

DATAMAR 2000

RADAR TIDE GAUGE



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

- Level measurements every second (1 Hz)
- Automatic clock synchronisation via internal GPS receiver (optional)
- 1 mm accuracy for averaged values
- Operation by internal battery and solar panel or mains
- High memory capacity with several months of autonomy for averaged data
- Real-Time Data Transmission to the Port Authority
- Data Accessibility via Internet (WEB Posting)
- Option GEO-AtoN AIS Transmitter

INTRODUCTION

DATAMAR 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** 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 3000

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, 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.

In addition, the **DATAMAR** tide gauge is equipped for the connection of one or more optional **DIGICAM** colour digital cameras, 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.

HIGH ACCURACY AND STABILITY

The RADAR level measuring sensor operates with microwave signals at the frequency of 26 GHz, offering a high accuracy 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 very second, does not suffer any degradation in the digitalization process performed by the 3000 unit, as it is equipped with a 24-bit Analogue/Digital converter capable of resolving more than one part in half a million. Any other digitizer 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 3000 Unit, it has an estimated accuracy of 1 mm, for calculation intervals from 1 minute onwards.

The stability in the measurements of the **DATAMAR** 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.

MEASUREMENT INTERVAL AND RECORDING

The RADAR water 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 model 3000 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 /3G modem, the 3000 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** 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	3000 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

STORING DATA AND STILL IMAGES

The Data Acquisition Unit Model 3000C, has a Flash-type internal memory.

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 3000C unit.

Finally, a part of the memory, can be used for the transitory storage of the color images captured by one or more digital **DIGICAM** 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 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/3G or by direct link.

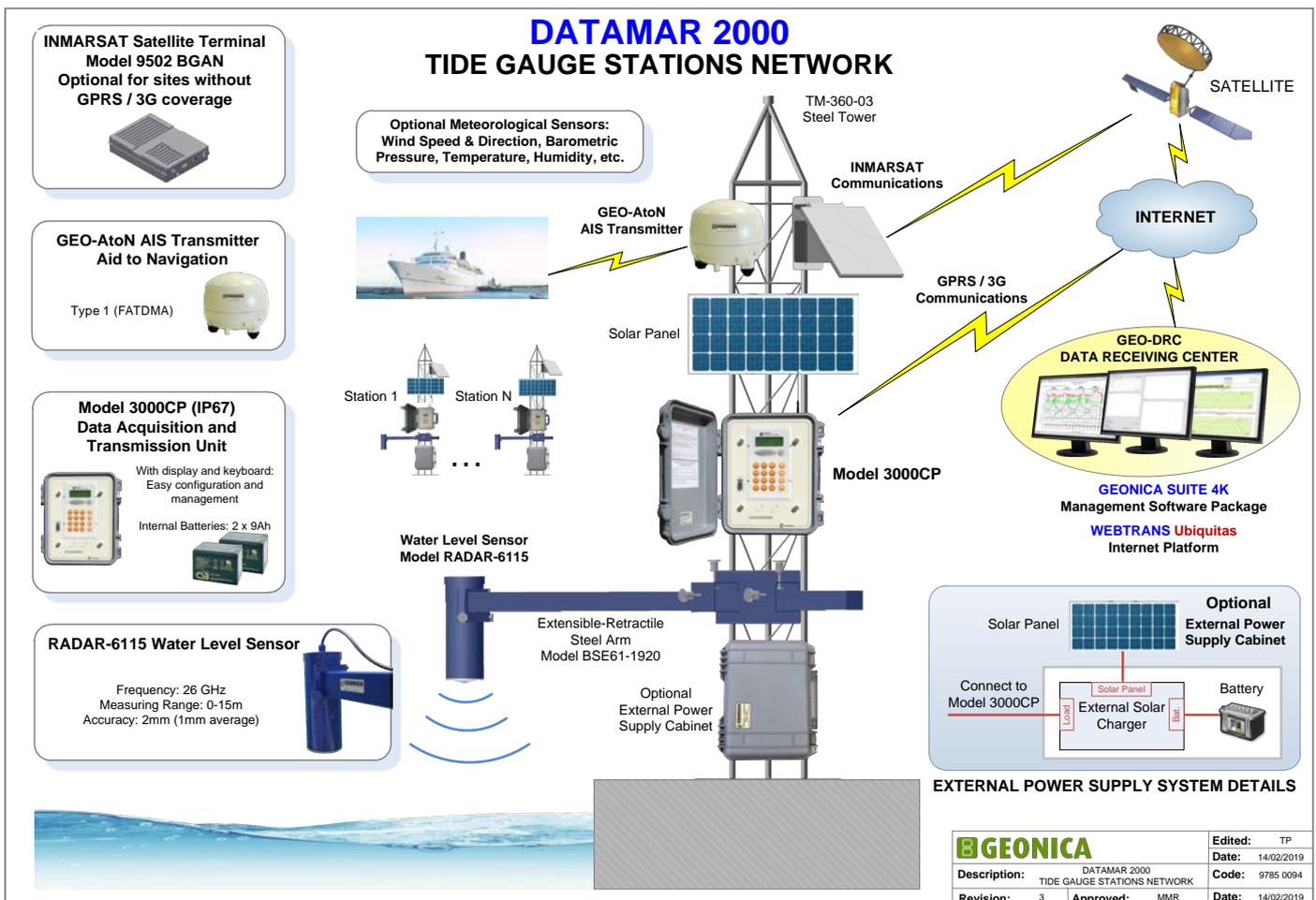
In any case, the data transmission strategies will be

defined in accordance with the infrastructures and needs of each Port.

Option GEO-AtoN AIS Transmitter is integrated with **DATAMAR**.

AIS AtoN is an aid to navigation for ships, an international standard using messages sent by a VHF transponder that are received by all ships having an AIS receiver (most of the ships).

All the information obtained by **DATAMAR** that is sent to Data Receiving Center can be sent (at the same time) to all ships with AIS.



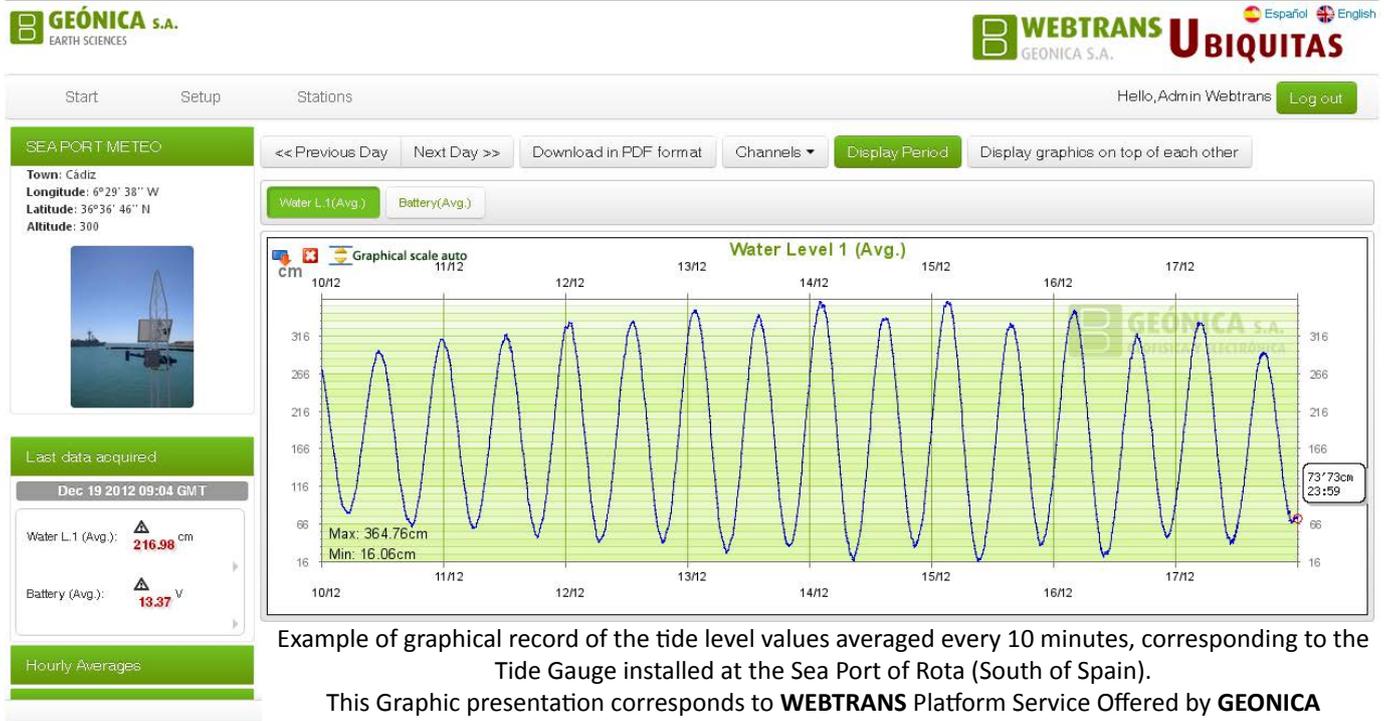
DATA MANAGEMENT AND BROADCASTING - WEBTRANS Platform

Once received all the information and of having being stored in the database of the Port Authority or in any other Main station already be in SQL, by means of the package software **GEONICA SUITE** there will be able to be exported files ASCII, XML, or binary, in order to allow his later treatment.

Besides the direct transmission of the information of the tide gauge to the Port Authority, the information can be transmitted across the network of cellular telephony GPRS up to any other center, and even publicize it in INTERNET using the Platform **WEBTRANS** developed by **GEONICA**. Thus, the information of tides of one or more ports of a country, they would be available in Internet for "universal" use.

An example of the graphical presentation in **WEBTRANS** Internet Platform of the level of the sea depending on the time, as well as of the values of other optional

parameters, as speed and wind direction, atmospheric pressure, etc. It can turn in the following illustration:



GEONICA offers to its customers the **WEBTRANS** Platform, as personalized service designed to provide users with simple and fast access through Internet to the data of their own measurement stations, without the need to communicate directly with each of them.

The access to **GEONICA's WEBTRANS** platform service is provided using a user name and password, and only requirement is to have an Internet connection, preferably ADSL type.

Data and graphics from each remote station will be displayed on the **Webtrans** screen and can be programmed from **GEONICA's** server to be updated every 5, 10, 20, 30 or 60 minutes (another period range can be selected).

A demo of our **WEBTRANS** service can be seen by accessing the following link: <http://demoWEBTRANS.GEONICA.com>

Alternatively, **GEONICA** offers the Internet platform **WEBTRANS Ubiquitas**, to be installed in the client's computer or local network (LAN), which also allows access to data and graphics via Internet, but in this case using the client's own server. Detailed information about **WEBTRANS Ubiquitas**, platform can be found in a separate document.

All these options of presentation and dissemination of tidal information and other environmental parameters can also be included within **SAFE PORT SYSTEM**, which performs the measurement and treatment of several other parameters related to marine currents, water quality, detection of hydrocarbons, etc.

ADDITIONAL OPTIONAL SENSORS

The Data Acquisition Unit, which belongs to the **DATAMAR** tide gauge, has 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
- Water temperature
- Air temperature
- Relative Air Humidity
- Atmospheric pressure
- Solar Radiation

- Precipitation
- Visibility
- Present Weather
- Currents profile
- Directional waves

Besides the above mentioned 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 TO CAPTURE STILL COLOUR IMAGES

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 3000 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.

INSTALLATION AND ASSEMBLY

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 3000 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 3000. The same cable is also used to power the transducer by means of the internal power supply of the 3000 Unit. These two compact elements, RADAR transducer and 3000 Unit, do not require connection to a computer or local PC to store the information, so the installation requirements are reduced to a minimum.

3000C DATA ACQUISITION UNIT

ASSEMBLY

- The 3000CP is mounted in a box or case (dimensions 340 x 300 x 170 mm 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 (optional 128 MB). As an option, additional retrievable 2GB SD memory card for 1Hz data storage (one-second level values) is available.
- Very high resolution 24 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 3000C Unit via any communications network with TCP/IP protocol, satellite networks, etc.



Model 3000CP



Water Level Sensor Model RADAR-6115

INPUTS AND OUTPUTS

- 16 input analogue channels
- 2 micro relay digital inputs
- 2 micro relay digital outputs
- 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 PSTN, 3G/GPRS communications (dedicated)
 - 2 additional serial ports (optional) for general purposes (Ethernet; SDI-12; Bluetooth; Wi-Fi; GPS receiver; RS232/422/485)

OTHER FEATURES

- Data storage capacity over 5 months, with the standard memory of 64MB
- Ultra low consumption (10 mA / 12Vdc)
- Compact design
- Internal GPS receiver for time synchronization
- Internal 3G / GPRS modem for data transmission over the cellular network, as well as, optionally, INMARSAT satellite modem, etc.

The **RADAR sensor - Unit 3000**, is a set of two compact elements, not requiring the connection to any computer or local PC to store the information, for what its cost and the demands of installation, assembly and maintenance of the tide gauge, are reduced to a minimum.

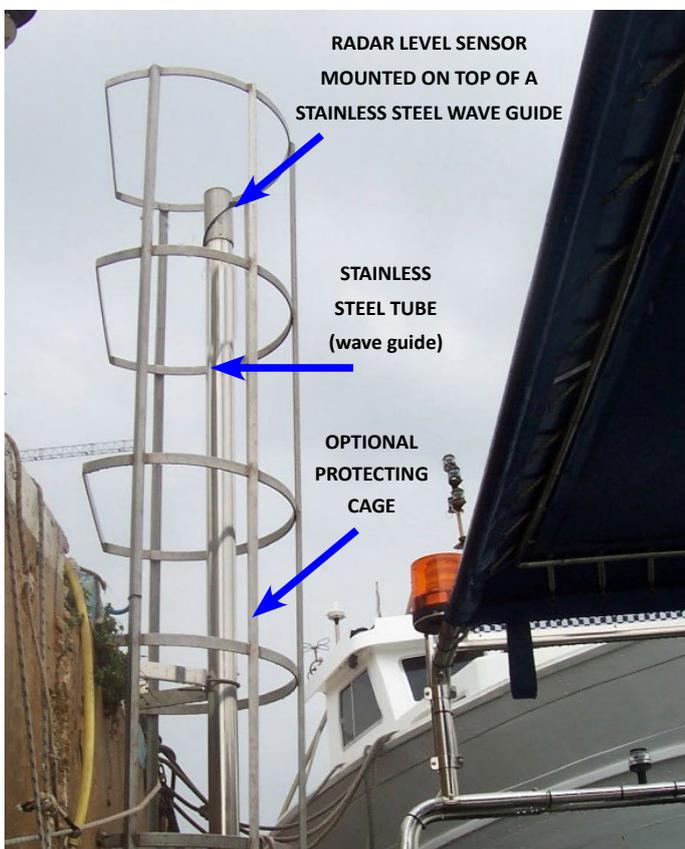
The RADAR level sensor or transducer is mounted on the inside a stainless steel protective housing, the which wraps it in its entirety. One bulkhead, closing hermetic, allows the passage of the interconnection cable with Unit 3000C.

The RADAR level sensor can be installed mounted on the air using a turret and extendible support arm, according to can be seen in the photograph on the right. On the turret normally the electronic unit is also mounted 3000C model, with its antenna for communication, as well like the solar panel for recharging the internal batteries that feed the whole.

As can be seen, the **DATAMAR** team constitutes a compact tide gauge with registration capability and transmission of data, very low consumption and total autonomy that can be installed in any site without the need for a network of feeding.



RADAR-6115 water level sensor assembly on extendible-retractile support arm mounted on a tower



RADAR level sensor assembly on stainless steel tube

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 th water to pass into the tube at its lower submerged part which remains open for the purpose.

TECHNICAL ESPECIFICATIONS

RADAR SENSOR	
Measuring range	0 to 15m (Model RADAR-6115) 0 to 35m (Model RADAR-6135)
Resolution	1 mm
Accuracy	±2 mm (individual measurements) ±1 mm (averaged values)
Radar frequency	26 GHz
Output	4-20 mA
Power	18-30 Vcc (from the 3000 unit)
Operat. Temp.	-40 a +80°C
Housing	IP-68 with additional stainless steel mechanical protection enclosure (heavy duty)

OPTIONAL SENSORS

The model 3000 acquisition unit allows, in addition to the RADAR level sensor, the connection of all types of meteorological, hydrological and environmental sensors.

OPTIONAL DIGITAL CAMERA

The 3000C unit also allows the connection of one or up to 4 digital colour cameras, type **DIGICAM**, for capturing and transmitting images sequentially.



DATAMAR RADAR Tide Gauge
with RADAR-6135 water level sensor mounted on the air