



DATAMAR 2000C / 3000C

MICROWAVE (26 GHz) RADAR TIDE GAUGE



BATTERY POWERED COMPACT AND STAND ALONE TIDE GAUGE WITH MICROWAVE RADAR SENSOR (26 GHz) PROVIDING EXTREMELY HIGH PRECISION AND STABILITY

- Level measurements every second (1 Hz)
- Automatic clock synchronisation via internal GPS receiver (optional)
- Accuracy of 1 mm precision for averaged values
- Operation by internal battery and solar Panel or mains.
- High memory capacity (64 MB) with several months of autonomy for averaged data
- Real-Time Data Transmission to the Port Authority
- Data Accessibility via Internet (WEB Posting)



INTRODUCTION

The new model **DATAMAR 2000C / 3000C RADAR TIDE GAUGE** designed by GEONICA, based on the latest electronic technology, is the ideal solution for measuring, recording and transmitting tide level data, not only due to its high-level features and advanced technical characteristics, but also due to its great versatility and low cost.

The **DATAMAR 2000C / 3000C** tide gauge is exclusively composed of two main parts, which are as follows:

- a) The level sensor based on RADAR technology at 26 GHz.
- b) The Data Acquisition and Transmission Unit Model 2000C or 3000C

DATAMAR is a compact, autonomous system, powered by internal batteries, rechargeable via solar panel or by connection to the mains, which does not require the use of a computer or local PC, as it already has all the necessary elements to carry out the sampling of the measuring signal, the digitalisation of this signal, the recording of the data in its own internal memory of 64 Mbytes, as well as the elements required to transmit the data in real or differed time to the Port Authority or to any Central Receiving Station.

The **DATAMAR** tide measuring station is a fully programmable system (both locally and remotely), with capacity for level sampling every second, which also enables the connection of additional meteorological and environmental sensors, for measuring data such as the water temperature, the wind speed and direction, the atmospheric pressure, the visibility, etc., etc.

In addition, the **DATAMAR** tide gauge is equipped for the connection of one or more optional colour digital cameras DIGICAM, to capture and transmit still images of the port area, in sequential mode.



Due to all these varied features as regards autonomy, low consumption, multi-functionality, compact design and low cost, you can be sure that the **DATAMAR** tide gauge is the best and most economical choice on the market.

MEASUREMENT INTERVAL AND RECORDING

The RADAR level sensor takes a measurement every second, and the data acquisition unit digitalises these measurements at the same frequency of 1 Hz.

As well as digitalising the data every second, the 2000C/3000C model Data Acquisition Unit also calculates the average, maximum and minimum values, etc., in programmable periods of time of 1, 2, 5, 10, 15, 30 or 60 minutes, storing all the information in its internal memory.

It is also possible to transmit periodically these averaged values to the Port Authority using the same connection via

radio or optical fiber, Ethernet, etc..., in near-real time, at the end of each averaged period, for instance, each ten minutes.

By an internal built in GPRS modem, the 2000C / 3000C Unit can transmit these averaged values also to other distant National Organizations or Institutions in such a way to centralize the averaged tide data of a number of remote tide gauges. All this information can be published in Internet by means of the WEBTRANS Platform, developed by GEONICA. The General Communications Diagram of the tide measuring network, based on the DATAMAR 2000C / 3000C station, is showed in Fig. 1, including data diffusion in Internet.

The table below shows a summary of the measuring and recording intervals:

RADAR SENSOR	2000C / 3000C UNIT
Measurement frequency: 1 Hz (one measurement every second)	Sampling frequency: 1 Hz
	Storage of averaged tide data including those of the optional meteorological parameters, with maximum and minimum values, etc...In programmable 1, 2, 5, 10, 15, 20, 30 and 60 minutes time periods



HIGH PRECISION AND STABILITY

The RADAR level measuring sensor operates with microwave signals at the frequency of 26 GHz, offering a high precision of 2 mm in each of the individual measurements, which is quite a lot higher than the one obtained by other sensors which use sweeping radars instead of pulse radars, as they have an error margin of around 10 mm, i.e. five times greater.

The accuracy of 2 mm guaranteed by the sensor for the raw data every second, does not suffer any degradation in the digitalisation process performed by the 2000C / 3000C unit, as it is equipped with a 20-bit Analogue/Digital converter capable of resolving more than one part in half a million. Any other digitiser which does not have such a degree of resolution

would introduce additional errors in the resulting final data.

As regards the level data averaged by the 2000C/3000C Unit, it has an estimated accuracy of 1 mm, for calculation intervals from 1 minute onwards.

The stability in the measurements of the DATAMAR 2000C /3000C tide gauge is also very high, as the RADAR sensor is not affected by the environmental conditions of temperature, humidity, presence of rain or wind, etc., unlike other types of measuring technologies, in particular, ultrasonic-type sensors.

STORING DATA AND STILL IMAGES

The Data Acquisition Unit Model 2000C / 3000C, has a Flash-type internal memory with a capacity of 64 Mbytes.

This large memory capacity is used to store the averaged water level data, along with those calculations of mean, maximum and minimum values, standard deviation, etc., that correspond to the signals measured by the additional environmental sensors, which may be optionally connected to the 2000C / 3000C unit.

Finally, a part of the memory, can be used for the transitory storage of the colour images captured by one or more digital cameras, which can be also optionally connected to the station.

It is also possible to store water level rough data each second by means of an optional SD retrievable memory card of 2GB, with capacity of storing up several months of 1Hz data.

TIME SYNCHRONISATION VIA GPS

As mentioned earlier, the **DATAMAR** tide gauge incorporates, as an option, an internal GPS receiver, primarily used to synchronise the internal clock of the unit. This way, the station's time base is completely precise and stable, allowing the temporary comparison of the level data with other similar tide gauges installed at any other location, either locally or remotely, enabling the creation and management of fully synchronised networks of tide gauges.

The internal GPS receiver is connected to an external aerial via the corresponding cable, all of which is part of the actual **DATAMAR** tide gauge.

If the optional GPS receiver is not included, the DATAMAR unit is automatically synchronized by the Central Receiving Station.

DATA TRANSMISSION

The Communications Diagram shown below indicates the different data transmission possibilities from the DATAMAR-2000/3000C tide gauge to the Port Authority's Local Network or to a Central and Processing Station. This diagram represents a particular case of the SAFE PORT SYSTEM designed by GEONICA, the functionalities of which are described in a separate document.

As indicated before, the different types of data stored in the DATAMAR tide gauge can be transmitted to the Port Authority's Local Network by different methods; the level data, updated every minute, five minutes, etc., can be transmitted nearly in real-time, for example through a direct optical fibre link, normally available at the Port, or via a point-to-point radio link.

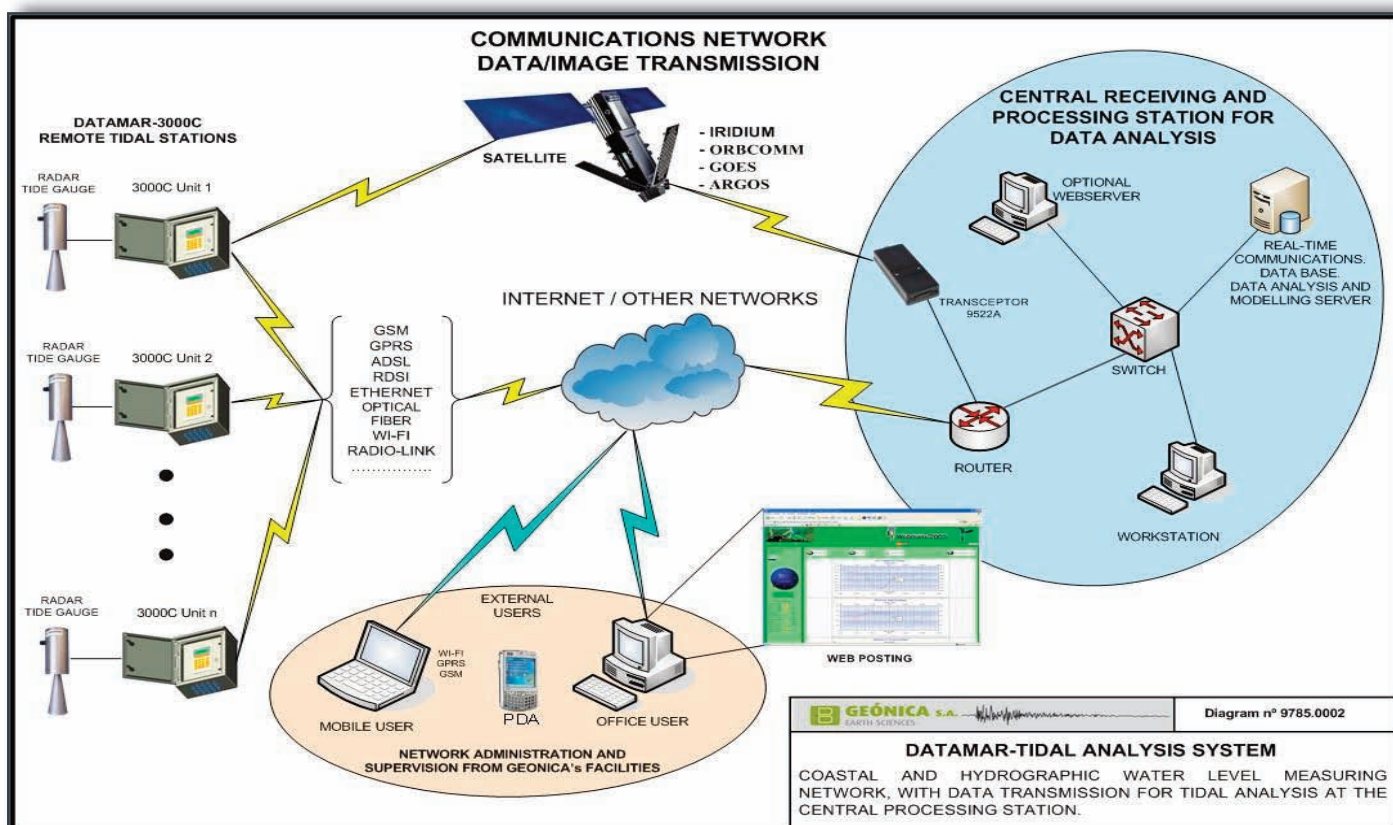
DATA TRANSMISSION

The averaged level data and the data corresponding to other meteorological parameters can be transmitted also via GPRS to the local network, at programmable time intervals and distributed via the Internet using GEONICA's WEBTRANS platform.

Finally, the transmission of the images captured by the

optional digital cameras can also be carried out via any of the above mentioned ways, by GPRS or by direct link.

In any case, the data transmission strategies will be defined in accordance with the infrastructures and needs of each Port.



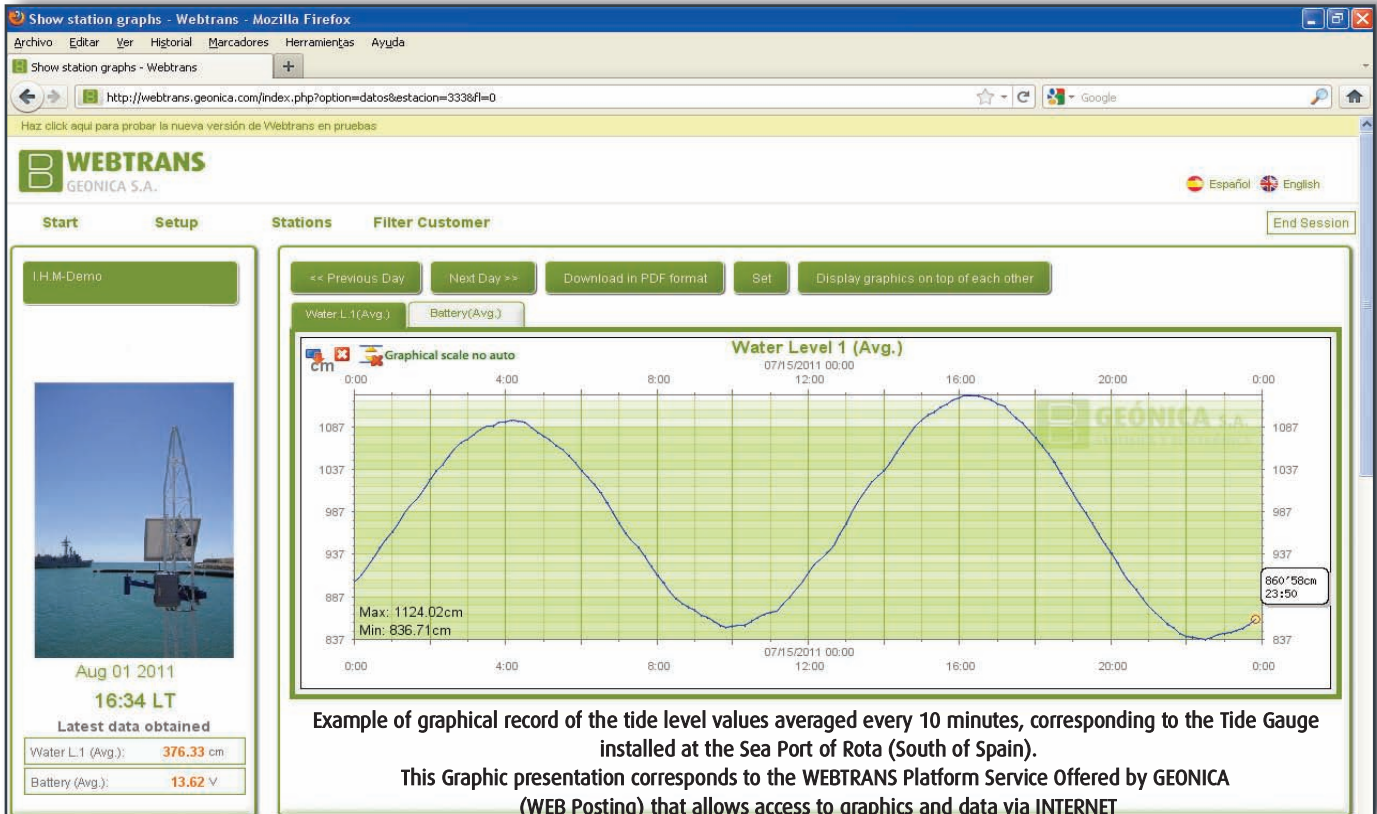
DATA MANAGEMENT AND BROADCASTING

Once all the information has been received and stored using either ACCESS or SQL, in the Port Authority's database, it is possible to export ASCII, XML or binary files for later treatment using the GEONICA SUITE software package.

The Port Authority will be able to broadcast on Internet the averaged tide data from the tide gauge, along with other optional environmental parameters (such as water temperature, wind conditions, visibility, etc.). Hence, ships and vessels can use this information to make easier the docking and leaving manoeuvres, etc., and Harbour Controllers are provided with very useful information.

All these presentation and broadcasting options of the information about tides and other environmental parameters, are considered within the SAFE PORT SYSTEM which also includes the measurement and treatment of several other parameters related to ocean currents, water quality, detection of hydrocarbons, etc., as described in a separate document.

Graphical information and data download is also available in Internet through the WEBTRANS Platform Service offered by GEONICA and, alternatively, through the WEBTRANS Ubiquitas Internet Platform. This application can be installed at the user's facilities, as described in a separate brochure.



ADDITIONAL OPTIONAL SENSORS

The Data Acquisition Unit, which belongs to the DATAMAR tide gauge, has 8 or 16 analogue input channels for the optional measurement of other additional environmental parameters, besides the water level.

The following meteorological and hydrodynamic parameters could be also measured:

- . Wind speed and direction
- . Precipitation
- . Solar Radiation
- . Air temperature

- . Water temperature
- . Present Weather
- . Visibility
- . Currents profile
- . Atmospheric pressure
- . Directional waves
- . Relative Air Humidity

Besides the abovementioned parameters, it is possible to connect also other special environmental sensors for radioactivity (gamma radiation), toxic gas detectors, multi-parametric water quality probes, and even hydrocarbon detectors for monitoring specific points of the port.

DIGICAM OPTION FOR SURVEILLANCE IMAGERY

Another interesting possibility of the Data Acquisition Unit is that it enables the connection of one or more digital cameras, to capture and store still images for transmission to the Port Authority.

The images can be transmitted in sequential mode, according to an automatic or manual process to be decided by the user. Each camera is identified by a specific address, and therefore, images can be requested from specific cameras depending on the requirements.

The images' transmission capacity, that is, the speed at which they can be transmitted, will depend on the bandwidth of the communication channel used in each case.

The digital camera has various types of lenses in order to offer panoramic images or close-ups depending on the focal distance selected.

The installation of cameras in different locations is always possible, as the 2000C / 3000C Unit has its own functionality and new units can be located in any other area of the port, with or without water level RADAR sensor.



EASY INSTALLATION

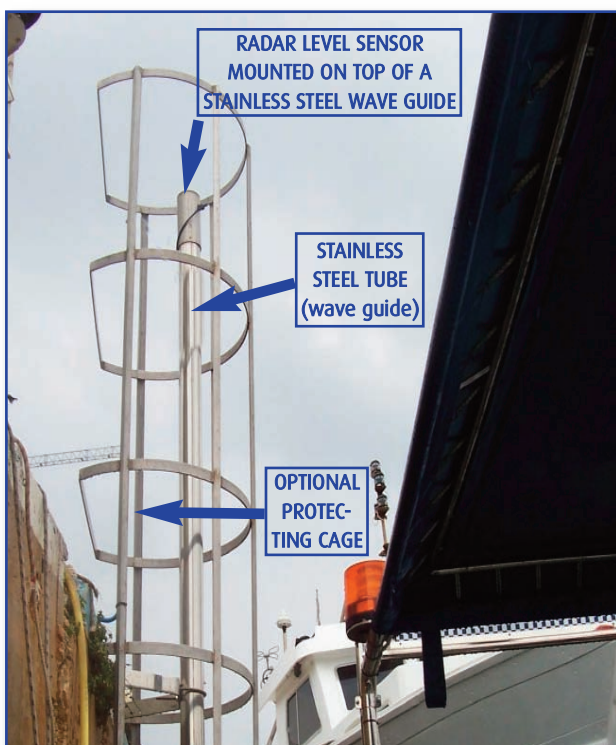
The installation of the DATAMAR tide gauge is very simple, as it does not require underwater work or complicated adjustments.

The RADAR sensor itself is supplied assembled inside a stainless steel closed cylinder, for total environmental protection.

Once the location of the tide gauge has been selected, the RADAR sensor must be mounted at the end of a suitable support arm (supplied optionally by GEONICA), attached to the quay, a tower or a similar structure. The antenna of the RADAR transducer must be orientated towards the water, in vertical position, at a suitable height above the high tide level and the agitation of the sea.

The Model 2000C / 3000C Data Acquisition and Transmission Unit can be fitted outdoors, on the same tower as the RADAR transducer support arm, or in any other location or building nearby that could be available.

The level output signal (4-20 mA) generated by the RADAR level sensor is connected via cable to the Data Acquisition and Transmission Unit Model 2000/3000C. The same cable is also used to power the transducer by means of the internal power supply of the 2000C / 3000C Unit. These two compact elements, RADAR transducer and 2000C / 3000C Unit, do not require connection to a computer or local PC to store the information, so the installation requirements are reduced to a minimum.



Alternatively to place the RADAR transducer in the open air, it is also possible to use a protective stainless steel tube, with a suitable diameter, so that the transducer's antenna is housed inside it. The tube acts as a wave-guide for the microwave signal in its two-way journey, reflecting on the sea's surface.

On the left is included a photographs showing a typical installation with protection tube at Ciutadella Sea Port (Menorca Island-Spain).

This installation mode provides quite effective protection against vandalism, whilst it also enables the tube to be used as a calming element to cushion the normal agitation of the sea's surface.

The assembly tube must be installed vertically, attached to the port's quay in the selected location.

The wave-guide formed by the protective tube has in the upper part, several aeration holes for the air to flow out, thus allowing the water to pass into the tube at its lower submerged



TECHNICAL SPECIFICATIONS

RADAR SENSOR

Measuring range	:	
		Programmable from 1 to 15meters (model RADAR-6115) 30m optional (model RADAR-6230)
Resolution	:	1 mm
Accuracy	:	± 2 mm (individual measurements) ± 1mm (averaged values)
Lobe width	:	8°
Radar frequency	:	26 GHz
Output	:	4-20 mA
Power	:	24 Vdc (from the 2000/3000 unit)
Operat. Temp.	:	-30 to +80°C
Housing	:	IP-68 with additional stainless steel mechanical protection enclosure (heavy duty)



Radar Level Sensor Model 6115

2000C or 3000C DATA ACQUISITION UNIT

ASSEMBLY

- The 3000CM series Data Acquisition Unit, is supplied mounted in a metallic box with the following dimensions: 430 x 330 x 200 mm, with double door and IP-66 protection.
- The 2000CP version is mounted in a box or case made of a special copolymer, which is highly resistant and offers IP-67 protection

KEY FEATURES

- Fully programmable data acquisition and local processing unit, with storage in internal Flash memory of 64 MB . As an option, additional retrievable 2Gb SD memory card for 1Hz data storage (one-second level values) is available.
- Very high resolution 20 bits Analogue to Digital Converter.
- LCD alphanumeric display with integrated membrane keyboard (optional)
- Fast connection internal strips for all the sensors, external radio transmitters, solar panel, supply network, etc.
- Electronic protection circuits against transients and surges for all the external connections.
- Built-in Power Supply module for the station, sensors and communications equipment, with charger for connection to mains voltage or photovoltaic solar panel
- IP interface circuit for communications via the INTERNET, Ethernet, wireless networks, etc., i.e. for accessibility to the 2000C/3000C Unit via any communications network with TCP/IP protocol, satellite networks, etc.

INPUTS AND OUTPUTS

- 8 or 16 input analogue channels
- 2 micro relay digital inputs (10 optional)
- 2 micro relay digital outputs (6 optional)
- 4 16-bit digital counters (for rain gauges, anemometers and other pulse output sensors)
- Communications ports:
 - 2 RS232 serial ports, one of them 422/485 programmable
 - 1 serial port for "firmware" development (dedicated)
 - 1 serial port for RTC/GSM/GPRS communications (dedicated)
 - 2 additional serial ports (optional) for general purposes (Ethernet; SDI-12; Bluetooth; Wi-Fi; GPS receiver; RS232/422/485)



2000CP



3000CM

**TECHNICAL SPECIFICATIONS****OTHER CHARACTERISTICS**

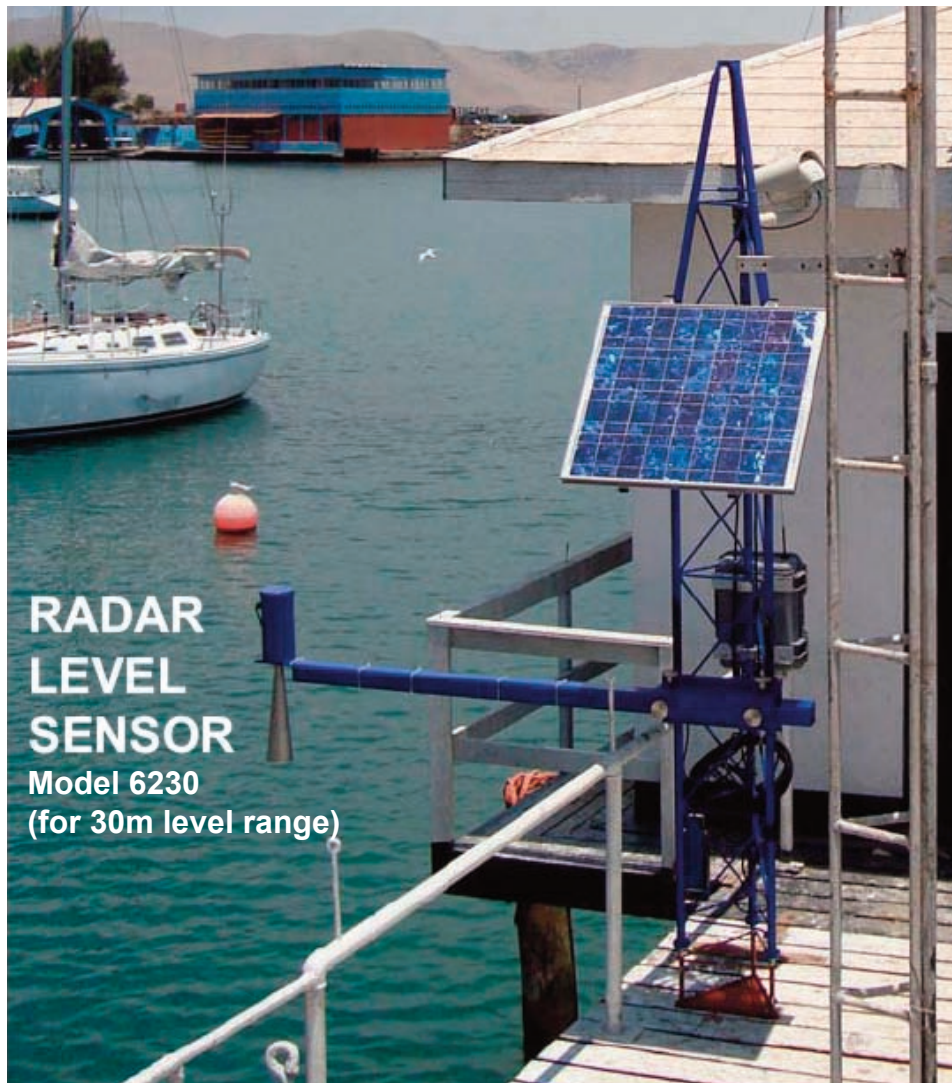
- Data storage capacity for over 5 months.
- Ultra low consumption (10 mA / 12Vdc)
- Compact design
- IP interface circuit for communications via Internet, Ethernet, etc.
- Internal GPS receiver for time synchronisation (optional)
- Internal GSM or GPRS modem for communications and data transmissions

OPTIONAL SENSORS

As well as the level RADAR sensor, the Model 2000C/3000C Data Acquisition Unit, enables the connection of all kinds of meteorological, hydrological and environmental sensors.

OPTIONAL DIGICAM

The 2000C / 3000C unit also allows for the connection of one or more DIGICAM-type colour cameras for sequentially capturing and transmitting still images.



TIDAL STATION DATAMAR-3000CP with RADAR-6230 water level sensor