

**Subsurface Mooring Monitoring Beacons**  
**SMM 2000, SMM 6000, SMM 2000X and SMM 6000X**

**User Manual**

**Version 1.3**

**February 2008**

**SiS Sensoren Instrumente Systeme GmbH**  
**Mühlenkoppel 12**  
**24222 Schwentinental**  
**Germany**  
**<http://www.sis-germany.com>**

**Contents**

- 1. General Information .....2**
  - 1.1 Description.....2**
  - 1.2 Switch Mode Power Supply Option .....2**
- 2. Operating Instructions .....3**
  - 2.1 Choosing Batteries for your Application.....3**
  - 2.2 Opening the Housing .....3**
  - 2.3 Insertion of Batteries .....3**
  - 2.4 Replacement of Moisture Absorbent.....4**
- 3. Principle of Operation .....4**
  - 3.1 SMM Operation .....4**
  - 3.2 CLS Argos Localisation Service .....4**
  - 3.3 Admission to the Argos System .....4**
- 4. Maintenance .....4**
  - 4.1 Maintenance Notes.....4**
  - 4.2 Maintenance Parts and Tools.....4**
  - 4.3 General Disassembly .....5**
  - 4.4 Replacement of Main Housing O-rings .....5**
  - 4.5 Replacement of Main Housing Screws.....5**
  - 4.6 Pressure Switch Replacement .....5**
  - 4.7 General Assembly .....6**
- 5. Appendix .....6**
  - 5.1 Technical Specification .....6**
  - 5.2 Warranty and Support.....7**

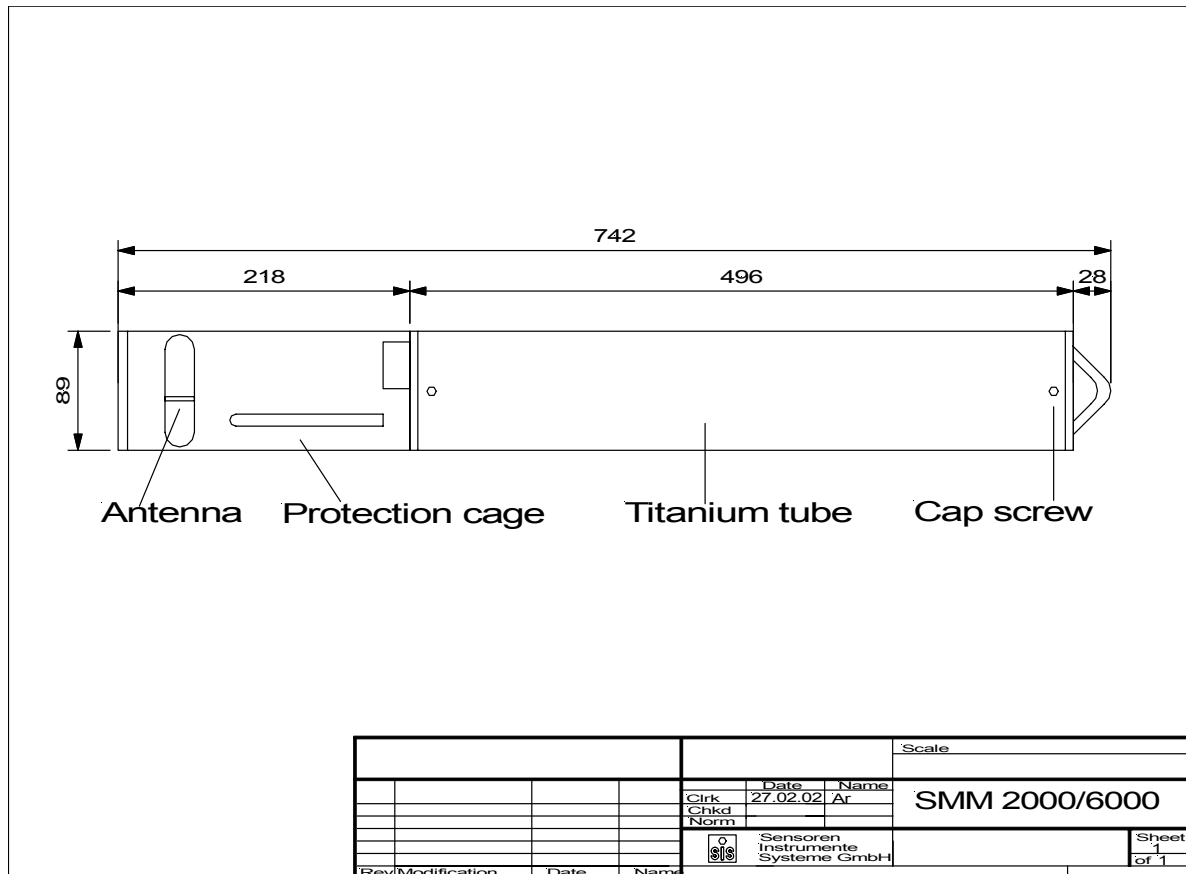
**List of Figures**

- Figure 1 SMM 2000/6000 .....2**
- Figure 2 Membrane.....6**

# 1. General Information

## 1.1 Description

The SMM 2000(X)/6000(X) consists of a titanium tube closed by end caps. The upper cap holds the antenna and the protection cage which is transparent to UHF radiation. The cage has openings for the outflow of seawater and a cover for the protection of snow and ice.



**Figure 1 SMM 2000/6000**

Inside the housing is a battery holder for two bundles of 5 batteries each in series. The batteries power the transmitter (PTT) directly or via an optional switch mode power supply (X Option). The power is switched on by a pressure switch inside the upper cap. The switch is separated by a membrane from seawater. The pressure transmission is done by silicon oil.

At the lower cap you will find a bow. This bow is for opening the housing in case of battery replacement. You must not use this bow for mooring of the instrument.

The depth capability of the SMM 2000(X) is 2000 m and that for The SMM 6000(X) is 6000 m.

Don't use the SMM 2000(X)/6000(X) in the euphotic zone, for the transmission might be interfered by biofouling. There is a shallow water version available with protected dry antenna (SMM 500 and SMM 500X).

## 1.2 Switch Mode Power Supply Option

Instruments marked with an X have the extended battery option. They can be used with a wider selection of battery types. The battery voltage is converted to the right level by a switch

mode power converter. For instruments without the X-option, the batteries directly power the transmitter. The X-option may be installed to all systems later.

## 2. Operating Instructions

### 2.1 Choosing Batteries for your Application

The cell voltage has to be between 2.2 V and 5.2 V. For instruments with the X-option the cell voltage has to be between 0.8 V and 5.2 V allowing the usage of alkaline batteries or nickel cadmium accumulators as well. For long term moorings in cold environment we recommend to use high quality Lithium cells.

The batteries must be able to source 350 mA continuous current and 1700 mA pulse current. So you should use a battery type which has good efficiency with high currents. This applies especially to Lithium and Lithium Thionyl Chloride Batteries.

For calculation of battery lifetime use the average power consumption when surfaced. Divide the energy content of the 10 or 5 batteries by the mean power consumption (100 mW) of the beacon. The table shows typical life times for different battery types:

<b>Temperature</b>	<b>Lithium</b>	<b>Alkaline</b>	<b>NC</b>
20 °C	150 days	60 days	30 days
0 °C	150 days	50 days	28 days
-30 °C	140 days	not applicable	not applicable

Lithium battery: Silberkraft Eternacell, Lithium-SO<sub>2</sub>, Size D, Capacity 10 Ah

Alkaline battery: Philips LR20, Green Alkaline, Size D, Capacity 13.2 Ah

NC battery: Panasonic 4000N, NC, Size D, Capacity 4 Ah

Please halve the times when using only 5 batteries. For instruments without the X option use the Lithium values only!

### 2.2 Opening the Housing

You open the housing by removing the end caps. The caps are fastened by two hexagon socket screws each. For opening please screw clockwise thereby turning in the screw into the cap. This paradox solution - screwing tight for opening and screwing loose for fastening - has the advantage that you won't lose the small screws. When the instrument is opened screws and end cap build one unit. You then may pull out the cap.

The inner part is fastened at the upper cap. Normally you don't have to remove the instrument from the housing. One of the screws of the upper cap is filled with epoxy resin. So you can't open inadvertently. A tight connection of the upper screws with the tube is necessary because a good electrical connection between cap and tube is important, for the tube is the ground plane for the antenna.

### 2.3 Insertion of Batteries

Don't open the housing by removing the upper cap. Open the housing by removing the lower one.

Put the instrument upside down on the floor. Place a rail through the upper opening of the antenna cage and fasten by getting up on the rail. Be sure not to interfere with the antenna inside the cage. Place a rod (e.g. screw driver) through the bow at the now upper cap and pull out the end cap.

You will now find a PVC disc, take it out and you will see two tubings in a PVC block and one contact pin. Put 5 pieces D type batteries into each tube, oriented with the minus terminal in direction of the antenna.

If you want the instrument to operate after insertion of batteries close the housing by insertion of the end cap.

In case you only want to insert batteries but later on want to operate, please place the PVC disk for isolation between batteries and cap.

## **2.4 Replacement of Moisture Absorbent**

The printed circuit boards are protected by coating, but condensation of humidity should be avoided. When leaving the factory, the instrument is filled with dry argon gas and a small pack with moisture absorbent is placed in a slot between the battery holder and the titanium housing at the lower end. We recommend to fill with dry gas or replace the moisture absorbent after every opening of the housing. Normally together with battery replacement. With the instrument we deliver some packs with moisture absorbent sealed in a plastic bag.

## **3. Principle of Operation**

### **3.1 SMM Operation**

The SMM 2000 and 6000 subsurface mooring monitoring beacons go down with the mooring up to 2000 and 6000 m respectively with the PTT cut off by the pressure switch. If the mooring line should break, or when the mooring is being recovered, the PTT will switch on as it approaches the surface. In the first case, the beacon will transmit for the lifetime of the batteries (typically 3 months with 5 Lithium batteries) in the second, the beacon is manually switched off after recovery.

### **3.2 CLS Argos Localisation Service**

CLS Service Argos has developed a special service for monitoring the status of the moorings. An alarm state is set upon reception of the signal by an orbiting satellite and recognition and processing at a ground centre. A warning that the mooring line has surfaced, with its position, will be sent to the user by email, fax or telex. Thereafter each satellite pass will result in another location and another alarm message until a specified maximum number of messages has been sent. Generation of alarm messages may be cancelled by the user at any time. Users always may access data on-line (e.g. via Telnet).

### **3.3 Admission to the Argos System**

The user must fill out some forms and forward it to the Argos User Office:

- Argos System Use Agreement
- Service Contract/Order Form

Please see the Argos documentation for detailed information.

## **4. Maintenance**

### **4.1 Maintenance Notes**

The replacement of the wearing parts, described below, should only be done by qualified technical personnel. Inexpert handling can produce serious damage.

### **4.2 Maintenance Parts and Tools**

Requires (depends on the parts to be replaced):

- SMM 2000/6000 pressure switch spare part kit with:
  - 1 x SMM 2000/6000 pressure switch (adjusted to 25 - 35 m)
  - 1 x O-ring, 15.6 x 1.78, 90 shore
  - 1 x O-ring, 4.47 x 1.78, 90 shore
  - 1 x silicon oil (AK 100, Wacker Chemie, FRG)
  - 1 x membrane (60EPDM/266, Carl Freudenberg, Reichelsheim, FRG)
  - 4 x slotted countersunk head screw, DIN 963, M3x8, titanium
- SMM 2000/6000 housing O-rings
  - 4 x O-ring, 69.44 x 3.53, 90 shore
- SMM 2000/6000 housing screws
  - 4 x titanium screw
- silicon paste (e.g. TEGO-Silikonpaste S 200, Th. Goldschmidt AG, Essen, FRG) or silicon-based O-ring lubrication (e.g. Super-O-Lube, Parker)
- cleaning cloth (not napped)
- screw driver for M3 screws (for pressure switch plate)
- screw driver for M4 screws (for pressure switch connection)
- 6 mm tubular socket wrench (for antenna cable)
- 24 mm tubular socket wrench (for pressure switch)
- 3 mm hex driver (for antenna cage screws)
- 4 mm hex driver (for housing screws)

#### **4.3 General Disassembly**

- Turn the two hexagon socket screws at the battery cap clockwise into the cap and remove the battery cap.
- Turn the two hexagon socket screws at the antenna dome clockwise into the dome and remove the titanium housing.
- Detach the antenna cable from the ARGOS transmitter.
- Remove the two screws that connect the main part to the antenna cap.
- Detach the cables from the pressure switch.

#### **4.4 Replacement of Main Housing O-rings**

- Remove the O-rings from the caps by using a small screw driver. Be carefully to make no marks in the grooves.
- Clean the grooves with the dry cleaning cloth.
- Check the grooves for marks. If there are any marks, replacement of the caps is necessary.
- Check the new O-rings for damage.
- Grease the O-rings very slightly with the silicon paste. There should only be a thin film on the rings.
- Place the new O-rings into the grooves.

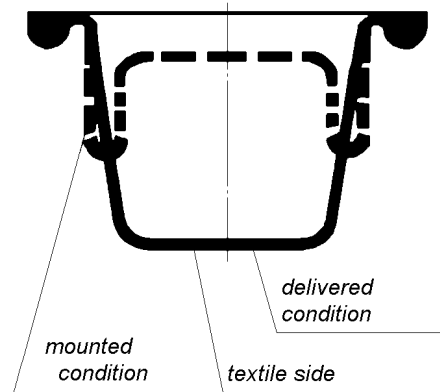
#### **4.5 Replacement of Main Housing Screws**

- Remove the old screws from the caps and replace them by the new ones.

#### **4.6 Pressure Switch Replacement**

- Remove the antenna protection cage by loosening the screws from the titanium cap.
- Remove the antenna.
- Unscrew the four countersunk head screws holding the plate.
- Remove the plate and the membrane and pour out the oil.
- Turn around the cap and loosen the old pressure switch with the tubular socket wrench (right-handed thread).

- Clean the O-ring grooves.
- Slightly grease the new O-rings and fit them in the grooves of the new pressure switch.
- Fit the new pressure switch (don't screw too tight).
- Turn around the housing and fill the hole nearly up to the border with new oil from the spare parts kit. Ensure that the hole is totally filled with oil; there should be no airbubbles.
- Prepare the new membrane according to Figure 2 and insert the membrane.
- Refit the plate and fasten it with the four screws.
- Refit the antenna and the protection cage.



**Figure 2 Membrane**

#### 4.7 General Assembly

- Pull the antenna cable through the hole of the main part.
- Fasten the cables at the pressure switch.
- Refit the antenna cap to the main part.
- Connect the antenna cable to the ARGOS transmitter.
- Refit the main housing to the antenna cap. The battery symbol on the main housing must point to the battery cap side.
- Refit the battery cap.

## 5. Appendix

### 5.1 Technical Specification

Mooring depth	2000 or 6000 m	
Pressure switch threshold	25 - 35 m	
Dimensions (l x d)	742 x 89 mm	
Mass without batteries	6.7 kg	
Displacement	3.1 dm <sup>3</sup>	
Power Supply	5 or 10 pcs. D cells resp.	
Battery Types without option X	Lithium or Lithium Thionyl Chloride (1)	
Battery Types with option X	NC, Alkaline, Lithium or Lithium Thionyl Chloride (1)	
Battery cell voltage (without option X)	2.2 V - 5.2 V	
Battery cell voltage (with option X)	0.8 V - 5.2 V	
Peak supply current	1700 mA	
Average power consumption when surfaced	100 mW	
Mooring life with Lithium cells	up to 2 years	
Transmission life with Lithium cells	3 or 6 months resp.	
Transmitter manufacturer (2)	Serpe IESM	Elta / CEIS
Transmitter model (2)	PTT 07	UHF 88 or HAL2
Output power	33 dBm (2 W)	33 dBm (2 W)
Message length (3)	32 bits	32 bits
Repetition rate (4)	90 seconds	90 seconds
Transmit frequency (5)	401.650 MHz	401.650 MHz (UHF88)
	401.620 MHz	401.630 MHz (HAL2)

#### Notes:

1. The used batteries must be able to source 350 mA continuous current and 1700 mA pulse current. Some low current types of Lithium Thionyl Chloride batteries can't be used.

2. There are three transmitter models used with the SMM. Instruments manufactured from 2003 to 2006 are equipped with the Serpe IESM PTT 07 model, those made since 2006 are equipped with the Elta HAL2 model while older instruments use the Elta / CEIS UHF 88 model.

3. The SMM did not send any user data. Therefore, the message length is set to the minimum value of 32 bits. With Elta HAL2 transmitters, a prefix byte (typ. 25 hex, with 20-bit ID only), temperature (°C), supply voltage (mV / 64) and power indication (mV / 4) are send.

4. The default repetition rate is 90 seconds (recommended by Argos). Other rates (e.g. 60 seconds) can be programmed upon request.

5. With Elta HAL2 transmitters, the transmit frequency is programmed to 401.630 MHz according to the Argos recommendations. With UHF 88 transmitters, the frequency is fixed at 401.650 MHz. The transmit frequency of PTT 07 is set by the manufacturer.

## **5.2 Warranty and Support**

SiS warrants this instrument to the original purchaser to be free of defects in material or manufacturing for a period of two years. Liability is limited to repair or replacement of the defective part which will be done without charge if the instrument is returned to our factory prepaid. This warranty does not apply to instruments subjected to misuse or tampering. No responsibility or warranty for consequential damage is included in the sale of this instrument.

SiS - Sensoren Instrumente Systeme GmbH  
Mühlenskoppel 12, D-24222 Schwentinental, Germany  
Tel.: +49-431-79972-0  
Fax: +49-431-79972-11  
Email: [info@sis-germany.com](mailto:info@sis-germany.com)  
WWW: <http://www.sis-germany.com>