DATA BUOY

ENVIRTECH DEEP SEA MKI-2

"TECHNICAL SPECIFICATIONS"

Envirtech SpA
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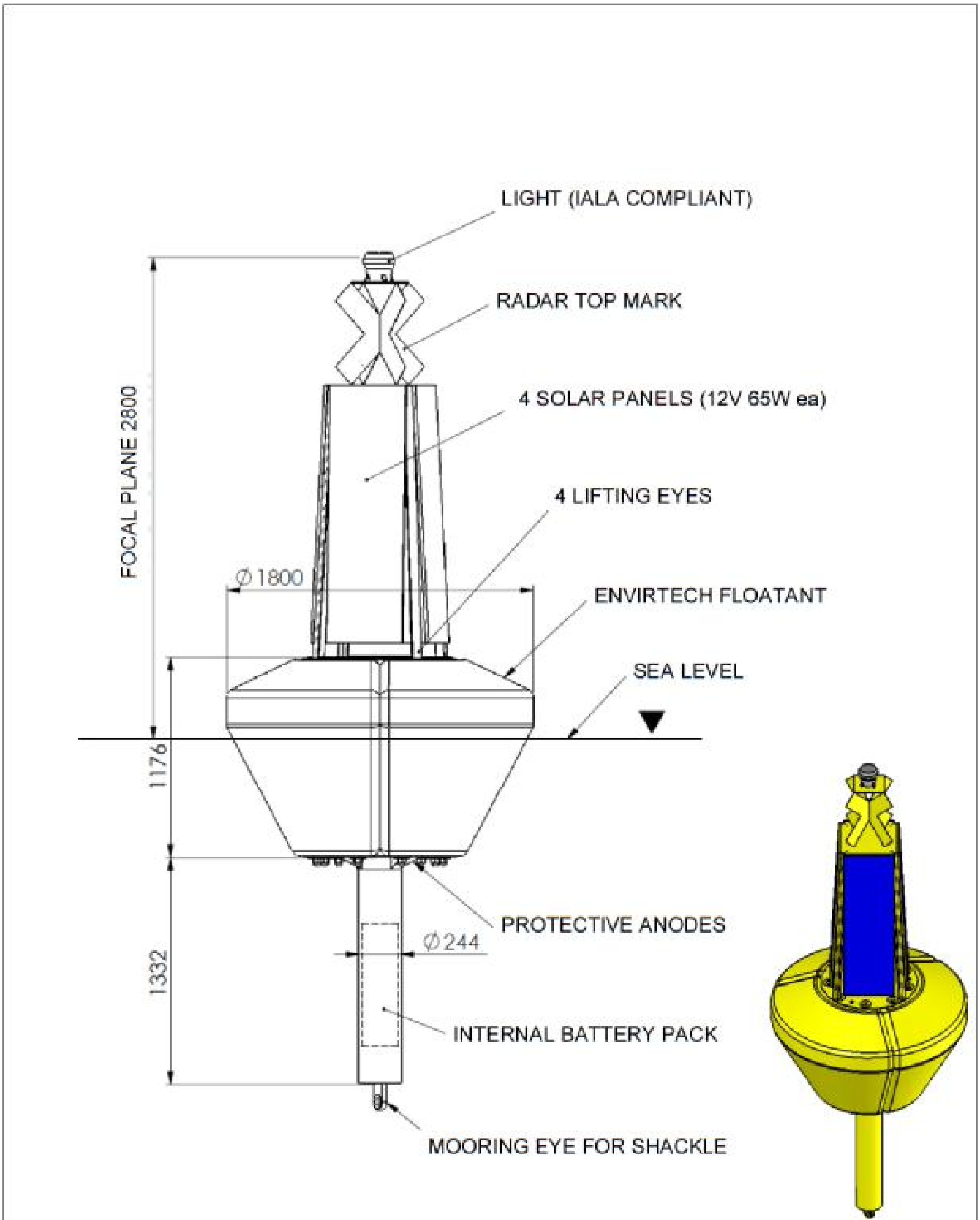
1 Introduction

The *Envirtech DEEP SEA MKI-2* data buoy is a general purpose platform to be used in any physical oceanography application. The buoy has been designed to assure the best available performance in directional sea waves measurement as well as meteorologic and water quality data gathering. The buoy hull shape (*Patend pending*) is a special truncated cone in rotational moulded Polyester consisting of three parts to consent an easy transportation. The special shape has been determined by computation and tests realized by Envirtech together University of L'Aquila in 2007. The buoy's backbone is a stainless steel (AISI316) pole crossing the buoyant and hosting the ballast in the lower part. The buoy top contains the payload and battery pack. A top frame hosts Solar panels, meteorologic instruments, transceivers antenna, obstruction light and radar reflector.



envirtech	DIM.	WEIGHT / NB	N. DISEGNO		REV.
AUTORE MB	mm	878kg / 1350 kg	21001-DIS-900		0
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2 Payload and navigation aid

The *Envirtech Deep Sea MKI-2*, is one of the most advanced directional wave buoy available on the market, its sea-wave sensor is based on MEMS[1] technology. The buoy integrates also a meteorologic station and can host further instrumentation for the measurement of water chemical and physical parameters. The size of the buoy and its obstruction light allow good visibility in day and night conditions for the safety of the navigation and of the buoy itself. Anyway the total buoy body has a low inertia that make it possible also the measurement of low frequency waves. The obstruction light has a 3 nm range.
A radar reflector, 10 sqm equivalent, consents a very good visibility up 5 nm.

The buoy can embed a multi-frequency, multi-satellite, simultaneus multi-channel GPS/GLONAS/GALILEO receiver for instantaneus sea level height measures (iSSH), too.
This further facility has been recognized by the WMO-IOC in the "Manual on Sea Level Measurement and Interpretation " Volume IV" – GPS Buoys

The technological and innovative aspects of *Envirtech Deep Sea MKI-2* buoy are:

- An inertial measurement device relied on MEMS sensors (Micro-Electro-Mechanical Systems) that integrates a heading sensor able to measure the directional wave spectra;
- The use of an electronic unit with a very low power consumption CPU with high processing capability;
- A VHF or UHF radio modem with a configurable transmission power from 100 mW to 10 W;
- An Inmarsat D+ satellite modem equipped with GPS receiver to be used as back up transmision system and emergency tracking device in case of off-mooring.
- In alternative to VHF/UHF transceiver an Inmarsat mini-C and/or an Iridium transceiver can be used.
- Autonomous power supply system relied on solar panels and dry accumulators.
- A backup lithium pack battery

[1] MEMS - *micro-electro-mechanical systems* is the technology of the very small. MEMS are made up of components between 1 to 100 micrometres in size (i.e. 0.001 to 0.1 mm) and MEMS devices generally range in size from 20 micrometres (20 millionths of a metre) to a millimetre.

All data provided by sensors are saved on board the buoy memory composed of a compact flash card with a capacity ranging from 1 to 4Gb: with one Gb it is possible to store 18 months of uninterrupted acquisition.

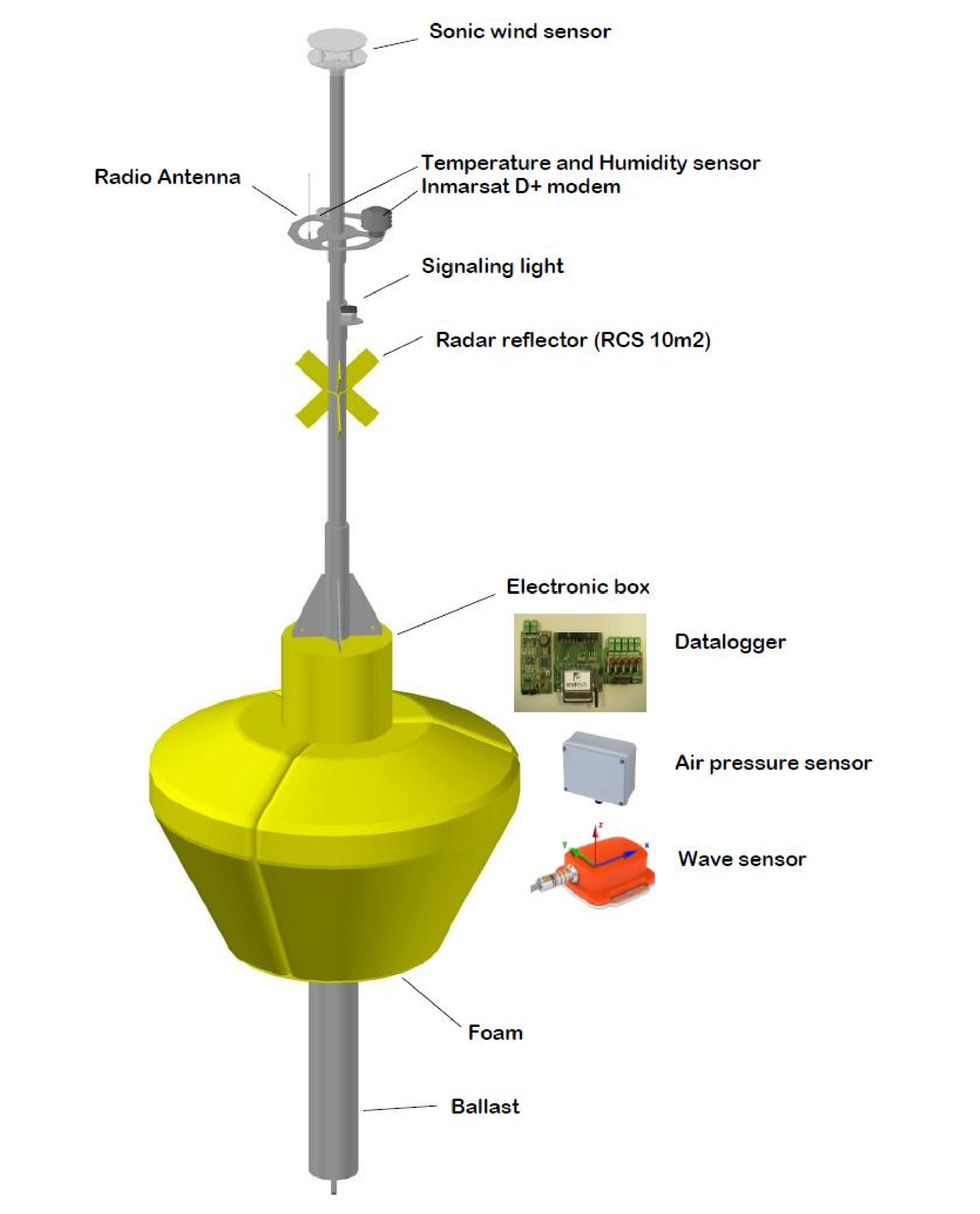
The electronic unit is interfaced with the radio modem through the serial link RS232. The VHF or UHF transmission ensure a 9.6kbps link up to 15-25 nautical miles of step-out distance from the coast depending on the sea waves and height of the receiving antenna.

The MKI-2 electronic unit integrates the wave sensor able to measure the heading of the buoy, the three axial acceleration and the three axial gyro: these raw data are real time processed to get the wave directional spectra and related statistical parameters of the sea waves.

The electronic unit is protected inside a water proof cylinder equipped with underwater connectors to interface the radio antenna, the meteo sensors, the satellite modem and optional multiparametric probe (CTD + other sensors) that can be fixed on the low part of the pole.

The pole and the foam part of the buoy can be dismounted to facilitate the transport of the buoy: in particular the pole can be splitted in two parts and the foam part can be divided in three segments.

3 Envirtech Deep Sea MKI-2 buoy Technical Characteristics



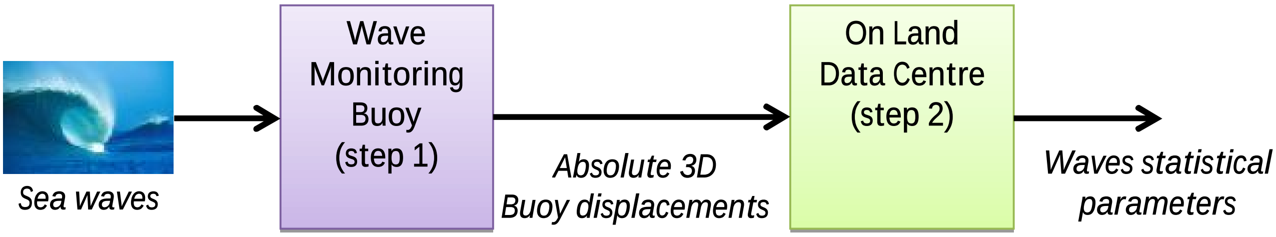
ENVIRTECH DEEP SEA MKI-2 - GENERAL INFORMATION	
Shape	1800 mm x 5800 (pole + buoyant)
Construction	Central metal pole in AISI 316 Stainless steel and rotationally moulded, medium density, UV stabilized, foam filled buoyant having the shape of a truncated cone composed of 3 parts.
Instrument case	AISI316 - Stainless Steel
Weight in air	878 Kg with ballast
Color	**Yellow**
Obstruction Light	**Yellow, IALA Code programmable - 3 nm range** Focal Plane 2.8 m above sea level
Radar Target	Corner reflector 10 sqm equivalent surface
Directional Wave Pack	**Micromachined Electro-Mechanical System (MEMS)** Wave height -25 .. +25 m / Accuracy 5 mm / Resolution 1 mm Wave Period 1.5 .. 35 s / Accuracy 0.1 s Wave direction 0.360° (resolution 0.1°) / Accuracy 0.1 °
Wind Gauge	**Gill Windsonic - 2-axys Ultrasonic** Range 0-60 m/s wind speed - accuracy 0.2 m/s Range 0-359° wind direction range (no dead band) Accuracy 3°
Barometric pressure	**WAISALA BAROCAP PTB110** – Range 600-1100 hPa - Accuracy +/- 0.3 hPa at 0..60 °C
Air Temperature & Humidity sensors	**VAISALA HMP155** **Temperature** Range -5 .. +60 °C Accuracy +/- 0.055°C **Humidity** Range 0 ... 100 %RH - ±3 %RH within 0 ... 90 %RH
Sea Surface Temperature (SST)	-5 .. + 45 °C - Accuracy 0.05 °C
Compass	**Micromachined Electro-Mechanical System (MEMS) Gyro-stabilized** Azimuth accuracy: 0.5° RMS, 0.1° resolution Inclination accuracy: 0.2° RMS, 0.1° resolution
Navigation GPS	12 Channels – single frequency embedded in Inmarsat D+ transceiver
(*) Tide Gauge (iSSH)	**Multi-satellite (GPS-GLONASS_GALILEO)**, multi-frequency, simultaneus multi-channel (more than 70) receiver, centimeter level accuracy . WMO-IOC recognized sea level data gathering method.
CPU	ARM Processor 16 bit - RAM 1024 Kb - Very low power consumption
Telemetry	VHF 150 MHz programmable, others on request Power 0.5 to 10 Watt **Inmarsat D+ Option Inmarsat mini-C – IRIDIUM . GSM/GPRS/EDGE**
Datalogger	NVRAM – up to 32 GB
(*) Power Pack	Solar Panels 4 x 50 Watt **- Gel rechargeable battery Pack**
	Lithium Battery pack as backup in needed

(*) OPTIONAL

NOTICE: Technical Characteristics can change at any time with NO further advice.

4 Waves processor

Next diagram shows the waves processing flow.



The processing chain involves two computations.

In the first one, embedded in the CPU on board the buoy, the buoy motion is converted in a 3D displacement file as better explaned in next paragraphs..

The output of the first Step processing is the absolute 3D buoy displacement file, named HNE (**H**eave, **N**orth/south,**E**ast/west.

In a second step, on shore processor [2], are performed a Zero crossing and a spectral analysis acting on the HNE file.

The HNE file is transmitted via Radio to the Shore station. In case of satellite transmissions, to reduce the traffic cost also the second processing is implemented on board the buoy and only few parameters (HM0, Dm,Dp, Tm, Tp etc.) can be transmitted, storing on local NVRAM remaining data to be recovered during scheduled maintenance.

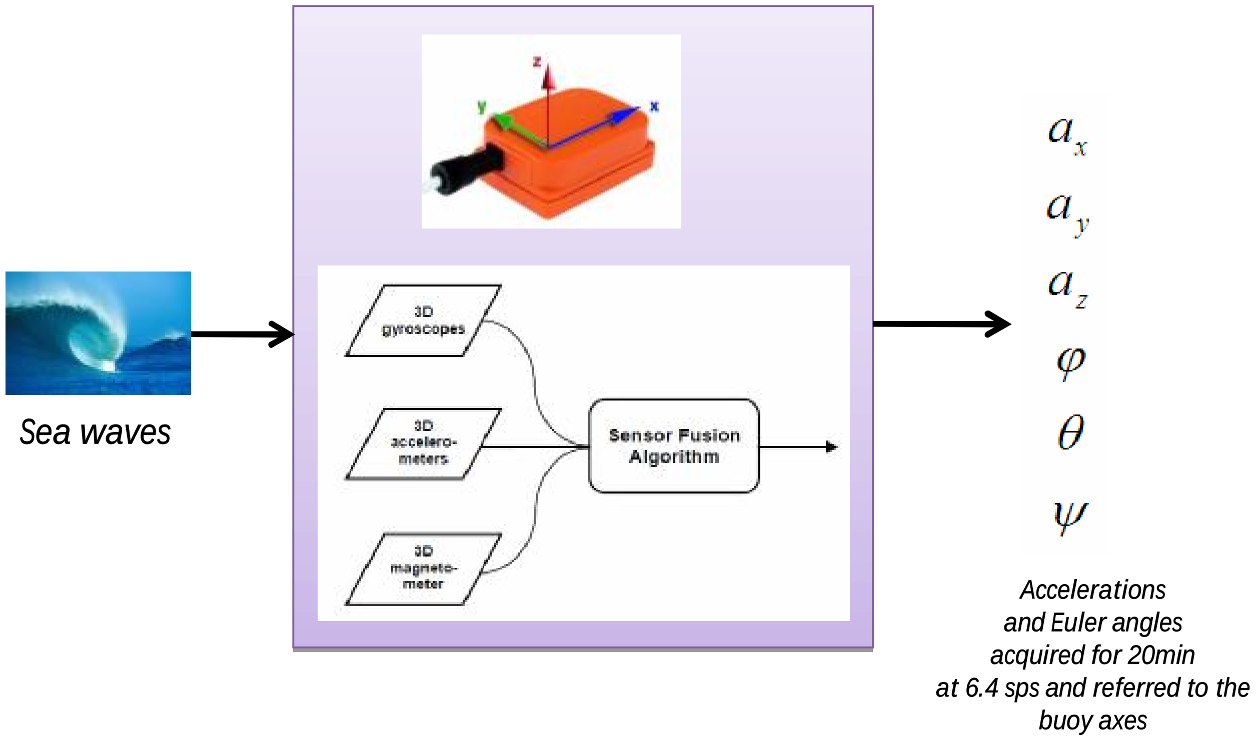
4.1 Data flow from the sensor to file HNE

The sensor used for the wave buoy measures is the *Envirtech MKI-2 WAVES*. By means of three accelerometers, three gyroscope and a magnetic field sensor, it is able to produce accelerations and euler angles measures. Next table shows its main performances.

Parameter	Range	Bandwidth [Hz]	Noise	Accuracy	Resolution
Acceleration	± 1,7g	30	0,007 m/s^2	0,03% FS	0,5 mm/s^2
Pitch/Roll	Pitch: ± 90° Roll: ± 180°	40	0,05 deg/s/Hz	Static 0,5 deg Dynamic <2 deg	0,05 deg
Heading	± 180°	10	0,5 mGauss	Static 1 deg Dynamic <2 deg	0,05 deg

Next picture shows the output from the sensors.

[2] The CPU payload can implement both computations on board the buoy. However a 2 step flow is implemented to maintain a backward compatibility with other manufacturer devices.



The sensor is programmed to produce accelerometric samples (three accelerations and three euler angles) with a rate of 6.4 sps.

The technique used to produce a motion history from this data consists of the following steps:

- Acquire data for 20 minutes
- Preprocess raw data (filtering, anti-spike…)
- Find rotational matrix
- Find inertial accelerations
- Apply a mirror to the last samples to obtain a 2^N samples vector
- Apply the Hamming window
- Apply band-pass filtering in the frequency domain
- Double integrate accelerations to obtain the motion history

This steps are explained in detail in the following paragraphs.

4.1.1 Acquisition

The acquisition is made in a time window of 20 minutes at a rate of 6.4 sps, thus producing 7680 samples.

4.1.2 Pre-processing of raw data

In order to eliminate some noise and errors in acquisition, an anti-spike and a moving average filter are applied to the raw data.

4.1.3 Rotational matrix

A rotational matrix is derived from the measured euler angles. This matrix transforms the acceleration vector from the sensor coordinate system to the inertial one. It can be obtained as the product of three rotational matrix around the fixed x y and z axes:

$$R_X = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos(j) & -\sin(j) \\ 0 & \sin(j) & \cos(j) \end{bmatrix}$$

$$R_Y = \begin{bmatrix} \cos(J) & 0 & \sin(J) \\ 0 & 1 & 0 \\ -\sin(J) & 0 & \cos(J) \end{bmatrix}$$

$$R_Z = \begin{bmatrix} \cos(y) & -\sin(y) & 0 \\ \sin(y) & \cos(y) & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

The final matrix is given by:

$$R_{XYZ} = R_Z * R_Y * R_X =$$

$$= \begin{bmatrix} \cos(J)\cos(y) & \sin(y)\cos(j)+\sin(j)\sin(J)\cos(y) & \sin(y)\sin(j)+\cos(j)\sin(J)\cos(y) \\ \cos(J)\sin(y) & \cos(y)\cos(j)+\sin(j)\sin(J)\sin(y) & \cos(y)\sin(j)+\cos(j)\sin(J)\sin(y) \\ \sin(J) & \cos(J)\sin(j) & \cos(J)\cos(j) \end{bmatrix}$$

4.1.4 Mirroring

In order to use the Fast Fourier Transform with a sequence of M samples, M should be a power of 2. If this is not the case, the mirroring technique is used. If $P=2^N$ is the smallest 2-power integer greater than M, a P-long sequence t(n) is constructed from this way from the original sequence s(n):

t(n) = s(n) if n <= M

t(n) = s(2M-n) otherwise

This corresponds to copying the last P-M samples of s(n) in the last part of t(n), reversing them.
In our case, M=7680, P=2^{13} = 8192.

4.1.5 Hamming window

It is convenient to apply an Hamming window to the signal in the time-domain before to perform the FFT. The chosen window is:

$$w(n) = 0.54 - 0.46\cos\left(\frac{2pn}{N-1}\right)$$

4.1.6 Fast Fourier Transform

At this step, the Fast Fourier Transform is calculated with. Afterwards, a band-pass filter is applied, in order to eliminate frequencies higher than 2 Hz or lower than 0.03 Hz. Subsequently, the double integration is performed, obtaining the motion history along the three axis in the frequency domain. At this point the inverse Transform is applied, leading to the time domain motions.

4.2 HNE file processing

Once the HNE data files has been received to the shore station or the Control Centre it is processed as follows.

Data files are composed of 20 minutes of data time spaced of 0.78 seconds. Every record holds the following fields:

- Wave elevation $z_G(t)$ in mm (High +, Low -)
- North-South movement $Y_N(t)$ in mm: (North +, South -)
- East-West movement $X_E(t)$ in mm: (East +, West -)

The above data are processed by the land station with the following procedure.

4.2.1 Fourier Transform

Fourier transform is applied according to the following formula:

$$\Im_Z = [Z(w)] = \frac{1}{\sqrt{2p}} \int_{-\infty}^{\infty} Z(t) \cdot e^{-iwt} \cdot dt$$

$$\Im_X = [X(w)] = \frac{1}{\sqrt{2p}} \int_{-\infty}^{\infty} X_E(t) \cdot e^{-iwt} \cdot dt$$

$$\Im_Y = [Y(w)] = \frac{1}{\sqrt{2p}} \int_{-\infty}^{\infty} Y_N(t) \cdot e^{-iwt} \cdot dt$$

4.2.2 Spectra

The above transforms allow to get the following spectra:

three auto-spectra:

$C_{ZZ}(w), C_{XX}(w), C_{YY}(w)$,

three cross-spectra:

$C_{ZX}(w), C_{ZY}(w), C_{XY}(w)$

three quadrature-spectra:

$Q_{ZX}(w), Q_{ZY}(w), Q_{XY}(w)$

Each spetrcum is defined by the following relationship:

$$C_{ZZ} = \Im_Z \cdot \Im_Z^*$$

$$C_{XX} = \Im_X \cdot \Im_X^*$$

$$C_{YY} = \Im_Y \cdot \Im_Y^*$$

$$C_{ZX} = RE(\Im_Z \cdot \Im_X^*)$$

$$C_{ZY} = RE(\Im_Z \cdot \Im_Y^*)$$

$$C_{XY} = RE\left(\Im_X \cdot \Im_Y^*\right)$$

$$Q_{ZX} = IM\left(\Im_Z \cdot \Im_X^*\right)$$

$$Q_{ZY} = IM\left(\Im_Z \cdot \Im_Y^*\right)$$

$$Q_{XY} = IM\left(\Im_X \cdot \Im_Y^*\right)$$

According to Euler's notation, " * " stands for the complex conjugate, "RE" stands for real part and "IM" stands for imaginary part of the complex number.

4.2.3 Moments

On the basis of the spectral distribution $C_{ZZ}(w)$ of the wave elevation, it is possible to identify the frequency of its maximum, accordingly the peak period T_P. Moreover, the statistical moments allow to get the values of the periods defined by the following relationship:

$$T_1 = 2p\sqrt{\frac{M_0}{M_2}}$$

$$T_2 = 2p\,\frac{M_0}{M_1}$$

$$T_3 = 2p\,\frac{M_{-1}}{M_0}$$

$$T_4 = 2p\sqrt{\frac{M_{-2}}{M_0}}$$

$$T_5 = 2p\sqrt{\frac{M_2}{M_4}}$$

and the value of the significant wave height H_S defined by the following relationship:

$$H_S = 4\sqrt{M_0}$$

where M_n is the n-order moment defined by the formula:

$$M_n = \int_0^{\infty} C_{ZZ}(w) w^n dw$$

4.2.4 Mean propagation direction, wave number, spread, skewness and kurtosis

Furthermore, it is possible to calculate the mean propagation direction q_0, the wave number k, the spread s, the skewness S and the kurtosis K that are defined according to the following formulas:

$$q_0 = \arctan \frac{b_1}{a_1}$$

$$k = \sqrt{\frac{C_{XX} + C_{YY}}{C_{ZZ}}}$$

$$s = \sqrt{2(1 - m_1)}$$

$$S = \frac{-n_2}{\sqrt[\frac{3}{2}]{\frac{1 - m_2}{2}}}$$

$$K = \frac{6 - 8m_1 + 2m_2}{s^4}$$

Where:

$$m_1 = a_1 \cdot \cos q_0 + b_1 \cdot \sin q_0$$

$$m_2 = a_2 \cdot \cos 2q_0 + b_2 \cdot \sin 2q_0$$

$$n_2 = b_2 \cdot \cos 2q_0 - a_2 \cdot \sin 2q_0$$

$$a_1 = \frac{Q_{ZX}}{k \cdot C_{ZZ}} \qquad a_2 = \frac{C_{XX} - C_{YY}}{k^2 \cdot C_{ZZ}}$$

$$b_1 = \frac{Q_{ZY}}{k \cdot C_{ZZ}} \qquad\qquad b_2 = \frac{2C_{XY}}{k^2 \cdot C_{ZZ}}$$

4.2.5 Spectral Analysis

The procedure adopted to analyze the data transmitted by the buoy allows to gain 4 typical parameters of the frequency directional distribution $D_f(q)$, without any preliminary hypothesis on the shape of the distribution itself:

$$D_f(q) = E(f,q)/E(f)$$

Where $E(f,0)$ is the energy directional spectrum and $E(f) =_0 \int^{2p} E(f,q)dq$ is the energy density.

The distribution is approximated with and expansion of the Fourier series that has been truncated at the first 4 coefficients:

$$D_f(q) = 1/p\,[1/2 + (a_1 Cosq + b_1 Senq) + (a_2 Cos2q + b_2 Sen2q)]$$

The coefficients a_1, b_1, a_2, b_2 are calculated from the retrieved data with the following procedure:

By applying a Fast Fourier Transform routine on the filtered data blocks of 256 terns of elevation (z), north/south slope (x) and east/west slope (y), 9 spectral density function are obtained in the interval from 0.005 Hz to 0.635 Hz, for 127 frequency bands of 0.005 Hz of amplitude:

3 autospecta	$[Czz(f), Cxx(f), Cyy(f)]$
3 cospectra	$[Czx(f), Czy(f), Cxy(f)]$
3 quadrature spectra	$[Qzx(f), Qzy(f), Qxy(f)]$

The 127 rows x 9 columns matrix obtained by the elaboration of the first block is mediated with the one obtained by the second block and go on until it is possible to have the representative matrix of the 30 minutes of data.

From the elevation autospectrum $Czz(f)$ it is possible to directly have the quantities: Hs significant wave height , Tm mean period and Tp peak period.
Indeed:

$$Czz(f) = E(f) =_0 \int^{2p} E(f,q)dq$$

By inticating with q_i the i-esimal order spectral moment equal to $_0\int^{\infty} f^i E(f)df$, it is obtained:

$$Hs = 4\{q_0\}^{1/2}; Tm = q_{-1} / q_0$$

The value of Tp is the one that is corresponding at the maximum value of $Czz(f)$.

With the obtained spectral density functions, the coefficients a_1, b_1, a_2, b_2, of the Fourier series expansion of the function $D_f(q)$ are calculated with the following relationships:

$$a_1(f) =_0 \int^{2p} D_f(q)\cos q dq = Q_{zx}(f)/k(f)C_{zz}(f);$$
$$a_2(f) =_0 \int^{2p} D_f(q)\cos 2q dq = C_{xx}(f) - Cyy(f)/k_2(f)C_{zz}(f);$$
$$b_1(f) =_0 \int^{2p} D_f(q) sen q dq = Q_{zy}(f)/k(f)C_{zz}(f);$$
$$b_2(f) =_0 \int^{2p} Df(q) sen 2q dq = 2C_{xy}(f)/k^2(f)C_{zz}(f)$$

Where K(f) is the wave number = $\{C_{xx} + C_{yy} / C_{zz}\}^{1/2}$.

The mean propagation direction for frequency band is obtained as:

$$q_0(f) = \arctan(b_1(f)/a_1(f))$$

From the Fourier series expansion, by a rotation of the coordinate system to have a null mean direction, the following functions are obtained:

$$m_1(f) = a_1(f)\cos[q_0(f)] + b_1(f)sen[q_0(f)]$$

$$m_2(f) = a_2(f)\cos[2q_0(f)] + b_2(f)sen[2q_0(f)]$$

$$n_2(f) = b_2(f)\cos[2q_0(f)] - a_2(f)sen[2q_0(f)]$$

Through the above relationships, the followings value for the frequency band are calculated:

Spread

$$s\,(f) = \{2[1 - m_1(f)]\}^{1/2}$$

Skewness

$$S(f) = -n_2(f)/[0.5(1 - m_2(f)]^{3/2}$$

Kurtosis

$$K(f) = (6 - 8m_1(f) + 2m_2(f))/[s\,(f)]^4$$

4.2.6 MINIMAL OUTPUT PARAMETERS

The parameters generated by the described procedure are:

Hs	Significant wave height in meters
Tz	Mean period in seconds
Tp	Peak period in seconds
D (prov.)	Mean origin direction in degrees
Spread	Directional Spread in degrees
Skew	Skewness
Kurt	Kurtosis
End	Final band of the sector
Start	Initial band of the sector

The last 5 values are relative to a frequency band of amplitude included from “start” to “end”. Their energy have to be about 1/12 of the full spectrum energy.

Other calculated parameters are:

T1	Mean period in seconds M0; M2
T2	Mean period in seconds M0; M1
T3	Mean period in seconds M-1; M0
T4	Mean period in seconds M-2; M0
T5	Mean period in seconds M2; M4
T6	Mean period in seconds M0; M1
Dmed	Mean total origin direction in degrees from the North
Dp	Mean peak direction in degrees from the North
Dwind	Mean windwaves direction in degrees from the North

Heave	in cm
Slope N/S	in cm
Slope W/E	in cm

5 Receiving and data processing equipments – Envirtech Shore Station

The shore station equipments consit of:

- Envirtech receiver, cable and omnidirectional antenna
- PC, monitor, mouse, keyboard (not included in Envirtech standard supply)
- Operating System and Application Software

The receiver is a radio modem powered by the main power supply source, tuned on the same frequency used by the buoy (VHF or UHF).
The standard antenna is a Ringo ominidirectional – Gain 1.2 dB. Directional antenna can be supplied on demand.
Data can be received up to 15 nm if buoy is at line of sight [3].
To maintain a good S/N ratio, in any seawave condition, could be used a directional antenna at shore station.
Please note that in case of very high sea waves the buoy moves (pitch, roll etc.) itself considerably and the radio signal could change its polarization or can be attenuated by the sea water. In such case could occurs data loss, consequently the best operative distance decreases respect the maximum theoretically calculated.

An Inmarsat mini-C or an iridium transceivers can be used in place of the Radio modems.
In this case another transceiver or a direct connection to the Inmarsat Land Earth Station (LES) or to the Public Switch Network, for Iridium, must be implemented.
GSM/GPRS and EDGE transceivers can be adopted as data telemetry option too.
Envirtech Software has interface capabilities for any of the mentioned solutions.

[3] Radio communication range can change depending on the sea waves height and weather conditions.

6 Software

On a personal computer, not included as standard supply, will be loaded the Envirtech RonView software.

6.1 RonView – stand alone Data Presentation Software

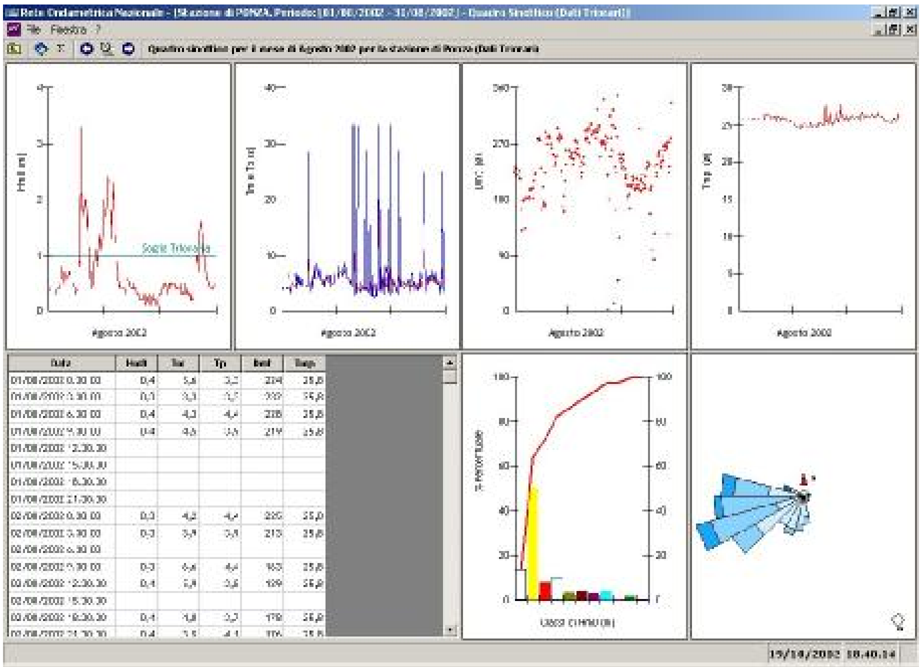
The software modules connects the radiomodem and periodically download meteorologic data, sea waves files (HNE and telemetry) and sea surface temperature. All data collected are stored in a database for further computations and are accessible by remote users.
Meteorologic data and sea waves data are showed by charts and in tabular format.
The software has been developed by Envirtech during last ten years of management of the Italian Data Buoy Network .
The software can collect data also via Inmarsat transceiver if the buoy has been equipped with.
It can be also used as Human/Machine interface in case of use of multi buoy system (Data Buoy Network).

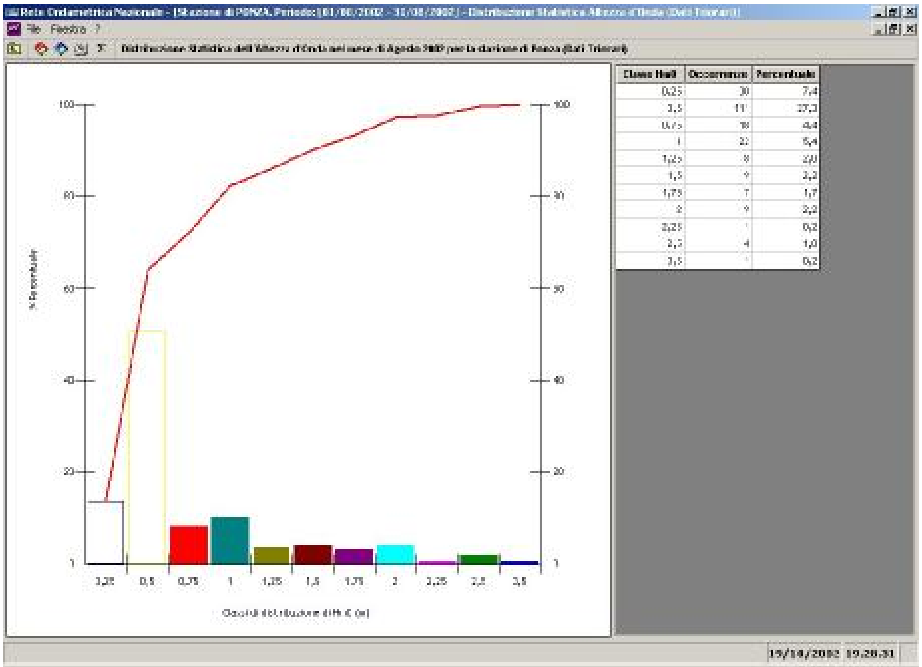
6.1.1 RonView features

The RonView software will consent:

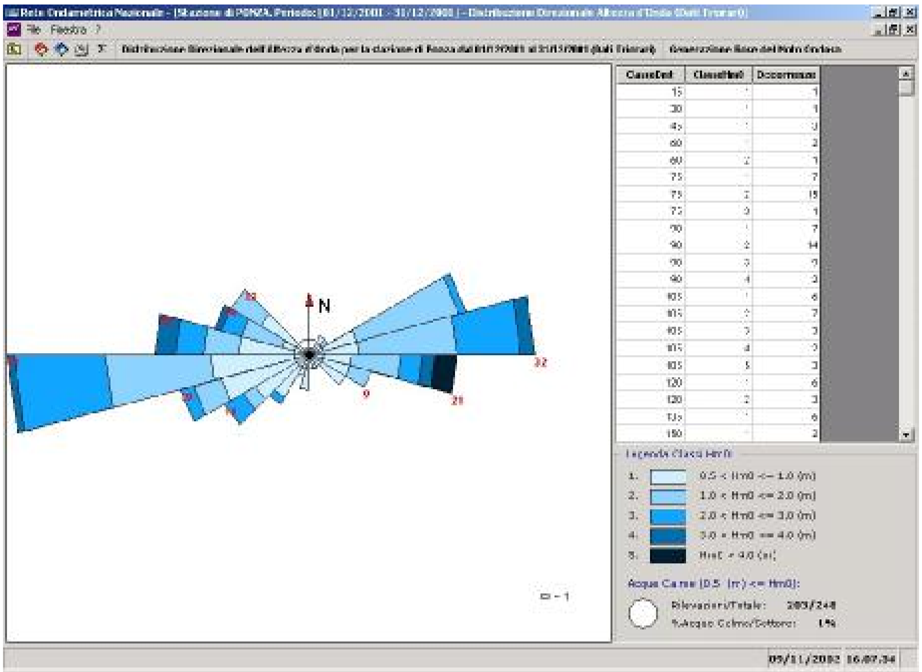
- F01 – Populate a local resident SQL database
- F02 – Obtain a chart for any gathered or calculated parameter in a selectable data range
- F03 – Obtain a tab for any gathered or calculated parameter in a selectable data range
- F04 – To consent remote access to the database
- F05 – To implement a schedule to upload last data periodically

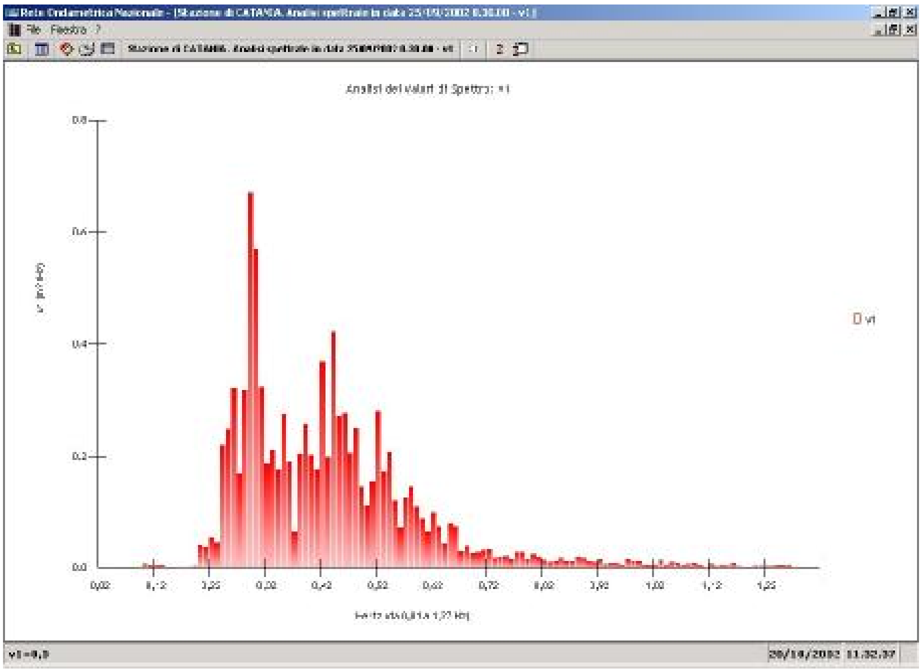
In next section are showed some Screen Shots from RonView.





Above pictures shows a main data presentation window. There are following daily charts for a requestred month: HM0, TS and TP, DMT, SST, HM0 classes, Climatic propagation directions.





Above pictures shows the HM0 distribution class respect the propoagation direction, and a waves spectra.

6.2 Remote Access

The PC forms a very small Local Area Network (LAN).
This small LAN will be accessible via ROUTER connected to a Wide Area network, like ADSL, ISDN (if available), GSM/GPRS or public telephone network.
Once accessed remotely to the LAN, the remote user, or any client program, can:

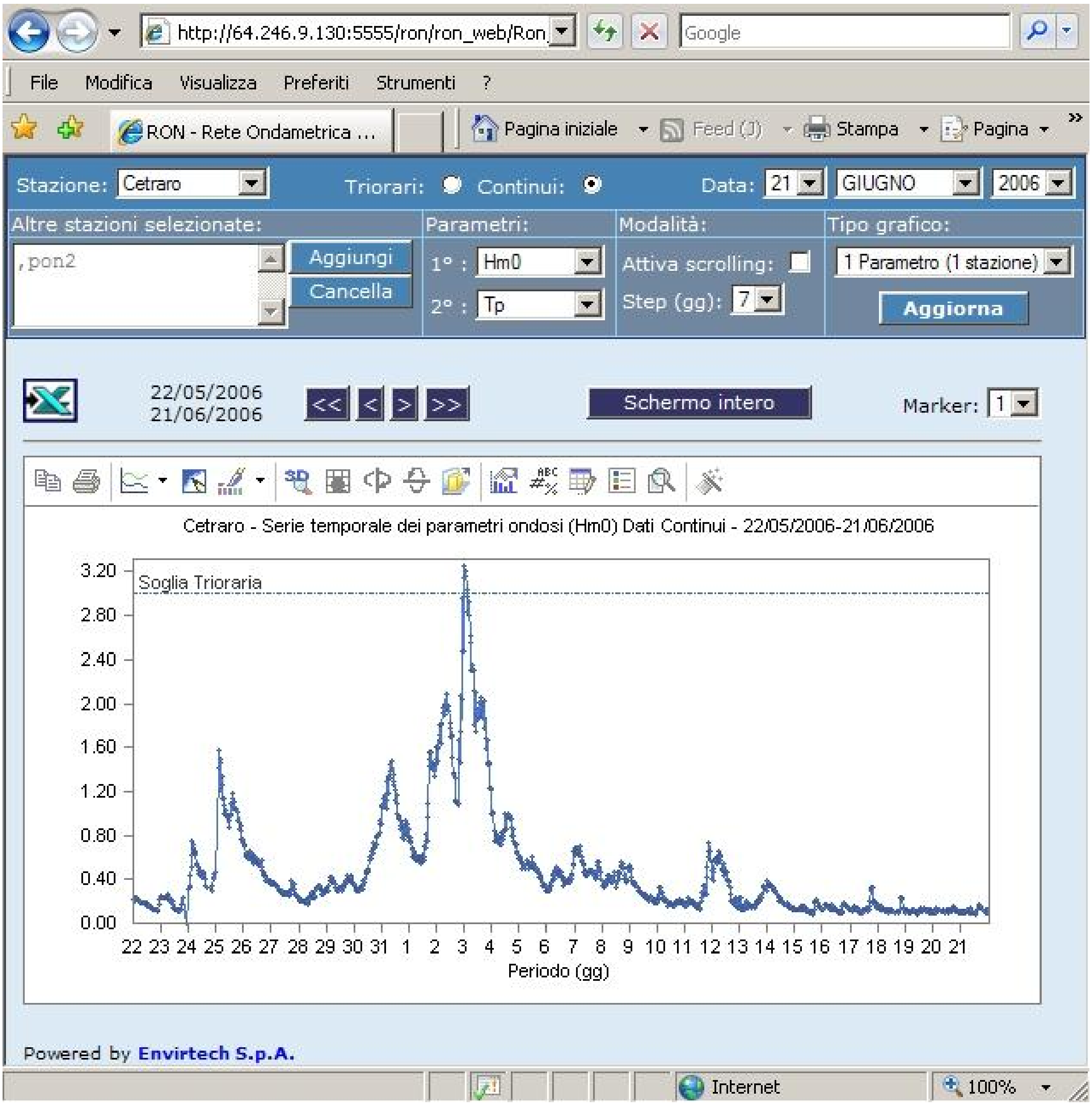
- Query the datalogger using HTTP or FTP protocol and changing some parameters
- Query the Database resident on PC, using others software or above mentioned protocols.

It is also possible to program the PC as a scheduler to access the remote location periodically to upload new data.

6.2.1 RonWeb – Web accessible Data Presentation Software

The main SQL database can be directly accessed via WEB to semplify multiclient applications working on Intranet or Internet.
Most of the features available on RonView are also available in RonWeb

Following screen shot shows the Significant Height of waves respect the time.
The user can select the parameter to show, choosing one or more from a list (Hs, Air temperature, barometric pressure and so on), the time interval and some other presentation options can be selected to refine the plot.



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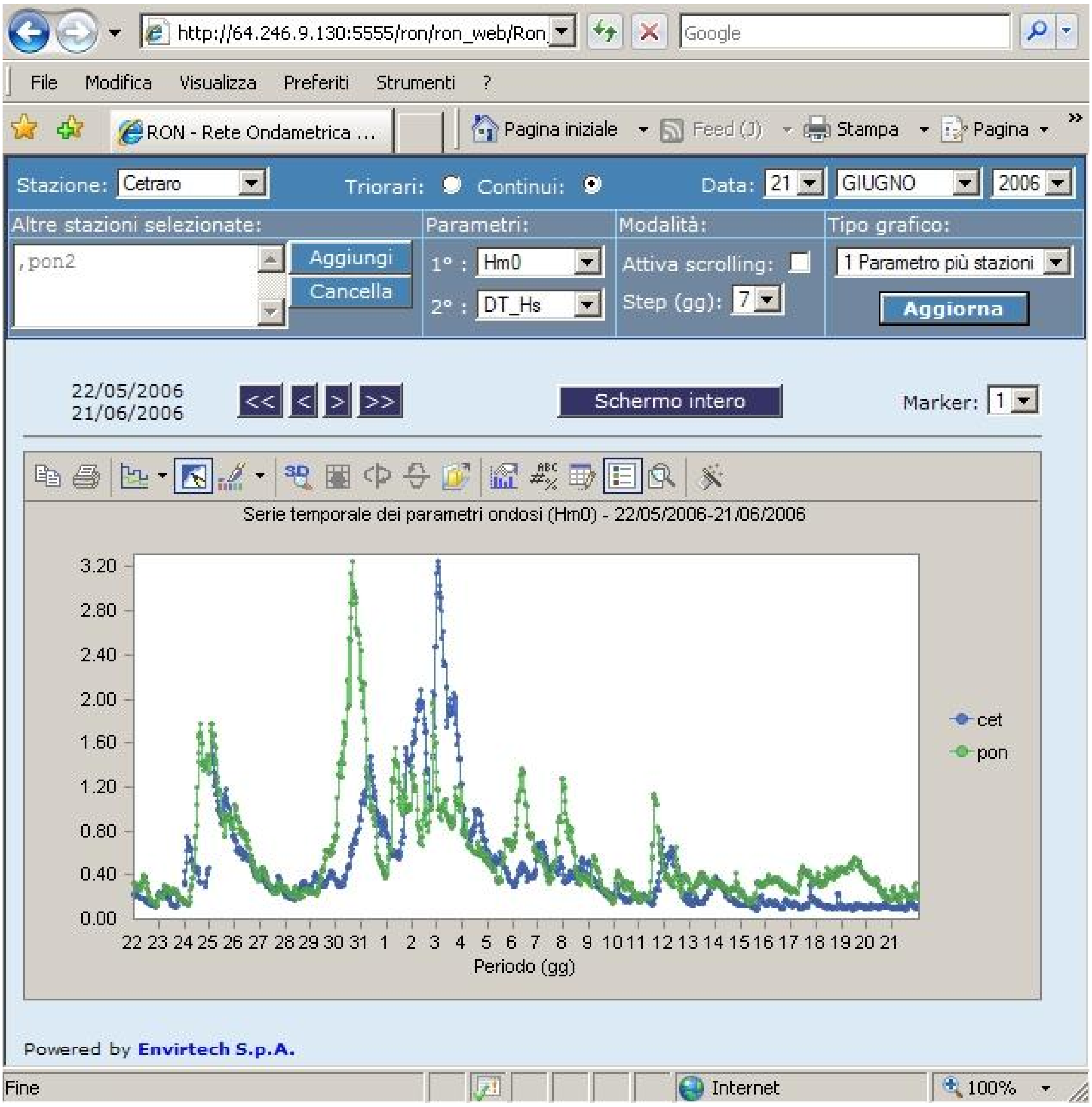
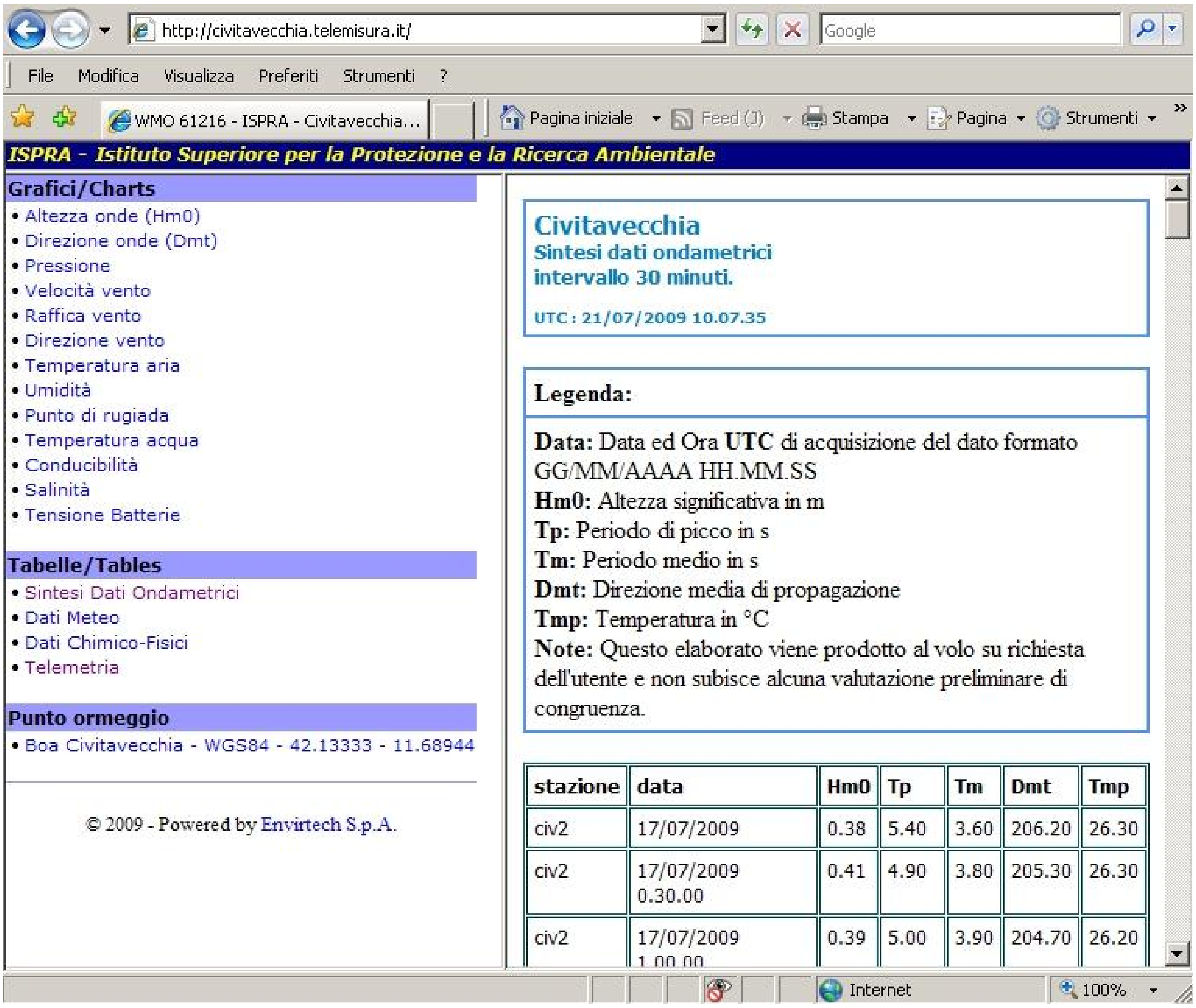
File Modifica Visualizza Preferiti Strumenti ?
RON - Rete Ondametrica ...
Pagina iniziale
Feed (J)
Stampa
Pagina
Stazione: Cetraro
Triorari:
Continui:
Data: 21 GIUGNO 2006
Altre stazioni selezionate:
,pon2
Aggiungi
Cancella
Parametri:
1° : Hm0
2° : Tp
Modalità:
Attiva scrolling:
Step (gg): 7
Tipo grafico:
1 Parametro (1 stazione)
Aggiorna
22/05/2006
21/06/2006
Schermo intero
Marker: 1
Cetraro - Serie temporale dei parametri ondosi (Hm0) Dati Continui - 22/05/2006-21/06/2006
Soglia Trioraria
3.20
2.80
2.40
2.00
1.60
1.20
0.80
0.40
0.00
22 23 24 25 26 27 28 29 30 31 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
Periodo (gg)
Powered by Envirtech S.p.A.
Internet
100%



More then one parameter can be charted at time, to implement a powerfull tool for interrogation and data mining.

Data are available in SQL tables. The user can obtain tabs and charts remotely querying via HTTP protocol the Web server embedded in the Datalogger or the Pc:



6.3 WMO GTS Data interchange

The main interchange format for data dissemination is the WMO BUFR (FM94-Version 4). Collected data, if requested, can be assembled using the mentioned format and dispatched to the Focal Point organization responsible for GTS data immission.

The buoy must be named using the preventively received code by the focal point organization.

6.4 Watch Circle alarm

The buoy transmits collected data each 30 minutes (programmable by the user during the installation). Each transmission contains also collected GPS position and can be used to evaluate if the buoy stays in position.

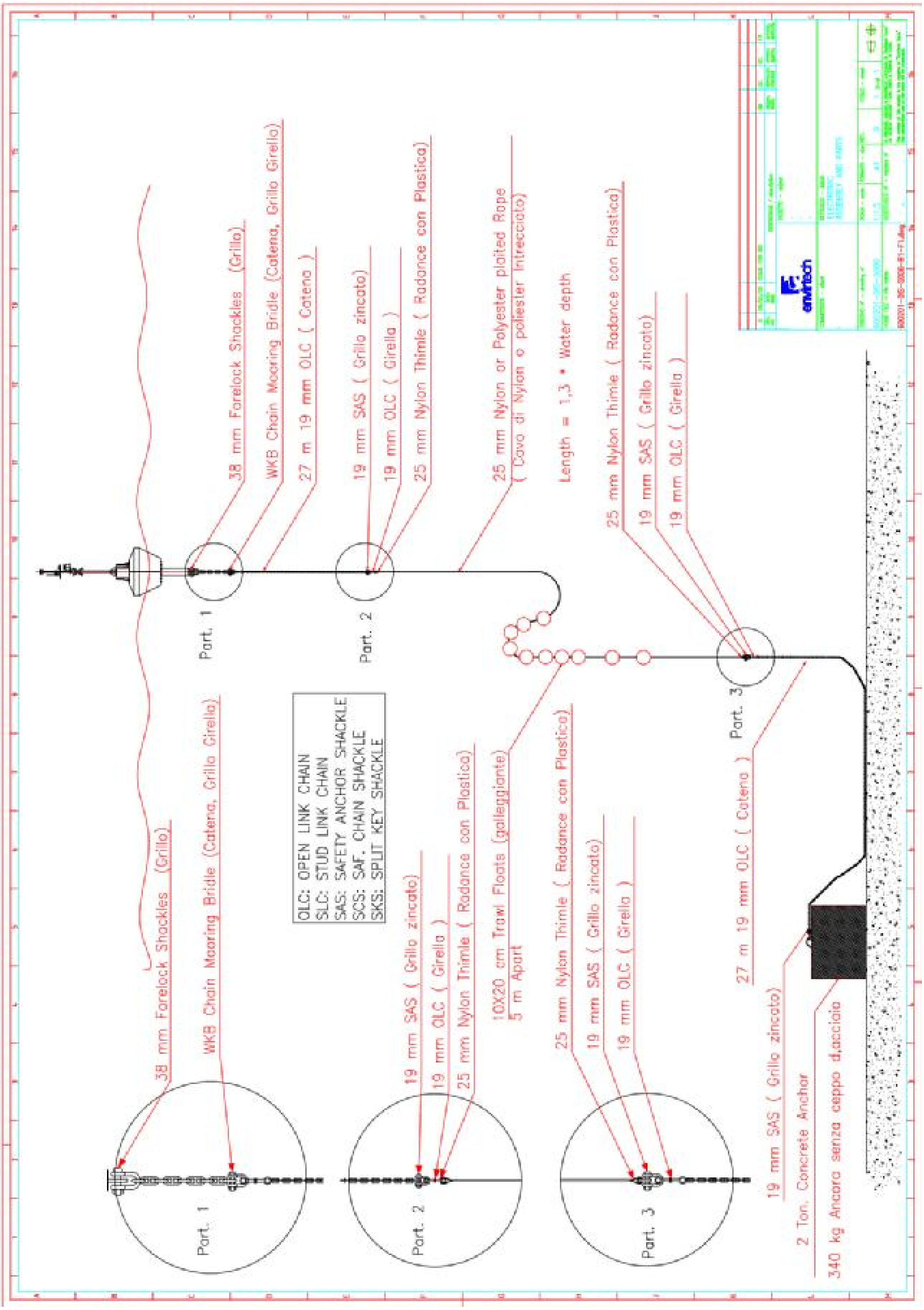
In case of off mooring, consequent to a ship collision, fishermen activities or other accidental causes, the buoy can go out of radio range respect the shore station.

When off moored also the Inmarsat D+ satellite transceiver will start to transmit the position to consent the buoy recovery. Satellite communications will be availble on an internet accessible web site and should be used to coordinate the rescue team.

An Inmarsat D+ daily transmission assure that the transceiver is ready to work properly when needed.

7 Mooring Line

On next page it has plotted a typical mooring line schematic diagram for a sea bottom deep 100 meters.



38 mm Forelock Shackles (Grillo)
WKB Chain Mooring Bridle (Catena, Grillo Girello)
27 m 19 mm OLC (Catena)
19 mm SAS (Grillo zincato)
19 mm OLC (Girella)
25 mm Nylon Thimle (Radance con Plastica)
25 mm Nylon or Polyester plaited Rope
(Cavo di Nylon o poliester intrecciato)
Length = 1,3 * Water depth
25 mm Nylon Thimle (Radance con Plastica)
19 mm SAS (Grillo zincato)
19 mm OLC (Girella)
Part. 1
Part. 2
Part. 3
OLC: OPEN LINK CHAIN
SLC: STUD LINK CHAIN
SAS: SAFETY ANCHOR SHACKLE
SCS: SAF. CHAIN SHACKLE
SKS: SPLIT KEY SHACKLE
10X20 cm Trawl Floats (galleggiante)
5 m Apart
27 m 19 mm OLC (Catena)
19 mm SAS (Grillo zincato)
2 Ton. Concrete Anchor
340 kg Ancora senza ceppo d,acciaio
38 mm Forelock Shackles (Grillo)
WKB Chain Mooring Bridle (Catena, Grillo Girello)
19 mm SAS (Grillo zincato)
19 mm OLC (Girella)
25 mm Nylon Thimle (Radance con Plastica)
25 mm Nylon Thimle (Radance con Plastica)
19 mm SAS (Grillo zincato)
19 mm OLC (Girella)
Part. 1
Part. 2
Part. 3