



# KODEN

## INSTALLATION MANUAL

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### DGPS SENSOR

# KBG-3

This product is specifically designed to be installed on boats and other means of maritime transport. If your country forms part to the EU, please contact your dealer for advice before attempting to install elsewhere.





## Declaration of Conformity

(As required by Article 6.3 of Directive 1999/5/EC-RTTE Directive)

Declares under his sole responsibility that the Marine GPS sensor module manufactured by

**Koden Electronics Co., Ltd.**

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Intended for Worldwide use as a Marine GPS sensor for use aboard non-SOLAS vessels and Identified by the type number **KBG-3** to which this declaration refers is in conformity with the EMC, Health and Safety standards of

**EN60945**

**and complies with the essential requirements of Directive 1999/5/EC**

Conformity assessment under Annex II of 1999/5/EC (internal production control) has been undertaken.

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Signed .....

**Kenichi Chiwaki**

**Manager / Quality Assurance Department**

Dated **20 Jun. 2006** .....





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### Amendment policy

When any change is applied in the document, only the document number of the relevant sheet(s) and cover sheet are modified and the rest of the sheets are not changed. The document number is shown in the footer area, right or left bottom of each sheet.

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## Preface

### Safety Precautions

- **Be Sure to "Disconnect" Inboard Power Supply**

It is still possible to receive an electric shock caused by unintentionally switching on the power supply during maintenance work. To prevent this from happening, be sure to disconnect the inboard power supply and the power supply switch of equipment. Place a notice "Men working" near the power supply switch of equipment to ensure safety.

- **Be Careful about Dust**

Dust can cause temporarily the respiratory diseases. While cleaning inside of equipment, be careful not to inhale dust. It is advisable to wear a safety mask etc.

- **Take Countermeasures against Static Electricity**

Carpets laid on the floor and synthetic fiber clothes can generate static electricity, and can damage the electronic parts on the printed circuit boards. Take appropriate countermeasures against static electricity before handling the printed circuit boards.

## Symbols used in this installation manual

The following symbols are used in this installation manual. You are requested to be fully aware of the meaning of each symbol before carrying out maintenance and check.

### Alarm mark



**Caution**

To handle the equipment ignoring this sign may lead to a malfunction or a failure of the equipment.

### Caution mark



**Warning**

To handle the equipment ignoring this sign may lead to injury to the human body or damage to the equipment.

### Prohibition mark



This sign indicates that a specified action is prohibited. The prohibited action will be shown in the vicinity of the mark.



## How to use this installation manual

### Scope

This installation manual contains necessary information about installation and inboard maintenance of the DGPS sensor KGB-3.

### Structure

To ensure quick reference of necessary information in this installation manual, the whole structure is divided into chapters according to the contents. The contents contained in each chapter are as follows.

#### **Chapter 1: Overview**

- About GPS
- About DGPS, SBAS
- Equipment outline
- Applicable standard
- Equipment interconnection diagram

#### **Chapter 2: Equipment composition**

- Standard equipment composition list

#### **Chapter 3: Equipment specifications**

- Specifications
- Serial data
- Power supply specifications
- Environment conditions
- External dimensions and weight

#### **Chapter 4: Installation**

- Installation precautions
- Unpacking and inspection of the goods
- Selection of the installation site
- Installation method

**Chapter 5: Technical references**

- Details of input/output data
- Cable connections and connector pinouts
- List of geodetic systems
- Table of DGPS reference stations

## Chapter 1 Overview

### Contents

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<b>1.3 Equipment outline</b> .....	<b>1-1</b>
<b>1.4 Applicable standard</b> .....	<b>1-1</b>
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## Chapter 1 Overview

### 1.1 About GPS

#### 1.1.1 GPS satellite alignment

GPS (Global Positioning System) is a position measuring system that uses 4 satellites for each of 6 orbits, with durations of 11 hours 58 minutes, orbiting approximately 20,000km above the earth.

#### 1.1.2 GPS system configuration

GPS is based on the principle of calculating the distance of 3 or more satellites from the user and deriving the user's position. The intersecting points of the sphere with the satellite located at its origin indicate the current position (latitude, longitude, and altitude) measured by you.

Note: GPS uses the WGS (World Geodetic System) coordinate system. Previous global maps used different coordinate systems for different zones.

The nautical chart of WGS coordinate system and the nautical chart of non-WGS coordinate system may be different in the latitude and longitude.

### 1.2 About DGPS, SBAS

DGPS (differential GPS) can improve the GPS positioning accuracy in coastal waters. To get DGPS positioning, you require a differential GPS navigator. The system works as follows.

Your GPS navigator gets position data from satellites (measured by the GPS) and combines this with correction data from a DGPS reference station (existing radio beacon station).

The DGPS station compares the known surveyed position of the station itself with current position information from the GPS system and calculates the error based on this data. The DGPS station then sends correction data via (RTCM SC-104 format) using the beacon transmitter and to your DGPS receiver module. The DGPS receiver module receives this information and applies this correction to your navigator.

The accuracy is higher the closer you are to the beacon station. Generally speaking, the DGPS system can be used within 100 to 200 nautical miles from the reference station.

SBAS is a robust system designed to improve the accuracy of GPS positioning using geostationary satellites that are currently being developed in the US, Europe and Japan. There are 3 types of systems being developed: WAAS in the US, EGNOS in Europe and MSAS in Japan. WAAS and EGNOS are in operation. MSAS is going through application testing and is transmitting position correction data at the same frequency as GPS satellites. Because position correction data is transmitted from geostationary satellites, it is possible to receive position correction data anywhere in the world. However, in case of application testing, the quality of the position correction data may be degraded depending on the time.

### **1.3 Equipment outline**

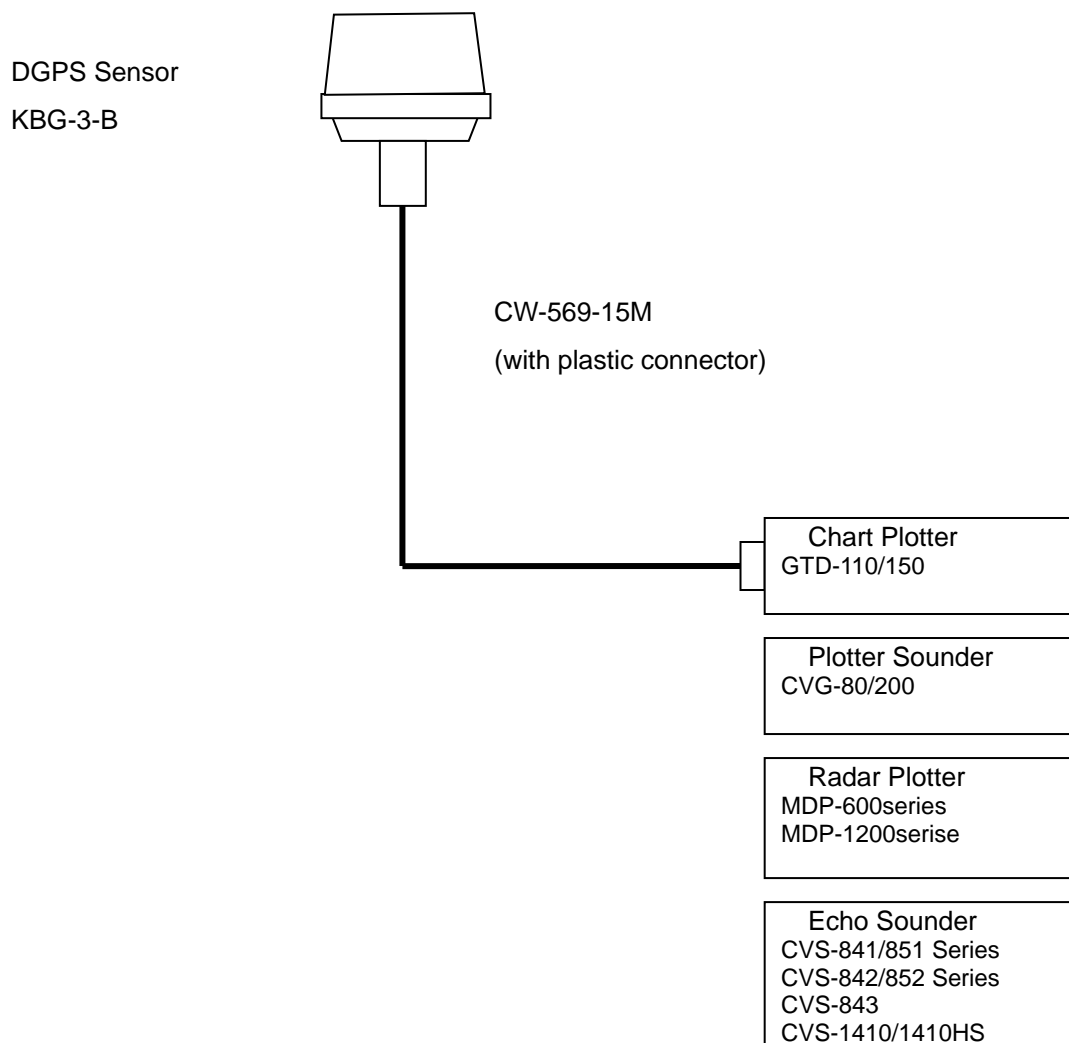
The KBG-3 incorporates an 18-channel parallel GPS receiver sensor that corresponds to SBAS. It also incorporates a DGPS beacon receiver. It is a high-performance DGPS sensor. By simply connecting a power supply, highly accurate position data can be quickly supplied to a Plotter or the ship's navigation devices.

When the unit is shipped out from the factory, it is initially set for automatic DGPS mode (Differential GPS by beacon signal) and automatically selects the best beacon station to use by just turning on the unit. If SBAS correction or manual selection of a beacon station is required, please setup the unit by referring to the operation manual of KBG-3 and the interlaced navigation equipment. Setup may not be effective sometimes except connection to Koden plotters.

### **1.4 Applicable standard**

The KBG-3 conforms to the technical criteria of international standard that specifies General Requirements of Maritime Navigation and Radiocommunication Equipment and Systems, IEC 60945 (Ed.4).

### 1.5 Interconnection diagram



**Fig. 1.1 DGPS sensor KBG-3 interconnection**

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## Chapter 2 Equipment Composition

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## Chapter 2 Equipment Composition

### 2.1 Standard equipment composition table

No.	Name	Descriptions	Remarks	Weight	Q'ty
1	DGPS sensor	KBG-3-A	Cable, CW-570-15M with metal connector	760 g excluding cable	1
		KBG-3-B	Cable, CW-569-15M with plastic connector		
2	Installation manual	English			1

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## Chapter 3 Equipment Specifications

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## Chapter 3 Equipment Specifications

### 3.1 Specifications

#### GPS receiver

Received frequency		1575.42MHz ± 1MHz
Receiving channels		18 parallel channels
Sensitivity		-130dBm
Positioning accuracy (PDOP ≤ 3)	Position	GPS: 10m (2drms, SA=OFF, PDOP ≤ 3)
		SBAS: 8m (2drms, SA=OFF, PDOP ≤ 3)
		DGPS: 5m (2drms, SA=OFF, PDOP ≤ 3)
	Speed	0.1kt (rms, SA=OFF, PDOP ≤ 3)
Tracking	Speed	Max. 190kt
	Accel.	Below 1 G
Position update time		1 sec
Initial positioning time	Cold start	50 secs (standard value)
	Warm start	45 secs (standard value)
	Hot start	20 secs (standard value)

#### Beacon receiver

Received frequency	283.5 to 325.0kHz
Receiving system	Double superheterodyne
Antenna	Ferrite loop antenna
Channel interval	500Hz step
Receiving sensitivity	10 μV/m or less
Dynamic range	90dB or more
Station selection	Automatic or manual
Beacon station data (when station is selected automatically)	Beacon station data everywhere in the world, automatic almanac registration

### 3.2 Serial data

(1) Format: NMEA-0183 compliant Ver. 2.0

(2) Input data

Parameter settings: KODEN PRIVATE COMMAND, 4800bps

Beacon setting: MSK, CRQMSK command

\* For details, refer to Chapter 5.

(3) Output data

Sentence: GGA, GLL, VTG, RMC, ZDA, (1 sec interval).

GSA, GSV, PKODA, PKODG, 1, PKODG 7 (2 secs interval)

MSS (any interval between 1 and 99 secs)

MSK (when CRQ is requested)

\* For details, refer to Chapter 5.

### 3.3 Power supply specifications

Input voltage: 10.8 to 31.2 VDC (negative earth connection)

Power consumption: 2.5 W or less.



#### Caution

*Never use this equipment for (+) earth power supply.*

### 3.4 Compass safe distance

Standard: 0.2m

Steering: 0.2m

### 3.5 Environment conditions

The main environment conditions are stated below.

(1) Temperature, humidity

Operating temperature: -25 to +55 degrees celsius

Storage temperature: -30 to +70 degrees celsius

Maximum humidity: 93 ± 3% (at +40 degrees celsius)

(2) Vibration

IEC 60945

(3) Water resistance

IPX6 type (IEC 60945)

Water resistant type (JISF8001)



### 3.6 External dimensions and weight

External dimension diagram: Refer to the diagram below

Weight: 760 g (excluding cable)

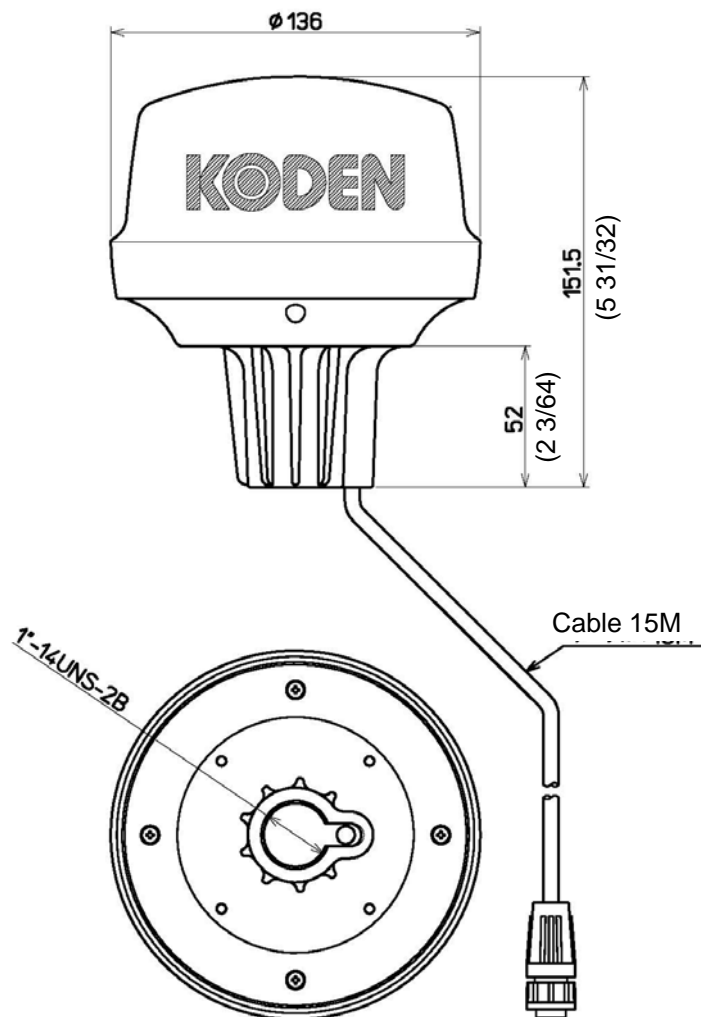


Figure 3.1 External dimension diagram

Unit: mm (inch)

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## Chapter 4 Installation

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<b>4.4 Installation method .....</b>	<b>4-3</b>

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## Chapter 4 Installation

### 4.1 Installation precautions

Installing the DGPS sensor comprises the following actions.

- (1) Unpacking and inspecting the components.
- (2) Checking the power supply voltage and current capacity that are supplied to the DGPS sensor.
- (3) Determining the installation site.
- (4) Cable laying.
- (5) Installing the GPS receiver module.

### 4.2 Unpacking and inspection of the goods

Unpack the contents and check each component against the component delivery list. If the contents differ from that which is on the list, or if there are damaged components, then contact the shipping agent or the nearest KODEN dealer.

### 4.3 Selection of installation site

Be sure to install the DGPS sensor in the highest possible location on the ship for optimum reception of the satellite signal.

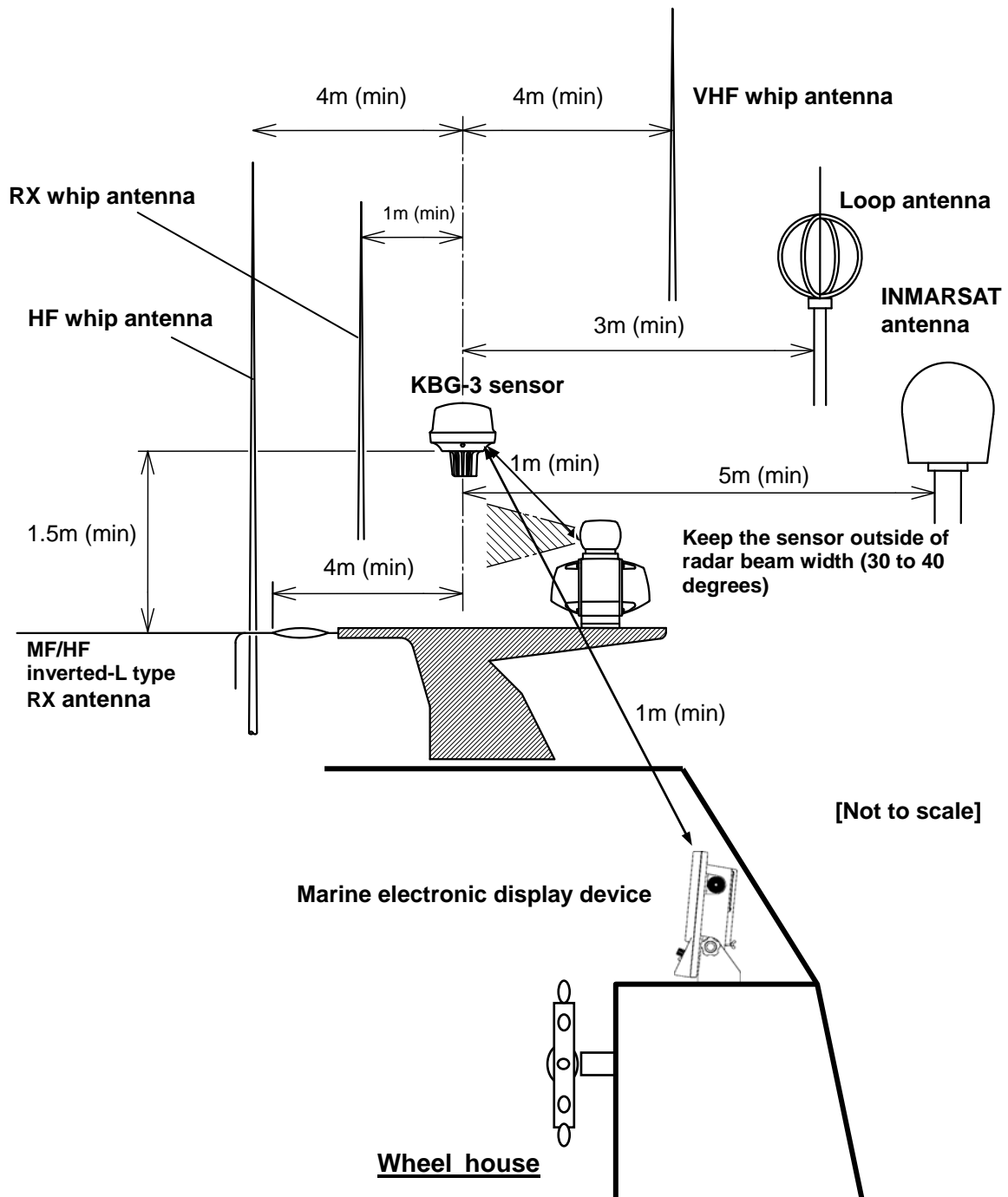
Any obstructions in the vicinity of the antenna could result in the loss of the satellite signal reception, positioning time degradation or a reduction in the position accuracy.

- (1) Keep the sensor at least 0.5m away from metallic objects.
- (2) Keep the sensor at least 4m away from MF/HF inverted-L type transmission antennas and VHF or HF whip antennas.
- (3) Keep the sensor at least 1.5m away upward from MF/HF inverted-L type transmission antennas.
- (4) Keep the sensor at least 1m away from receive antennas.
- (5) Install the sensor away from the ship's radar beam (straight beam angle: 30 to 40 degrees).
- (6) Keep at least 1m away from the ship's Radar antenna.
- (7) Keep the sensor at least 5m away from the INMARSAT antenna.
- (8) Keep the sensor at least 3m away from loop antennas.
- (9) Keep the sensor at least 2m away from the ship's engine.
- (10) Display devices such as cathode ray tubes and LCDs can sometimes emit noise and interfere with the reception of beacon signals. Keep the sensor at least 1m away from display devices such as Plotters, Radars and Sounders.

For the recommended safe installation distances from inboard structures that are cylindrical, such as support struts and pipes, refer to Table 1.

**Table 1 Minimum distances between support struts**

Object	Diameter	Minimum distance
Support strut	10cm	1.5m
Support strut	30cm	3.0m



**Fig. 4.1 Recommended installation site for DGPS sensor**

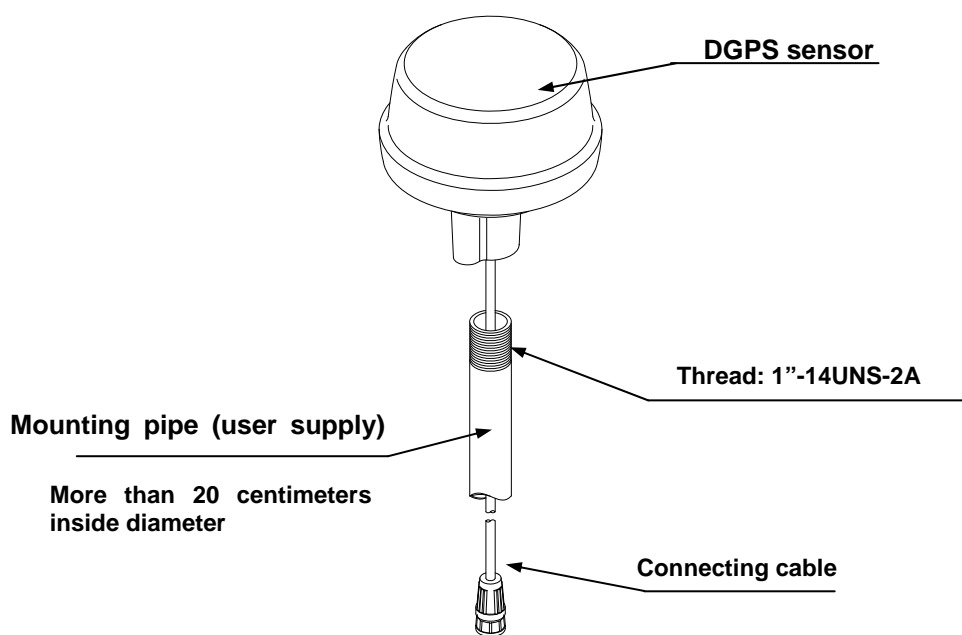
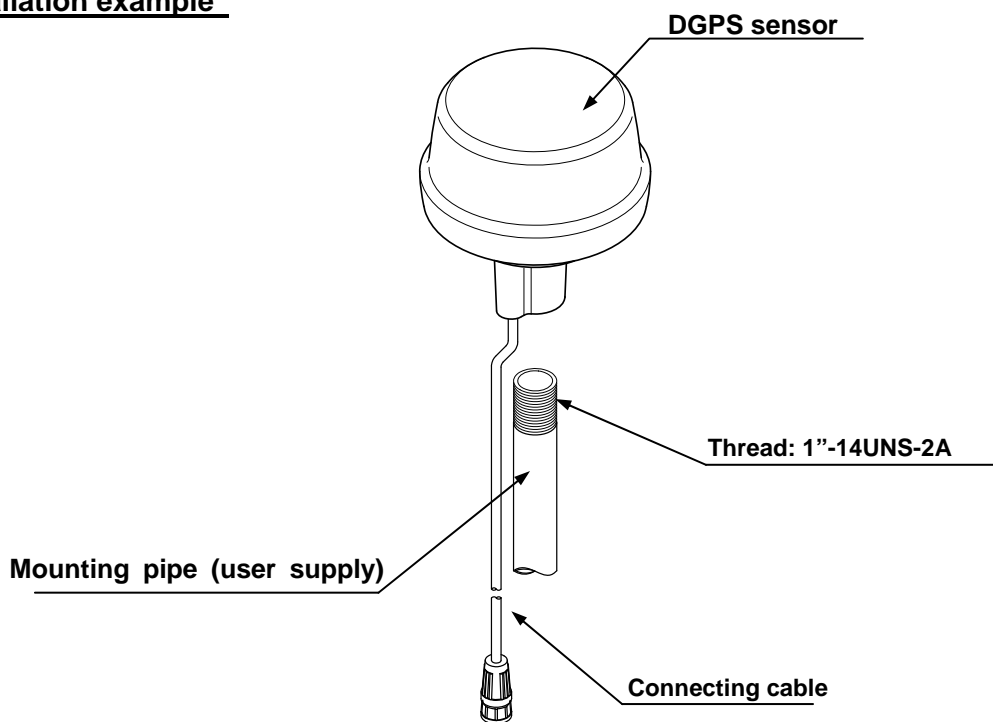
### 4.4 Installation method

The following examples show typical installation methods.

Installation example: The mounting pipe is already screw threaded (1"-14UNS-2A). Fix the cable to the pipe at a constant interval (of about 30 – 40 cm), by using an appropriate tie (See NOTE).

NOTE: A plastic cable tie is subject to deterioration caused by ultraviolet ray, etc. You should use a stainless tie having stable characteristics against the harsh marine environment.

#### Installation example



### **Installation precautions**

- (1) Adhesive plastic sealant or silicone for plastic is recommended for fixing screws.



**Caution: Use of other solvent or anaerobic based-bond may cause cracking of the chassis.**

- (2) Stroke of screw insertion should be up to 25mm.



**Caution: Overtightening of the screw may cause cracking of the chassis.**



## Chapter 5 Technical References

### Contents

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## Chapter 5 Technical References

### 5.1 Details of input/output data

#### 5.1.1 Data type

Baud rate: 4800bps  
 Data bit: 8 bits  
 Parity: None  
 Start bit: 1 bit  
 Stop bit: 1 bit

#### 5.1.2 Input data

##### 5.1.2.1 Various settings

X 0000 <CR><LF>      1 : Header (HEX)  
 1     2     3                2 : Setting value (ASCII code, integer)  
                                  3 : End code

Item to set	Header (hex)	Setting range	Initial setting
Antenna height	10	0-9999m	0
Elevation angle limit	11	0-45°	10
PDOP limit	12	0-30	7
HDOP limit	13	0-20	10
S/N limit	14	0-25	3
Geodetic system	15	00-86	00: WGS-84
Averaging number	16	1-3	3
Lat / Lon units (GGA)	17	0: 0.001, 1: 0.0001 min	0: 0.001
DGPS setting	18	0: OFF, 1: ON (Beacon), 2: ON (SBAS)	1: ON (Beacon)
DGPS time-out	19	10-180 sec	100
Initialization	1E1E1E	_____	_____

**NOTE)**

- Set the PDOP limit to 0 when using 2D positioning.
- The Averaging Number 1 sets for maximum averaging. The Averaging Number 3 sets for minimum averaging.

5.1.2.2 Beacon setting

Note: <CR>: Carriage return <LF>: Line feed

<b>GPMSK</b>	Setting of beacon receiver  <b>\$ GP MSK, xxx.x, A/M, xxx, A/M, xx, *hh &lt;CR&gt;&lt;LF&gt;</b> 
<b>GPCRQ, MSK</b>	MSK sentence output request of beacon receiver  <b>\$ GP CRQ,MSK *2E &lt;CR&gt;&lt;LF&gt;</b> 

5.1.3 Output data

5.1.3.1 Data format

NMEA-0183 Compliance Ver.2.0 \*Ver.1.5 has option

5.1.3.2 Data configuration

Signal speed	Output voltage level	Output current	Output sentence	Update rate
4800 Baud	RS-422	Max. 20 mA	GGA, GLL, VTG, RMC, ZDA PKODA, PKODG,1, PKODG,7 GSA, GSV MSS  MSK (when CRQ is requested)	1 sec 2 secs  1 to 59 secs

5.1.3.3 Details of output sentence

Note: <CR>: Carriage return <LF>: Line feed

<p><b>GPGGA</b></p>	<p><b>GPS positioning data</b></p> <p><b>\$ GP GGA, hhmss, xxxx.xxx, N/S xxxxx.xxx, E/W, x, xx, xxx, 0/- xxxx, M, 0/-xxx, M, xxx, xxxx *hh&lt;CR&gt;&lt;LF&gt;</b></p>
<p><b>GPGLL</b></p>	<p><b>Geographic position (latitude/longitude)</b></p> <p><b>\$ GP GLL, xxxx.xx, N/S, xxxxx.xx, E/W*hh &lt;CR&gt;&lt;LF&gt;</b></p>
<p><b>GPVTG</b></p>	<p><b>Course over ground and ground speed</b></p> <p><b>\$ GP VTG, xxx.x, T, , , xxx.x, N, xxx.x, K*hh &lt;CR&gt;&lt;LF&gt;</b></p>
<p><b>GPRMC</b></p>	<p><b>Minimum specific GPS data (minimum data required by regulations)</b></p> <p><b>\$ GP RMC, hhmss, A, xxxx.xxx, N/S, xxxxx.xxx, E/W, xxx.x, xxx.x, xxxxxx,xxx.x,E/W *hh &lt;CR&gt;&lt;LF&gt;</b></p>

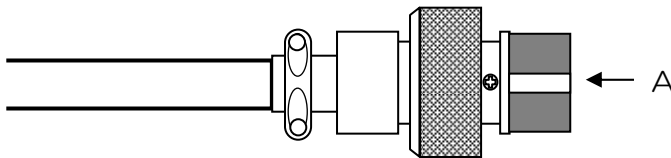
<p><b>GPGSA</b></p>	<p><b>Active satellite and DOP value</b></p> <p><b>\$ GP GSA, A, x, xx, xx, xx, xx, xx, xx, xx, xx, xx, xx, xx, xx, xx, xx, xx, xx, xx, *hh &lt;CR&gt;&lt;LF&gt;</b></p>
<p><b>GPGSV</b></p>	<p><b>Active satellite</b></p> <p><b>\$ GP GSV, x, x, xx, xx, xx, xxx, xx, xx....., xx, xx, xxx, xx*hh &lt;CR&gt;&lt;LF&gt;</b></p>
<p><b>GPZDA</b></p>	<p><b>Time and date</b></p> <p><b>\$ GP ZDA, hhmmss, xx, xx, xxxx, , *hh &lt;CR&gt;&lt;LF&gt;</b></p>
<p><b>PKODA</b></p>	<p><b>Satellite information (KODEN proprietary sentence)</b></p> <p><b>\$ PKODA, P/H, xxx.x, xx, xx, xx, xx, xx, xx, xx, xxx, M, xxx.x, N, xxx.x, 0/-xx.x, x, x &lt;CR&gt;&lt;LF&gt;</b></p>

<p><b>PKODG,1</b></p>	<p><b>Satellite information (KODEN proprietary sentence)</b></p>
	<p><b>\$ PKODG, 1, x, xx, +/-xx, xxx, xx, xx, xx, xx, xx, xx, xx, xx, xx, &lt;CR&gt;&lt;LF&gt;</b></p> <p>Quality indicator 1:GPS positioning 0:Positioning poor</p> <p>Sentence type</p> <p>Satellite ID number</p> <p>Satellite elevation</p> <p>Satellite azimuth</p> <p>Year</p> <p>Month</p> <p>Day</p> <p>Datum</p> <p>Averaging number</p> <p>PDOP limit</p> <p>HDOP limit</p> <p>S/N limit</p> <p>Elevation angle limit</p> <p>Start of sentence</p>
<p><b>PKODG,7</b></p>	<p><b>DGPS information (KODEN proprietary sentence)</b></p>
	<p><b>\$ PKODG, 7, x, x, xxx &lt;CR&gt;&lt;LF&gt;</b></p> <p>Tome-out value (010~180sec)</p> <p>DGPS positioning (1: DGPS ON, 0: DGPS OFF)</p> <p>DGPS (0: OFF, 1: RTCM ON, 2: SBAS ON)</p> <p>Sentence type</p> <p>Start of sentence</p>
<p><b>GPMSK</b></p>	<p><b>Setting condition of beacon receiver</b></p>
	<p><b>\$ GP MSK, xxx.x, A/M,xxx, A/M, &lt;CR&gt;&lt;LF&gt;</b></p> <p>Automatic(A)/Manual(M)</p> <p>Beacon data communication speed (50,100,200 bit/sec)</p> <p>Automatic(A)/Manual(M)</p> <p>Received frequency (283.5~325.0KHz)</p> <p>Sentence type</p> <p>Talker device</p> <p>Start of sentence</p>
<p><b>GPSS</b></p>	<p><b>Received information of beacon receiver</b></p>
	<p><b>\$ GP MSS, , xx, xxx.x, xxx &lt;CR&gt;&lt;LF&gt;</b></p> <p>Beacon data communication speed (50,100,200 bit/sec)</p> <p>Received frequency (283.5~325.0KHz)</p> <p>Signal-to-noise ration (0 to 30dB)</p> <p>This field is not used</p> <p>Sentence type</p> <p>Talker device</p> <p>Start of sentence</p>

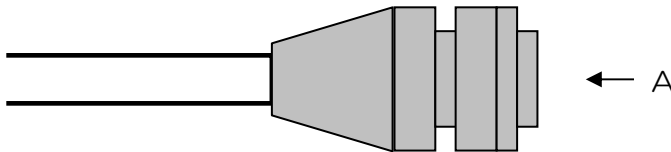
### 5.2 Cable connections and connector pin-outs

There are 2 types of cables for connecting the KBG-3 to external equipment, depending on specifications.

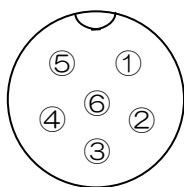
KBG-3-A  
 Cable CW-570-15M  
 Metal connector



KBG-3-B  
 Cable CW-569-15M  
 Plastic connector



#### Connector pin-outs



- |                         |                  |
|-------------------------|------------------|
| ① DC (−) & Shield / GND | : Black / Shield |
| ② Data input (+)        | : Orange         |
| ③ Data input (−)        | : Blue           |
| ④ Data output (+)       | : White          |
| ⑤ Data output (−)       | : Green          |
| ⑥ DC (+)                | : Red            |

Connector pin-outs seen from Plane A



### 5.3 List of geodetic system

Location	No.	Location	No.	No.	Location	No.	Location
Iceland 1955	11	Tunisia	42	00	WGS-84	44	Paraguay
Ireland 1965	12	Diego Garcia	52	01	WGS-72	45	Brazil
Ascension Islands	31	Tern	33	02	Tokyo	46	New Georgian I.
Alaska / Canada	04	Tokyo	02	03	NAD-27	47	Easter Islands
Argentina	39	Tristan	80	04	Alaska/Canada	48	Maldives *
Easter Islands	47	Trinidad/Tobaco	64	05	Europe 1950	49	Guam 1963
Iwo Islands	32	Nigeria	63	06	Australia 1969	50	Guadalcanal
England	20	Japan	24	07	South Asia	51	Hong Kong1963
Italy 1940	15	New Zealand	13	08	South America	52	Diego Garcia
India / Nepal	18	New Georgian Is..	46	09	Greenland	53	Johnston Island
Egypt	66	Barren Islands	27	10	NAD-83	54	Sri Lanka
Ethiopia / Sudan	25	Bermuda Islands 57	37	11	Iceland 1955	55	Kelguelen
NAD-27	03	Paraguay	44	12	Ireland 1965	56	Caiman Black Is
NAD-83	10	Hawaii	21	13	New Zealand	57	Liberia 1964
Efate/ Eromanga	36	East Fauklands 43	76	14	Europe 1979	58	Maha Is. 1971
Eritrea	60	Pitcairn	69	15	Italy 1940	59	Salvage Island
Australia 1969	06	Fiji Islands	81	16	South America	60	Eritrea
Oman	67	Phillipines	19	17	Saudi Arabia	61	Morocco
Caiman Black Is.	56	Finland	84	18	India/Nepal	62	Midway
Qatar	72	Faial/Terceira	78	19	Phillipines	63	Nigeria
Guadalcanal	50	Phoenix Islands	40	20	England	64	Trinidad/Tobaco
Canary Islands	68	Peurto Rico	71	21	Hawaii	65	Corvo/Flores
Guam 1963	49	Taiwan	86	22	Jakarta	66	Egypt
Greenland *	09	Brazil	45	23	Malaysia/Sing.	67	Oman
Kenya	30	Brunei/E-Malaysia	79	24	Japan	68	Canary Islands
Kelguelen	55	Florida/Bahamas	41	25	Ethiopia / Sudan	69	Pitcairn
Cocos Islands	28	Porto Santo/Madeira	77	26	Somalia	70	Southern Chile
Corvo/Flores	65	Hong Kong 1963	51	27	Barren Islands	71	Peurto Rico
Colombia	38	Marcus Islands	35	28	Cocos Islands	72	Qatar
Saudi Arabia	17	Marshall Islands	82	29	Zambia/Zimbabwe	73	Mascarene
Salvage Island	59	Maha Island 1971	58	30	Kenya	74	Santo Island
Santa Maria Is.	75	Mascarene	73	31	Ascension Islands	75	Santa Maria Is.
Santo Island	74	Malaysia/Singapore	23	32	Iwo Islands	76	East Fauklands 43
Zambia/Zimbabwe	29	Midway	62	33	Tern	77	Porto Santo/Madeira
Jakarta	22	South Asia	07	34	St. Helena Island	78	Faial, Terceira
Johnston Island	53	South Africa	16	35	Marcus Islands	79	Brunei/East Malaysia
Sweden	85	South America	08	36	Efate/ Eromanga	80	Tristan
Suriname	83	Southern Chile	70	37	Bermuda Is. 57	81	Fiji Islands
Sri Lanka	54	Maldives	48	38	Colombia	82	Marshall Islands
St. Helena Island	34	Morocco	61	39	Argentina	83	Suriname
Somalia	26	Europe 1950	05	40	Phoenix Islands	84	Finland
WGS-72	01	Europe 1979	14	41	Florida/Bahamas	85	Sweden

WGS-84	00	Liberia 1964	57	42	Tunisia	86	Taiwan
Chatham	43			43	Chatham		

### 5.4 Table of DGPS reference stations

ID	Country	Station name	Latitude	Longitude	Freq. kHz	Bit rate bps	Cov. nm
686	JAPAN	Tsurugizaki	35 ° 08'N	139 ° 41'E	309	200	100
692		Daiozaki	34 ° 17'N	136 ° 54'E	288	200	100
680		Kinkazan	38 ° 17'N	141 ° 35'E	316	200	100
682		Inubousaki	35 ° 42'N	140 ° 52'E	295	200	100
688		Hachijoujima	33 ° 05'N	139 ° 51'E	302	200	100
694		Murotomisaki	33 ° 15'N	134 ° 11'E	295	200	100
706		Toimisaki	31 ° 22'N	131 ° 20'E	309	200	100
704		Oosesaki	32 ° 37'N	128 ° 36'E	302	200	100
702		Wakamiya	33 ° 52'N	129 ° 41'E	295	200	100
670		Hamada	34 ° 53'N	132 ° 02'E	305	200	100
696		Esaki	34 ° 36'N	135 ° 00'E	320.5	200	60
698		Oohama	34 ° 05'N	132 ° 59'E	321	200	60
700		Seto	33 ° 26'N	132 ° 13'E	320	200	60
660		Kusirozaki	42 ° 57'N	144 ° 33'E	288	200	100
662		Abasiri	44 ° 00'N	144 ° 18'E	309	200	100
664		Souyamisaki	45 ° 31'N	141 ° 56'E	295	200	100
666		Syakotanmisaki	43 ° 22'N	140 ° 28'E	316	200	100
668		Matumae	41 ° 25'N	140 ° 05'E	309	200	100
674		Hekurazima	37 ° 51'N	136 ° 55'E	295	200	100
676		Sakata	38 ° 57'N	139 ° 50'E	288	200	100
678		Siriyazaki	41 ° 26'N	141 ° 28'E	302	200	100
672		Tango	35 ° 47'N	135 ° 48'E	316	200	100
684		Urayasu	35 ° 37'N	139 ° 54'E	321	200	30
690		Nagoya	35 ° 02'N	136 ° 51'E	320	200	30
710		Gesaji	26 ° 36'N	128 ° 09'E	288	200	100
712		Miyakojima	24 ° 44'N	125 ° 26'E	316	200	100
708		Tokaranakanosima	29 ° 49'N	129 ° 55'E	320.5	200	100
	BELGUIM	Oostende Phare	51 ° 14'N	002 ° 55'E	312	100	50
		Hasselt	50 ° 56'N	005 ° 20'E	287	100	100
		Oostdyck	51 ° 16'N	002 ° 26'E	311.5	100	59
	BULGALIA	Cavarna	43 ° 25'N	028 ° 22E	300	100	50
452	DENMARK	Blaavandshuk	55 ° 33'N	008 ° 05'E	290	100	150
451		Hammer Odde	55 ° 18'N	014 ° 46'E	289.5	100	178
453		Skagen	57 ° 44'N	010 ° 35'E	296	100	100
454		Torshavn	62 ° 01'N	006 ° 50'W	287.5	100	200
840	ESTONIA	Ristna	58 ° 56'N	022 ° 04'E	307	100	110
		Narva	59 ° 28'N	028 ° 02'E	295.5	100	100
601	FINLAND	Mantyluoto	61 ° 36'N	021 ° 28'E	287.5	100	140
604		Turku	60 ° 26'N	022 ° 13'E	301.5	100	60
603		Outokumpu	62 ° 41'N	026 ° 01'E	304.5	100	40
600		Porkkala	59 ° 58'N	024 ° 23'E	293.5	100	140

602		Puumala	61 ° 24'N	028 ° 14'E	290	100	40
		Marjaniemi	65 ° 02'N	024 ° 35'E	314.5	100	135
		Kuopio	63 ° 00'N	027 ° 30'E	295	100	38
		Savonlinna	61 ° 55'N	028 ° 45'E	286	100	38
		Klamila	60 ° 30'N	027 ° 30'E	287	100	135
		Kokkola	63 ° 50'N	023 ° 10'E	295	100	135
		Porvoo	60 ° 12'N	025 ° 50'E	292.5	100	135
		Vaasa	63 ° 13'N	021 ° 10'E	294	100	135
486	FRANCE	Cap Bear	42 ° 31'N	003 ° 08'E	304.5	100	100
466		Cap Ferret	44 ° 39'N	001 ° 15'W	310	100	100
469		Porquerolles	42 ° 59'N	006 ° 12'E	286.5	100	100
463		Phare de Pen Men	47 ° 39'N	003 ° 30'W	309	100	100
464		Les Sables-d'Olonne	46 ° 31'N	001 ° 48'W	307	100	108
462		Pont de Buis	48 ° 18'N	004 ° 05'W	308.5	100	108
460		Heauville	49 ° 34'N	001 ° 46'W	299	100	
822	GERMANY	Hergoland	54 ° 11'N	007 ° 53'E	298.5	100	154
491		Wustrow	54 ° 20'N	012 ° 23'E	308	100	154
824		Kobblenz	50 ° 22'N	007 ° 35'E	302.5	200	100
763		Zeven	53 ° 17'N	009 ° 15'E	303.5	200	154
764		Ilfesheim	48 ° 50'N	008 ° 07'E	293.5	100	154
765		Bad Abbach	48 ° 56'N	012 ° 02'E	314.5	100	154
766		Mauken	51 ° 43'N	012 ° 49'E	313.5	100	154
412	ICELAND	Bjargtangar	65 ° 30'N	024 ° 31'W	300	100	81
415		Djupivogur	64 ° 39'N	014 ° 17'W	291	100	135
414		Raufarhofn	66 ° 27'N	015 ° 57'W	289.5	100	216
411		Reykjanes	63 ° 49'N	022 ° 43'W	293.5	100	189
413		Skagata	66 ° 07'N	020 ° 06'W	289	100	108
416		Skardsfjara	63 ° 31'N	017 ° 59'W	287	100	189
	LATVIA	Ventspils	57 ° 22'N	021 ° 31'E	308.5	100	
428	NETHERLAND	VLIELAND	53 ° 27'N	005 ° 37'E	294	200	120
650		Hoek VanHolland	51 ° 59'N	004 ° 07'E	312.5	200	120
655		Ameland	51 ° 59'N	004 ° 07'E	299.5	200	120
652		Gilze Rijen	51.37'N	005 ° 31'E	301	200	100
		Ijmuiden Phare	52.28'N	005 ° 35'E	301		49
794	NORWAY	Andenes	69 ° 19'N	016 ° 07'E	311	100	30
500		Faerder	59 ° 01'N	010 ° 31'E	310.5	100	162
790		Halten	64 ° 10'N	009 ° 24'E	301	100	90
797		Frubolmen	71 ° 06'N	023 ° 59'E	309.5	100	30
503		Lista	58 ° 06'N	006 ° 34'E	304	100	162
791		Sklinna	65 ° 12'N	010 ° 50'E	303.5	100	90
793		Skomvaer	67 ° 24'N	011 ° 52'E	286.5	100	90
788		Svinoey	62 ° 19'N	005 ° 16'E	302.5	100	90
796		Torsvaag	70 ° 14'N	019 ° 30'E	284	100	90
505		Utsira	59 ° 18'N	004 ° 52'E	313	100	162

787		Utvaer	61 ° 02'N	004 ° 30'E	314	100	90
800		Vardoe	70 ° 23'N	031 ° 09'E	305.5	100	90
		Jan Mayen	70 ° 57'N	008 ° 40'W	307	100	162
		Torungen	58 ° 23'N	008 ° 47'E	299	100	162
		Bjornaya	74 ° 30'N	019 ° 00'E	301	100	200
		Bellsund	77 ° 43'N	013 ° 57'E	302.5	100	162
		Ekofisk	56 ° 35'N	003 ° 12'E	289	100	100
		Slettnes	71 ° 05'N	028 ° 13'E	288.5	100	162
		Skrova	68 ° 09'N	014 ° 39'E	300	100	162
481	POLAND	Dziwnow	54 ° 01'N	014 ° 44'E	283.5	100	81
482		Rozewie	54 ° 49'N	018 ° 20'E	301	100	70
		Jaroslawiec	54 ° 33'N	016 ° 33'E	295	100	49
504	SPAIN	Estaca de Bares	43 ° 47'N	007 ° 41'W	293	100	180
514		Cabo Gata	36 ° 43'N	002 ° 11'W	298.5	100	
		Pnt Liobregat	41 ° 19'N	002 ° 39'E	288.5	100	
518		Cabo de Nao	38 ° 44'N	000 ° 14'E	297.5	100	100
516		Cabo de Palos	37 ° 38'N	000 ° 41'W	302	100	100
502		Cabo Pennas	43 ° 39'N	005 ° 51'W	295	100	100
526		Cabo Salou	41 ° 03'N	001 ° 10'E	291	100	100
528		Cabo San Sebastian	41 ° 53'N	003 ° 12'E	313.5	100	100
524		Castellon	39 ° 58'N	000 ° 01'E	286	100	100
		Punta Sila	43 ° 24'N	004 ° 25'W	289	100	100
500		Machichaco	43 ° 27'N	002 ° 45'W	285	100	100
522		Mahon	39 ° 52'N	004 ° 18'E	293	100	100
512		Malaga	36 ° 43'N	004 ° 25'W	299.5	100	100
508		Rota	36 ° 38'N	006 ° 23'W	303.5	100	100
		Tarifa	36 ° 00'N	005 ° 36'W	302.5	100	100
530		La Entallada	28 ° 13'N	013 ° 56'W	284	100	100
520		Cala Figuera	39 ° 27'N	002 ° 31'E	294.5	200	50
506		Cabo Finisterre	42 ° 53'N	009 ° 16'W	296	100	
		P Rosca	28 ° 01'N	016 ° 33'W	285	100	
461	SWEDEN	Bjuroklubb	64 ° 29'N	021 ° 34'E	311.5	100	100
467		Hjortons Udde	58 ° 38'N	012 ° 40'E	302	100	68
465		Hoburg	56 ° 55'N	018 ° 09'E	297.5	100	90
466		Kullen	56 ° 18'N	012 ° 27'E	293	100	127
469		Goteborg	57 ° 30'N	011 ° 56'E	296.5	100	130
463		Orskar	60 ° 37'N	017 ° 26'E	299.5	100	90
462		Jamas	63 ° 29'N	019 ° 39'E	289	100	100
		Njurunda	62 ° 17'N	017 ° 23'E	288.5	100	100
		Nynashamn	58 ° 56'N	017 ° 57'E	298	100	130
460		Holmsjo	56 ° 26'N	015 ° 39'E	292	100	130
		Kapellskar	59 ° 43'N	019 ° 04'E	307.5	100	130
		Otterbacken	58 ° 52'N	017 ° 26'E	288.5	100	130
480	ARABIAN	Bahrain	28 ° 07'N	050 ° 39'E	298	200	250

283	KUWAIT	Mina Al Ahmadi	29 ° 07'N	048 ° 08'E	295	200	250
484	UAE	Ras Al Khaimah	25 ° 59'N	056 ° 04'E	292	200	250
486		Abu Dhabi	24 ° 06'N	052 ° 56'E	314	200	250
670	IRELAND	Tory Island	55 ° 16'N	008 ° 15'W	288.5	100	150
660		Mizen Head	51 ° 27'N	009 ° 49'W	284	100	100
665		Loop Head	52 ° 34'N	009 ° 56'W	293	100	100
		Wicklow head	52 ° 58'N	006 ° 00'W	306.5	100	100
681	ENGLAND	Lizard	49 ° 57'N	005 ° 12'W	306	100	100
680		St.Catherines	50 ° 35'N	001 ° 18'W	307.5	100	100
688		North Foreland	51 ° 23'N	001 ° 27'W	299.5	100	100
687		Flamborough	54 ° 07'N	000 ° 05'W	290.5	100	100
682		Point Lynas	53 ° 25'N	004 ° 17'W	297.5	100	100
689		Nash Point	51 ° 24'N	003 ° 33'W	309.5	100	100
		Wormleighton	52 ° 12'N	001 ° 22'W	291	100	100
446	SCOTLAND	Girdle Ness	57 ° 08'N	002 ° 03'W	297	100	150
444		Butt of Lewis	58 ° 31'N	006 ° 16'W	295.5	200	100
445		Sumburgh Head	59 ° 51'N	001 ° 16'W	291.5	100	200
		Stirling	56 ° 04'N	004 ° 04'W	285.5	100	100
		Duncansby Head	58 ° 39'N	003 ° 01'W	286.5	100	200
608	CHINA	Beitang	39 ° 07'N	119 ° 43'E	310.5	200	160
606		Qing Huang Dao	39 ° 55'N	119 ° 37'E	287.5	200	160
602		Da San Shan	38 ° 52'N	121 ° 50'E	301.5	100	160
614		Wang Jia Mai Dao	36 ° 04'N	120 ° 26'E	313.5	200	160
652		Bao Hu	20 ° 00'N	110 ° 56'E	310.5	200	160
612		Cheengshanjiao	37 ° 24'N	122.41'E	317	200	160
624		Dajishan	30 ° 49'N	122 ° 10'E	307.5	200	160
626		Dinghai	30 ° 01'N	122 ° 04'E	310	200	160
646		Fangchen	21 ° 35'N	108 ° 19'E	287	200	160
622		Haozhigang	32 ° 01'N	121 ° 43'E	304	200	160
640		Luyu	23 ° 20'N	116 ° 45'E	317	200	160
644		NaoZhoudeao	20 ° 54'N	110 ° 36'E	301	200	160
654		Sanya	18 ° 17'N	109 ° 22'E	295	200	160
642		Sanzao	22 ° 00'N	113 ° 24'E	307	200	160
628		Shitang	28 ° 16'N	121 ° 37'E	295	200	160
630		Tiandashan	25 ° 28'N	119 ° 42'E	313	200	160
656		Yanggpu	19 ° 43'N	109 ° 12'E	313	200	160
620		Yanweigang	34.29'N	119 ° 47'E	291	200	160
632		Zhenhaijiao	24.16'N	118 ° 08'E	320	200	160
604		Laotieshan	38.44'N	121 ° 08'E	307.5	200	160
	HONG KONG	Kau Yi Chau	22 ° 15'N	114 ° 04'E	289	200	100
720	KOREA	Yongdo	35 ° 02'N	129 ° 05'E	300	200	100
722		Palmido	37 ° 21'N	126 ° 30'E	313	200	100
724		Komundo	34 ° 00'N	127 ° 19'E	287	200	100
726		Chumunjin	37 ° 53'N	128 ° 50'E	295	200	100

728		Ochongdo	36 ° 07'N	125 ° 58'E	295	200	100
732		Changgiot	36 ° 04'N	129 ° 34'E	310	200	100
		Marado	33 ° 06'N	126 ° 16'E	290	200	100
		Ullungdo	37 ° 31'N	130 ° 47'E	319	200	100
		Chukto	34 ° 13'N	125 ° 58'E	290	100	100
757		Chuncheon	37 ° 59'N	127 ° 42'E	286	200	43
753		Chungju	36 ° 58'N	127 ° 45'E	318	200	43
755		Seongju	35 ° 55'N	128 ° 15'E	296	200	43
749		Yeongju	36 ° 51'N	128 ° 32'E	289	200	43
751		Pyeongchang	37 ° 20'N	128 ° 29'E	303	200	43
740		Cheojin	38 ° 33'N	128 ° 23'E	292	200	43
747		Muju	35 ° 45'N	127 ° 34'E	322	200	43
	MALAYSIA	Kuching	01 ° 43'N	110 ° 31'E	305	200	100
		Bintulu	03 ° 11'N	113 ° 00'E	310	200	100
		Uttan	19 ° 16'N	072 ° 46'E	286	100	300
	SINGAPORE	Singapore	01 ° 09'N	103 ° 44'E	298	100	100
	EGYPT	Alexandria	31 ° 10'N	029 ° 50'E	284	200	100
		Mersa Matroh	31 ° 21'N	027 ° 14'E	307	200	100
		Port Said	31 ° 16'N	031 ° 17'E	290	200	100
		Ras Umm Sid	27 ° 51'N	034 ° 18'E	293.5	200	100
		Ras Gharib	28 ° 21'N	033 ° 06'E	298	200	100
		Quseir	26 ° 08'N	034 ° 15'E	314.5	200	100
700	AUSTRALIA	Cape Schanck	38 ° 30'S	144 ° 53'E	314	200	100
702		Horn Island	10 ° 36'S	142 ° 18'E	320	200	100
701		Karratha	20 ° 45'S	116 ° 27'E	304	200	100
705		Cape Flattery	14 ° 58'S	145 ° 18'E	304	200	180
704		Mackay	21 ° 06'S	149 ° 12'E	315	200	100
703		Sydney	33 ° 59'S	150 ° 58'E	308	200	100
707		Brisbane	27 ° 04'S	153 ° 03'E	294	200	100
709		Weipa	13 ° 00'S	141 ° 50'E	316	200	
706		Gladstone	24 ° 02'S	151 ° 21'E	313	200	100
708		Ingham	18 ° 33'S	146 ° 18'E	306	200	
710		Corny Point	34 ° 53'S	137 ° 01'E	316	200	
		Albany	35.05S	117 ° 54E	315	200	200
		Perth	31.47S	115 ° 55E	306	200	200
201	SOUTH AFRICA	Cape Columbine	32 ° 49'S	017 ° 51'E	310	100	150
203		Cape Agulhas	34 ° 49'S	020 ° 00'E	301	100	120
205		Cape Recife	34 ° 01'S	025 ° 42'E	291	100	150
208		Cooper	29 ° 56'S	031 ° 00'E	292	100	100
		Cape Point	34.21'S	018 ° 29'E			
	RUSSIA	Africa	56 ° 11'N	163 ° 21'E	291.5	100	35
		Alevina	58 ° 50'N	151 ° 21'E	303.5	100	130
		Anapsky	44 ° 53'N	037 ° 18'E	315.5	100	170
		Andrea	76 ° 44'N	110 ° 27'E	291.5	100	180

		Astrahnasky	44 ° 28'N	048 ° 01'E	291.5	100	100
		Baltiysk	54 ° 38'N	019 ° 54'E	286.5	100	
		Begichev	47 ° 31'N	112 ° 15'E	300.5	100	90
		Camenka	69 ° 28'N	161 ° 14'E	318.5	100	100
		Canin-Nose	68 ° 38'N	043 ° 18'E	285.5	100	100
		Caraginsky	58 ° 33'N	163 ° 33'E	301.5	100	100
		Corsakovsky	46 ° 37'N	142 ° 48'E	312.5	100	100
		Cotelny	75 ° 59'N	137 ° 53'E	310.5	100	100
		Crutogorova	55 ° 05'N	155 ° 35'E	300.5	100	100
		Dedgneva	66 ° 01'N	169 ° 43'E	303.5	100	100
		Dgedginsky	65 ° 13'N	036 ° 49'E	298.5	100	100
		Elizarova	54 ° 25'N	143 ° 43'E	318.5	100	100
		Enisey	68 ° 25'N	086 ° 18'E	315.5	100	100
		Gamov	42 ° 33'N	131 ° 13'E	306.5	100	95
		Indygirsky	71 ° 16'N	150 ° 17'E	324.5	100	100
		Oleniy	72 ° 35'N	077 ° 39'E	294.5	100	90
		Petropavlovsky	52 ° 33'N	158 ° 42'E	291.5	100	35
		Russian Cat	64 ° 34'N	178 ° 33'E	315.5	100	100
		Set.Navolock	69 ° 24'N	033 ° 03'E	318.5	100	100
		Shepelevskiy	59 ° 59'N	029 ° 09'E	298.5	100	100
		Sterlegov	75 ° 24'N	088 ° 45'E	318.5	100	100
		Stolbovoy	74 ° 10'N	135 ° 27'E	306.5	100	100
		Tonky	69 ° 51'N	061 ° 06'E	303.5	100	100
		Van-Der-Linda	45 ° 35'N	149 ° 24'E	312.5	100	100
		Vasilieva	50 ° 00'N	155 ° 23'E	294.5	100	100
		Vize	79 ° 30'N	076 ° 59'E	294.5	100	100
		Vrangelia	70 ° 59'N	178 ° 29'E	309.5	100	100
		Yarangai	69 ° 54'N	170 ° 32'E	291.5	100	100
		Gorkovsky	59 ° 50'N	030 ° 10'E	288.5		54
		Kodoshskiy	44 ° 06'N	039 ° 02'E	289.5		108
		Novorossiyykay 01	44 ° 36'N	037 ° 58'E	292		108
		Novorossiyykay 02	44 ° 36'N	037 ° 58'E	315		108
		Taganrogsky	47 ° 12'N	038 ° 57'E	310	100	108
		Temiryukskiy	45 ° 20'N	037 ° 14'E	285		108
338	CANADA	Cape Race	46 ° 46'N	053 ° 11'W	315	200	280
340		Cape Ray	47 ° 38'N	059 ° 14'W	288	200	188
336		Fox Island	45 ° 19'N	061 ° 04'W	307	200	161
316		Lauzon	46 ° 48'N	071 ° 09'W	309	200	125
320		Moisie	50 ° 12'N	066 ° 07'W	313	200	100
326		Partridge Island	45 ° 14'N	066 ° 03'W	295	200	161
280		Biorka Island,AK	56 ° 51'N	135 ° 32'W	305	100	
332		Point Escuminac	47 ° 04'N	064 ° 47'W	319	200	161
		Point Patrie	43 ° 50'N	077 ° 09'W	303	100	25
		Port aux Basques	47 ° 34'N	059 ° 09'W	290	100	



		Port Weller	43 ° 14'N	079 ° 13'W	302	100	25
042		C2cen ,Portsmouth,VA	36 ° 52'N	076 ° 21'W	313	200	75
344		Rigolet	54 ° 15'N	058 ° 30'W	299	200	161
		Sombra	42 ° 43'N	082 ° 29'W	306	100	15
312		St.Jean sur Richelieu	45 ° 19'N	073 ° 18'W	296	200	100
		Triple Island	54 ° 17'N	130 ° 52'W	308	100	
		Trois Riveres	46 ° 23'N	072 ° 27'W	321	200	85
334		Western Head	43 ° 59'N	064 ° 39'W	312	200	161
300		Alert Bay	50 ° 35'N	126 ° 55'W	309	200	450
302		Amphitrite Point,B.C	48 ° 55'N	125 ° 32'W	315	200	350
304		Richmond,BC	49 ° 20'N	123 ° 16'W	320	200	75
306		Sandspit,B.C	53 ° 14'N	131 ° 48'W	300	200	450
308		Cardinal,ON	44 ° 47'N	075 ° 25'W	306	200	250
005		Bassano,AB**	50 ° 47'N	112 ° 27'W	325	200	250
318		Riviere-DU	47 ° 45'N	069 ° 36'W	300	200	250
310		Wiaraton,ON	44 ° 44'N	081 ° 06'W	286	200	100
003		Winnipeg,MB	49 ° 50'N	097 ° 30'W	312	200	100
		Watrous,SK*	50 ° 40'N	105 ° 26'W	321	200	250
		Cranberry Island	45 ° 19'N	060 ° 55'W	286	100	
		East Point	46 ° 27'N	061 ° 58'W	314	100	
342		Cape Norman,NFLD	51 ° 30'N	055 ° 49'W	310	200	188
330		Hartlen Point NS	44 ° 36'N	063 ° 27'W	298	200	188
146	USA	Clark,SD	44 ° 55'N	097 ° 57'W	309	100	215
144		Hartsville	36 ° 24'N	086 ° 05'W	317	100	116
036		Savannah,GA	32 ° 08'N	081 ° 42'W	319	100	160
148		Whitney,NE	42 ° 44'N	103 ° 19'W	310	100	245
012		Cape Henry,VA	36 ° 55'N	076 ° 00'W	289	100	100
256		Chico,VA	39 ° 25'N	121 ° 36'W	318	100	218
050		Hackleburg,AL	34 ° 17'N	087 ° 52'W	307	100	100
		Lexington,NC	35 ° 49'N	080 ° 14'W	303	200	100
040		Alexandria,VA	38 ° 45'N	077 ° 07'W	305	100	35
048		Macon,GA	32 ° 41'N	083 ° 34'W	301	200	162
278		Annette Island,AK	55 ° 04'N	131 ° 36'W	323	100	170
032		Aransas Pass,TX	27 ° 50'N	097 ° 04'W	304	100	180
		Barber Point,HI	21 ° 18'N	158 ° 07'W	325	100	
280		Biorka Island,AK	56 ° 51'N	135 ° 32'W	305	100	170
044		Penobscot,ME	44 ° 27'N	068 ° 46'W	290	200	235
042		Brunswick,ME	43 ° 53'N	069 ° 57'W	316	100	175
006		Moriches,NY	40 ° 47'N	072 ° 48'W	293	100	100
018		Cape Canaveral,FL	28 ° 27'N	080 ° 32'W	289	100	200
		Cape Chiniak,AK	57 ° 37'N	152 ° 10'W	313	100	150
010		Cape Henlopen,DE	38 ° 46'N	075 ° 05'W	298	200	180
012		Driver,VA	36 ° 57'N	076 ° 33'W	289	100	130
288		Cape Hinchbrook,AK	60 ° 14'N	146 ° 39'W	292	100	120

270		Cape Mendocino,CA	40 ° 26'N	124 ° 24'W	292	100	180
112		Cheboygan,MI	45 ° 39'N	084 ° 28'W	292	200	100
016		Charleston,SC	32 ° 46'N	079 ° 51'W	298	100	150
004		Chatham,MA	41 ° 40'N	069 ° 57'W	325	200	95
296		Cold Bay,AK	55 ° 06'N	162 ° 42'W	289	100	180
116		Detroit,MI	42 ° 18'N	083 ° 06'W	319	200	90
110		Neebish Island,MI	46 ° 19'N	084 ° 09'W	309	200	95
024		Egmont Key,FL	27 ° 36'N	082 ° 46'W	312	200	210
028		English Turn,LA	29 ° 53'N	089 ° 57'W	293	200	170
014		Ft Macon,NC	34 ° 42'N	076 ° 41'W	294	100	130
272		Ft Stevens,OR	46 ° 12'N	123 ° 57'W	287	100	180
030		Galveston,TX	29 ° 20'N	094 ° 44'W	296	100	180
284		Gustavus,AK	58 ° 25'N	135 ° 42'W	288	100	170
292		Kenai,AK	60 ° 40'N	151 ° 21'W	310	100	140
022		Key West,FL	24 ° 34'N	081 ° 39'W	286	100	110
294		Kodiak,AK	57 ° 37'N	152 ° 12'W	313	100	180
260		Kokole Pt.,HI	21 ° 59'N	159 ° 46'W	300	200	300
152		Memphis,TN	35 ° 28'N	090 ° 12'W	310	200	100
020		Miami,FL	25 ° 44'N	080 ° 10'W	322	100	75
160		Miller's Ferry,AL	32 ° 05'N	087 ° 24'W	320	200	130
106		Milwaukee,WI	43 ° 00'N	087 ° 53'W	297	100	120
026		Mobile Point,AL	30 ° 14'N	088 ° 01'W	300	100	170
006		Montauk Point,NY	41 ° 04'N	071 ° 52'W	293	100	130
110		Pickford,MI	46 ° 03'N	084 ° 21'W	309	200	50
096		Brainerd,MN	46 ° 22'N	094 ° 13'W	292	100	
		Nikishka,AK	60 ° 44'N	151 ° 22'W	310	100	150
266		Pigeon Pt.,CA	37 ° 11'N	122 ° 24'W	287	100	135
264		Vandenberg AFB,CA	34 ° 49'N	120 ° 33'W	321	100	180
268		Point Blunt,CA	37 ° 51'N	122 ° 25'W	310	200	60
262		Point Loma,CA	32 ° 40'N	117 ° 15'W	302	100	180
002		Portsmouth,NH	43 ° 04'N	070 ° 43'W	288	100	100
290		Potato Pt.,AK	61 ° 04'N	146 ° 42'W	298	100	100
		Presque Ile,MI	45 ° 21'N	083 ° 30'W	293	100	70
274		Robinson Pt.,WA	47 ° 23'N	122 ° 22'W	323	200	60
114		Saginaw Bay,MI	43 ° 38'N	083 ° 50'W	301	100	70
008		Sandy Hook,NJ	40 ° 28'N	074 ° 01'W	286	200	100
		San Juan,PR	18 ° 00'N	060 ° 00'W	295	100	100
		Seul Choix Pt.,MI	45 ° 55'N	085 ° 55'W	322	200	95
		St.Davids Head	32 ° 22'N	064 ° 39'W	323	100	100
154		St.Louis,MO	38 ° 37'N	089 ° 46'W	322	200	100
104		Sturgeon Bay,WI	44 ° 48'N	087 ° 19'W	314	100	95
258		Upolu Pt.,HI	20 ° 15'N	155 ° 53'W	286	100	170
102		Upper Keweenaw,MI	47 ° 14'N	088 ° 38'W	298	100	130
150		Vicksburg,MS	32 ° 20'N	090 ° 55'W	313	200	100

276		Whidbey Is.,WA	48 ° 19'N	122 ° 42'W	302	100	90
108		Whitefish Pt.,MI	46 ° 46'N	084 ° 57'W	318	100	70
038		Wildwood,NJ	38 ° 57'N	074 ° 51'W	301	200	75
100		Wisconsin Point,WI	46 ° 42'N	092 ° 01'W	296	100	150
118		Youngstown,NY	43 ° 14'N	078 ° 58'W	322	100	130
034		Isabella,PR	18 ° 28'N	067 ° 04'W	295	100	125
164		Kansas city,MO	39 ° 07'N	095 ° 24'W	305	200	100
156		Rock Island,IL	42 ° 00'N	090 ° 14'W	311	200	130
162		SALLISAW,OK	35 ° 22'N	094 ° 49'W	299	200	140
158		St.paul,MN	44 ° 18'N	091 ° 54'W	317	200	130
172		Appleton	45 ° 47'N	121 ° 19'W	300	100	217
168		Louisville,KY	38 ° 00'N	085 ° 18'W	290	200	130
166		Omaha,NE	41 ° 46'N	095 ° 54'W	298	200	145
170		Reedy Point,DE	39 ° 33'N	075 ° 34'W	309	200	62
098		Onondaga,MI	42 ° 48'N	084 ° 27'W	296	200	95
264		Point Arguello,CA	34 ° 38'N	120 ° 38'W	321	100	75
314		Trios-Rivieres,QC	46 ° 23'N	072 ° 27'W	321	200	75
198		Acushnet,MA	41 ° 45'N	070 ° 53'W	306	200	200
054		Albuquerque,NM	34 ° 57'N	106 ° 30'W	291	100	150
246		Angleton,TX	29 ° 18'N	095 ° 29'W	301	100	150
058		Annapolis,MD	39 ° 00'N	076 ° 37'W	301	200	157
074		Austin,NV	39 ° 23'N	117 ° 18'W	312	100	135
084		Bakersfield,CA	35 ° 08'N	119 ° 07'W	305	100	150
062		Billings,MT	45 ° 58'N	108 ° 00'W	313	100	216
136		Bobo,MS	34 ° 07'N	090 ° 41'W	297	200	138
064		Flagstaff,AZ	35 ° 13'N	111 ° 49'W	319	100	243
046		Greensboro	36 ° 04'N	079 ° 45'W	303	100	108
130		Hagerstown,MD	39 ° 33'N	077 ° 43'W	307	100	135
184		Hawk Run,PA	40 ° 53'N	078 ° 11'W	291	100	162
094		Hudson Falls	43 ° 16'N	073 ° 32'W	324	200	135
192		Kensington,SC	33 ° 29'N	079 ° 21'W	292	100	108
282		Level Island,AK	56 ° 28'N	133 ° 05'W	295	100	170
210		Lincoln,CA	38 ° 51'N	121 ° 21'W	314	200	122
264		Lompoc,CA	34 ° 50'N	120 ° 34'W	321	100	180
176		Medora,ND	46 ° 54'N	103 ° 16'W	325	100	175
174		Myton,UT	40 ° 06'N	110 ° 03'W	303	100	150
196		New Bern,NC	35 ° 11'N	077 ° 03'W	294	100	140
254		Pahoa,HI	19 ° 31'N	154 ° 58'W	290	100	125
096		Pine River,MN	46 ° 52'N	094 ° 43'W	292	100	135
060		Polson,MT	47 ° 40'N	114 ° 07'W	287	100	162
200		Pueblo,CO	38 ° 17'N	104 ° 21'W	307	100	108
214		Seneca,OR	44 ° 10'N	119 ° 04'W	310	100	162
068		Spokane,WA	47 ° 31'N	117 ° 25'W	316	100	162
052		Summerfield,TX	34 ° 49'N	102 ° 30'W	318	100	200

244		Tampa,FL	27 ° 51'N	082 ° 32'W	312	200	210
202		Topeka,KS	39 ° 03'N	096 ° 02'W	289	200	200
296		Dandridge	55 ° 11'N	162 ° 42'W	289	100	180
066		Essex	34 ° 45'N	115 ° 14'W	298	100	180
138		Klamath Falls	42 ° 17'N	121 ° 40'W	294	100	190
218		Mequon	43 ° 12'N	088 ° 04'W	304	200	125
	BERMUDA	St.Davids Head	32 ° 22'N	064 ° 39'W	323	100	100
	BRAZIL	Abrolhos	17 ° 58'S	038 ° 41'W	290	100	100
		Santa Marta	28 ° 36'S	048 ° 49'W	310	100	100
		Canivete	00 ° 30'S	050 ° 24'W	310	100	100
		Moela	24 ° 03'S	046 ° 16'W	305	100	100
		Sao Marcos*	02 ° 29'S	044 ° 18'W	300	100	100
		Rio Grande	32 ° 08'S	052 ° 06'W	290	100	100
		Sao Tom	22 ° 02'S	041 ° 03'W	300	100	100
		Calcanhar	05 ° 09'S	035 ° 29'W	305	100	100
		Aracaju	10 ° 58'S	037 ° 02'W	320	100	100
		Lilha Rasa	26 ° 00'S	043 ° 06'W	315	100	100
468		Sergipe	10 ° 58'S	037 ° 02'W	320	100	
001	ARGENTINA	San Carlos Centro	31 ° 58'S	060 ° 55'W	297.5	200	115
002		Bolivar	36 ° 22'S	060 ° 03'W	317.5	200	100
	PORTUGAL	Cabo Carvoeiro	39 ° 22'N	009 ° 24'W	311.5	200	200
		S Vicente	37 ° 01'N	008 ° 57'W	305.5	200	200
		Horta	38 ° 32'N	028 ° 37'W	308	200	300
		Porto Santo	33 ° 04'N	016 ° 21'W	287.5	200	200
		Leca	41 ° 12'N	008 ° 42'W	290		100
		S Miguel	37 ° 44'N	025 ° 39'W	312.5		200
	PANAMA	Gatun	09 ° 15'N	079 ° 56'W	307	200	90
		Miraflore	08 ° 59'N	079 ° 35'W	302	200	90
410	INDIA	Aguada	15 ° 29'N	073 ° 46'E	288	100	100
428		Dolphin's Nose	17 ° 40'N	083 ° 17'E	295	100	100
438		Keating Point	09 ° 15'N	092 ° 46'E	317	100	100
418		Minicoy Island	08 ° 15'N	073 ° 01'E	306	100	100
400		Okha	22 ° 28'N	069 ° 04'E	296	100	100
414		Periyar	10 ° 11'N	076 ° 09'E	301	100	100
422		Pondicherry	11 ° 54'N	079 ° 49'E	315	100	100
434		Sagar Island	21 ° 39'N	088 ° 02'E	318	100	100
412		Suratkal Point	13 ° 00'N	074 ° 47'E	320	100	100
406		Után Point	19 ° 16'N	072 ° 47'E	306	100	100
402		Porbandar	21 ° 37'N	069 ° 37'E	293	100	100
420		Ratnagiri	16 ° 59'N	073 ° 16'E	308	100	100
426		Nagapatinam	10 ° 46'N	079 ° 51'E	323	100	100
432		Krishnapatnam	14 ° 15'N	080 ° 07'E	297	100	100
424		Pandiyan Thivu	08 ° 47'N	078 ° 12'E	309	100	100
440		Paradip	20 ° 15'N	086 ° 39'E	290	100	100

436		Antervedi	16 ° 19'N	081 ° 44'E	320	100	100
444		Indira Point	06 ° 45'N	093 ° 50'E	303	100	100
404		Gopnath	21 ° 12'N	072 ° 06'E	299	100	100
498		Hazira	21 ° 06'N	072 ° 39'E	314	100	100
430		Pulicat	13 ° 25'N	080 ° 20'E	319	100	100
442		East Island	13 ° 38'N	093 ° 03'E	313	100	100
475	FRENCH GUIANA	Cayenne	04 ° 57'N	052 ° 19'W	307	100	108
	ITALY	Ferro	41 ° 09'N	009 ° 31'E	298	100	150
		Messina	38 ° 12'N	015 ° 36'E	295	100	150
		Piombino	42 ° 55'N	010 ° 37'E	304	100	150
		S.Maria de Leuca	39 ° 47'N	018 ° 22'E	292	100	150
		S.Vito lo Capo	38 ° 11'N	012 ° 44'E	306.5	100	150
		Trieste	45 ° 41'N	013 ° 46'E	284.5	100	150
		Vieste	41 ° 53'N	016 ° 11'E	292.5	100	150
		Piombino	42 ° 55'N	010 ° 37'E	304	100	108
		Punta della Maestra	45 ° 10'N	012 ° 19'E	298.5	100	81
		S.Maria di Leuca	39 ° 45'N	018 ° 22'E	292	100	108
		Trieste	45 ° 41'N	013 ° 46'E	284.5		150
		Vieste	41 ° 53'N	016 ° 11'E	292.5		150
	LITHUANIA	Kleipada	55 ° 43'N	021 ° 05'E	304.5	200	50
		Nida	55 ° 18'N	021 ° 00'E	315.5		20
	NEW ZEALAND	Whangaparao	36 ° 36'S	174 ° 50'E	294		
961	SAUDI ARABIA	Jeddah	21 ° 28'N	039 ° 08'E	320	200	248
962		Gizan	16 ° 53'N	042 ° 32'E	324	200	248
943	SRI LANKA	Barbery	06 ° 27'N	079 ° 58'E	300	200	200
941		Colombo	06 ° 57'N	079 ° 57'E	295	200	200
944		Dondra	05 ° 55'N	080 ° 35'E	305	200	200
	TUNISIA	Cap Bon	37 ° 04'N	011 ° 03'E	296.5		
	TURKEY	Kefken	41 ° 13'N	030 ° 17'E	287		
		Kerempe	42 ° 01'N	033 ° 20'E	286.5		
		Mehmetcik	40 ° 02'N	026 ° 10'E	286		
		Mersin	36 ° 47'N	034 ° 37'E	288		
		Mugla	37 ° 02'N	028 ° 10'E	283.5		
		Rumeli	41 ° 13'N	029 ° 06'E	289		
086	UKRAINE	Khersonesskiy	44 ° 35'N	033 ° 23'E	283.5		60
		Mys Aytodorskiy	44 ° 26'N	034 ° 08'E	284.5		60
		Mys Tarkhankutiskiy	45 ° 21'N	032 ° 30'E	295.5		108
086		Odes'ky	46 ° 23'N	030 ° 45'E	297	200	95
		Ostrov Zmeiny	45 ° 15'N	030 ° 12'E	294.5		108
		Yenikalskiy	45 ° 23'N	036 ° 39'E	288		108



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