a racon respond to a side-lobe pulse from a nearby vessel, multiple traces would be painted on the radar display, and the radar operator would not know which of those traces represented the actual racon position relative to the vessel.

At some locations, the geography of the racon installation site is such that side lobes are not a concern for racon operation because vessels are unable to approach close enough for side lobes to trigger a racon response. At other locations, side lobes have a significant effect on racon operation. The side-lobe suppression feature enables the SeaBeacon® 2 *System 6* racon to discriminate between pulses from the main lobe and those from the side lobes of the same radar. The racon is inhibited from responding to side-lobe pulses.

Any of the pre-programmed Morse code characters (shown in Table 1) can be used to identify the racon. The choice of code and of code character length is made by means of an external handheld keypad or computer terminal.

MORSE CODE					
A	• —	N	— •	0	— — — — —
B	— • • •	O	— — —	1	• — — — —
C	— • — •	P	• — — •	2	• • — — —
D	— • •	Q	— — • —	3	• • • — —
E	•	R	• — •	4	• • • • —
F	• • — •	S	• • •	5	• • • • •
G	— — •	T	—	6	— • • • •
H	• • • •	U	• • —	7	— — • • •
I	• •	V	• • • —	8	— — — • •
J	• — — — —	W	• — —	9	— — — — •
K	— • —	X	— • • —	NE	— • •
L	• — • •	Y	— • — —	NW	— • • — —
M	— —	Z	— — • •	SE	• • • •
				SW	• • • • — —

Table 1: Racon Codes

1.2 MECHANICAL FEATURES

The major assemblies of the racon are a control box and base housing/chassis assembly that contains the electronics, the X-band and S-band antennas, and a radome that provides weather protection for the antennas.

The base housing material is marine grade aluminum. On the outside, the housing is painted with Corthane enamel. The radome is attached to the housing and sealed by means of an airtight O-ring. This arrangement protects the internal assemblies from saltwater intrusion. Sealed cable connectors assure submersibility at water depths up to 10 meters (35ft.).

The reliability of the circuit interconnections is enhanced by the use of a printed circuit back plane and connectors with gold-plated contacts.

The radome is made from gray polycarbonate structural foam, a material that is highly transparent to microwave energy and remain stable under ultraviolet radiation. The exterior of the radome is coated to seal the structural foam and painted with polyurethane enamel.

1.3 ADDITIONAL FEATURES

1.3.1 Inhibit

Racon responses may interfere with fixed local radars that are on the platform. Inhibiting can be used to eliminate an undesirable racon reply. To use this function connect an inhibit control signal from the fixed local radar to the racon. The inhibit signal should have the characteristics shown in Figure 1.

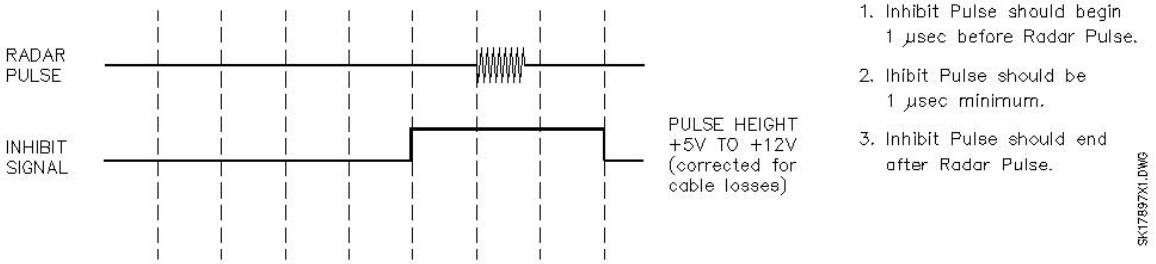


Figure 1: Inhibit Signal

The inhibit signal is driven from an external source of +5V to +12V pulses from a local radar. These signals are to be connected to the INHIBIT (+) with a return connected to INHIBIT (-). The pulses should go active about one microsecond before the radar begins transmission and remain till about one microsecond after the transmission has ended. The input to the inhibit circuit is a NEC PS8101. The NEC PS8101 is an optically coupled isolator containing a GaAIAs LED on the light emitting diode (input) side and a PIN photodiode and a high speed amplifier transistor on the output side. Typical ratings are VF = 1.7V at IF = 16mA (max), VF = 1.6V at IF = 1mA for the LED. The LED has 520 ohms of external resistance in the anode circuit and 50 ohms in the cathode circuit for a total of 570 ohms of series resistance added see Figure 2.

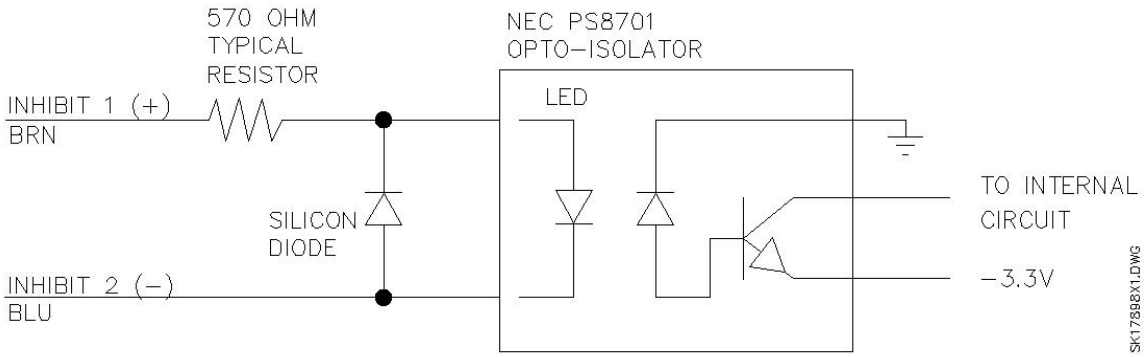


Figure 2: Inhibit Circuit

1.3.2 Status Display

The status display lines (GO/NO GO + and -) provide a means of continuously monitoring whether or not the racon has passed its self test. Figure 3 shows a functionally equivalent circuit along with a possible method for implementing the GO/NO GO function. The circuit can switch an outside current source of 125 mA or less.

The polarity or signal sense that the SeaBeacon® 2 *System 6* racon provides, is user selectable. The opto-isolator is normally turned on only if there is a racon malfunction.

The output of the GO/NO GO circuit is a NEC PS2702-1 optically coupled isolator containing a GaAs light emitting diode and an NPN silicon darlington-connected phototransistor. There are two 50 ohm resistors, one on the GO/NO GO (+) and the other on the GO/NO GO (-), and a 1N4148W diode in series on the GO/NO GO (+) see Figure 3

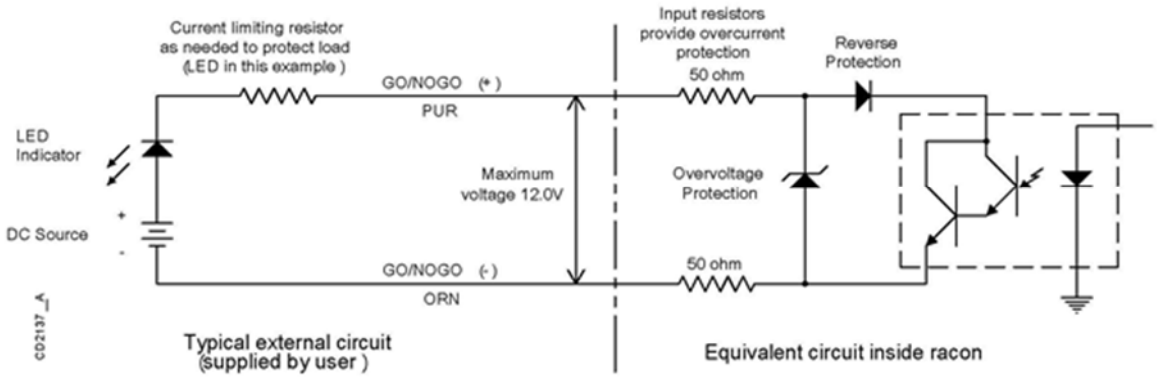


Figure 3: GO/NO GO Circuit

1.4 INPUT POWER REQUIREMENTS

The SeaBeacon 2® *System 6* racon requires and input voltage of 18 to 32 volts DC (Direct Current) that can be supplied by several types of DC power sources. An AC-powered battery charger and storage battery combination is a reliable method of obtaining unlimited power to operate the racon. In remote locations where AC mains power is not available, the racon can be powered by a photovoltaic generator coupled to a 24 volt battery system. Under all conditions, the effective source impedance of the voltage supply must be less than 0.05 Ohm.

Under limited-power conditions, racon power consumption becomes an important factor. The power management feature of the SeaBeacon 2® *System 6* racon ensures minimum power consumption.

For power consumption figures see Appendix A.

2. INSTALLATION

Your racon is packaged and shipped in a large box that should be temporarily retained for possible warranty returns. All materials required for normal installation are included in the shipping container. The shipping container has within it the racon, a control box, an installation manual and a bag of mounting hardware.

NOTE: Do not discard the installation manual. The manual contains operating instructions that will be needed after the racon is installed.

2.1 INITIAL INSPECTION

Initial inspection of a SeaBeacon® 2 *System 6* racon, as followed.

2.1.1 Receiving

When the SeaBeacon 2® *System 6* racon arrives, make note of any physical damage to the exterior of the shipping container. Exterior damage may be the only clue to possible interior damage caused by rough handling in shipment.

2.1.2 Unpacking

Unpack the racon carefully without damaging the shipping container. The container has custom designed cavities that conform to the shape of the racon. Save it for future use in shipping the racon.

2.1.3 Visual Inspection

After the unit is unpacked, visually inspect the racon for obvious damage. Check that all associated hardware is accounted for and damage free.

2.2 LOCATION PREPARATION

2.2.1 Site Preparation

The racon should be leveled. For fixed mounting surfaces, install the racon within a few degrees of true vertical. For best results, locate the racon as high as practical in order to provide a clear line-of-sight path between the racon and where the client ships or vessels are or will be located. In general, the higher the racon is mounted; the better is its useful range.

For example: A ship's radar antenna is 15 meters (50 ft) above water, and the highest point of land the vessel is approaching is 91 meters (300 ft) resulting in a nominal radar range of approximately 28 nautical miles. This is calculated using the following equation.

$$R_{NM} = 2.08\left[\sqrt{H_{TX}} + \sqrt{H_{TR}}\right]$$

R is in Nautical Miles

H_{TX} and H_{TR} are Heights in Meters

For more information about racon range estimates, please see the latest IALA publication "Guidelines on Racon Range Performance".

2.2.2 Racon Orientation

The racon must be mounted vertically. The orientation arrows on the lift ring (opposite the connectors) should point seaward or toward the longest range of the traffic service area.

2.2.3 Interference

The racon must be installed in an area that has a clear view or sight of where the client ships or vessels are located. Do not install the racon behind poles, posts, fences or guard rails. The racon signal behaves like light and cannot go through or around objects of any kind.

2.3 RACON MOUNTING

The racon can be mounted on a level surface with four hole mounting or on a tilted surface with 3 hole mounting. The racon has a wide vertical divergence of 22º and is well tolerant of slight out of vertical installations. However, maximum range can only be achieved with height, see "Site" above, and a near vertical installation.

Locate the TSC 901.1042-00 kit, "LEVELING MOUNTING HARDWARE" or bag of mounting hardware. The kit consists of Table 2.

QUANTITY	DESCRIPTION	TIDELAND P/N
4	SCR HX, M10X1.5X100MM SST, A-THD	211.1467-00
4	NUT HEX LOCK M10X1.5 NYLON, SST	221.1055-00
12	NUT HEX STD, M10X1.5 --316 SST	221.1064-00
9	WASHR FLAT STND, M10 CLEAR SST	230.1034-00
3	WASHR LOK EXTRNL M10 CLEAR SST	232.1008-00
6	WASHR SPLIT-LOCK M10 CLEAR SST	233.1043-00

Table 2: Leveling Mounting Hardware

2.3.1 Level Mounting Surfaces

1. Find an included drawing 901.1042-00.
2. Drill four 13 mm or 0.5 inch diameter holes in the mounting surface. Use the drawing to locate the 4 holes.
3. Set the racon over the holes and orientated to enable easy wiring.
4. Insert the bolts, SCR HX, M10X1.5X100MM SST, A-THD, in the 4 indicated holes first through the base housing and then through the mounting surface as shown on the drawing 901.1042-00.
5. From underneath the mounting surface, install a flat washer, WASHR FLAT STND, M10 CLEAR SST, a split washer, WASHR SPLIT-LOCK M10 CLEAR SST, and a standard hex nut, NUT HEX STD, M10X1.5 --316 SST. Snug up the nuts but do not tighten them.
6. Tighten the nuts in an alternating bolt sequence to initially 13 N-m or 10 ft lb.

7. Again, in alternating bolt sequence, tighten the nuts to 40 N-m ± 2.5 N-m or 30 ft lb ± 2 ft lb.
8. Optionally, install a NUT HEX LOCK M10X1.5 NYLON, SST on each of the bolts. Snug the nylon lock nut up against the torqued nut.

⚠ CAUTION!: The ground strap must securely connect to an earth ground for lightning protection

2.3.2 Non-Level Mounting Surfaces

1. Find an included drawing 901.1042-00.
2. Drill three 13 mm or 0.5 inch diameter holes in the mounting surface. Use the drawing to locate the three holes labeled 1, 3, and 5 on the drawing.
3. As shown in the drawing, install three bolts, SCR HX, M10X1.5X100MM SST, A-THD, on the flange of the base housing. On each bolt install a flat washer, WASHR FLAT STND, M10 CLEAR SST, a split washer, WASHR SPLIT-LOCK M10 CLEAR SST, and two standard hex nuts, NUT HEX STD, M10X1.5 --316 SST.
4. Tighten the top nut, closest to the base housing, to 11 ± 0.7 N-m or 8 ± 0.5 ft lb.
5. Further, on each of the bolts install a star lock washer, WASHR LOK EXTRNL M10 CLEAR SST, another hex nut, NUT HEX STD, M10X1.5 --316 SST and finally a flat washer, WASHR FLAT STND, M10 CLEAR SST.
6. Insert the bolts into the drilled holes orienting the racon for ease of wiring.
7. From underneath underneath the mounting surface, install a flat washer, WASHR FLAT STND, M10 CLEAR SST, a split washer, WASHR SPLIT-LOCK M10 CLEAR SST, and a standard hex nut, NUT HEX STD, M10X1.5 --316 SST. Snug up the nuts but do not tighten them.
8. Put a carpenter's level on the lift ring. Adjust the nuts as needed to level the racon.
9. Tighten the nuts above and below the mounting surface to initially 13 N-m or 10 ft lb.
10. Tighten the nuts above and below the mounting surface to 40 N-m ± 2.5 N-m or 30 ft lb ± 2 ft lb.
11. Optionally, install a NUT HEX LOCK M10X1.5 NYLON, SST on each of the bolts. Snug the nylon lock nut up against the torqued nuts.

⚠ CAUTION!: The ground strap must securely connect to an earth ground for lightning protection

2.4 SYSTEM WIRING

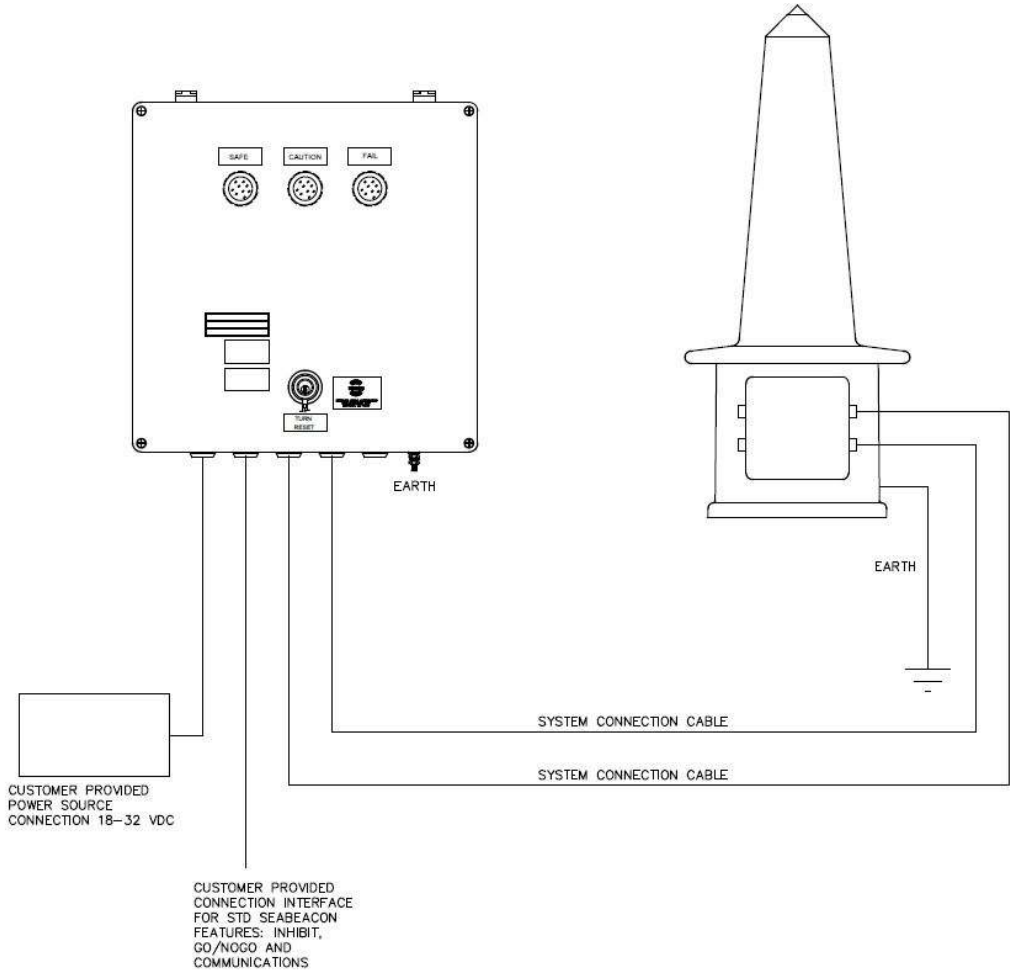


Figure 4: System Wiring

2.4.1 Field to Control Box Connections

The control box, 630.1422-01, is an Ex e II T4, IP 66 rated enclosure. Wiring connections within the control box are made to Weidmuller PDU 2.5/4 push-in type terminal blocks and Weidmuller PPE 2.5/4 push in type earth terminal blocks.

TERMINAL	WIRE SIZE	STRIPPING LENGTH
Weidmueller PDU 2.5/4	0.5mm² - 4 mm² AWG 26 - AWG 10	12 mm
Weidmueller PPE 2.5/4	0.5mm² - 4 mm² AWG 26 - AWG 10	12 mm

Table 3: Control Box Terminal Specifications

Install approved cable glands per manufacturers' instructions. Route wires in a neat and workman-like manner. Provide service loops. Install wiring per local electrical code requirements. See drawing 070.1016-DWG included with your racon. All "Customer Field Wiring" should be as short as is practicable.

FIELD CONNECTION	CONTROL BOX CONNECTION
EARTH (SAFETY GROUND)	TB1-53A
VDC SUPPLY	TB1-52A
VDC COMMON	TB1-51A
GO/NOGO	TB1-50A
GO/NOGO RETURN	TB1-49A
INHIBIT	TB1-48A
INHIBIT RETURN	TB1-47A
RX DATA	TB1-46A
TX DATA	TB1-45A

Table 4: Control Box Connections

2.4.2 Control to Junction Box Connections

The control box, 6301421-00, is an Ex e II Gb, IP 66 rated enclosure. Wiring connections within the junction box are made to Weidmuller WDK 4N screw type terminal blocks and Weidmuller WDK 4N/PE screw type earth terminal blocks.

TERMINAL	WIRE SIZE	STRIPPING LENGTH
Weidmueller WDK 4N	0.5mm² - 2.5 mm² AWG 26 - AWG 12	8 mm
Weidmueller WDK 4N/PE	0.5mm² - 2.5 mm² AWG 26 - AWG 12	8 mm

Table 5: Junction Box Terminal Specifications

Install approved cable glands per manufacturers' instructions. Route wires in a neat and workman-like manner. Provide service loops. Install wiring per local electrical code requirements. See drawing 070.1016-DWG included with your racon. All "Customer Field Wiring" should be as short as is practicable.

SIGNAL	CONTROL BOX CONNECTION	JUNCTION BOX CONNECTION
EARTH (SAFETY GROUND)	TB1-1A	TB1-1A
VDC COMMON	TB1-2A	TB1-2A
VDC SUPPLY	TB1-3A	TB1-3A
INHIBIT	TB1-4A	TB1-4A
INHIBIT RETURN	TB1-5A	TB1-5A
GO/NOGO	TB1-6A	TB1-6A
GO/NOGO RETURN	TB1-7A	TB1-7A
RX DATA	TB1-8A	TB1-8A
TX DATA	TB1-9A	TB1-9A
WARN NORMALLY CLOSED	TB1-10A	TB1-10A
WARN COMMON	TB1-11A	TB1-11A
WARN NORMALLY OPEN	TB1-12A	TB1-12A
ALARM NORMALLY CLOSED	TB1-13A	TB1-13A
ALARM COMMON	TB1-14A	TB1-14A
ALARM NORMALLY OPEN	TB1-15A	TB1-15A
WARN EARTH	TB1-16A	TB1-18A
ALARM EARTH	TB1-17A	TB1-20A

Table 6: Junction Box Connections

3. RACON POWER TEST

When power is initially applied to the control box, the red LED indicator light will come on. In this initial condition there is no power to the racon.

1. Insert, rotate the key clockwise. This action sends a reset or temporary power to the racon.
    a. If the internal pressure is greater than 2.0 +/- 1.5 PSI (14 +/- 10 kPa) but less than 5 PSI (35 kPa) then the yellow LED light will come on and stay on.
    b. If the internal pressure of the racon is greater than 5.5 +/- 1.5 PSI (38 +/ 10 kPa) then the green LED light will come on.
    c. If either of the yellow or the green lights are on then the racon will function normally.

NOTE: The yellow light is a warning that the racon is low on pressure and may soon fail.

    d. If the red LED light stays on then the internal pressure of the racon is less than 2.0 +/- 1.5 PSI (14 +/- 10 kPa) or there is a wiring error or other failure and the racon will not be allowed to be powered up.

2. If the green light is on then the racon is on and the protection circuits are working.

3. Test your racon with local radars for Morse Code, Time ON and Time OFF, range and area availability.

3.1 PURGE AND PRESSURE

Your racon was factory pressured and purged to 15 PSI (106 kPa) with dry nitrogen. Nitrogen is used to reduce the aging effects of corrosion and oxidation. While nitrogen is recommended it is not required to pressure your racon. Dry air will work for the task; but it must be dry. Any moisture in the air will eventually condense out onto the internal electronics and will significantly shorten the useful life of the racon.

The purposes of the pressure are twofold:

1. First, pressuring is necessary to meet the permit requirements of this hazardous area certified product.

2. Second, the internal pressure is an indicator of how well, or not, the racon is sealed against the external marine and potentially explosive environment. The internal electronics are extremely fragile and they are easily damaged beyond reasonable repair efforts by moisture or by chemical contamination.

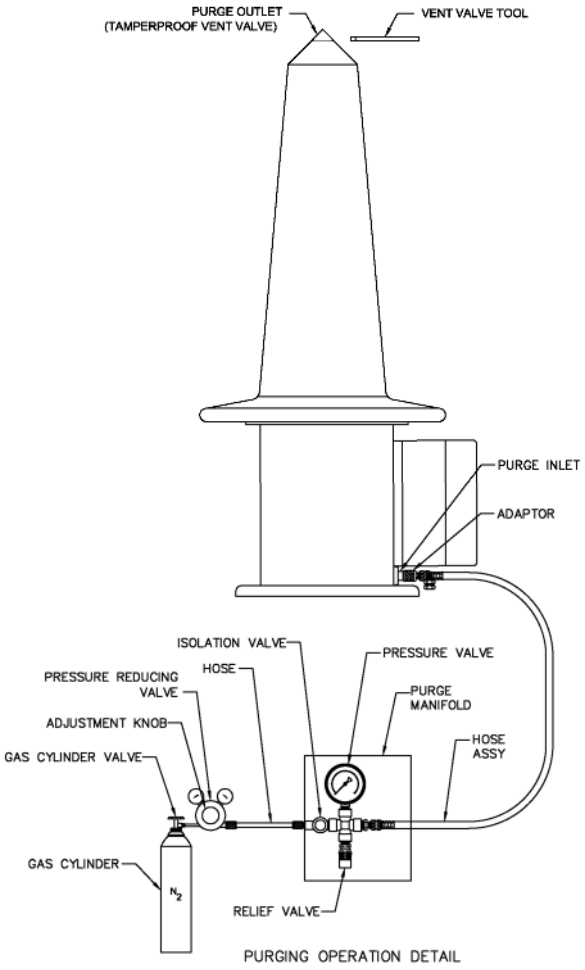
Routine pressuring or purging is not required nor is it recommended. Routine checks of the pressure are recommended at six month intervals and not longer than one year.

Part	Note
Pressured Nitrogen Source	A High Pressure Bottle
Low Pressure Regulator	Pressures in excess of 30 PSI (207 kPa) will cause damage to the racon that will require extensive costly repairs
Pressure Gauge	Capable of displaying low pressures of 1 PSI(7 kPa) to 15 PSI (103 kPa)
Interconnecting hoses and adapters	For Connections

Table 7: Pressure Materials

3.1.1 Purge

Tideland signal can provide a Purge kit, "901.1058-00 KIT, PURGE RACON SEABEACON 2", to help you in this process. See Figure 5. Assemble the parts as shown on the drawing.



1. Close the isolation valve.
2. Set the outlet pressure of the low pressure refulator to 20 to 25 PSI (138 to 172 kPa).
3. Remove the cap from the purge inlet valve. Set it aside for later. Install adapters as needed.
4. Remove the tamper resistant vent valve at the top of the racon radome. The vent tool, 297.1010-00, or other appropriately sized rod will do. Save the flat gasket.
5. Connect the pressure source hose to the racon.
6. Slowly open the isolation valve. Do not let the pressure climb above 15 PSI (106 kPa).
7. Let the gas flow through the racon and out the top valve for about 5 minutes.
8. Close the isolation valve.
9. Install the vent valve gasket and the vent valve. Tighten the valve with the vent tool until the valve seats firmly on the radome. Excessive torque will damage the radome bolt, 211.1550-00 SCREW CONT RETAINING SBCN-2.

Figure 5: Racon Assembly, X+S Band, SBCN-2 Ex

3.1.2 Pressure

The pressure may be tested with an external low pressure gauge or by communications with the racons' internal pressure sensor. Some loss of pressure can be expected over long periods of time. Pressure losses that cause the yellow LED light to come on should be promptly attended to.

1. Slowly open the pressure isolation valve till the gauge reads 15 PSI (106kPa).
2. When the gauge reaches 15 PSI (106 kPa) then close the isolation valve. The gauge reading will drop.
3. Open the isolation valve again till 15 PSI (106 kPa) is reached. Close the valve again.
4. Repeatedly open and close the isolation valve until the gauge reading holds at 15 PSI (106 kPa).
5. Close the isolation valve.
6. Turn off the gas to the low pressure regulator.
7. Quickly remove the hose from the racon purge inlet valve.
8. Firmly reinstall the purge inlet valve cap.
9. Your racon is now purged and pressured.
10. Test for leaks. This can be done with soapy water applied around all connections. If bubbles are seen then the racon seals must be repaired. Please contact your Tideland Signal Corp. representative for assistance.

4. OPERATION

The SeaBeacon® 2 *System 6* racon has been configured at the factory with the standard settings listed in Table 8 unless otherwise specified at time of purchase.

The user interface of the SeaBeacon® 2 *System 6* racon allows the user to change the operating characteristics of the racon the meet his particular requirements. Also, the user can command the racon to perform internal tests for maintenance and diagnostic purposes.

The user communicates with the racon by using an external terminal to enable features or specify operating values to the racon. The external terminal can be any ANSI compatible ASCII terminal, including computers running terminal emulation programs such as HYPERTERM, or PuTTY.

4.1 COMMUINCATION CONNECTION

Run a terminal emulation program. Connect to the racon using a serial connection with the properties seen in Table 8. Then connect to the terminal emulation program with settings shown in Table 9.

RACON	DB-25 (PC)	DE-9 (PC)
TX	3	2
RX	2	3
GND	7	5

Table 8: Serial Connection

ANSI TERMINAL	
COM PORT	Varies
Baud Rate	9600
Data Bits	8
Parity	None
Stop Bit	1
Flow Control	None

Table 9: Communication Protocol

4.2 SETUP ROUTINE

To communicate with the racon, press the letter [O] within 4 seconds of either the beeps or the SYSTEM OK update message. (If you do not press the [O] within 4 seconds of the beep or SYSTEM OK, wait one complete power management cycle and then press [O] within 4 seconds of the next beep or SYSTEM OK.) A complete power management cycle is the duty cycle of the racon: the sum of the Active ON and the Standby OFF times. The standard factory setting is 40 seconds.

If you do not want to continue to perform another User Function, turn the keyboard off by pressing the letter [O].

FUNCTION NUMBER	FUNCTION NAME	STANDARD SETTING	OPTIONS
1	BAND ENABLE		
	X-Band	Yes	Yes, No
	S-Band	Yes	Yes, No
3	DUTY CYCLE		
	Active On	20 sec	4 to 60 sec
	Standby Off	20 sec	0 to 60 sec
	EXT Enable	No	Yes, No
	EXT Period	5 sec	1 to 10 sec
4	RESPONSE CODE		
	Code	Q	A-Z, 0-9(zero) NW, NE, SW, SE
	Length	60 µsec	5 to 80 µsec
	Proportion	Yes	Yes, No
5	LOW BATTERY		
	Enable	No	
	Voltage	11.2	Yes, No
6	RUN SELF TEST	N/A	N/A
7	RACON MONITOR	N/A	N/A
8	TERMINAL DEVICE		
	Display Type	PC	PC, QTERM, PSION
	Change Baud	9600	300, 600, 1200, 2400, 4800, 9600 Baud
9	NO GO SELECT		
	Active NO GO	Yes	Yes, No

Table 10: Racon Functions

4.3 OPERATING INSTRUCTIONS

Actual keys used in operating the external terminal are enclosed in brackets [ ]. Keys to be used and descriptions of their uses are listed below.

KEYS USED FOR EXTERNAL TERMINAL	DESCRIPTION
Letter [O] OR [o]	Turns keyboard ON or OFF; keyboard must be ON to use functions; when not used, the keyboard automatically reverts to OFF after a programmed timeout.
[ESC] or [*]	Exits a function.
[DEL or Backspace]	Deletes the last character entered on the display.
[ENTER] [EXE]	Transfers the displayed value into the racon; starts an action.
[<] or [,]	Decrements the displayed value; moves between selections; [EXE] or [ENTER] must be used to transfer the value into the racon.
[>] or [,]	Increments the displayed value; moves between selections; [EXE] or [ENTER] must be used to transfer the value into the racon.
[0] [1] [2] [3] [4] [5] [6] [7] [8] [9] or [-]	Enter digits into the display.
[/]	Restores old entry value, quits the entry, moves to next entry; this is essentially a “whoops” key or can be used to skip an entry.
[;] [^] or [#]	Restores old entry value, quits the entry, backs up to previous menu entry.

Table 11: Usable Keys

4.3.1 Select and Set

Select: The racon presents the user with a list from which a parameter can be chosen. Items are displayed one at a time. The list can be viewed forwards or backwards using the [^] or [;] and [/] or [ENTER] keys respectively or press the increment (>) or decrement (<) keys to change the indicated value.

To choose an item from the list for use by the racon, press [ENTER].

To skip the selection, press [/].

To return to the USER FUNCTION prompt, press [ESC].

Set: The racon requires the user to enter a particular value. Press the [-] key (if needed), then press the [0] through [9] keys as needed to form the value.

If wrong digits are entered, press [backspace], to delete each of the digits entered.

To store the value into the racon, press [ENTER].

To skip the setting, press [/].

To return to the USER FUNCTION prompt, press [ESC].

4.3.2 User Functions

1 BAND ENABLE:

Selects band enable for each of X and S bands

USE X BAND: using increment/decrement keys, select "YES" to use band; default value is "NO"

USE S BAND: using increment/decrement keys, select "YES" to use band, default value is "NO"

NOTE: since band enable default values ate "NO", the User must set one or both bands to "YES" in order for the racon to operate, see also RESPONSE CODE, function 4, CODE entry

2 SERIAL NUMBERS:

Displays the racon and chassis serial numbers

RACON S/N: this is the racon serial number

CHASSIS S/N: this is the electronics chassis serial number

3 DUTY CYCLE:

Sets the active and standby times for the power management cycle and enables and set the period for the extended idle feature

ACTIVE ON: sets in range of 4 to 60 seconds; default is 20 seconds.

STANDBY OFF: set in range of 0 to 60 seconds; default is 20 seconds.

EXT ENABLE: using increment/decrement keys, select "YES" to use the extended idle feature or "NO" for normal operation; default is "NO"

EXT PERIOD: set in range of 1 to 10 ACTIVE ON plus STANDBY OFF cycle; default is 5

ON MONTH set in range of 1 to 12 set month racon starts ON season; set to 0 to disable seasonal mode; default is 0

ON DAY first day of ON season; set in the range of 0 to 31; 0 turns off seasonal function; default is 0

OFF MONTH last of ON season; set in the range 0 to 12; 0 turns off seasonal function; default is 0

OFF DAY last day of ON season; set in the range 0 to 31; 0 turns off seasonal function; default is 0

NOTE: **an EXT PERIOD setting of 1 with EXTENABLE selected to "YES" behaves as if EXT ENABLE is selected to "NO"**

4 RESPONSE CODE:

Selects the response code, sets maximum response length and selects proportional response

CODE:	using increment/decrement keys, select one of "A-Z", "NW", "NE", "SW" or "SE"; default is "invalid" to prevent use of racon until correct code is entered by the User
LENGTH:	set in range of 5 to 80 microseconds; default is 60;
PROPORTION:	using increment/decrement keys, select "YES" for proportional or "NO" for fixed response length; default is "YES"

NOTE: **if length is set to below 20 microseconds, PROPORTION is automatically selected to "NO"**

5 LOW BATTERY:

Sets the battery voltage below which the racon will remain in STANDY OFF

ENABLE:	using increment/decrement keys, select "YES" to enable low voltage cutoff; default is "YES"
VOLTAGE:	set in range 9.0 to 36.0 volts; default is 11.2

6 SELFTEST:

WATCHDOG:	reports "FAIL" if the watchdog timer did not time out properly
PROGRAM:	reports "FAIL" if the program ROM check code is not correct
DATA:	reports "FAIL" if the program RAM fails testing
CONFIG:	reports "FAIL" if the configuration storage EEPROM is corrupted; for operation, default values will be substituted for corrupted values; NOTE: default values will not be written into the configuration EEPROM; see also BAND ENABLE, function 1, and RESPONSE CODE, function 4 entries
FPGA:	reports "FAIL" if the fpga did not load correctly

CAL X BAND:	reports “FAIL” if a calibration failure is detected
CAL S BAND:	reports “FAIL” if a calibration failure is detected
CAL X VCO:	reports “FAIL” if a vco failure is detected
CAL S VCO:	reports “FAIL” if a vco failure is detected
RUN SELFTEST:	runs complete selftest and calibration

7 RACON MONITOR:

TEMPERATURE:	in units of degrees C
PRESSURE:	current pressure in units of kPa, psia and psig
PRESSURE 25C:	current equivalent pressure at 25°C, in units of kPa, psia and psig; NOTE: pressure in the racon will vary with temperature; this value is provided as an easy check to see if the pressure in the racon is at specification
BATTERY:	in units of volts
+3.3 VOLTS:	in units of volts
+10 VOLTS:	in units of volts
-3.3 VOLTS:	in units of volts
VREF VOLTS:	in units of volts
HOUR METER:	in units of hours
CALENDAR:	current calendar HH:MM:SS DD:MM:YYYY

8 TERMINAL DEVICE:

Selects the terminal device and serial port rate

TYPE:	using increment/decrement keys, select one of “PSION”, “QTERM”, or “PC”; default is PC
CHANGE BAUD:	using the increment/decrement keys, select “YES” to change the serial port baud rate
BAUD:	using the increment/decrement keys, select one of “300”, “600”, “1200”, “2400”, “4800”, or “9600” baud; default is “9600”

9 NOGO SELECT:

Selects the GO/NOGO signal to be either active during fault or active during normal operation

ACTIVE NOGO: using the increment/decrement keys, select “YES” for active during fault (low power setting) or “NO” for active during normal operation (fail safe setting); default is “YES”

NOTE: When ACTIVE NOGO “YES” is selected, racon indicates a false GO if power has failed.

10 UNUSED ENTRY:

11 MISC FUNCTIONS:

CLEAR OPERATION: using the increment/decrement keys, select “YES” to clear the user’s hours of operation

DISPLAY VERSION: using the increment/decrement keys, select “YES” to display the racon’s hardware and software version information

5. MAINTENANCE

Field maintenance should include the following.

5.1 FIELD INSPECTION

1. Closely inspect the racon. Look for chips, dings, loose connections, loose bolts and nuts, excessive metal loss, damaged cables and cracks. Racons that have cracked radomes, even ones with very tiny cracks, must be replaced immediately.
2. Is the racon still mounted vertically? A Tideland Signal racon was designed for installation on sea-going buoys; it need not be perfectly vertical. However, racons that are not vertical within five or so degrees may experience a compromised operational range. The antennas are designed to have a vertical beam divergence of approximately 22° from the horizontal. This is stated at ±3dBc or at the half power point; i.e., half of the power received and transmitted is lost when the racon tilts 22°.
3. Look for battery damage such as leaks, cracks, corrosion, and contamination.
4. Look for changes in the vicinity. Changes in local structures can affect the coverage area of a racon. A racon is a line of sight device. Do not let anything come between the racon and the maritime user.
5. Pay extra attention to the power source. Solar cells should be cleaned, batteries cleaned, cables and connectors cleaned and seated.
6. Check the racon mounting. Look for loose mounting bolts. Make sure that the racon us firmly mounted on a firm foundation. Make sure that there is nothing in close proximity to the racon that could cause damage to the housing, i.e., a swinging rope or line, moving platform, or walkway.

5.2 FIELD CLEANING

1. Clean the outside of the racon with soap-and-water, alcohol, or a product called “Fantastik, All Purpose Cleaner”, made by S.C. Johnson & Son, Inc. If you decide to use the “Fantastik” cleaner, make sure you only use the “All Purpose” product. Excessive surface contamination and build up from bird droppings can reduce the range of the racon. The plastic radome is transparent to microwave energy and is incredibly strong. However, it is susceptible to chemicals such as solvents, gasoline, and common de-greasers. The use of products other than those listed here will cause the plastic to crack at some time in the future allowing the internal gas to leak out and sea water to come in.

   NOTE: The electronics within the racon will not survive seawater immersion. Usually after any amount of contamination, they can no longer be repaired
2. Do not attempt to paint the radome. Most paints are not transparent to microwaves and contain chemicals that will permanently damage the racon.
3. Chips and scratches of the metal base housing should be attended to immediately. Clean and repair the chips or scratches as soon as you can. Failure to perform this simple maintenance can cause severe damage to the housing with such a loss of metal that it cannot be repaired.
4. Don’t hesitate to paint over scratches in the metal housing.
5. Do not let the paint touch the plastic radome.

6. DISMOUNTING AND SHIPPING

In the event the racon needs to be returned to the intermediate repair facility for maintenance, use the following procedures for dismounting and shipping the racon.

CAUTION!: To prevent damage to the racon, do not under any circumstance break the seal of the racon in the field.

6.1 DISMOUNTING

The dismounting procedure is the reverse of the mounting procedure. Disconnect the electrical connections first, and then remove the mounting hardware and retain it with the racon.

6.2 PREPARATION FOR SHIPMENT

The shipping container for the racon has internal cavities that conform to the shape of the racon. Use the original shipping container to pack the racon for reshipment.

6.3 SHIPPING

Should the SeaBeacon® 2 System 6 racon need to be returned for any reason, obtain a Return Material Authorization number from Tideland prior to shipping. Contact your nearest Tideland representatives for instructions.

Facilities authorized to repair the SeaBeacon® 2 System 6 racon are listed on the contact page at the beginning of the manual.

7. APPENDIX A: POWER CONSUMPTION

SeaBeacon® 2 *System 6* IECEx Racon Power Consumption and Discussion of Programmable Features Available to Alter Power Consumption

All racons vary in daily power consumption due to operating conditions, i.e., number of ships, short or long-range settings on radars, racon owner settings, etc.

In an effort to assist you with power supply sizing, the following is presented:

Typical Power Consumption for SeaBeacon® 2 *System 6*

(Based on a PRF of 1 kHz and 20 µsec code length)

System 6			
Idle	15 mA	Typical	.015 X (50% of 24) = .18
Listen	150 mA	Typical	.150 X (50% of 24) = 1.8
Transmit	150 mA	Typical	1.98 AH/day

Optimizing *System 6* features to get most efficient power usage

As you can see from the figures noted above, the *System 6* racon uses power efficiently. However, you will see that in the figures below, any racon that is interrogated with multiple radars operating on long range, the corresponding long (60+ µsec) racon code length response significantly increases the power consumption.

PRF	S-Band transmit current		X-Band transmit current	
	20 µsec code length	60 µsec code length	20 µsec code length	60 µsec code length
1 kHz	140mA	172mA	143mA	178mA
2 kHz	160mA	226mA	162mA	230mA
3 kHz	180mA	282mA	183mA	288mA
4 kHz	201mA	355mA	201mA	346mA
5 kHz	222mA	412mA	220mA	400mA
6 kHz	243mA	469mA	240mA	455mA
7 kHz	264mA	525mA	258mA	510mA
8 kHz	282mA	581mA	277mA	564mA

**Listen current was 130mA and idle current was 12mA. Extended idle mode was turned off.

With the above information it is easy to see that by limiting the maximum code length (an adjustable feature on all SeaBeacon® 2s) in a busy location, the daily power consumption can be drastically reduced.

In busy locations, normally the short and medium range traffic are the ones who need the racon paint trace the most. A shorter code length has two obvious advantages. First the paint obscures fewer desirable targets because the paint is smaller. Second, as you can see above, the power consumption is reduced. The disadvantage is that when the radar is set at its maximum range the Morse character can be so small as to be difficult to read on the screen.

Published power consumption is based on values obtained with two controlled parameters, the PRF set at 1 kHz and the code length set at 20 µsec. Only one band is active during this test. Since the X+S band racon receives radar pulses that are interleaved, the SeaBeacon® 2 *System 6* Racon handles the response on the same basis. The racon can be thought of as a serial device that handles radar pulse one at a time. Therefore, the power consumption of X and S band is not additive.

From the table at 1 kHz and 20 µsec code length, we can see that the listen of 130mA and transmit of 140mA and 143mA are close enough to the same value that the difference between transmit and listen is negligible. Using the worst case of 143mA and adding 5% safety = 150mA X 12 hours (@50% duty) = 1.8 AH/day.

The SeaBeacon® 2 *System 6* Racon brochure states 2.12 AH/day as an averaged figure. If the PRF is increased to 3 kHz and the code length is limited to 20 µsec we have .183 A X 12H = 2.2 AH/day. However, if you change both the PRF to 3 kHz and increase the code length to 60 µsec the power consumption increases to 288mA X 12H = 3.46 AH/day.

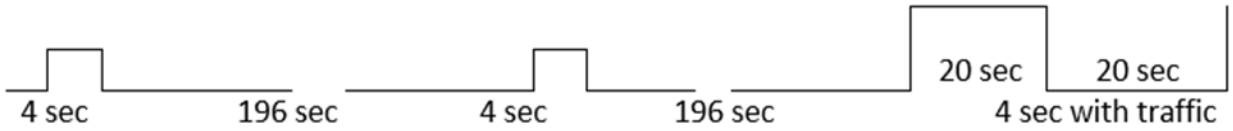
Based on this example and past experience, we know that for 95 % of the racon locations a power source that will deliver an average of 2 AH/day at 12 volts.

For the roughly 5% of locations that are very busy, and don't fit the above model, the power available must be increased and/or some of the SeaBeacon® 2 *System 6* Racons programmable power efficiency features must be used to fit the location. In the most severe cases an increased power source and the setting of the racon's programmable features may be needed to best fit the racon to the requirements of the location and the maximum power available.

An important tool to this end is the extended idle mode feature that is available on the SeaBeacon® 2 *System 6* racon. It's purpose is to limit the racon power consumption during periods when there is no local radar traffic. Multipliers of 1 to 10 may be selected by the operator/owner. This multiplier determines the length of the extended idle time before the racon automatically goes into the listen mode for 4.0 seconds. If radar traffic is present during this 4.0-second listen period, the racon will respond normally for as long as radar signals are being received, i.e., the On/Off cycle times are not altered. If no radar signals are received for a period of at least 4.0 seconds the racon goes into the extended idle for the length of time selected. See the following example:

Racon is programmed for 20 seconds on 20 seconds off duty cycle and the extended idle is activated using a multiplier of 5.

(20 sec on + 20 sec off) X 5 (multiplier) = 200 sec



At the beginning of the 20-second on period the listen mode is turned on and stays on for only 4.0 sec if there is no radar traffic present. The racon will go into the low power idle mode for 196 seconds at the end of which it will pop up for another 4 second look for radar traffic. If radar traffic is detected then the racon will resume its normal 20 second on and 20 second off cycle.

In Summary

The following are programmable power saving features of the SeaBeacon® 2 *System 6* that can be used to reduce power consumption in addition to providing tailored performance influenced by site requirements:

1. On-time Off-time
2. Code length
3. Extended Idle

8. APPENDIX B: SPECIAL CONDITIONS FOR SAFE USE

SeaBeacon® 2 *System 6* IECEx Racon Conditions for Safe Use

Safety Instructions:

1. The SeaBeacon® 2 *System 6* IECEx Racon must be used in locations as certified – Zone 1 or 2
2. Changes of the design and modifications to the SeaBeacon 2 System 6 IECEx are not permitted
3. The SeaBeacon® 2 *System 6* IECEx shall be operated as intended and only in undamaged conditions
4. Only genuine Tideland Signal spare parts may be used for replacements
5. Repairs that affect the explosion protection may only be carried out by Tideland Signal

Standards of Conformity:
The SeaBeacon® 2 *System 6* IECEx Racon meets the requirements of:
EN60079-0:2012+A11:2013 and IEC 60079-2011 6th Edition
EN60079-2:2014 and IEC 60079-2:2014 6th Edition
EN60079-7:2015 and IEC 60079-7:2015 5th Edition

Technical Data:
Ex II 2G
IECEx ITS 16.0007X
Ex db eb pxb IIc T4 Gb
ITS16ATEX18410X
IP66
Maximum Voltage: 32 VDC
Maximum Current: 5 Amps
Cable Entries: M25