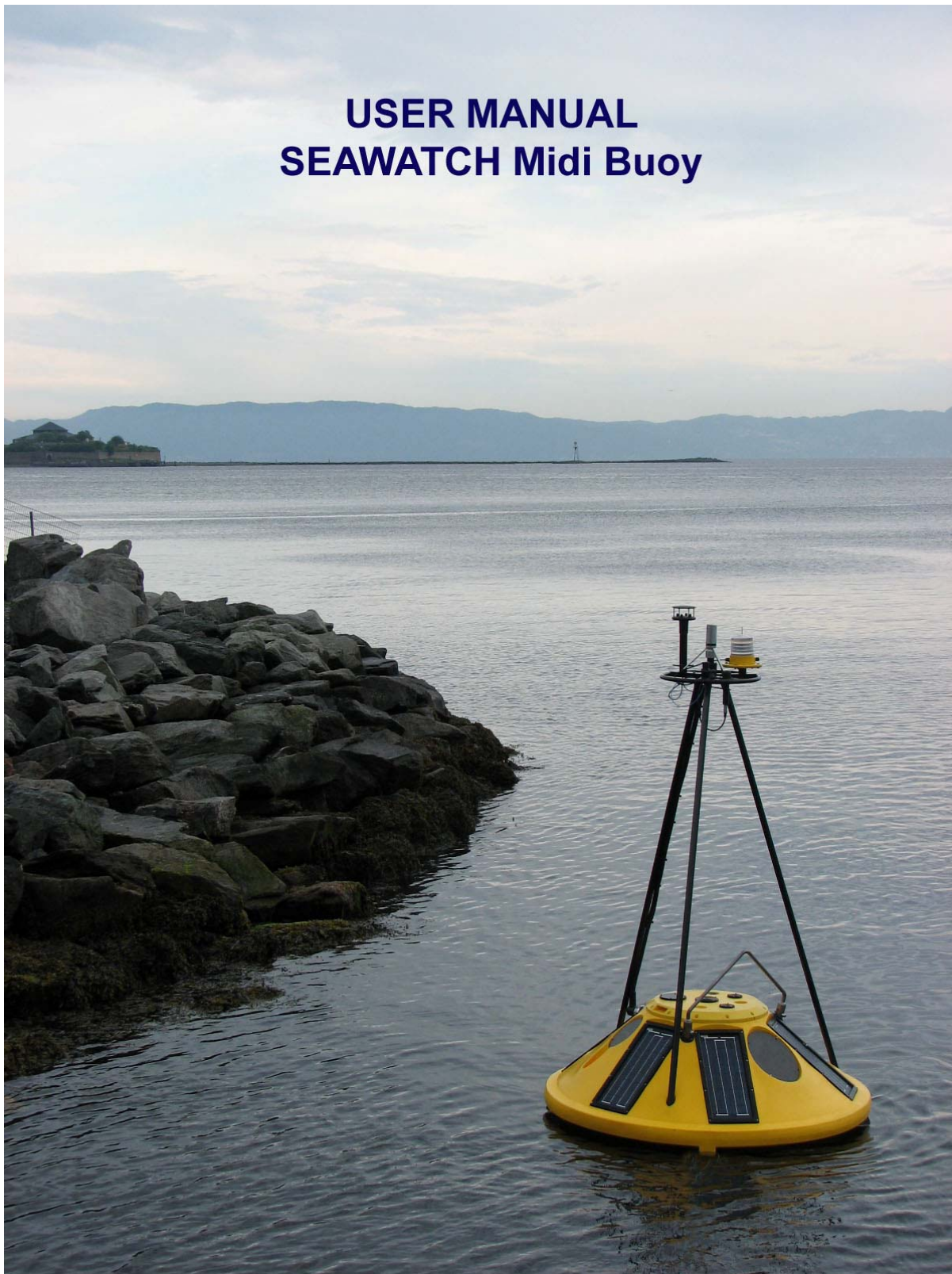


USER MANUAL SEAWATCH Midi Buoy




Fugro OCEANOR AS

Pir-Senteret, P.O. Box 1224, Sluppen, N-7462 Trondheim, Norway

Tel: + 47 7354 5200, Fax: + 47 7354 5201, e-mail: trondheim@oceanor.com

Fugro OCEANOR AS

Address: Pirsenteret, P.O. Box 1224, Sluppen, N-7462 Trondheim, Norway
 Telephone: +47-73 54 52 00, Telefax: +47-73 54 52 01
 URL://www.oceanor.com, e-mail: trondheim@oceanor.com

		
DOCUMENT TITLE:		DOCUMENT No.:
		OCN SW - 472
MIDI BUOY USER MANUAL		REVISION:
		1
PROJECT No.:	DATE:	
C75154	04.12.11	
ISSUED BY:	CONTROLLED BY:	APPROVED BY:
Venthan Sanmuganathan	Ståle Solvang	Arve Berg
DISTRIBUTION:		
AGEOTEC, srl - Italy		
COMMENTS:		
<p>Manufacturer Support: Ståle Solvang Project Manager Fugro OCEANOR Pirsenteret, P.O. Box 1224, Sluppen N-7462 Trondheim, Norway Tel: +47 7354 5200 Fax: +47 7354 5201 s.solvang@oceanor.com (copy to trondheim@oceanor.com) www.oceanor.com</p>		
<p>This document must not be copied without Fugro OCEANOR's written permission, and the contents thereof must not be disclosed to any third party, or be used for any unauthorized purpose. Legal action will be taken in the event of contravention.</p>		



DISCLAIMER

Fugro OCEANOR reserves the right to make changes to the products described in this document in order to improve the performance and to supply the best possible products.

Fugro OCEANOR assumes no responsibility for the use of the products in any application except for applications specifically covered by the contract.

Fugro OCEANOR does not warrant that any application or product mentioned in this manual is free from patent infringements.

Fugro OCEANOR shall not be held liable for any technical or editorial mistakes or omissions in this manual.



INDEX

1	INTRODUCTION
2	GENERAL SYSTEM INFORMATION
3	CUSTOMER SPECIFIC CONFIGURATION
4	OPERATING THE WAVESCAN SYSTEM
5	MECHANICAL
6	DATA ACQUISITION AND PROCESSING UNIT
7	BUOY COMMUNICATION SYSTEM
8	POWER SUPPLY
9	SENSORS
10	OPERATIONS
11	MISCELLANEOUS
12	CABLING
13	PART LIST
14	SPARE PART LIST
15	TROUBLESHOOTING



1. INTRODUCTION

Contents

1. THE SEAWATCH MIDI BUOY SYSTEM	1-1
1.1 Manuel structure	1-1

1. The SEAWATCH Midi Buoy system

The SEAWATCH Midi data buoy, being the trademark of Fugro OCEANOR metocean data collection system, is the central part of the Midi buoy system described in this manual.

The standard system (refer to "Customer specific configuration, chapter 3" for other configurations) comprises of two main parts:

- **SEAWATCH Midi buoy** – Buoy including all sensors, telemetry system and mooring.
- **Shore station** – The land part of the system, consisting of telemetry system, computer (s) and software for data reception. (refer to the separate manual).

1.1 Manuel structure

The SEAWATCH Midi Buoy User Manual has the following structure:

- Description of a general Midi buoy system with telemetry.
- System configuration for your specific buoy with listing of sensors, buoy modules, miscellaneous, assembly drawings, mooring and special solutions for this buoy.
- How to operate the buoy.
- A description of control, analyse and presentation of all system modules and buoy sensors containing function, technical data, test procedures and maintenance.
- A mechanical part with all data for buoy hull assembling and maintenance.
- A general description of the structure of buoy software and its functions.
- Complete cable list.
- Part list
- Appendix containing FAT/SAT.

Fugro OCEANOR appreciates any suggestion to changes or supplementary information to this manual.

Please send your suggestions to:

Fugro OCEANOR AS
Pir-senteret
P.O. Box 1224, Sluppen
N-7462 Trondheim
NORWAY
E-mail: trondheim@oceanor.com



2. GENERAL SYSTEM INFORMATION

Contents

2. THE SEAWATCH MIDI BUOY SYSTEM	2-1
--	-----

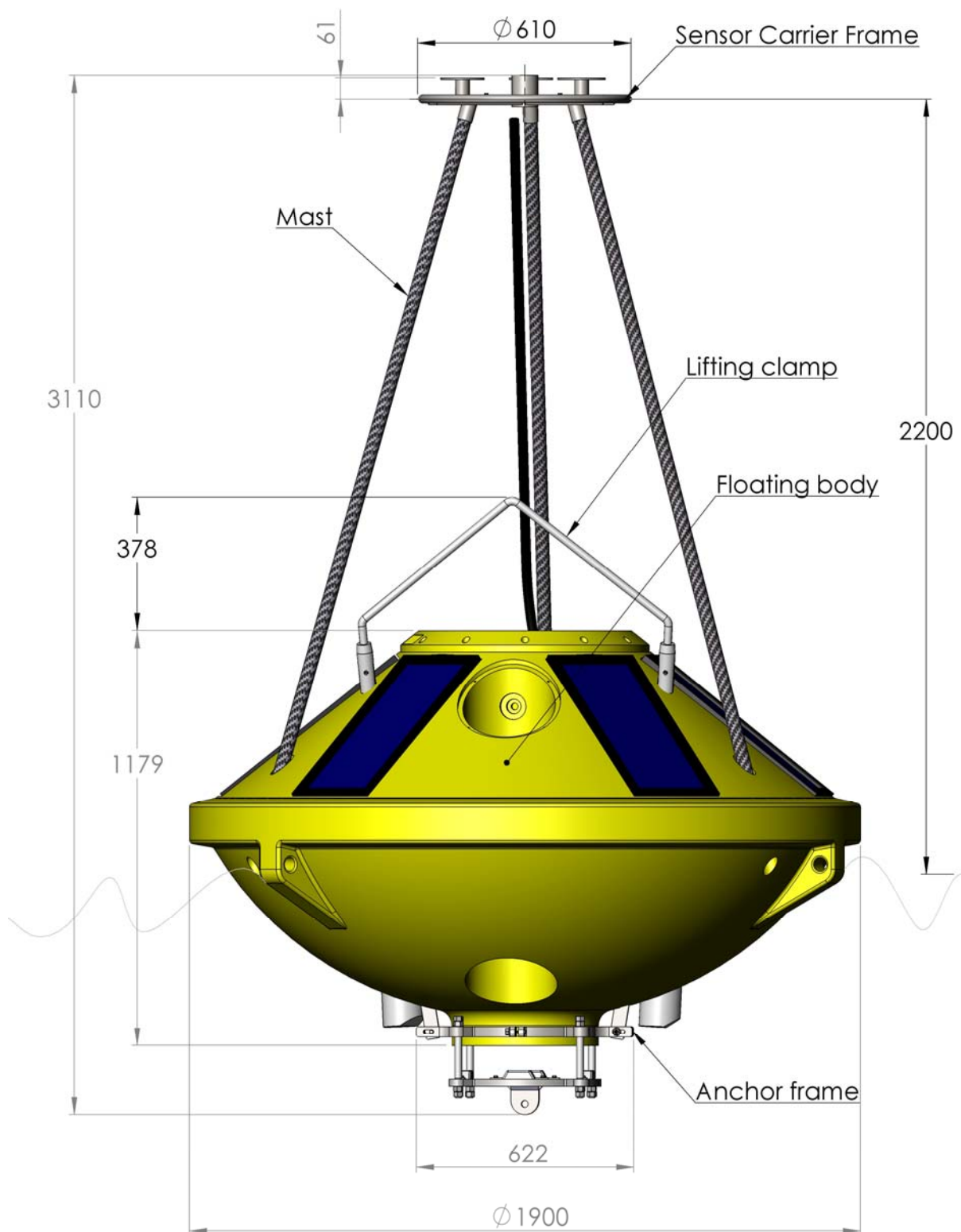
2. The Seawatch Midi Buoy System



Fugro OCEANOR

User Manual – SEAWATCH Midi Buoy

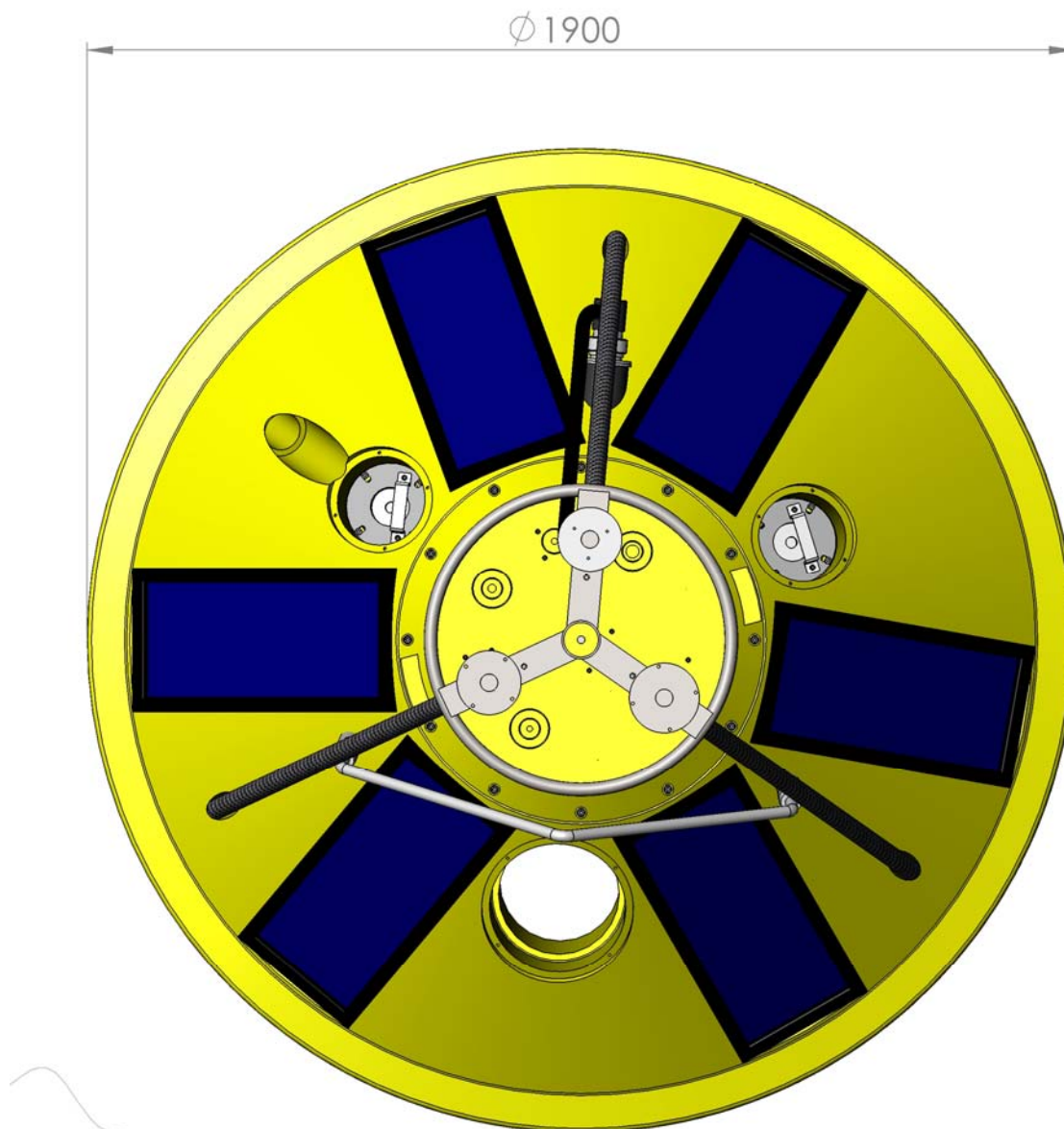
2. General system information



Fugro OCEANOR

User Manual – SEAWATCH Midi Buoy

2. General system information



Topp view



The SEAWATCH MIDI185 is a medium size discus shaped general purpose monitoring buoy, featuring:

- Multi-parameter and multi-application real-time monitoring
- Long-term unattended operation due to large solar charging and battery capacity
- High visibility reducing the risk of being run into and damaged by boats
- Extremely robust construction
- Suitable for measuring oceanographic parameters, waves, water quality and meteorology
- Sensors easily accessible without having to lift the buoy out of water

Hull

SEAWATCH MIDI185 buoy is made of foam filled high flexibility polyethylene. Such material is normally used in fenders. The choice of material ensures no risk of corrosion and sulphation as well as excellent resistance to impacts. The buoy is practically unsinkable. Below the water surface it is spherically shaped to ensure optimal wave measuring capability. The buoy is designed in such a way that risk for theft and vandalism is limited. The solar panels are recesses in the buoy hull.

Power Supply

Maintenance free marine grade solar panels and sealed lead-acid batteries enable long-term unattended operation. Accumulated charge and load current are transmitted to shore for control of the power consumption. For low sun radiation conditions (winter use), lithium or alkaline batteries can be supplied.

Applications

- Harbour and coastal monitoring
- Monitoring estuaries and large rivers
- Lake/reservoir monitoring
- Offshore design and operations
- Wave energy studies
- Maritime traffic control
- Water quality control studies

Communication

SEAWATCH MIDI185 buoy allows two-way communication via radio link, GSM/GPRS or wireless Ethernet. For long distance data transfer, Inmarsat-C or Iridium satellite communication may be used. The buoy's position can also be monitored by means of satellite position tracking.

Directional wave measurements

The buoy hull design is based on the dynamic response and stability requirements from comprehensive wave tank testing. The optional directional wave sensor is a complete solid-state design with no moving parts. When used for wave measurements, the integrated wave sensor and data logger means one less power consuming processor, decreased system complexity and hence increased system reliability

**Meteorological measurements**

SEAWATCH MIDI185 is equipped with a Tri-pod mast made of carbon fibre tubes, making it suitable for meteorological parameters that require measurements a certain height above the water surface (air temperature, humidity, wind).

Water Quality measurements

Water quality sensors require frequent service, maintenance and calibration and analysers even more because of valves, pumps and refill of chemicals. SEAWATCH MIDI185 is equipped with 4 wells making the water sensors accessible without having to lift the buoy out of the water. This reduces the operation cost because work can be done without large boats and heavy lifting equipment. The wells can also be used for current sensors. In the wells the sensors are well protected against environment as well as theft and vandalism.

The SEAWATCH buoy family

SEAWATCH MIDI185 is a medium size buoy filling the gap between SEAWATCH Mini II and SEAWATCH Wavescan both with regard to application, range/size of parameters/sensors and price, and a low cost alternative for the older SEAWATCH buoy.

General

Material:..... Polyethylene
Flash light: LED based, 3-4 nautical miles range,
..... IALA recommended characteristics
Processing..... On-board calculation of all
..... parameters, 32-bit microprocessor
Flash memory:..... 28MB, sufficient for approx 1 year of
..... raw data
Input: Large number of serial and analogue
..... ports
Positioning:..... GPS receiver

Technical Specifications**Dimensions and Environmental Data**

Diameter:..... 1.85 m
Height (plastic): 1.18 m
Weight: 600 kg
Net buoyancy: 800 kg
Mast height (above water)..... 2.50 m
Operating temperature: -5 to +60 °C

Power

Solar panels: 102 W (6x17)
Angel to horizontal:..... 40o
Lead-acid battery bank:..... 248 Ah (standard)
Lead-acid battery bank:..... 308 Ah (large)
Optional: Lithium batteries:..... 1088 Ah

Fugro OCEANOR

User Manual – SEAWATCH Midi Buoy

2. General system information



Wells

- 1 large size for analyzers up to Ø215 mm
- 2 medium sizes for sensors up to Ø120 mm
- 1 small for surface sensors up to Ø63 mm

Communication

Short range:..... UHF/VHF (up to 10W)
..... GSM/GPRS
..... Wireless Ethernet
Long range: Inmarsat-C, Iridium



3. CUSTOMER SPECIFIC CONFIGURATION

Contents

3. CUSTOMER SPECIFIC CONFIGURATION	3-1
3.1 Sensors	3-1
3.2 Buoy modules	3-1
3.3 Miscellaneous	3-1
3.4 Mechanical	3-2
3.4.1 General arrangement of buoy	3-2
3.4.2 Weather station mast configuration	3-3
3.4.3 Buoy lid configuration – seen from above	3-4
3.4.4 Buoy lid configuration – seen from below	3-5
3.4.5 Electronic module bracket configuration	3-6
3.4.6 Battery cover plate assembly	3-7
3.4.7 Battery package configuration	3-8
3.4.8 Current profiler – location/installation	3-9
3.4.9 General arrangement of Midi buoy dimension	3-11
3.4.10 Mooring drawing	3-12
3.4.11 Check list	3-13
3.4.12 Buoy power budget	3-16
3.4.13 List of supplied documents	3-17



3. CUSTOMER SPECIFIC CONFIGURATION

Applies to Midi Buoy serial no.:	SWMidi 17 – AGEOTEC, srl
---	---------------------------------

This buoy has a special configuration due to the customer's specifications. Please read this chapter carefully to notice the special properties of this buoy. In addition we have included buoy assembly drawings, mooring drawing, buoy check list, power budget and list of supplied documents.

3.1 *Sensors*

This buoy is equipped with the following sensors:

- Wavesense 3 (400030-Integrated wave sensor and data logger, Fugro OCEANOR)
- Wind speed and direction (Windsonic, Gill)
- Wind speed and direction (04106-16-JR-MA, R.M.Young)
- Air temperature (311010, FO/Omega)
- Air pressure (PTB 330, Vaisala)
- Air humidity (HMP 155, Vaisala)
- Compass (TCM 2.5, PNI)
- GPS Receiver (Jupiter 31/FO 319023)
- Current profiler (400 MHz, Nortek), **Delivered by Customer.**

3.2 *Buoy modules*

The buoy is equipped with the following system modules:

- Power Management Unit - PMU (400016, Fugro OCEANOR)
- Junction box under the lid (210114-01, Fugro OCEANOR)
- Junction box on electronic module bracket (210114-02, Fugro OCEANOR)
- GSM modem (Cinterion, MC35i)
- GSM/GPS dual antenna (planTec, K70ear)
- VHF radio (3ASd, 5W – 142.0 MHz, Sateline SATEL)
- VHF radio antenna (VHFS-U, Trans Voice)
- Power supply (Lead acid/Lithium battery package and solar cell panel)

3.3 *Miscellaneous*

- Flash light (Sealite, SL07)
- Passive radarreflektor (Mobri, S2)
- Mooring, 100m (FO)

Fugro OCEANOR

User Manual – SEAWATCH Midi Buoy

3. Customer specific configuration



3.4 Mechanical

3.4.1 General arrangement of buoy



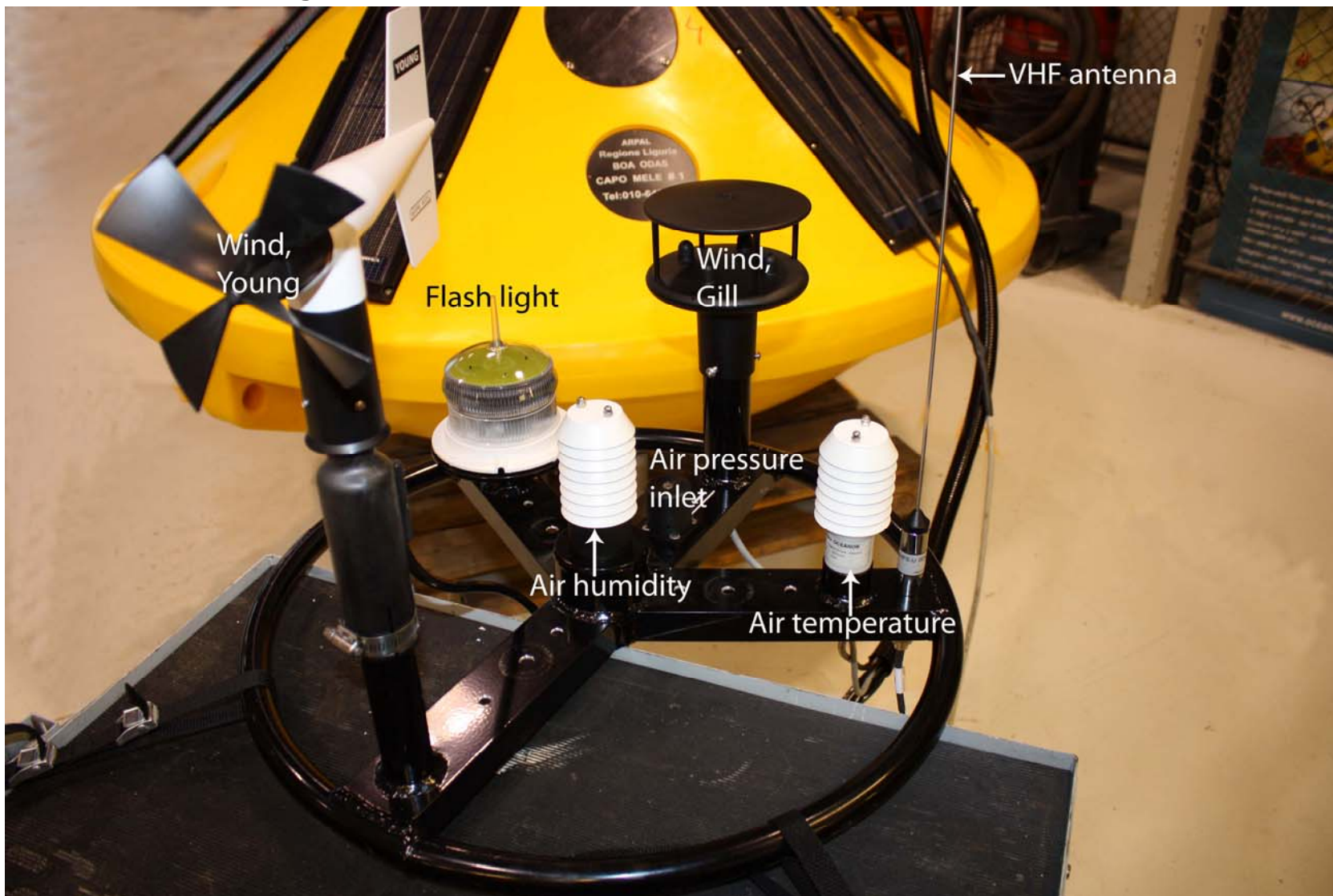
Fugro OCEANOR

User Manual – SEAWATCH Midi Buoy

3. Customer specific configuration



3.4.2 Weather station mast configuration



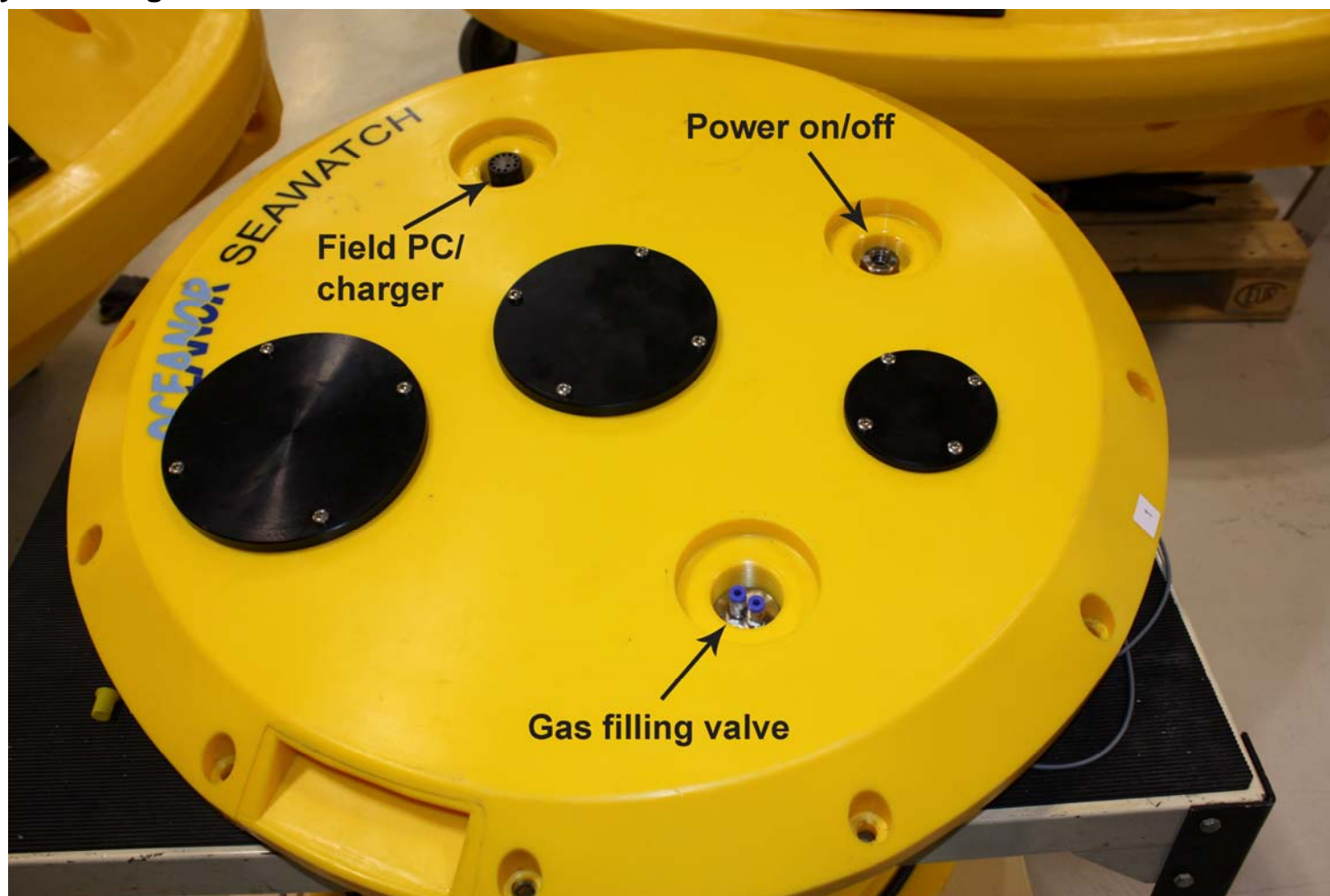
Fugro OCEANOR

User Manual – SEAWATCH Midi Buoy

3. Customer specific configuration



3.4.3 Buoy lid configuration – seen from above



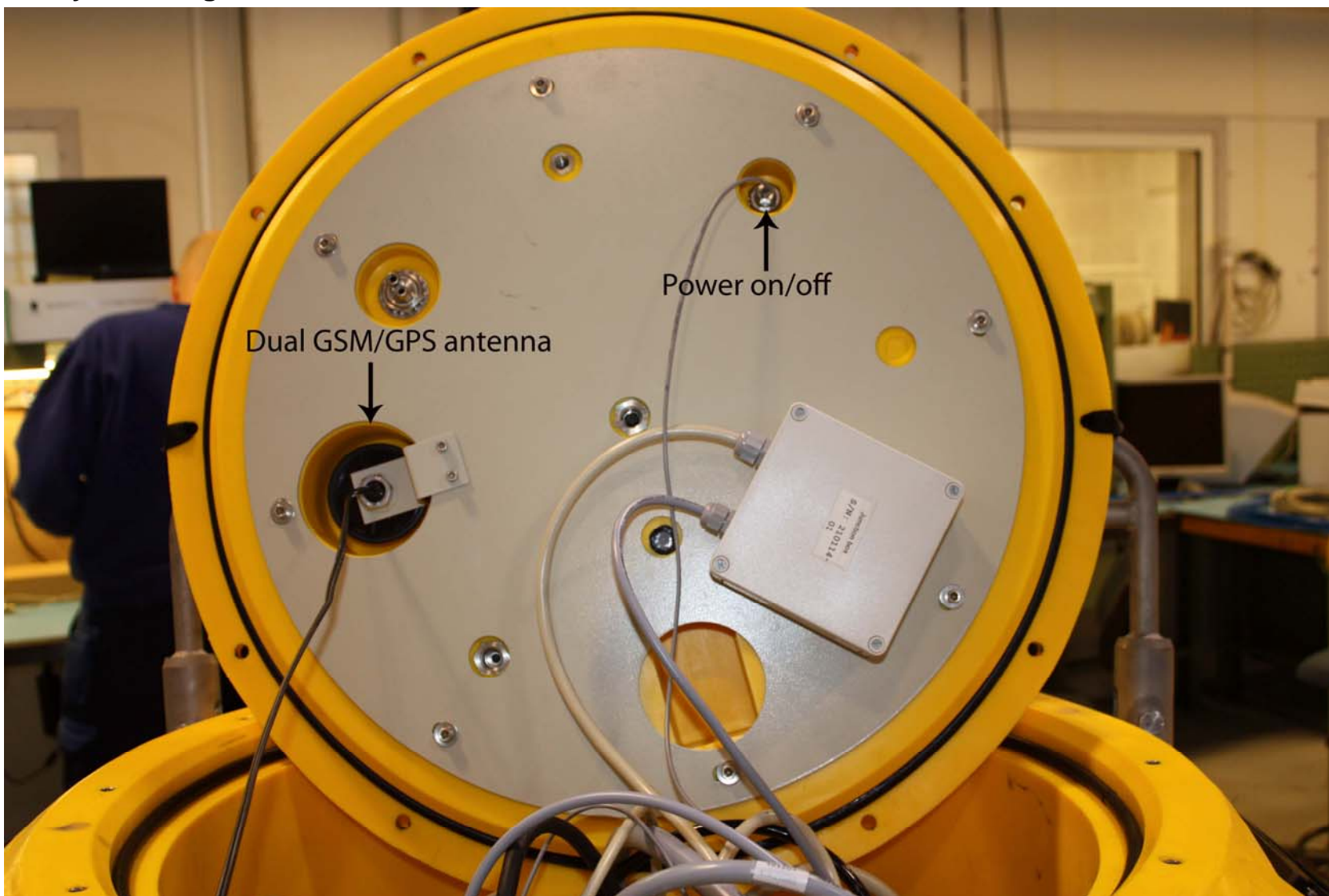
Fugro OCEANOR

User Manual – SEAWATCH Midi Buoy

3. Customer specific configuration



3.4.4 Buoy lid configuration – seen from below



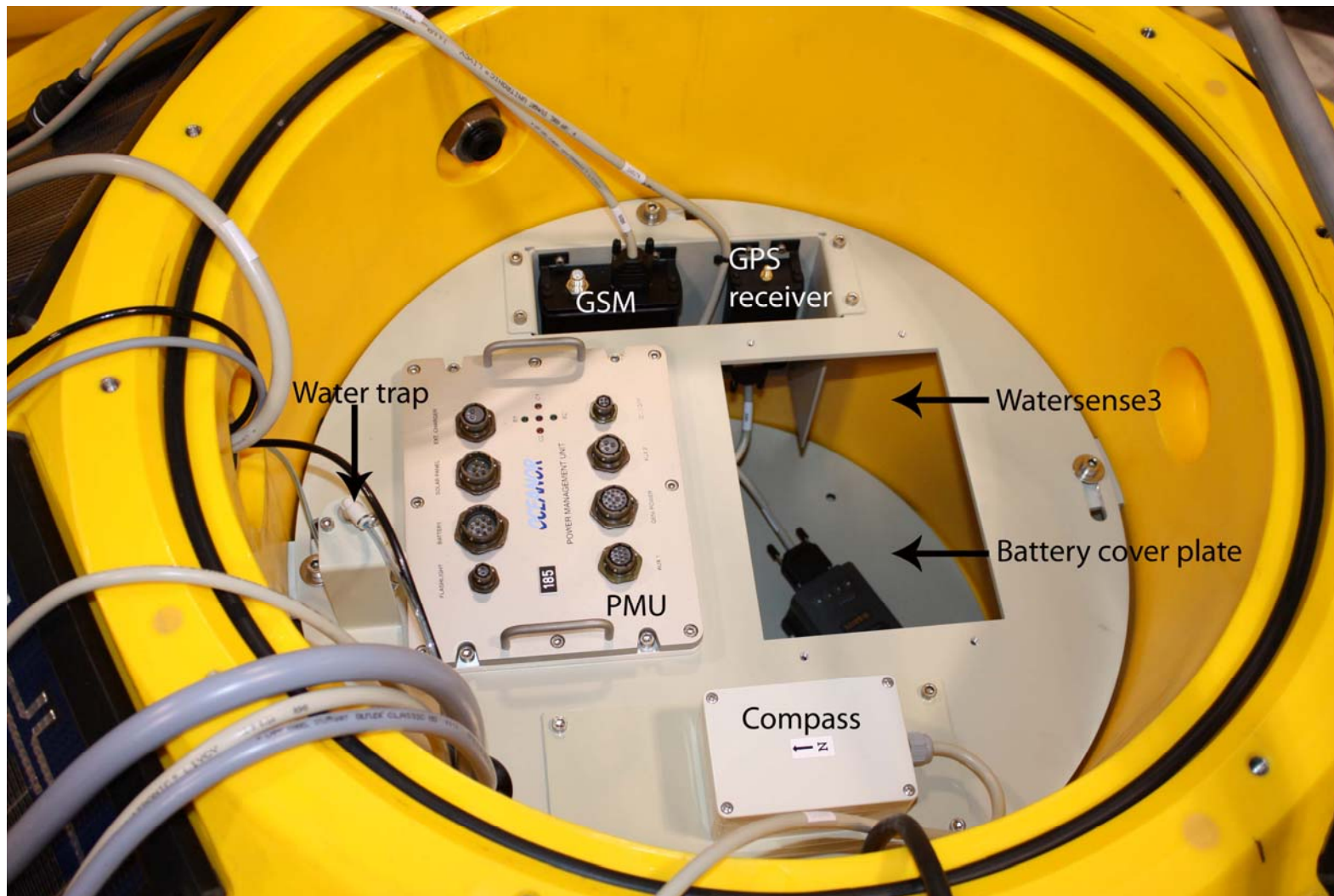
Fugro OCEANOR

User Manual – SEAWATCH Midi Buoy

3. Customer specific configuration



3.4.5 Electronic module bracket configuration



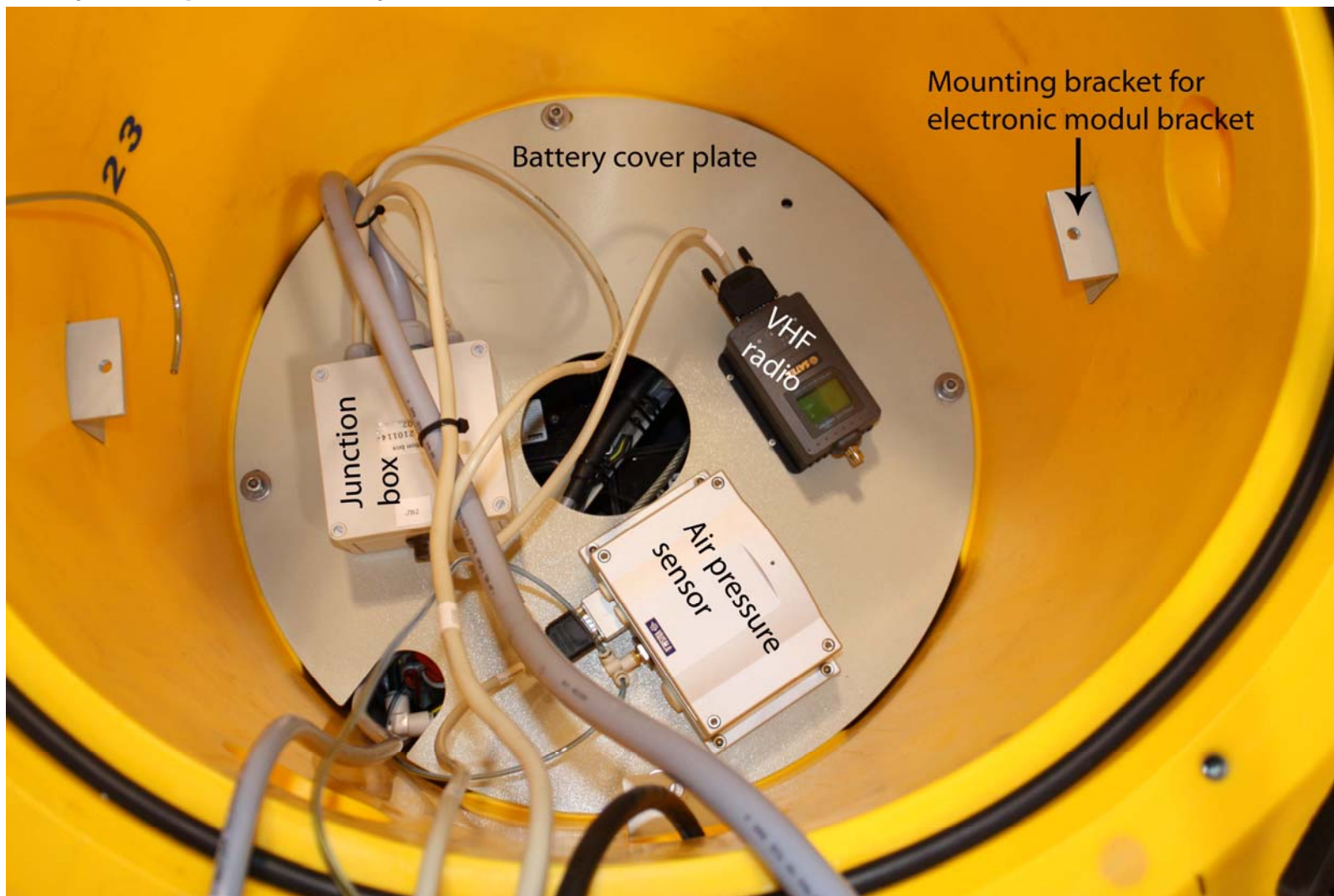
Fugro OCEANOR

User Manual – SEAWATCH Midi Buoy

3. Customer specific configuration



3.4.6 Battery cover plate assembly



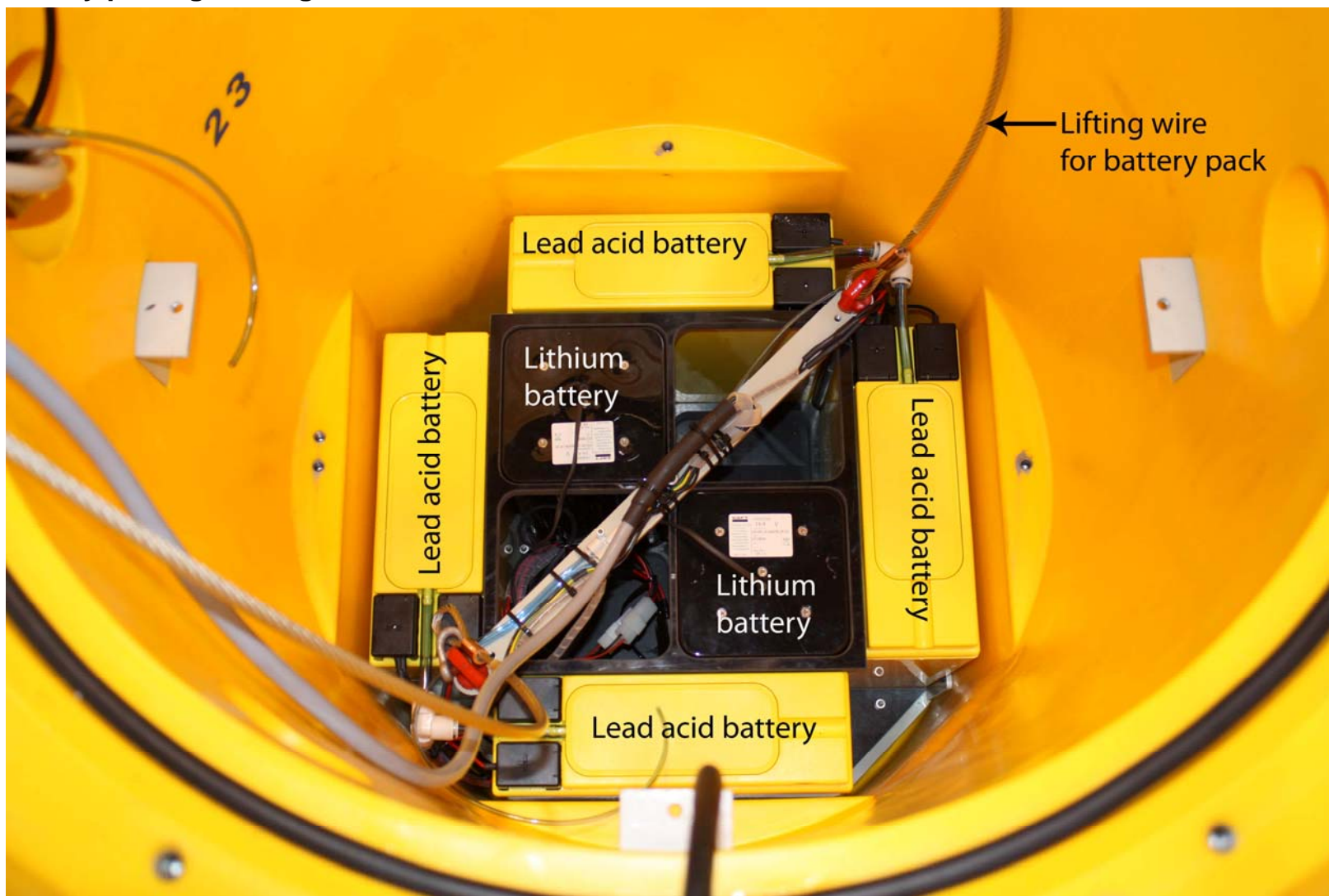
Fugro OCEANOR

User Manual – SEAWATCH Midi Buoy

3. Customer specific configuration



3.4.7 Battery package configuration



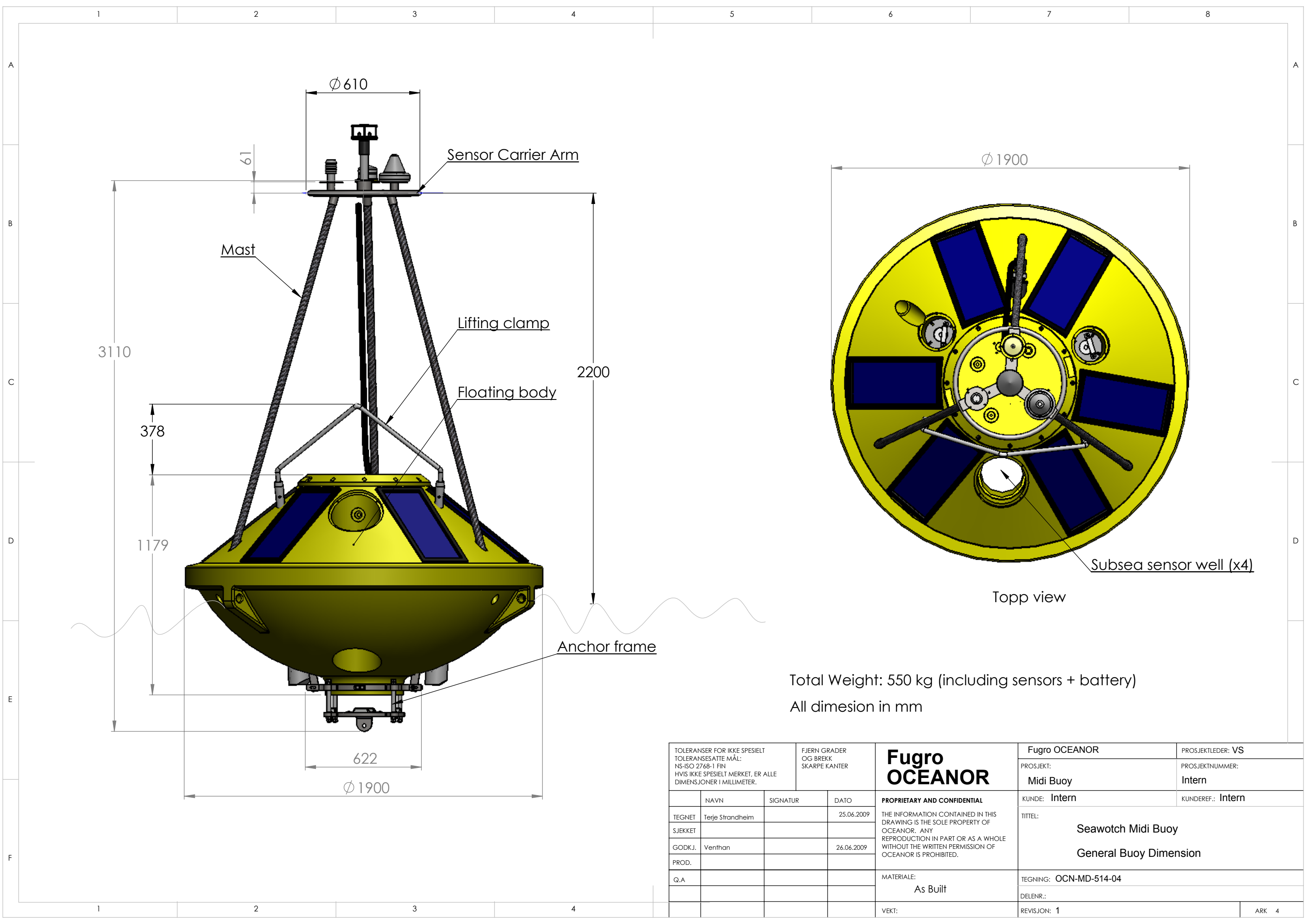
A photograph showing a person's hands holding a black cylindrical instrument. The instrument has a silver handle at the top and a silver band with a small label in the middle. The top part is labeled 'Holder' and the bottom part is labeled 'Current profiler'. The person is standing next to a large yellow structure with a circular opening labeled 'Well'. The background shows a laboratory setting with various equipment and cables.

Orientation of the current profiler





3.4.9 General arrangement of Midi buoy dimension



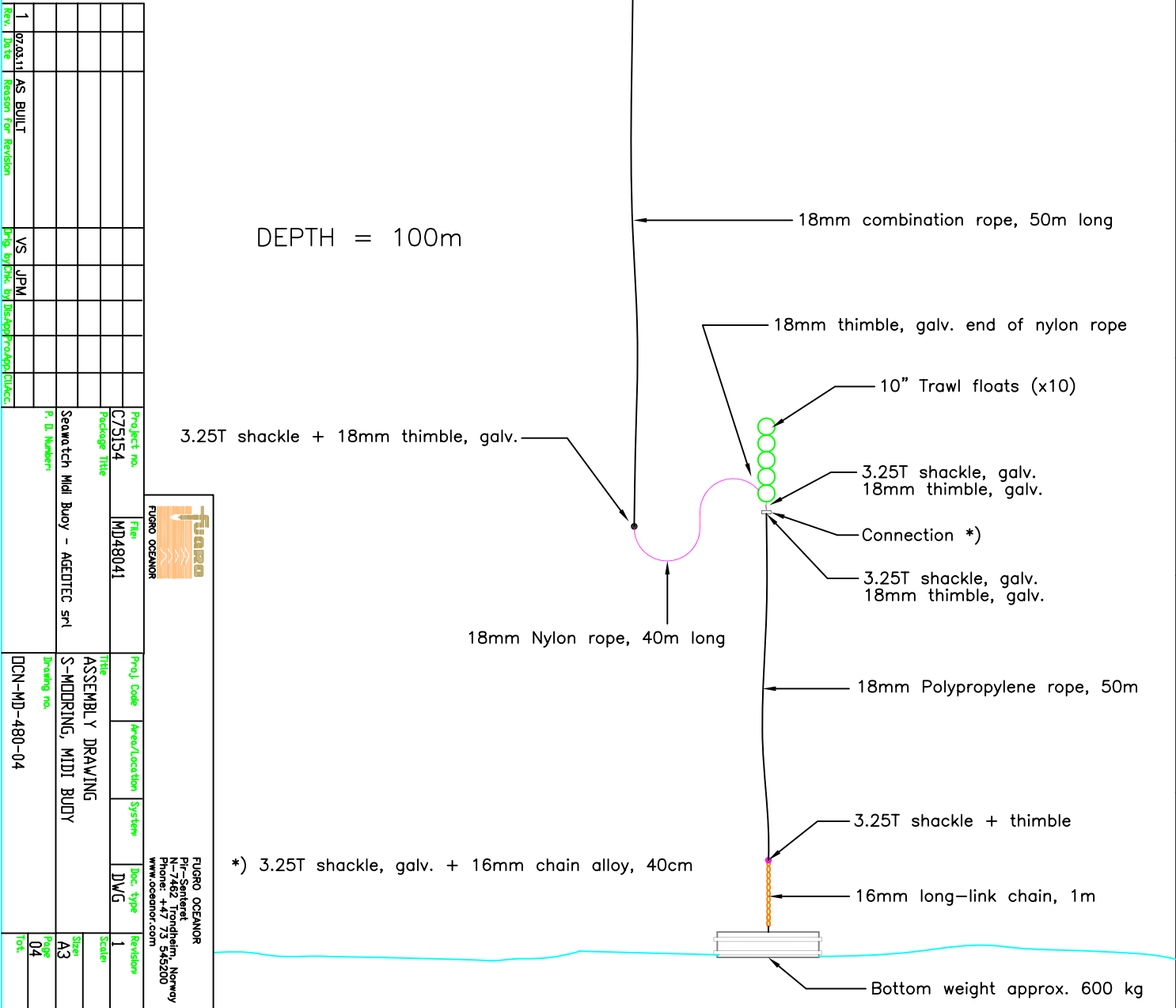
Total Weight: 550 kg (including sensors + battery)
All dimesion in mm

TOLERANSER FOR IKKE SPESIELT TOLERANSESATTE MÅL: NS-ISO 2768-1 FIN HVIS IKKE SPESIELT MERKET, ER ALLE DIMENSJONER I MILLIMETER.			FJERN GRADER OG BREKK OG BREKK SKARPE KANTER		<div>Fugro OCEANOR</div>	Fugro OCEANOR		PROSJEKTLEDER: VS	
						PROSJEKT: Midi Buoy	PROSJEKTNUMMER: Intern		
	NAVN	SIGNATUR	DATO	<div>PROPRIETARY AND CONFIDENTIAL</div> <div>THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF OCEANOR. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF OCEANOR IS PROHIBITED.</div>		KUNDE: Intern		KUNDEREF.: Intern	
TEGNET	Terje Strandheim		25.06.2009			<div>TITTEL:</div> <div>Seawotch Midi Buoy</div> <div>General Buoy Dimension</div>			
SJEKKET									
GODKJ.	Venthan		26.06.2009						
PROD.									
Q.A				<div>MATERIALE:</div> <div>As Built</div>		TEGNING: OCN-MD-514-04			
						DELENR.:			
				VEKT:		REVISJON: 1			ARK 4



3.4.10 Mooring drawing

		Project no.	C75154	File	MD48041	Proj Code	Avala/location	System	DWG type	Revision
		Paper Size	A3	Title	ASSEMBLY DRAWING S-MODERING, MDDI BUOY				Scale	1
		Seawatch Mod Buoy - AGENTEC srl		Drawing no.	DCN-MD-480-04					
		P. B. Numbers								Total
Rev	Date	Reason for Revision	VS	JPM						
1	07.03.11	As built								





3.4.11 Check list

List of checks/inspections/works that must be carried out by the user during service (maintenance). Please copy this list and insert the completed lists behind this template list.

For more sensor maintenance/service detail please refer the sensor manual delivered by manufacture.

The time periods between service and maintenance operations given here should be taken as estimates and need to be refined by the service personnel as experience is gained and may also need to be varied according to season, fouling conditions of the site etc.

Buoy No.: **Date:** **Time:** **Performed by:**

Description	Carried out every n'th month:				Remarks
	n=3	n=6	n=9	n=12	
1. Floatation body outer skin cleaned and marine growth removed by high-pressure washer, be aware of solar panel and sub sea sensors when using high-pressure washer.		<input type="checkbox"/>		<input type="checkbox"/>	_____
2. Lifting clamp (handle) inspected for wear/damage and replaced if necessary.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
3. Mast and the sensor carrier arm inspected for damage, cracks, loose or missing bolts, nuts and washer and replaced if necessary.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
4. Mooring clamps,bolts and mooring fixing point inspected for damage, cracks, loose or missing bolts, nuts and washer and replaced if necessary.		<input type="checkbox"/>		<input type="checkbox"/>	_____
5. Zinc anodes inspected for heavy corrosion and replaced if necessary on ballast chain/mooring frame below the float and on the bottom part of the mast tube.		<input type="checkbox"/>		<input type="checkbox"/>	_____
6. Mooring cleaned for marine growth.		<input type="checkbox"/>		<input type="checkbox"/>	_____
7. Chain, shackle, rope, wire and thimbles inspected for sign of corrosion and replaced if necessary		<input type="checkbox"/>		<input type="checkbox"/>	_____
8. Solar panels inspected and cleaned.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____
9. Flashlight inspected and checked by covering it and the flash sequence observed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____

Fugro OCEANOR

User Manual – SEAWATCH Midi Buoy

3. Customer specific configuration



Description	Carried out every n'th month:				Remarks
	n=3	n=6	n=9	n=12	
10. Antennas inspected.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
11. Air pressure inlet inspected.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
12. Water trap inspected for water and emptied if necessary.		<input type="checkbox"/>		<input type="checkbox"/>	
13. Buoy lid and lid special screws inspected.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
14. Apply grease (Nova Lube) to lid special screws if necessary.					
15. Buoy name plate inspected for damage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
16. Air temperature sensor inspected and the readings seemed correct.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
17. Air humidity sensor inspected and the readings seemed correct.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
18. Wind sensor inspected and the readings seemed correct.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
19. Air pressure sensor readings seemed correct.		<input type="checkbox"/>		<input type="checkbox"/>	
20. Current profiler, see the manual enclosed.					
21. Battery voltage measured on the pc/charge connector (pin 1&3) on lid and charged if voltage level was below 12.5V.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Replace the lead-acid battery after 6 years.

Replace the lithium battery after 5 years or when the battery capacity drop down to 80% of the total capacity.



Other observations / comments:

Signature:

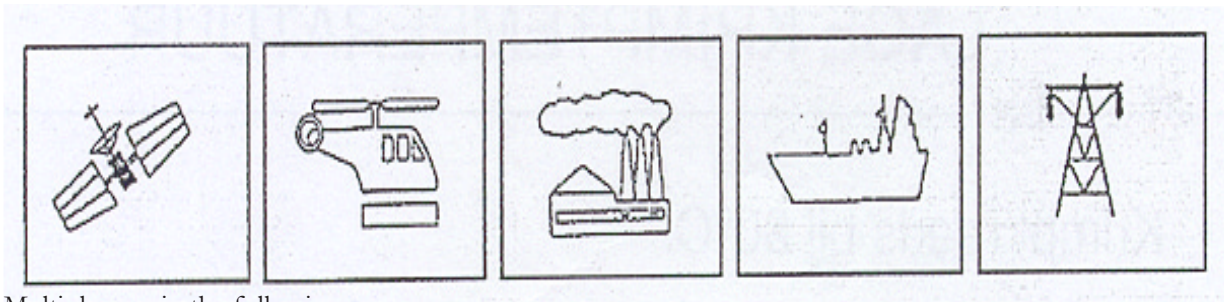
Date:

The warranty is only valid as long as the client carries out scheduled service and maintenance as specified by the supplier above.

Data sheet for lubricating grease, Nova lube are attached to end of this chapter.

NOVA LUBE

APPLICATIONS



Multiple uses in the following areas:

Steel, paper, chemical, gas works, refineries and petrochemical plants, power plants, the automobile industry, in the production of sanitary installations, water treatment equipment, workshops for the repair of engines, equipment for road construction, maintenance shops, garages, the food and packaging industry, marine workshops, mines, glass factories, etc.

NOVA LUBE



NOVA LUBE is a protective and lubricating compound made of micronized pure metal particles and a synthetic carrier which protects against corrosion and oxidation.

NOVA LUBE penetrates the smallest pores and crevices of the metal and forms a fine dividing film that is protective and long lasting. Assembled units can be easily taken apart with standard tools, even after years. There are no more problems with corrosion or seizure.

NOVA LUBE is a heat conductor and cannot be destroyed. It resists temperatures ranging from -180°C to +1200°C and withstands exposure to water, salt water, acids, caustic solutions, vapours, gases, oils, most chemical products and solvents. It may not be used on oxygen or acetylen installations.

NOVA LUBE is non-toxic, it does not contain any lead or nickel.

NOVA LUBE seals, does not drip and is very economical in use.

- ☐ Protects against galvanic action and corrosion.
- ☐ Withstands high pressure - 230 N/mm²
- ☐ Extreme temperature range (-180°C + 1200°C)
- ☐ Contains no nickel.

TECHNICAL

Solidity	: NLGI GLASS 1	TEST METHOD
Specific weight at 20°C	: 1.6 g/cm ³	DIN 51757
Pressure test	: 4000 N	VKA TEST
Flow temperature	: 1200°C	
Freezing temperature	: -180°C	
Water resistant	: at 20°C -50°C-90°C	



3.4.12 Buoy power budget



Project no.: C75154
 Date: 03.11.2011
 Prepared by: HTØ

Consumption						
Model	Description	Active (mA)	Measurement duration (s)	Measurement interval (h)	Idle (mA)	Consumption per day (Ah)
Geni 3	Data Acquisition Unit, GENI 3	125	3600	1,0	75	3,00
FO 200043 with Geni3	Wave sensor	85	1365	0,5	7	1,59
Gill Windsonic	Ultrasonic wind speed and direction	40	600	0,5	0	0,32
RM Young MODEL 85106	Ultrasonic wind sensor	150	600	0,5	0	1,20
FO 319022	Buoy Position Sensor	48	180	0,5	0	0,12
Vaisala HMP155	Air Humidity/Temperature Sensor	4	60	0,5	0	0,00
FO 311010	Air Temperature Sensor	0,1	60	0,5	0	0,00
PNI TCM 2.5/2.6	External compass	20	660	0,5	0	0,18
Nortek Aquadopp	Current Speed and Direction Sensor	47	600	0,5	0	0,38
Satel 3AS VHF	VHF Modem at 1W	240	40	0,5	0	0,13
Siemens MC35i	GSM Mobile Phone Unit	500	60	0,5	0	0,40
FO 332001	PMU	4	3600	1,0	4	0,10
Sealite SL07	Beacon light	60	43200	24,0	0	0,72
Total						8,12

Found from
Aquadopp
program

Production						
Model	Description	Maximum current for all panels (A)	Latitude	ESH	Efficiency	Production per day (Ah)
Seawatch Midi	Solar cell panels, 6x 18 W	4,5	44	3	0,3881183	5,24
Total						5,24

Storage						
Model	Description	Battery Voltage (V)	Nominal Capacity (Ah)	No. of Batteries	Total Capacity (Ah)	Lifetime, no charging (days)
Altitec	Litium	14,4	272	2	544	54
Powersafe 12VF62	Lead Acid	12	62	4	248	24
Total						78,01



3.4.13 List of supplied documents



This list shows supplied documents (manuals + software + calibration certificate) in this delivery of Midi buoy no.: 17

Description	Manufacture / Model	Manuals/data sheet (Qty.)	Software – CD (Qty..)	Calibration certificate	Recommended tools	Transport boxes	Remarks	Date / Controlled by:
Wavesense 3	Fugro OCEANOR, (wave sensor + data logger)	X	-	X	-	-		
Wind	Gill, Windsonic	X	X	-	-	-		
Wind	Young	X	-	X	-			
Air pressure	Vaisala, PTB330	X	-	X	-	-		
Air humidity	Vaisala, HMP155	X	-	X	-			
GSM modem	Cinterion, MC35i	X	-	-	-	-		
GPS receiver	FO, Jupiter 31	X						
VHF radio	Satel, 3AS – 5W	X	-	-	-	-		
Buoy User Manual	Fugro OCEANOR	X	-	-	-	-		
Buoy software CD:	Fugro OCEANOR	X	-	-	-	-		

Transport box for assembled buoy delivered (x1).
Service tool box delivered (x1).
Transport box for Wavesense delivered (x1).



4. RECEIVING/OPERATING THE BUOY SYSTEM

Contents

4. THE SEAWATCH MIDI BUOY SYSTEM	4-1
4.1 Receiving the SEAWATCH Midi Buoy	4-1
4.2 Assembling the buoy.....	4-1
4.3 Handling the buoy	4-1
4.3.1 Lifting	4-1
4.3.2 Transport	4-3
4.3.3 Storage	4-4
4.3.4 Flushing/leak testing with inert gas.....	4-4
4.3.5 Flushing procedure	4-5
4.3.5.1 Leak testing procedure	4-5
4.3.6 Closing the buoy lid	4-5
4.3.7 Prior to deployment.....	4-6
4.3.8 Powering the system	4-6
4.4 System tests	4-6
4.5 Mooring, Deployment and Recovery.....	4-7
4.5.1 Single point mooring with sub surface buoy.	4-8
4.5.2 Personal safety	4-10
4.5.3 Deployment.....	4-10
4.5.4 Recovery.....	4-11
4.5.5 Deployment and recovery vessel.....	4-11
4.5.6 Safety elements in mooring design.....	4-12
4.6 Maintenance	4-13
4.7 Safety precautions	4-14



4. The SEAWATCH Midi Buoy system

4.1 Receiving the SEAWATCH Midi Buoy

The buoy hull, lid and anchor frame will arrive assembled. Sensor carrier arm, mast, and sensor/antennae must be mounted on location. For a complete listing of the components that constitute a Seawatch Midi buoy reference is made to Parts List, chapter 13 or Package list.

The formal acceptance of the buoy is regulated in the contract. Typically this is handled by either at Factory Acceptance Test (FAT) or Site Acceptance Test (SAT) where representatives from the customer may be present.

Damaged or missing parts of the delivery must be reported to Fugro OCEANOR immediately. The actions and responsibilities will be regulated by the contract between the two parties to which the delivered buoy forms a part.

The different parts of the buoy should be handled with care, and preferably stored indoors. If stored outdoors for a short period of time, the equipment must be protected from direct sunlight in tropical countries, and from temperatures below -5°C in countries where this might occur.

4.2 Assembling the buoy

In case you need to assemble the buoy please refer to chapter 5 "Mechanical". To install the various sensors and modules please refer to the corresponding chapters in this manual.

The sensor carrier arm, mast and protection/anchor hold frame will normally be disassembled when storing or transporting the buoy.

If the buoy has to be disassembled for some reason e.g. reconfiguration, change of battery or repair etc., it is very important that the **O-rings under the lid and on top of the instrument compartment** are mounted properly and a leak test must be carried out before deployment.

4.3 Handling the buoy

The buoy can be handled fully assembled by a crane, or a trolley.

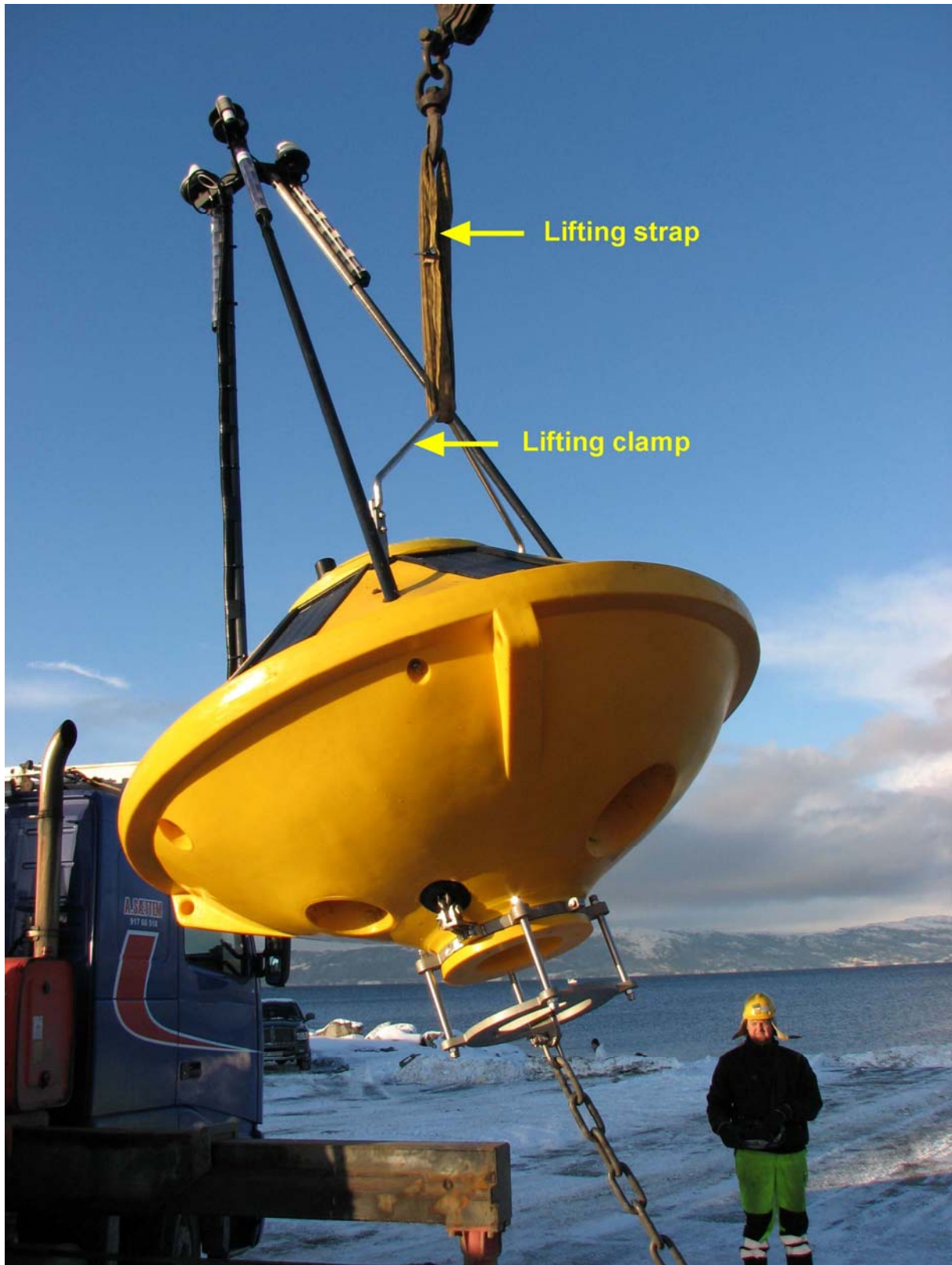
4.3.1 Lifting

Total weight of the buoy is approximately 620 kg. Lift the buoy **by the lifting clamp mounted on the float body**.

Note! Please make attention to the mast/sensor carrier arm mounted to the buoy, when lifting.

Fugro OCEANOR

User Manual – The SEAWATCH Midi Buoy
4. Receiving/Operating The Buoy System



Lifting the buoy

Fugro OCEANOR

User Manual – The SEAWATCH Midi Buoy

4. Receiving/Operating The Buoy System



4.3.2 Transport

The buoy's mast/subsea sensors/anchor frame under the hull may be disassembled for transportation.

The buoy arrives in a wooden pallet and can be air freighted.

Use the wooden pallet which the buoy is shipped with **during all transportation**.

Wooden pallet dimensions: 2.0 x 1.8 x 0.5 m



4.3.3 Storage

Clean the o-rings and apply a thin film of silicon-grease prior to closing. Close the lid and tighten the bolts.

For long time storage with wave sensor and electronics installed, keep the buoy flushed with inert gas. If unable to flush the buoy, remove electronics, power supply (batteries) and wave sensor and store them in a dry, temperate environment.

Always cover open connectors with caps or cover with plastic bags or similar.

Refer to the power system chapter 8 for information regarding battery storage.

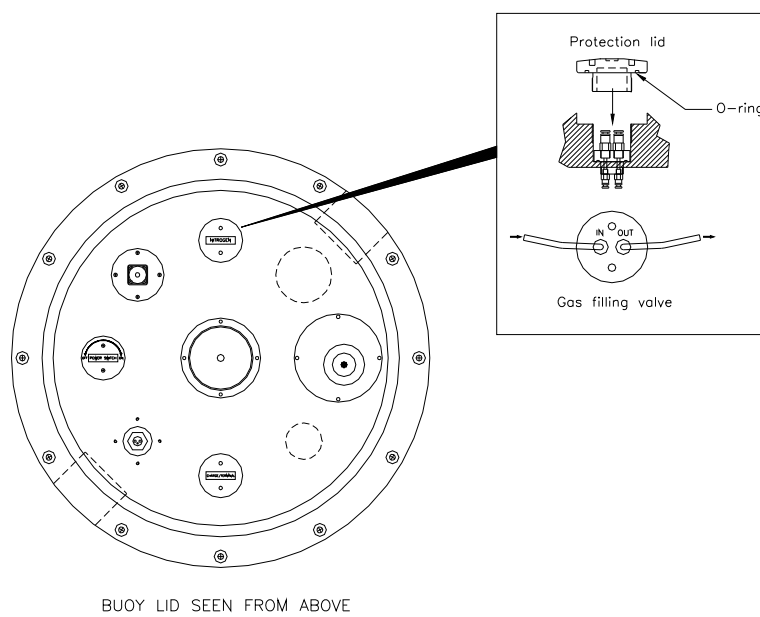
4.3.4 Flushing/leak testing with inert gas

The Buoy shall always be flushed with inert gas (nitrogen, N₂, or similar) to prevent air moisture from condensing in the respective compartments.

When flushing with inert gas, a leak test can be performed if desired. This can be performed by using compressed air as well, but this will not give protection from condensing / corrosion.

WARNING!

PRESSURISED GAS CAN BE DANGEROUS!!
OBSERVE ALL APPLICABLE REGULATIONS!!
MAXIMUM PRESSURE: 0.2 bar (2.9 psi)
USE SAFETY VALVE ON GAS SUPPLY TUBE



Gas valve location



4.3.5 Flushing procedure

Remove (screw out) the protection lid for gas valve from the buoy lid.

Now you have access to safety-valves (normally closed) marked IN and OUT.

Attach a small piece of $\varnothing 4\text{mm}$ tube to valve marked OUT.

Attach the gas tube to the valve marked IN and flush the buoy for approx. 10 minutes.

Shut off the gas and quickly remove the gas tube.

Attach the protection lid to the buoy lid. **(Remember the O-ring).**

4.3.5.1 Leak testing procedure

Follow the steps over (chapter 4.3.5).

Shut off the gas and keep the pressure inside the buoy.

Search for gas leakage around the edge of the floating body and clamping ring by applying a coating of soap water to the areas where leakage might occur.

Inspect for bubbles indicating leakage.

If leakage is detected, locate damage, repair and test again.

If no leakages then quickly remove the gas tube and re-insert the protection lid.

NOTE !!

If inert gas is difficult to obtain, it can be substituted by applying plenty of moisture absorbent (silica gel or similar agent). Place the moisture absorbent inside the instrument component.

4.3.6 Closing the buoy lid

Prior to closing the lid verify that the o-rings are free from damage and that o-ring and groove are clean.

When fastening the screw, use lubricant (grease). Oceanor recommend Nova Lube

Tighten lid bolts diagonally. Max. tightening torque 5.0Nm

Special screw (bolt):	M 8 x 35	12 each
-----------------------	----------	---------



4.3.7 Prior to deployment

Prior to deployment there are several steps to be performed to minimise the risk of malfunction due to omissions.

- Mount the antenna, flashlight and mast sensor/s to sensor carrier arm on mast top if not already done.
- Mount the subsea sensor/s if delivered.
- Mount the subsea sensor protection / anchor hold frame. See chapter 5 for details.
- External connectors inspected and sprayed with contact cleaner.
- Apply silicon grease to external SUBCONN connectors if necessary.
- Switch on the buoy power. See chapter 4.3.8 for more details.
- Switch on the tracker, if delivered.
- Test communication link.

If changes have been made, do the following:

- Test all modules and sensors.
- Test communication link.
- Inspect all module compartment boxes to make sure that all cables are properly connected.
- Flush the buoy with inert gas if opened.
- All modules must be properly fastened.
- All connectors/inlets on the buoy lid must be attached by protection lid.

4.3.8 Powering the system

The system is powered from the battery pack via the Power Management Unit (PMU). To start and stop the system just use the power on/off switch mounted on *the buoy lid*. Use only the tool provided by Oceanor (tamperproof hexagon wrench). To power on the system turn the cap screw clockwise until it stops. To power off system turn the cap screw counter clockwise until it stops.

Note!

As a safety precaution, always turn off the buoy's power when it is collected from location.

4.4 System tests

Testing the system is performed by using the terminal to execute the procedures described in the corresponding chapter 10 for each system module or sensor. Prior to deploying the system, performance should be tested to minimise the risk of system malfunction during the deployment period. Please refer to the specific chapter for testing a particular module or sensor.

4.5 Mooring, Deployment and Recovery

Standard principal mooring systems for use in deep and shallow water are presented in this chapter.

For all mooring designs it is important that the water level line for the Midi Buoy is just below (1-5 cm) fender on the middle of the buoy.

For detailed design and specifications for production, refer to chapter 3 in this manual where the customer's configurations are highlighted.

When choosing / designing a suitable mooring for the SEAWATCH MIDI II buoy the following objectives should be considered:

1. The expected site conditions (wave height, wave period, tidal range, surface and current profile, seabed sediment type and bathymetry etc) should be identified for input to the mooring design.
2. The mooring should secure the buoy to a fixed location. If the mooring is designed to allow movement along the seabed, this should be identified.
3. The mooring should be designed to reduce drag forces on the buoy.
4. The buoy should be able to move freely with the waves especially if wave data are to be collected. For wave measurements a rubber element/s should be included to achieve this (where possible, approx 30m).
5. The mooring elements should have known working load limits so that suitable deployment and recovery procedures can be implemented so that the work can be done safely. In general it is unlikely that the anchor weights can be lifted safely using the rubber element. The use of an acoustic release system may be considered to assist recovery especially in deep water.

The following recommendations are based on Fugro OCEANOR's experience of designing and producing mooring systems:

1. Dissimilar metals should be isolated from each other to protect against corrosion. Sacrificial anodes should also be installed on appropriate elements.
2. If locking shackles are chosen they should be locked with their pins. If non-locking shackles are used they should be fastened with cable ties.
3. During selection of near surface and surface materials or design, consideration should be given to the surface conditions to which the buoy will be exposed.
4. Where the mooring elements are expected to rotate and a swivel is not used, braided rope constructions should be used. For example, such rope is often used between a sub-surface buoy and the surface buoy.
5. High quality mooring elements (rope, wire, chain, shackle, thimble etc) should be selected.
6. The buoy should ideally be moored so that the water level is just below (1-5 cm) the fender on the middle of the buoy.
7. Mooring components should be inspected and replaced regularly.
8. The client should take all possible measures to protect the buoy from third party interference or damage.
9. We recommend that caution be applied when deploying the buoy and its mooring and its performance visually monitored.



10. The usual safety factors should be considered such as deploying the buoy outside of shipping channels, issuing appropriate Notice/s to Mariners, and involving local fishing communities in education / awareness / protection / emergency assistance etc as appropriate.

4.5.1 Single point mooring with sub surface buoy.

Manufacturer	Fugro OCEANOR
Model	Single point mooring
Function	Anchoring of buoy

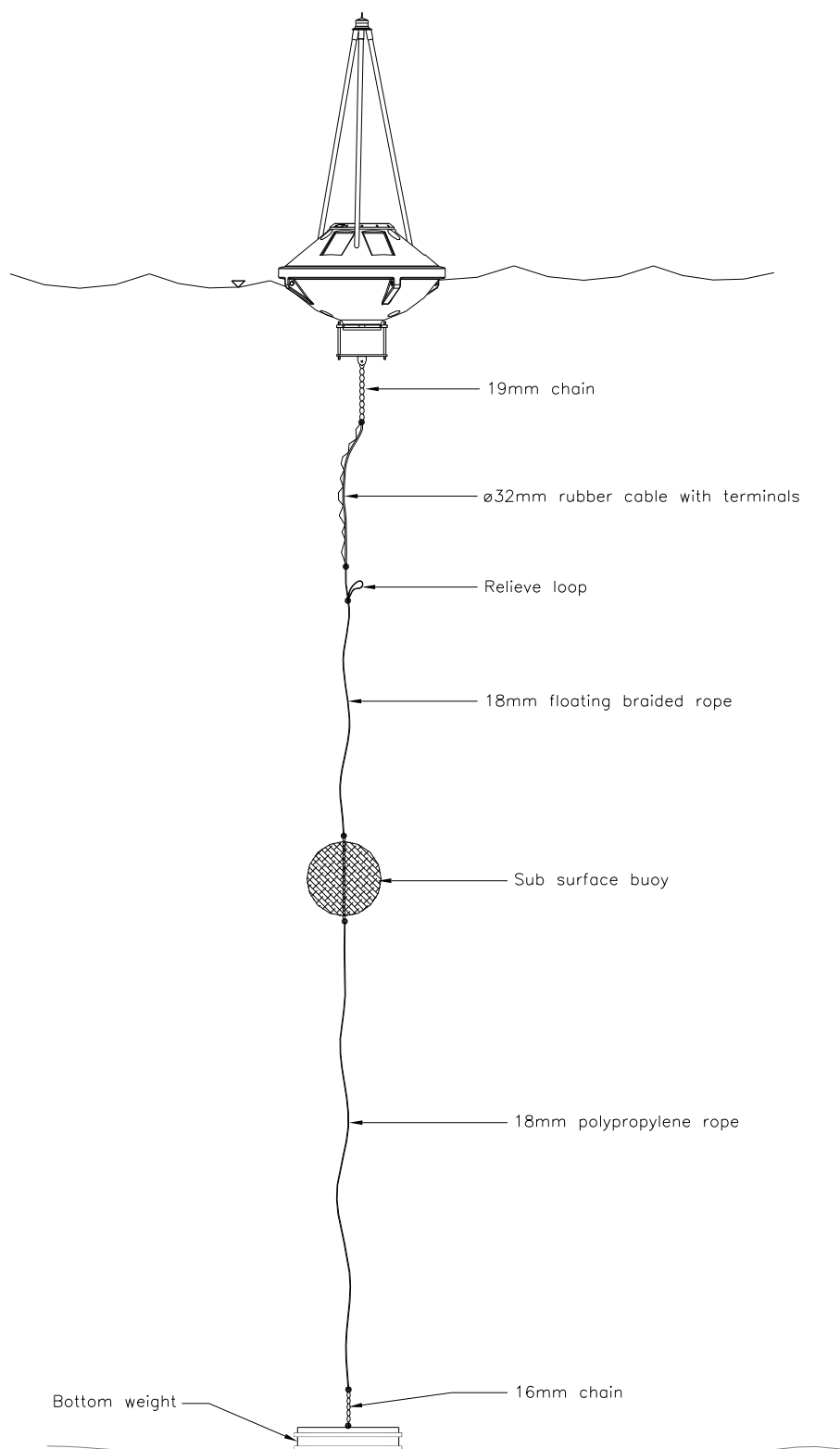
The complete mooring system consists of the following components, from the surface to the bottom:

- Stainless chain for buoy connection.
- Rubber cable with stainless steel connection terminals on each end. This element is very flexible and will allow the buoy to follow the surface level during different wave and tide variations. It's important that you never pull the mooring with the rubber cable. The breaking strength is approx. 1000 kg. It should be pulled by hand.
- Braided floating rope with connecting devices in both ends. The length of the element must be ≈ 10 meters longer than the depth down to the sub surface buoy.
- The sub surface buoy consists of a body pressure rated normally for a working depth of 100 meters. The shape and the dimensions of this body will be defined after a calculation where local conditions are given as inputs.
- Mooring string between the sub surface buoy and the bottom anchor. There should be a relieve loop for recovery ≈ 2 meters below the sub surface buoy's connecting point.
- Bottom anchor with chain connection is the element, which shall hold the measuring system on location during all different conditions. The weight has to be calculated, and the need for an extra drag anchor evaluated after bottom conditions in the location.

Fugro OCEANOR

User Manual – The SEAWATCH Midi Buoy

4. Receiving/Operating The Buoy System



Single point mooring with sub surface buoy

4.5.2 Personal safety

The mooring system will also function as a tool for deployment and recovery of moored buoys.

It's important that all elements and operations in which the field personnel are involved, are considered when writing the job description and designing the mooring.

Job safety analysis is important for ensuring that the critical job elements, where personnel are involved in the working area, are described and discussed with the operational field team before work is started.

The overall target is to reduce the risks of personal and equipment hazard as much as possible.

4.5.3 Deployment

The deployment of the Seawatch Midi Buoy can be done in two different ways.

1) If you are quite sure about the water depth, the bottom material and the bottom topography variation, the mooring can be connected together before deployment onboard the vessel. Then the buoy and the complete mooring are floated from the vessel on the sea surface until only the bottom anchor is onboard. The anchor is dropped (move to the water surface first before dropping) from the vessel side, and it free falls down to the seabed. For this operation we recommend a Quick Release Hook (for example: Toggle Release TR7, from SEA CATCH).

2) If there are one or more of the following variations of the water depth near the anchoring location, rocky seabed and a strong current profile, the mooring system should be to be lowered in a controlled manner by the vessel's winching gear until the anchor reaches the bottom. In that case the following procedure must be followed:

- Start the buoy and check its working.
- Spool the braided floating rope onto the winch drum.
- Connect the floating rope to the mooring string.
- Spool the mooring string on the winch drum.
- Connect a trawl block on the top of the crane or boom.
- Put the mooring string through the block, and connect it to the anchor chain.
- Lift the anchor over the vessel side, and lower it down to the connection point between the mooring string and the floating braided rope.
- Hang the mooring on the shipside, and connect the subsurface buoy into the mooring system
- Lower the anchor until it reaches the seabed
- Pull the rest of the braided rope from the winch drum, and out of the block.
- Connect the floating rope and the buoy's rubber cable
- Lift the buoy over the shipside, and loose the crane hook from the buoy's handling rope. During this operation it's important to use helping ropes connected to the buoy so it's not allowed to move from side to side when lifting it from deck and over the ship side.



For deployment using this method, the vessel must be equipped with a suitable winch and crane. The vessel also has to hold position on location during the deployment job, so there is a need for thrusters, good navigation equipment and an echo sounder.

4.5.4 Recovery

Recovery of moored buoy.

- Move up to the buoy against the current direction.
- Hook up the handling rope.
- Take the buoy onboard the vessel by using a crane and connect a trawl block on the top of the crane or boom. (Be careful and stop the buoys swinging by using helping ropes.)
- Pull the rubber cable on board.
- Disconnect the rubber cable from the braided floating rope.
- Connect the braided floating rope to the winch cable.
- Spool the winch until the sub surface buoy reaches a level over the shipside.
- Connect the loop on the mooring string on the shipside. And disconnect the sub surface buoy.
- Connect the mooring string again to the winching line.
- Spool the winch until the chain on the bottom anchor reaches the surface level.
- If an acoustic release has not been used hook the bottom anchor and lift it on board by using the crane. (Be careful when taking the bottom anchor shipside and use safety slings for reducing swinging)

4.5.5 Deployment and recovery vessel

The survey vessel is the working platform during deployment, service and recovery of the buoys and the mooring system. It's of utmost importance that the vessel ordered for the operation has the right specifications and is equipped with the necessary tools for doing the job safely.

The following elements should be considered:

- The vessel's work classification
- Deck working area
- Crane
- Winch
- Echo sounder
- Positioning equipment
- Communication between bridge and deck working area
- Thrusters

4.5.6 Safety elements in mooring design

Jobs where crew have to work under hanging load must be carefully considered when designing the mooring elements. All mooring parts in working area on board during such operations must be designed with a safety factor of 9.

Correct design shall ensure that, in case the mooring string breaks, the breaking point will be located below the water surface, and not on board where people are working.

Where mooring systems are designed with heavy bottom weights (>500kg), it is strongly recommended to use an acoustic release for recovery of the mooring string. Releasing the bottom weight from the mooring system before starting the on board winching, will reduce the risk factor to a minimum for people working with on board loading.

Recommendation

For HSE security purposes, follow the five recommendations below prior to using the buoy:

1. Input all design criteria applicable for the moored buoy.
2. Make your calculations and specify all dimensions of the mooring elements.
3. Make the job description when you know the vessel, equipment on board and the working crew.
4. Undertake a safety job analysis for reducing risk elements before confirming the working plan.
5. Undertake a risk assessment and a "Toolbox Talk" with the crew prior to starting the work.



4.6 Maintenance

The buoy is designed to have minimum maintenance. **Based on experience, we suggest service intervals of 3 to 6 months. However, longer or shorter intervals may be advisable depending on the measuring location and individual measuring sensors.** Normally the maintenance is limited to inspection of the modules and sensors to ensure that no damage has occurred. Calibration of sensors / electronics also are Minimised.

If the solar panel is dirty, clean it with a soft cloth or sponge using water and mild detergent.

For sensors please refer the sensor manual delivered by manufacture.

At recovery the marine growth should be removed from the buoy hull and from the mooring. The mooring should be inspected for wear and tear. Look for corrosion at the clamping rings. Inspect for loose and missing bolts at protection frame, clamping rings and mooring.

NOTE!

It is recommended that the user performs a complete maintenance of all parts the first time, and then arranges a new maintenance plan adjusted to local conditions.

The specific maintenance procedure (check list) for your buoy is stated in chapter 3.4.9



4.7 Safety precautions

Be aware that the buoy is equipped with lead acid batteries. The batteries are of a sealed type that under normal operation does not generate Hydrogen gas. If the batteries are exposed to excessive heat during charging or being over-charged, a mixture of Hydrogen and Oxygen gas may be generated. The Hydrogen/Oxygen mixture is **extremely explosive** and special care must be taken when handling the buoy. The following precautions should always be followed:

- The batteries should never be charged when the buoy is exposed to direct sunlight onshore or on deck. This involves disconnecting the solar panels and not using a conventional battery charger. This precaution also applies when the air temperature is above 35°C. At such conditions, battery recharge should only take place in a vented area protected from direct sunlight.
- Handle the buoy with care when retrieving it after months of operation. Flush the buoy with Nitrogen (or Air) immediately after recovering it.
- If possible, always store the buoy indoors. During outside storage in temperatures outside ± 5 to 35°C or in direct sunlight, remove the batteries. For long-term storage, charge the batteries periodically. If these precautions are not followed, the lifetime of the batteries is severely reduced and the risk of malfunction increased.

Follow the recommendations in the Power Supply section of this manual. Note that the exact lifetime of the batteries is dependant on many factors, such as temperature, charge/recharge cycle, storage time etc. At the service intervals, check the state of the batteries, recharge if required, and measure the current state of the batteries before deploying the buoy. The state may be determined by comparing the measured battery voltage (measured after a rest period of 12 – 24 hours after end of recharge) with the table in the Power Supply section. Alternatively a battery tester may be used.



5. MECHANICAL

Contents

5. MECHANICAL.....	5-1
--------------------	-----



5. Mechanical

Read this chapter carefully before trying to disassemble the buoy. Also refer to the drawings (end of this chapter) for locating the different parts described in this chapter!

The buoy main parts are:

1) The buoy lid containing:

- Buoy power on/off switch.
- Connector for field pc/battery charger.
- Junction box, mounted under lid.
- Tracker, mounted under lid (if delivered).

2) Floating body containing:

- Solar panel (x6).
- Mast connector inlet.
- Subsea well

3) Instrument compartment containing:

- Electronic modules.
- Battery package.

4) Mast containing:

- Mast (glass fiber tube x3).
- Sensor carrier arm.
- Met.sensor/s, antennas and flash light.

5) The subsea sensor protection frame/anchor holder containing:

- Subsea sensor/s.
- Subsea connector.
- Mounting bracket for subsea sensor/s.
- Anchor holder

The buoy lid is fastened to instrument compartment with special Torx screws. It is very important that the **O-rings under the lid and on top of the instrument compartment** are mounted properly and a leak test must be carried out before deployment.

The Tri-pod mast is fastened to floating body. A sensor carrier arm is mounted on top of the mast to carry mast sensors/antenna/flash light.

The sensor protection frame/anchor hold mounted under the floating body for protecting the sub sea sensors, and connecting the buoy to the mooring.



Disassembling the buoy

Before disassembling the buoy it is recommended that the buoy is switched off and all sensors be removed from the buoy. All sensors have connectors and can be disconnected from the sensor cable or adapter.

If necessary the protection frame/anchor hold can also be removed. The frame/anchor hold is clamped on the lower part of the "floating body" and can be removed by loosening the two 10-mm bolts on opposite sides of the anchor hold.

Access to electronic modules

To get access to the electronic modules remove the buoy lid. This is done by loosening the 8-mm Torx screws. This requires a **special tool** to unscrew. This is to prevent the buoy from being tampered with by unauthorised personnel. When lifting the lid make sure to disconnect the cables before removing the lid completely.

Access to battery package

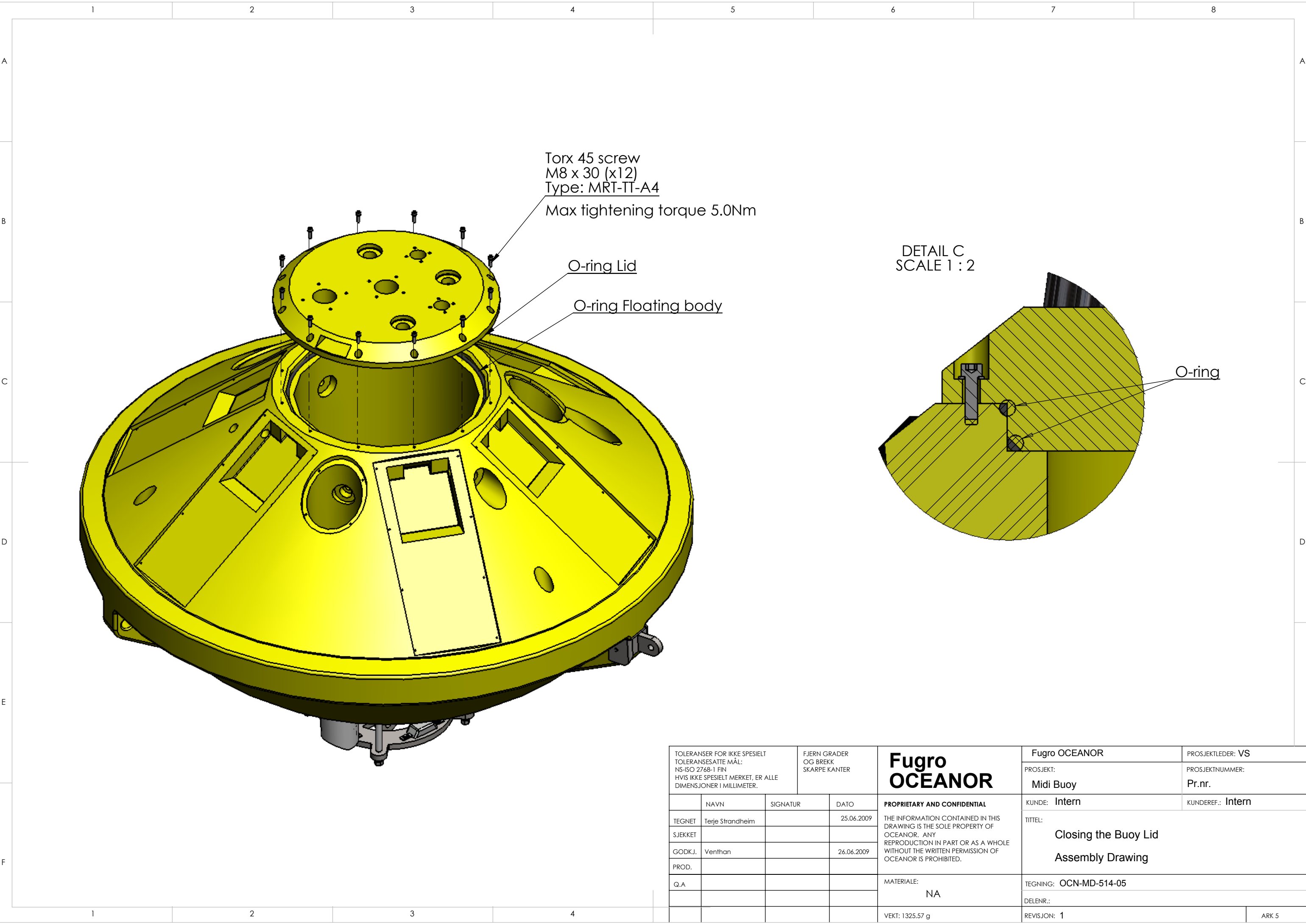
If access to the battery package is required the mounting bracket for electronic modules, distance bolt and battery cover plate must be removed. Then disconnect the sub sea cables and power cable before unscrewing the 8-mm nut on the three-distance bolt holding the electronic module bracket. Now the whole bracket can be removed without removing all modules mounted on top of it first.

The battery container located under the electronic mounting bracket consists of lead acid/lithium batteries. The batteries are held in position by ethafoam. When disconnecting the wires on the battery poles, always make sure not to short-circuit the batteries. The batteries can be lifted directly out of the ethafoam and changed if necessary.

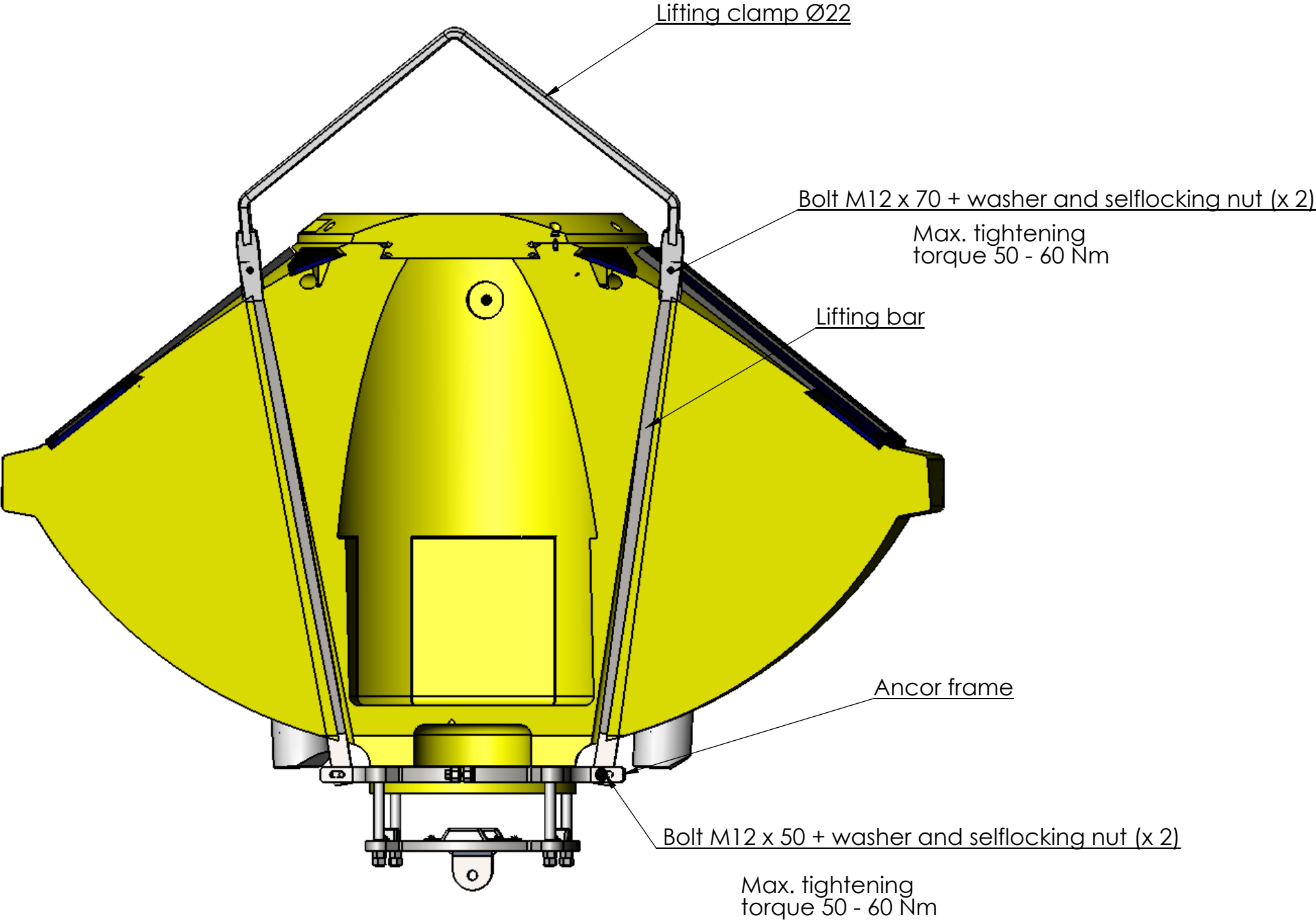
Note!

Do not apply excessive force when fastening the M12 on bottom part of the mast.

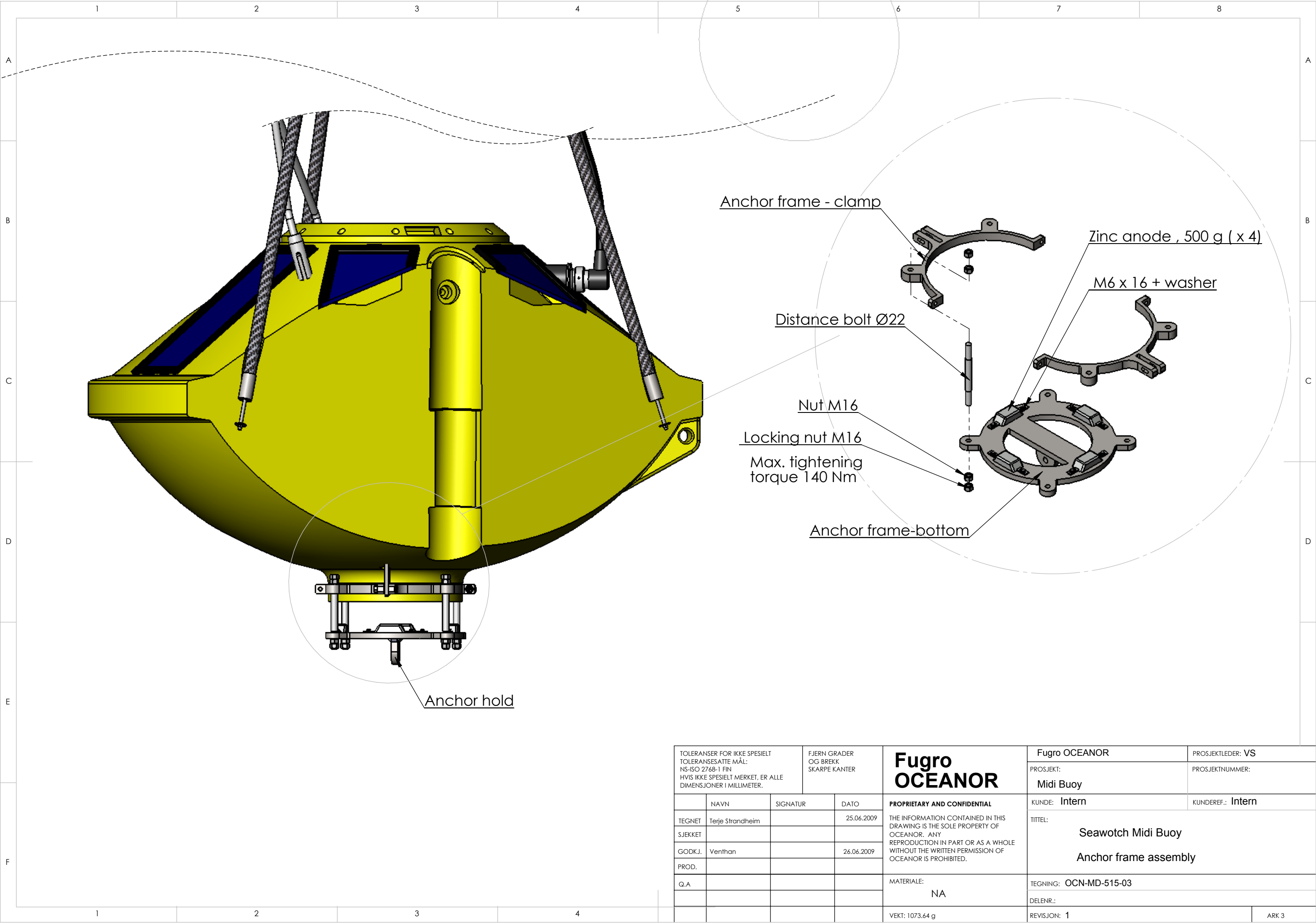
When fastening the screws, use lubricant (grease) specially the external screws. Oceanor recommend Nova Lube.



TOLERANSER FOR IKKE SPESIelt TOLERANSESAITTE MÅL: NS-ISO 2768-1 FIN HVIS IKKE SPESIelt MERKET, ER ALLE DIMENSJONER I MILLIMETER.				FJERN GRADER OG BREKK SKARPE KANTER		<div>Fugro OCEANOR</div>		Fugro OCEANOR		PROSJEKTLEDER: VS	
								PROSJEKT: Midi Buoy		PROSJEKTNUMMER: Pr.nr.	
	NAVN	SIGNATUR	DATO	PROPRIETARY AND CONFIDENTIAL THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF OCEANOR. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF OCEANOR IS PROHIBITED.				KUNDE: Intern		KUNDEREF.: Intern	
TEGNET	Terje Strandheim		25.06.2009					TITTEL: Closing the Buoy Lid Assembly Drawing			
SJEKKET											
GODKJ.	Venthan		26.06.2009								
PROD.											
Q.A				MATERIALE: NA				TEGNING: OCN-MD-514-05			
								DELENR.:			
				VEKT: 1325.57 g				REVISJON: 1			



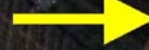
TOLERANSER FOR IKKE SPESIelt TOLERANSESATTE MÅL: NS-ISO 2768-1 FIN HVIS IKKE SPESIelt MERKET, ER ALLE DIMENSJONER I MILLIMETER.				FJERN GRADER OG BREKK SKARPE KANTER		Fugro OCEANOR		Fugro OCEANOR		PROSJEKTLIDER: VS	
								PROSJEKT: Midi Buoy		PROSJEKTNUMMER:	
	NAVN	SIGNATUR	DATO	PROPRIETARY AND CONFIDENTIAL THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF OCEANOR. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF OCEANOR IS PROHIBITED.		KUNDE: Intern		KUNDEREF.: Intern			
TEGNET	Terje Strandheim		25.06.2009			TITTEL: Seawatch Midi Buoy Lifting clamp assembly					
SJEKKET											
GODKJ.	Venthan		26.06.2009								
PROD.											
Q.A				MATERIALE: NA		TEGNING: OCN-MD-515-02					
						DELENR.:					
				VEKT: 1318.12 g		REVISJON: 1				ARK 2	



TOLERANSER FOR IKKE SPESIelt TOLERANSESATTE MÅL: NS-ISO 2768-1 FIN HVIS IKKE SPESIelt MERKET, ER ALLE DIMENSJONER I MILLIMETER.				FJERN GRADER OG BREKK SKARPE KANTER		Fugro OCEANOR		Fugro OCEANOR		PROSJEKTLEDER: VS	
								PROSJEKT: Midi Buoy		PROSJEKTNUMMER:	
	NAVN	SIGNATUR	DATO	PROPRIETARY AND CONFIDENTIAL THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF OCEANOR. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF OCEANOR IS PROHIBITED.		KUNDE: Intern		KUNDEREF.: Intern			
TEGNET	Terje Strandheim		25.06.2009			TITTEL: Seawotch Midi Buoy Anchor frame assembly					
SJEKKET											
GODKJ.	Venthan		26.06.2009								
PROD.											
Q.A				MATERIALE: NA		TEGNING: OCN-MD-515-03					
						DELENR.:					
				VEKT: 1073.64 g		REVISJON: 1				ARK 3	

Mast Cable Asembly

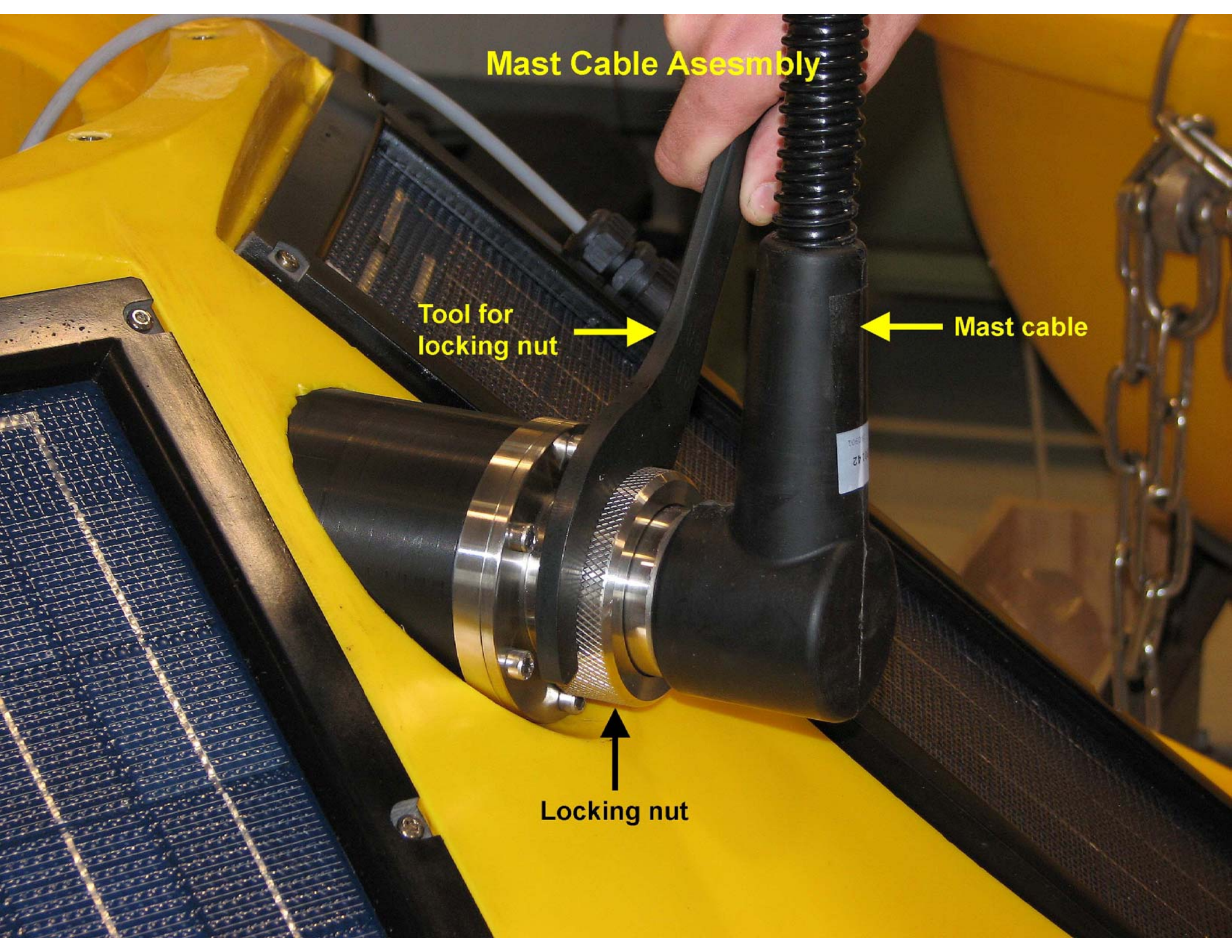
Tool for
locking nut

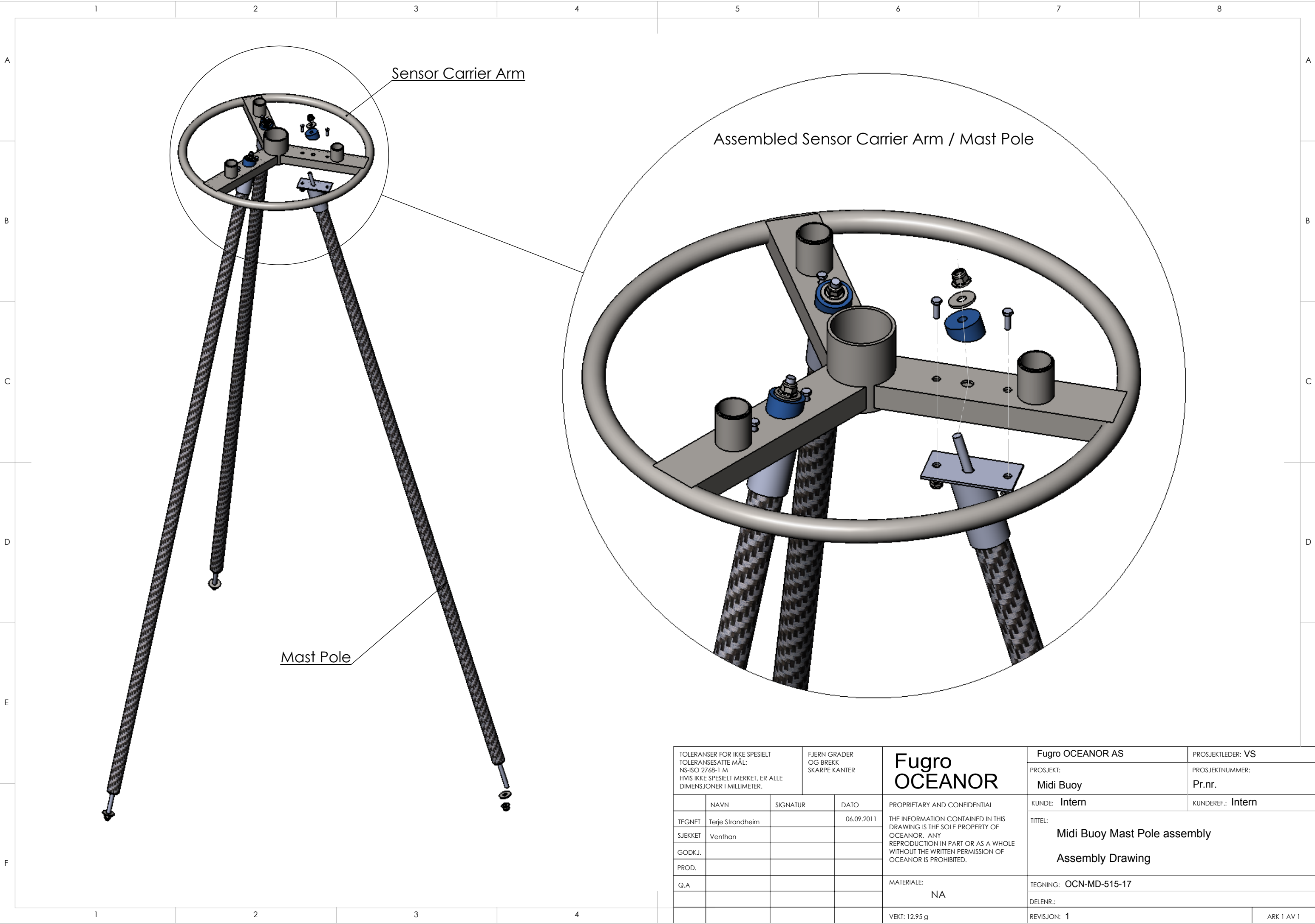


Mast cable



Locking nut





TOLERANSER FOR IKKE SPESIelt TOLERANSESATTE MÅL: NS-ISO 2768-1 M HVIS IKKE SPESIelt MERKET, ER ALLE DIMENSJONER I MILLIMETER.				FJERN GRADER OG BREKK SKARPE KANTER		Fugro OCEANOR		Fugro OCEANOR AS	PROSJEKTLDER: VS
								PROSJEKT: Midi Buoy	PROSJEKTNUMMER: Pr.nr.
								KUNDE: Intern	KUNDEREF.: Intern
								TITTEL: Midi Buoy Mast Pole assembly Assembly Drawing	
								TEGNING: OCN-MD-515-17	
								DELENR.:	
								REVISJON: 1	
								ARK 1 AV 1	



6. DATA ACQUISITION UNIT / WAVE SENSOR

Contents

6.	DATA ACQUISITION UNIT / WAVE SENSOR	6-1
6.1	Introduction	6-1
6.2	Specifications	6-1

6. Data Acquisition Unit / Wave Sensor

6.1 Introduction

The purpose of this document is to summarize the key features of the OCEANOR Wavesense integrated data acquisition unit and wave sensor.

Wavesense is the latest generation of OCEANOR's data acquisition and processing system for marine applications. The unit is built upon the Geni datalogger and has an additional electronic board and software for performing wave measurements.

The main application is use in buoys environmental monitoring systems.

The main characteristics are:

- Low power consumption, high processing capability.
- Wave measurement capability.
- Versatile interfaces for direct connection to a variety of different sensors (analog, digital, frequency, RS232, RS422/485, Relay contacts, power control etc)
- Proven operating system (Linux)
- Flash data storage
- Standard bus design (PC/104)
- Robust design

6.2 Specifications

POWER SUPPLY:

Input voltage:	7 – 15 V
Power consumption (standby)	0.9 W
Power consumption (operating)	1.3 W
Power consumption (wave meas.)	3 W

MECHANICAL:

Weight:	4.25 kg
Size (W x H x D)	266 x 208 x 163 mm
Material	Aluminium
Protection classification:	IP66
Coating:	Thermosetting polyester resin powder coating
Connectors:	851 Series, MIL contacts

ENVIRONMENTAL:

Temperature range:	÷5 - 70 °C
Chemical resistance:	MIL-C 26482 G Series 1 and NFC 93422-HE 301 B Code A
Resistance to salt spray:	48 hours at environmental temperature
EMC requirements:	Designed to meet EN500082-2 and EN500081-1

Fugro OCEANOR

User Manual – SEAWATCH Midi Buoy
6. Data Acquisition Unit / Wave Sensor



CPU:

Processor:

PXA255 XScale RISC processor running at 400 MHz.

Precise RTC:

Accurate to ± 1 Min/Month. A backup Li-battery for the RTC can keep the time information in more than 3 years with power turned off.

Program memory:

32 MB Flash

SDRAM:

64 MB

Data memory:

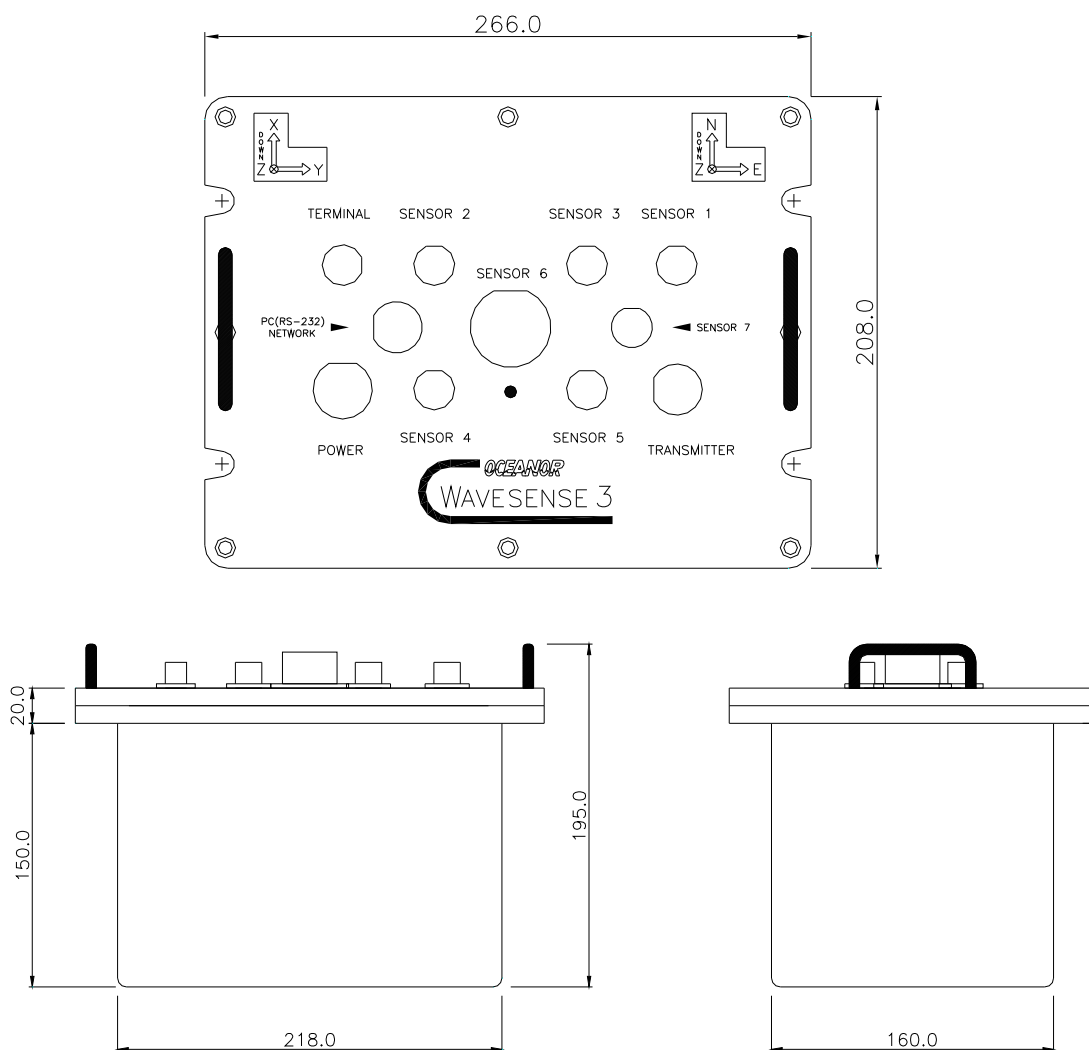
512 MB Flash (or more)

External Watchdog circuit

SOFTWARE:

Linux 2.6 operating system

Oceanor modular software for data acquisition, data analysis, data storage and transmission.



Mechanical sketch of Wavesense fp-11



INPUTS / OUTPUTS:

Number of inputs/outputs depends heavily on the version of Wavesense.

All inputs/ outputs are EMI filtered and ESD protected

The analogue inputs have 16-bit resolution and +/-5V range (some are configurable to 4-20 mA)

Thermistor / pt100 inputs (0.1° accuracy over temperature range with Thermistor)

Relay contact outputs (Max 1A)

Frequency input (50 mV sensitivity, 0-3 kHz)

Controllable power outputs (2A/channel)

Supply voltage monitoring

Wavesense-*fp11* has the following connectors and signals:

Connector	Pin	Signal description
TERMINAL	A	GND
	B	COM4 RS-422 Rx-
	C	COM4 RS-422 Tx-
	D	NC
	E	COM4 RS-422 Tx+
	F	COM4 RS-422 Rx+
POWER	A	1.247V Voltage output (Wind direction out)
	B	AD2+ (Wind direction in)
	C	IO 13
	D	IO 12
	E	COM13 RS-232 Tx
	F	COM13 RS-232 Rx
	G	COM11 RS-232 Tx
	H	COM11 RS-232 Rx
	J	ACH20+
	K	GND
	L	O 0 (OC)
	M	IO 14
	N	5V Voltage output
	P	SUPPLY VOLTAGE (9-15V)
	R	GND
TRANSMITTER	A	Power8
	B	GND
	C	COM16 TTL Tx
	D	COM16 TTL Rx
	E	COM3 RS-232 CTS

Fugro OCEANOR

User Manual – SEAWATCH Midi Buoy

6. Data Acquisition Unit / Wave Sensor



Connector	Pin	Signal description
	F	COM3 RS-232 RTS
	G	DIO1
	H	COM3 RS-232 Tx
	J	COM3 RS-232 Rx
	K	COM3 RS-232 DCD
SENSOR 1	A	GND
	B	Thermistor2+
	C	Thermistor-
	D	Power7
	E	COM19 RS-232 Tx
	F	COM19 RS-232 Rx
	G	DIO3
SENSOR 2	A	GND
	B	Thermistor3+
	C	Thermistor-
	D	Power2
	E	COM7 RS-232 Tx
	F	COM7 RS-232 Rx
	G	DIO6
SENSOR 3	A	GND
	B	AD8+ (4-20 mA configurable)
	C	AD8-
	D	Power3
	E	COM8 RS-232 Tx
	F	COM8 RS-232 Rx
	G	DIO7
SENSOR 4	A	GND
	B	AD9+ (4-20 mA configurable)
	C	AD9-
	D	Power5
	E	COM10 RS-232 Tx
	F	COM10 RS-232 Rx
	G	DIO8
SENSOR 5	A	GND
	B	AD11+
	C	AD11-
	D	12V Unregulated Voltage Output
	E	COM14 RS-232 Tx
	F	COM14 RS-232 Rx
	G	DIO9

Fugro OCEANOR

User Manual – SEAWATCH Midi Buoy

6. Data Acquisition Unit / Wave Sensor



Connector	Pin	Signal description
SENSOR 6	A	GND
	B	NC
	C	Power10
	D	Power11
	E	IO 19
	F	GND
	G	COM6 RS-232 Tx
	H	COM6 RS-232 Rx
	J	DIO11
	K	GND
	L	Power4
	M	COM15 RS-232 Rx
	N	COM15 RS-232 Tx
	P	COM5 RS-422 Rx-
	R	COM5 RS-422 Rx+
	S	Power1
	T	GND
	U	GND
	V	AD10+ (4-20 mA configurable)
	W	AD3+
	X	AD4+
	Y	AD5+
	Z	Thermistor-
	a	Thermistor1+
	b	GND
	c	12V Unregulated Voltage Output
	d	COM12 RS-232 Tx
	e	COM12 RS-232 Rx
	f	GND
	g	COM17 TTL Rx
	h	COM17 TTL Tx
	i	AD12+
	j	COM5 RS-422 Tx-
	k	GND
	m	DIO10
	n	COM9 RS-232 Tx
	p	COM9 RS-232 Rx
	q	AD13+ (4-20 mA configurable)
	r	AD14+ (4-20 mA configurable)
	s	GND
	t	COM5 RS-422 Tx+

Fugro OCEANOR

User Manual – SEAWATCH Midi Buoy

6. Data Acquisition Unit / Wave Sensor



Connector	Pin	Signal description
SENSOR 7	A	GND
	B	ACH2+
	C	ACH20+ (Wind speed)
	D	Power6
	E	COM2 RS-422 Tx+
	F	COM2 RS-422 Rx+
	G	1.247V Voltage output (Wind direction out)
PC(RS-232) NETWORK	A	GND
	B	GPIO 7
	C	LAN GND
	D	COM0 Tx
	E	COM0 Rx
	F	ETX+
	G	ETX-
	H	ERX+
	J	ERX-
	K	GND



Location/Installation

The Wavesense is attached to the electronic module bracket within the buoy using M6x20 (x4) screws.

The sensor is labelled with the sensor axis definitions on the housing. These define the sensor oriented co-ordinate system, X, Y and Z, as well as how the sensor should be mounted in terms of North, East and Down. The software in the sensor assumes that the X-axis of the sensor is pointed towards what is defined as the North direction of the buoy, the Z-axis directly down and the Y-axis will then point in the East direction of the buoy. It is important that these directions are followed.

Care should be taken to mount the sensor in a mechanical stable way, vibrations must be avoided and the sensors Z-axis should point exactly vertically when the buoy is floating on the (still) water.

MAINTENANCE

The Wavesense normally does not need any maintenance. The housing should not be opened outside the factory, (should only be opened with guidance from Oceanor personnel).

The lithium battery which maintains the Real Time Clock has a shelf life of three years. If the GENI is not connected to any external power, the battery will be discharged after three years. Return the Wavesense to Fugro OCEANOR workshop for battery replacing. **Use the special transport/service box during all transportation.**

CALIBRATION

Field calibration not necessary. The unit should be returned to the factory every 3 years to have the calibration checked.

SPARE PARTS

Fuse on P013 IO board:

- Fuse 4A slow, 5x20 mm, 1500A breaking capacity
- Fuse 1A fast, 5x20 mm, 1500A breaking capacity



7. BUOY COMMUNICATION SYSTEM

Contents

7. BUOY COMMUNICATION SYSTEM	7-1
7.1 GSM modem	7-1
7.2 VHF Radio	7-8



7. Buoy communication system

7.1 GSM modem

Manufacture:	Cinterion
Model:	MC35i
Function:	GSM/GPRS
Antenna:	REEL, planTec GSM 900/1800 MHz – K70EAR

FUNCTIONAL DESCRIPTION

The MC35i is designed for use in a system environment comprising a GSM900/1800 mobile radio network with one or more network operators per country. The functional environment for the MC35i is constituted by a so-called base unit, which supports the interfaces of the MC35i. The base unit must support at least 8 V power supply, a SIM card interface and an AT command interface via the serial interface (V.24/V.28). The base unit is a terminal device, which uses the GSM as a medium for transmitting data. In this system it is possible to transmit data whenever wanted to. The buoy has configurable transmitting and receiving intervals.

The buoy data is transmitted by GPRS service to land.

LOCATION/INSTALLATION

The modem is mounted in a aluminium box that is located on the electronics-module bracket within the buoy. The GSM antenna is mounted under the buoy lid. (Se chapter 3.4.2/3.4.3 for more details)

1. **SIM card** must be inserted in the card holder to put the terminal into operation.
2. Connect the power/data communication and antenna cables.

MAINTENANCE

None.

CALIBRATION

None.

SPARE PARTS

None.

**INTERFACING**

If a new modem is purchased it must be set up with the correct communication settings before use with the buoy. The table below shows the settings for interfacing with GENI(Wavesense).

When setting up a new modem, connect it either directly to a PC or to the GENI(Wavesense). When using the GENI(Wavesense), log into the GENI(Wavesense) and start the Debug program. Use the chat function to communicate and send commands to the modem. (See GENI(Wavesense) User Manual for how to use the Debug program.) If connecting the modem directly to a PC, gLink may be used to communicate with the modem. When communicating with the modem for the first time, log into the modem using the original communication settings.

Note. If the modem was set up with flow control, a PC has to be used to disable this function. This is because flow control may require up to two extra wires. These wires are not installed in the buoy.

Commands to change the modem communication setting:

Command:	Meaning:
AT&F	Factory setting
AT+IPR=9600	Set serial port baud rate to 9600 bps
AT+CBST=71,0,1	Selects V.110 protocol at 9600 bps
AT\Q0	No flow control
ATS0=1	Autoanswer
AT&D0	Don't care for DTR
AT&W	Save the configuration

Note. After the baud rate has been changed, it may be required to log into the modem again with the new baud rate.

Communication settings used to interface GSM modem to GENI(Wavesense).

Unit	IO type	Port	Baud rate	Data bit	Stop bit	Parity	Duplex	Flow ctrl.	Power line
GSM modem	RS232	3-Transmitter	9600	8	1	No	Full	None	PWR 8

TESTING

To verify that a modem is working properly, this simple test may be used; just call your own telephone. Log into the modem as previously described. Send the command; **ATDxxxxxxx**, where xxxxxxxx is your telephone number. Your telephone should start ringing immediately. Remember to connect an antenna to the modem.

INTERFACING GPRS

When the system is installed the first time, the modem needs to be configured with the proper serial settings to use GPRS. The Geni 3 needs to be configured with matching serial settings, as well as the proper APN, AT commands and PPP settings. The examples in this chapter are based on a configuration for the TDC network.

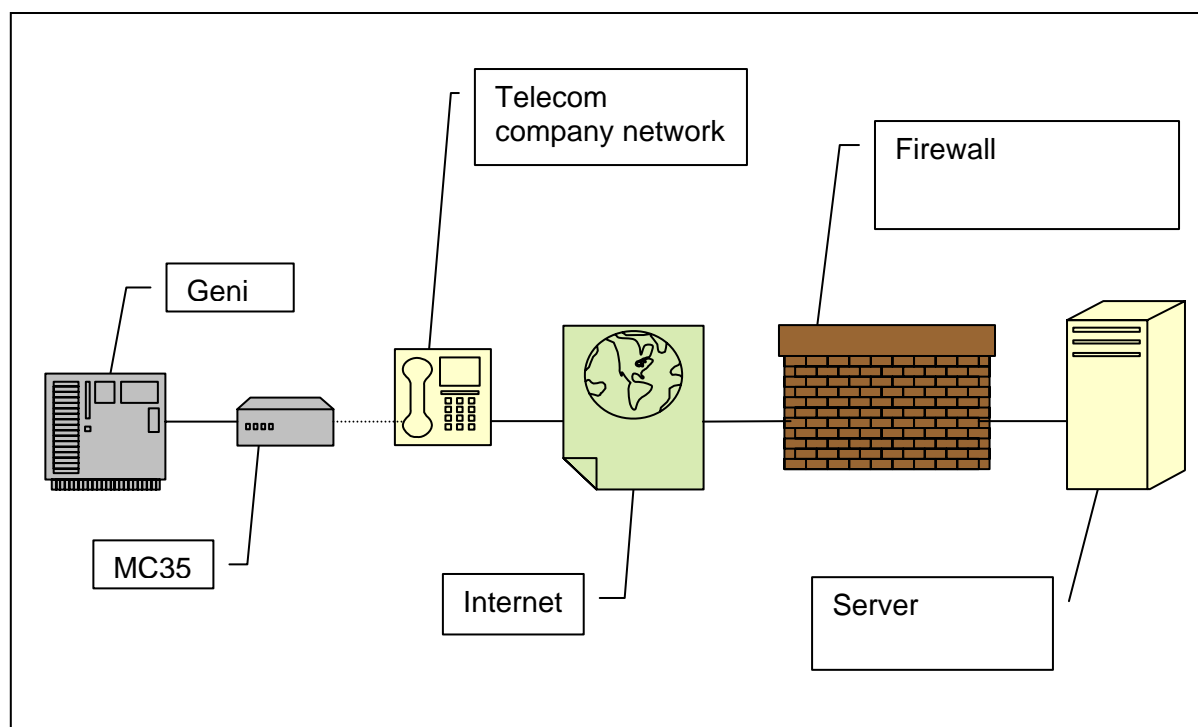


Figure 1: GPRS communication chain

The GENI uses a serial link to the MC35i to relay a PPP link to the telecom company network. The telecom company acts as a gateway to the Internet, which serves as the final transport layer before reaching the server.

The Geni 3 normally powers the GPRS modem and then spawns a PPP connection to the telecom company's network when data are ready to be sent.



To test the connection manually use the following commands. The example assumes that the GPRS modem is powered with power line 7.

```
# genitest -P7
# pppd call gprs
# tail -f /var/log/messages
Nov  9 12:12:04 geni-136 pppd[1204]: pppd 2.4.3 started by oceanor,
uid 500
Nov  9 12:12:05 geni-136 chat[1205]: report (CONNECT)
Nov  9 12:12:05 geni-136 chat[1205]: timeout set to 60 seconds
Nov  9 12:12:05 geni-136 chat[1205]: abort on (BUSY)
Nov  9 12:12:05 geni-136 chat[1205]: abort on (ERROR)
Nov  9 12:12:05 geni-136 chat[1205]: abort on (VOICE)
Nov  9 12:12:05 geni-136 chat[1205]: abort on (NO CARRIER)
Nov  9 12:12:05 geni-136 chat[1205]: abort on (NO DIALTONE)
Nov  9 12:12:05 geni-136 chat[1205]: abort on (NO DIAL TONE)
Nov  9 12:12:05 geni-136 chat[1205]: abort on (RINGING)
Nov  9 12:12:05 geni-136 chat[1205]: send (ATH^M)
Nov  9 12:12:05 geni-136 chat[1205]: expect (OK)
Nov  9 12:12:05 geni-136 chat[1205]: ATH^M^M
Nov  9 12:12:05 geni-136 chat[1205]: OK
Nov  9 12:12:05 geni-136 chat[1205]: -- got it
Nov  9 12:12:05 geni-136 chat[1205]: send
(AT+CGDCONT=1,IP,"internet.no"^M)
Nov  9 12:12:06 geni-136 chat[1205]: expect (OK)
Nov  9 12:12:06 geni-136 chat[1205]: ^M
Nov  9 12:12:06 geni-136 chat[1205]:
AT+CGDCONT=1,IP,"internet.no"^M^M
Nov  9 12:12:06 geni-136 chat[1205]: OK
Nov  9 12:12:06 geni-136 chat[1205]: -- got it
Nov  9 12:12:06 geni-136 chat[1205]: send (ATD*99***1#^M)
Nov  9 12:12:06 geni-136 chat[1205]: expect (CONNECT)
Nov  9 12:12:06 geni-136 chat[1205]: ^M
Nov  9 12:12:43 geni-136 chat[1205]: ATD*99***1#^M^M
Nov  9 12:12:43 geni-136 chat[1205]: CONNECT
Nov  9 12:12:43 geni-136 chat[1205]: -- got it
Nov  9 12:12:43 geni-136 chat[1205]: send (^M)
Nov  9 12:12:43 geni-136 pppd[1204]: Serial connection established.
Nov  9 12:12:43 geni-136 pppd[1204]: Using interface ppp0
Nov  9 12:12:43 geni-136 pppd[1204]: Connect: ppp0 <--> /dev/ttyS19
Nov  9 12:12:44 geni-136 pppd[1204]: Warning - secret file
/etc/ppp/pap-secrets has world and/or group access
Nov  9 12:12:46 geni-136 pppd[1204]: local IP address 85.19.161.75
Nov  9 12:12:46 geni-136 pppd[1204]: remote IP address
192.168.254.254
Nov  9 12:12:46 geni-136 pppd[1204]: primary DNS address 80.232.41.10
Nov  9 12:12:46 geni-136 pppd[1204]: secondary DNS address
80.232.41.20
```

The above example shows a successful connection.



Note that the Geni is set up to shut down the Ethernet interface when connecting with PPP, and vice versa. This is due to issues with routes and DNS resolution. So when bench testing connect your PC to the Geni 3 with a serial cable.

NECESSARY MODIFICATIONS AT FIRST INSTALLATION

For the automatic startup of the PPP network interface, the following command must be run as root, to allow the system to assume the identity of root for the purpose of running pppd.

```
# chmod +s /usr/sbin/pppd
```

The necessary configuration for a new network on the Geni is located in the following files:

```
/etc/ppp/chat/gprs  
/etc/ppp/peers/gprs  
/etc/ppp/options  
/etc/network/interfaces
```

/etc/ppp/chat/gprs

The file `/etc/ppp/chat/gprs` will initially contain the following the following line:

```
OK AT+CGDCONT=1,IP,"internet.no"
```

The string "internet.no" is the Access Point Name (APN). The local telecom company will provide the correct APN. Please refer to file comments and the pppd man pages for further information.

Timeout for the GPRS connection is normally set to 60 seconds with the line:

```
TIMEOUT 60
```

/etc/ppp/peers/gprs

Serial settings for the connection to the modem must be set here; namely device number and connection speed. The example file includes the following two lines who set up the serial settings:

```
/dev/ttyS19  
9600
```

Additionally, the peers/gprs file sets up some PPP specific settings that should not be necessary to alter. Please refer to file comments and the pppd man pages for further information.

/etc/ppp/options

This file sets up some more PPP options that should not be necessary to alter. Please refer to file comments and the pppd man pages for further information.



/etc/network/interfaces

This is where the ppp0 interface is set up. The provided file not only adds the ppp0 interface, but handles problems related to routing and DNS resolution calls. The eth0 and ppp0 interfaces have conflicting interests in both the resolv.conf (DNS setup) file and the network routing table. The routing problem is avoided by bringing down the eth0 interface when the ppp0 is brought up, and vice versa. The resolv.conf problem is avoided by switching the active resolv.conf files when the ppp0 interface is brought up and down.

These work around uses two shell scripts in /etc/ppp/ called fixresolv (for handling the resolv.conf issue) and spotppp (which is called when bringing up the Ethernet interface, and brings down the ppp0 interface if it is running).

Further modifications should not be necessary. Please refer to file comments and the ifup man pages for further information.

/etc/ppp/pap-secrets

PAP (Password Authentication Protocol) is used for user identification and authentication when trying to connect to a PPP server, as for instance when a GPRS terminal initializes its network link. The necessary authentication information is stored in the file /etc/ppp/pap-secrets. It should look something like the following (hash is a comment marker):

```
# Secrets for authentication using PAP
# client      server      secret          IP addresses
logon name single asterisk password    single asterisk
```

The correct values for these are provided by the local telecom company. Note that the TDC configuration uses blanks for username and password.

/etc/ppp/chat/disconnect

This script ensures that the modem is hung up after terminating a connection.

TROUBLESHOOTING

Having brought up the interface whether manually or through a scheduled process; it may be determined whether the Geni is able to transmit data. Simply try and ping a computer connected to the Internet. If the GPRS service provider does not provide a DNS, IP addresses should be used in the place of hostnames:

```
ping -c 3 www.db.no
ping -c 3 81.93.163.115
```

Note that establishing the GPRS link may take up to a minute or so. The command

```
ifconfig ppp0
```

will reveal if the interface is up and running. If the interface does not come up, try restarting it by using the following commands.



```
ifdown ppp0  
ifup ppp0
```

If this still doesn't work, check the following

- Modem is powered
- SIM card is installed
- Serial cable connected, to the correct port
- Modem serial settings and Geni serial settings match
- APN correctly defined in `/etc/ppp/chat/gprs`

If the interface comes up (according to `ifconfig ppp0`) but no traffic (using neither hostnames or IP addresses) seems to be going out from the Geni, a routing problem is likely. Use:

```
route -n
```

to check if the routing table has the following entries (IP addresses will vary):

Kernel	Destination	Gateway	IP	Genmask	routing	Flags	Metric	Ref	Use	Iface
	192.168.254.254	0.0.0.0		255.255.255.255	UH	0	0	0	0	ppp0
	0.0.0.0	192.168.254.254	0.0.0.0		UG	0	0	0	0	ppp0

These should be the only entries in the routing table. If there are any tied to the interface `eth0`, there is a problem with the mutual exclusion between `ppp0` and `eth0`, check `/etc/network/interfaces` and the `/etc/ppp/spotppp` shell script.

If IP address traffic is working but DNS resolution is not, there is likely to be a problem with the `resolv.conf` handling. Verify that `/etc/resolv.conf` contains the nameservers of the service provider. Note that after bringing up the interface there may be a delay before the name servers show up in the `resolv.conf`. The problem may also be related to the switching between the different `resolv.conf` files. Refer to `/etc/network/interfaces` and the associated `/etc/ppp/fixresolv` shell script.

Fugro OCEANOR

User Manual – SEAWATCH Midi Buoy

7. Buoy communication system



7.2 VHF Radio

VHF Radio

Manufacturer:	Satel
Model:	Satellite – 3AS, 142.0 MHz, 5W with heat sink
Function:	Two way radio communication
Enclosure:	Original

VHF Radio antenna

Manufacture:	Trans Voice
Model:	W VHFS-U ½ (Universal), 144-175 MHz
Function:	VHF antenna
Enclosure:	Original

FUNCTIONAL DESCRIPTION

The communication with the buoy is bi-directional and use an error correction protocol. The buoy has configurable transmitting intervals. Use the gLink program to receive the data and save into the database.

LOCATION/INSTALLATION

The VHF radio is located on the electronics-module bracket within the buoy.

The VHF radio antenna is located at the sensor carrier arm at the mast top.

MAINTENANCE

Before every deployment check connector, cable and antenna for sign of damage.

CALIBRATION

None.

SPARE PARTS

None.

Fugro OCEANOR

User Manual – SEAWATCH Midi Buoy

7. Buoy communication system



INTERFACING

Sensor	IO	Port	Baud rate	Data bit	Stop bit	Parity	Duplex	Power
VHF Radio	RS-232	Sens or -6	9600	8	1	N	F	11

Enter the menu (on radio) and check these settings:

Baudrate: 9600 (on COM1-radio)

Error correction: ON

Error check: ON

Leave rest of the settings to factory defaults.

TECHNICAL DATA

RADIO TRANSCEIVER

Frequency Range 138...174 MHz (138...160 and 155...174 MHz variants)
218...238 MHz

Channel Spacing 12.5 / 25 kHz

Number of Channels 1600 / 800

Frequency Stability $< \pm 650$ Hz

Type of Emission F1D

Communication Mode Half-Duplex

RADIO TRANSMITTER

Carrier Power 100 mW, 500 mW, 1 W, 5 W / 50

Carrier Power Stability $+ 1.5$ dB / -1.5 dB

Adjacent Channel Power according to EN 300 220 / EN 300 113 and CRF47 part90

Spurious Radiation according to EN 300 220 / EN 300 113

RADIO RECEIVER

Sensitivity - 115... -110 dBm (BER $< 10^{-3}$) *2

Common Channel Rejection > -12 dB

Adjacent Channel Selectivity > 50 dB @ 12,5 kHz, > 60 dB @ 25 kHz

Intermodulation Attenuation > 60 dB

Spurious Radiation < 2 nW

MODEM

Interface level RS-232 or RS-485, RS-422

Interface One port for data and one for NMS

Interface Connector D15, female

Data Speed of Serial Interface 1200 – 38400 bps

Data Speed of Radio Interface 19200 bps (25 kHz channel)

9600 bps (12.5 kHz channel)

Fugro OCEANOR

User Manual – SEAWATCH Midi Buoy

7. Buoy communication system



Data format

Asynchronous data

GENERAL

Operating Voltage	+ 8 ...+ 30 VDC
Power Consumption (average)	1.7 VA (Receive), 6.6 VA (Transmit at 1W) 0.07 VA (in Standby Mode)
Operating Temperature Range	-25 °C...+55 °C
Antenna Connector	TNC, 50 , female
Housing	Aluminium enclosure
Size H x W x D	137 x 67 x 29 mm without a heat sink
Installation Plate	137 x 80 x 56 mm with a heat sink 130 x 63 x 1 mm
Weight	265 g without a heat sink 550 g with heat sink

*1 Full compliance with the Tx parameter limits. Please refer to specifications above

for minor deviations from Rx parameter limits.

*2 Depending on Receiver settings

For further information see the User Guide enclosed with the radio modem.



8. POWER SYSTEM

Contents

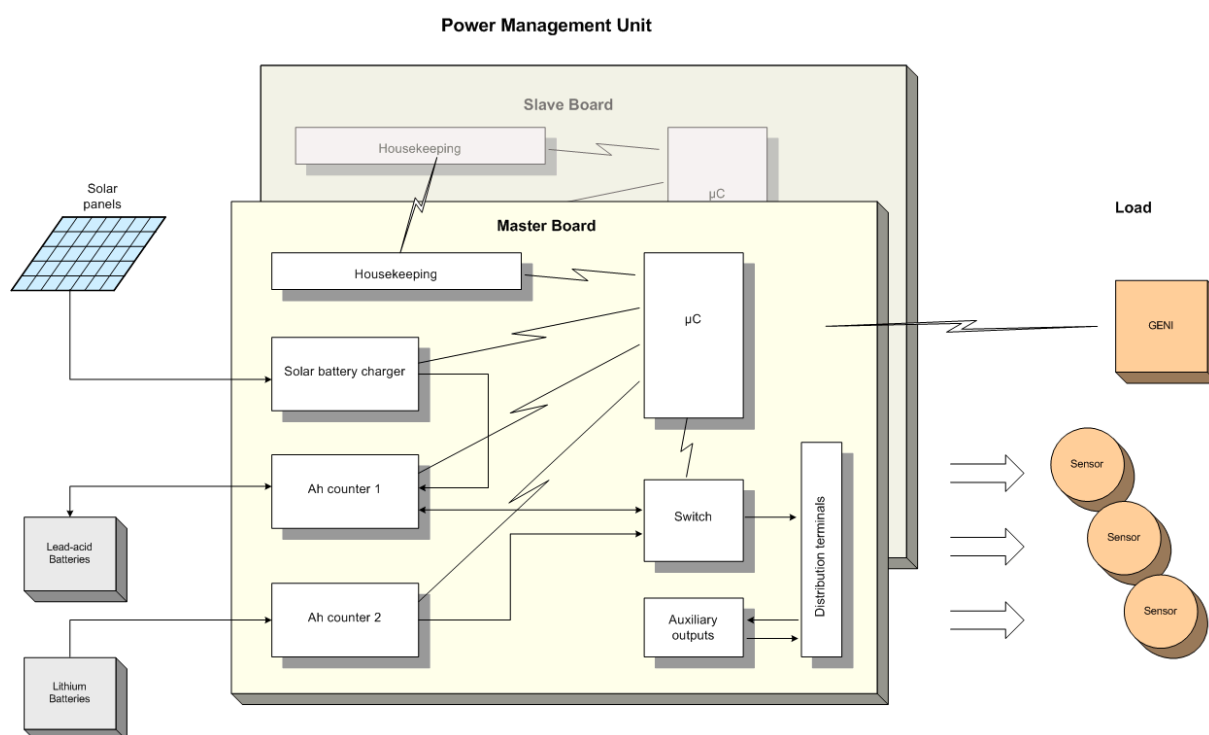
8. POWER SYSTEM	8-1
8.1 Power Management Unit (PMU)	8-1
8.2 External connection of the Power Management Unit.....	8-3
8.3 LED indicator array	8-5
8.3.1 Start-up	8-5
8.3.2 Operation	8-6
8.4 Solar Panels.....	8-7
8.5 Batteries.....	8-8
8.6 Safety precautions	8-11

8. Power system

8.1 Power Management Unit (PMU)

The Power Management Unit is the central node in the power supply system of *Oceanor* oceanographic buoys. The main functions of the unit are:

- Control the charging and discharging of the batteries.
- Supervise the battery voltage and switch to back-up source or disconnect the load if necessary.
- Power ON/ OFF switch.
- Distribute power to the different users.
- Provide power system status information to the GENI data logger.



Power system of oceanographic buoy.



In addition, the unit provides auxiliary features like:

- DC/DC conversion
- Externally controlled high-power drivers
- 5-LED status indicator panel

To provide fail-safe operation of the system, the Power Management Unit comprises two boards in a 2:1 redundancy configuration. The boards are identical, but one is configured as master (nominally active) and the other is configured as slave (nominally passive). If an error situation is detected in the master, a flag is raised. The slave then automatically takes over operation and inhibits the master.

LOCATION/INSTALLATION

The PMU is mounted on the electronic module bracket (see 3.5.5 for details).

1. Mount PMU to the module bracket using M6x16 screws (x4).

MAINTENANCE

The PMU normally does not need any maintenance.

CALIBRATION

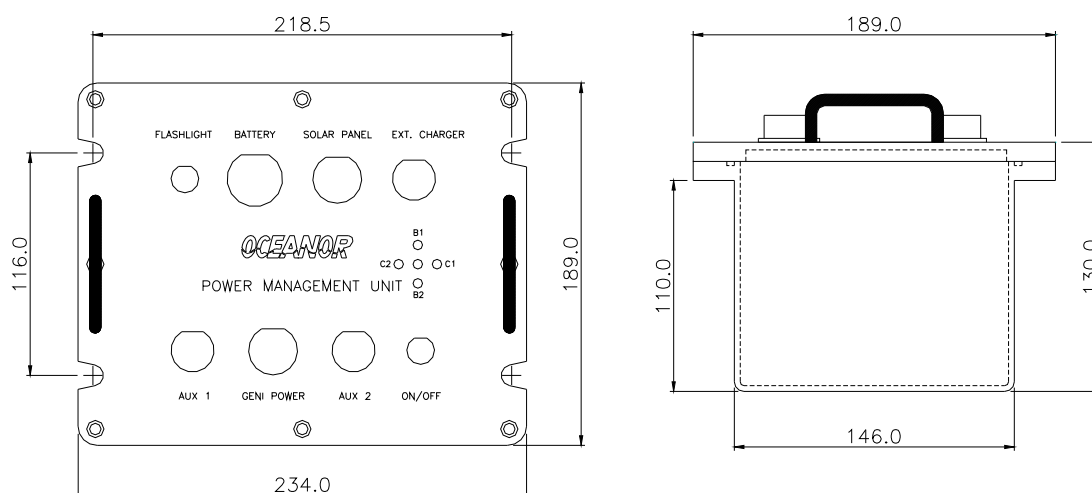
NA

SPARE PARTS

Fuse 10A Fast (ATO) in the PMU

Fuse 7.5A Fast (ATO) in the PMU.

8.2 External connection of the Power Management Unit



IP64 Protective housing of the 200054 module.

Table 8-1: Front panel connections, general (see the chapter 12.4 for your specific connections)

Connector	Terminal no.	Designator	Description
J1 851-8-2S	A	Flashlight	Separately controlled power output
	B	GND	Power ground (load-)
J2 851-16-8P	A	BATT1+	Battery pack 1 +
	B	BATT1+	Battery pack 1 +
	C	BATT1-	Battery pack 1 -
	D	BATT1-	Battery pack 1 -
	E	BATT2+	Battery pack 2 +
	F	NTC +	Battery temperature sense +
	G	BATT2-	Battery pack 2 -
	H	NTC -	Battery temperature sense -
J3 851-12-5P	A	SOLAR+	Solar panels +
	B	SOLAR+	Solar panels +
	C	SOLAR-	Solar panels -
	D	SOLAR-	Solar panels -
	E	N.C.	
J4 851-12-2S	A	CHARGE+	External charger +
	B	CHARGE-	External charger -

Fugro OCEANOR

User Manual – The SEAWATCH Mini II Buoy

8. Power system



Connector	Terminal no.	Designator	Description
J5 851-8-4S	A	EXT ON/OFF O	External power switch output
	B	EXT ON/OFF I	External power switch input
	C	BATT1+	Battery pack 1 +
	D	BATT2+	Battery pack 2 +
J6 851-12-3S	A	PWR+	Inmarsat modem power +
	B	GND	Inmarsat modem power -
	C	ON/OFF	Inmarsat modem ON/OFF
J7 851-14-15S	A	Voltage Ref	
	B	Wind Dir	
	C		
	D		
	E		
	F		
	G	COM 11 TX	RS-232 DTE TX
	H	COM 11 RX	RS-232 DTE RX
	J	Wind Speed	
	K	Gnd	
	L		
	M		
	N		
	P	BATT+	Unregulated power+ (load+)
	R	GND	Power ground (load-)
J8 851-12-10S	A	Voltage Ref	
	B	Wind Dir	
	C	Wind Speed	
	D	EXT CTR 3	External on/off for regulated power
	E	EXT CTR 1	External on/off for high-power driver 1
	F	AUX OUT 1	High-power driver 1
	G	GND	Power ground (load-)
	H	EXT CTR 2	External on/off for high-power driver 1
	J	AUX OUT 2	High-power driver 2
	K	GND	Power ground (load-)



8.3 LED indicator array

8.3.1 Start-up

System status information is provided by diode D2 during start-up. The start-up sequence comprises two stages: 1) configuration information and 2) error information.

Flashes	Configuration
3	Master
2	Slave

Table 8-2: Configuration information provided by D2 during start-up

After half a second delay the unit may give an additional 1 to 7 flashes to indicate an error condition depending on the temperature sensor, battery 1 or power 1 voltage.

Flashes	Error condition
1	T
2	C
3	C, T
4	B
5	B, T
6	B, C
7	B, C, T

Table 8-3: Error information provided by C1 during start-up

Error condition codes:

- T Temperature outside normal limits
- C Charger 1 voltage outside normal limits
- B Battery 1 voltage outside normal limits

Fugro OCEANOR

User Manual – The SEAWATCH Mini II Buoy

8. Power system

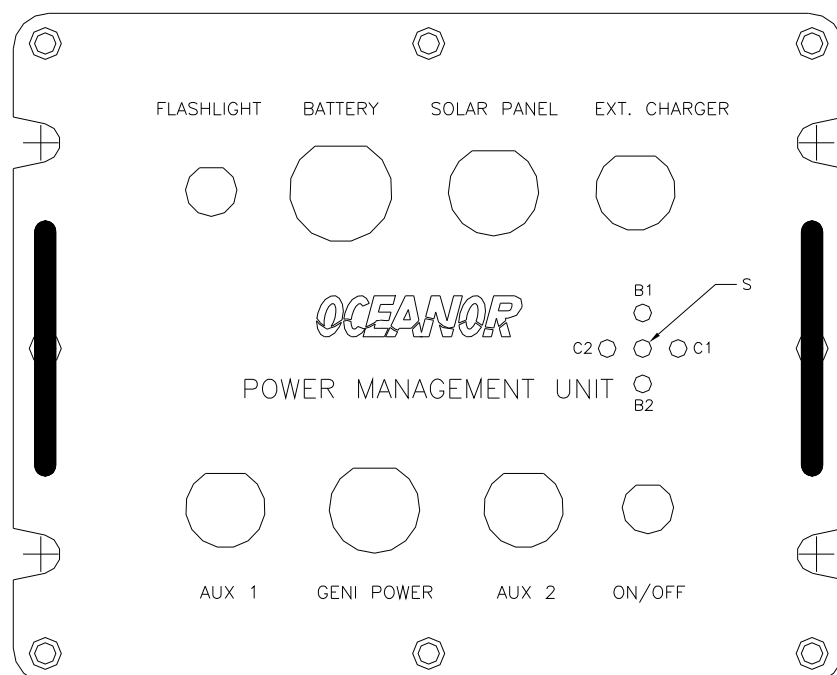


8.3.2 Operation

The PMU is equipped with a 5-LED indicator array to display the operational status of the unit. The interpretation is given in table 8-4. Sketch in chapter 8.2 shows the location of the LEDs on the front panel.

Designator	Colour	Indicator	Code
B1	Green	Battery pack 1	Flash period ~1.6 sec.: connected to load
C1	Yellow	Charger 1 activity	Flash period ~1 sec.: float charge Constantly on: bulk charge
S	Red	Inhibit (slave only)	Flash period ~1.6 sec.: slave board is active
C2	Yellow	Charger 2 activity	Flash period ~1 sec.: float charge Constantly on: bulk charge
B2	Green	Battery pack 2	Flash period ~1.6 sec. connected to load

Table 8-4: Properties of the 5-LED status indicator panel during operation





8.4 Solar Panels

The main power supply for the buoys stems from a set of 6 solar panels, each with 17 W charge capacity. Each solar cell panel is protected against reverse current by a diode. The charge current is gated through pg-nipple on the junction box mounted rear side of panel and is fed into a pulse mode regulator (within the PMU) that prevents over-charging of the lead-acid batteries.

LOCATION / INSTALLATION

The solar panels are mounted in recesses on the floating body.

MAINTENANCE

Cleaning: Dirt accumulation on the module's front surface can reduce the light energy collected by the module, decreasing its power output. If the module surface is dirty, gently clean it with a soft cloth or sponge using water and mild detergent.

Do not use a scrub brush; it may damage the module front surface. Wear rubber gloves to protect against possible electric shock.

If the buoy is stored outdoor the panels must be covered to avoid unnecessary ageing.

TECHNICAL DATA:

Type:	SOLARA SM 60M/S
Dimensions include frame:	63.5 × 28 x 1 cm
Performancer:.....	.72 Wh/d *
Power (Pmpp).....	17 Wp*
Open circuit voltage.....	22.6 V
Voltage (Vmpp)	19.0 V
Current (I mpp)	0.9 A
System voltage.....	12 V



8.5 Batteries

When the buoy is equipped with solar panels these require a back-up battery bank, which is by means of sealed lead-acid batteries. The battery packs are ventilated out in the open through a valve on the buoy lid. The buoy is equipped with 4 lead-acid batteries and 2 back up lithium batteries. The PMU automatically switches over to Li cells when the voltage on the accumulators is too low.

The batteries are arranged in two separate branches that are charged by the solar panels through a pulsed mode regulator, within the PMU. A temperature sensor (connected to the PMU) is mounted close to the battery pole to regulate the charging voltage depending on the battery temperature. If the temperature is above 45°C, the charging is stopped.

Batteries	Battery Voltage	Nominal	No. of	Total
	(V)	Capacity	Batteries	Capacity
		(Ah)		(Ah)
Lead acid, Powersafe	12	62	4	248
Lithium 4S16P	14	272	2	544

LOCATION / INSTALLATION

The battery package is located at the bottom of the inside battery container of the Mini buoy (See chapter 3.4.3 for more details).

LEAD-ACID BATTERY

MAINTENANCE

To obtain maximum performance of the battery package and the solar panels, some maintenance should be performed. The following maintenance intervals are recommended:

Storing

Before storing a battery package, a refreshing charge must be performed by connecting the battery charger to the battery's power cable. This charge is to be **repeated every 4 month** as long as the batteries are stored, or when battery voltage drops below 12.5 V.

At one year intervals

- Lift up the battery package and inspect terminals for sign of corrosion. If sign of corrosion, rinse and apply special grease (non-acid) on terminals.
- Check for loose connections at terminal blocks.
- Check connectors for possible damage.

At six years intervals

- To keep the system within the original specifications, replace the batteries.



Charging the battery package

Before every deployment the battery package is to be charged.

If the battery package has been totally discharged for some time (battery voltage is below 10.5V), the package must be replaced.

Handling precautions

- **Avoid short-circuiting the + and - poles as the battery package will produce a very high short circuit current.**
- Keep flames away.
- Use tools with insulated handles.
- Do not place or drop metal objects on top of the batteries.
- Remove rings, wristwatches and articles of clothing with metal parts that might come in contact with the battery terminals when working with the **battery package**.
- Do not bend or penetrate solar panels.
- Make sure that the batteries are correctly positioned.
- Fasten the lid securely by tightening the nuts alternately using **moderate** force until the friction rubber pads in lid and bottom are compressed where the force is applied. **Do not apply great force.**
- Fasten the cables by tightening the nipples with correct torque (5Nm)
- Insert the fuse.

Replacing the batteries

See the chapter 5 Mechanical.

NOTE:

Care should be taken when handling the battery (see the chapter 4.7).

TECHNICAL DATA

Battery type	PowerSafe
Capacity	62 Ah
Voltage	12 V
Length	390 mm
Width	125 mm
Height	228 mm
Weight	31 kg
Terminals	2
Internal resistance	4.8 mΩ

Battery package state of charge Voltage (pin E - C after 24 hours rest)

100 %	12.84 V
80 %	12.54 V
60 %	12.36 V
40 %	12.12 V
20 %	11.82 V



Note

When the batteries are in service, approximately 0.25 V can be subtracted from the voltage levels in the table above. To monitor the correct battery level during operation, only the data from night time is valid because as long as the sun excites the solar panels the voltage monitored will be the charging voltage

LITHIUM BATTERY

The buoy is supplied with Lithium battery packs (2ea) to ensure safe long-term operation of the buoy when little or no charge current is available.

CAUTION!

The cells are hermetically sealed and should be handled and disposed of in accordance with manufacturer's instructions. (See the safety data sheet end of this chapter for more details)

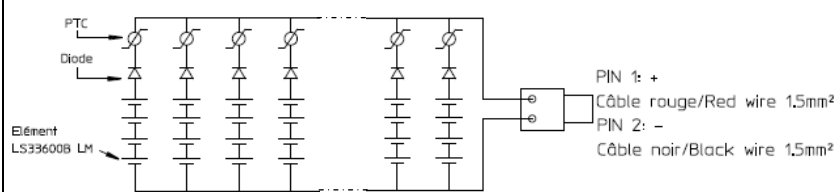

Do not dispose of in fire. Do not charge.

Normal operation of battery cells:

1. Do not store or use the batteries in temperature above 75°C.
2. Be aware of impacts that may lead to physical damage of the battery cell and its insulation.
3. Never charge the batteries.
4. Store the batteries at 20°C or lower temperature, in air with low humidity.

TECHNICAL DATA

Type	Saft - LS 33600 LM, Size D – 3.6V
Nominal voltage (V)	14.6
Nominal capacity (Ah)	272
Weight (kg)	6.5
Dimensions	H x W x T = 258 x 136 x 136 mm
Number of cells per battery	64

Nom <i>Name</i>		4S16P LS33600B LM OC	Couple électrochimique	<i>Chemistry</i>
Code Produit <i>Battery P/N</i>		05789X	Lithium / Thionyl chloride	
			Li / SOCl ₂	
Conception <i>Design</i>	Circuit électrique <i>Electrical diagram</i>			
	Protections <i>Protective devices</i>	Diodes & PTC		
	Enveloppe <i>Casing</i>	Hot forming plastic top with spacers and screws		
	Sorties <i>Terminals</i>	Connector AMP: Housing ref: 180 923-0 Terminal ref: 141 013-2 with black and red wires KY30-07 AWG18		
Caractéristiques <i>Specifications</i>	Fem <i>OCV</i>	14.68 Volts		
	Tension nominale <i>Nominal voltage</i>	14.4 Volts		
	I max <i>I max current</i>	4 A		
	Capacité nominale (conditions) <i>Nominal capacity</i>	272 Ah (at 80 mA, + 20.0°C, 8.0 V cut off)		
	T stockage <i>Storage T range</i>	+ 30°C max. recommended		
	T opération <i>Operating T range</i>	- 60°C / + 85°C		
	Dimensions ext. max. <i>Max. ext. dimensions</i>	Height x Width x Thickness = 258 x 136 x 136 mm		
	Poids <i>Weight</i>	7000 grams max		
Transport	Assigned to « CLASS9 » dangerous good category			
Emballage <i>Packaging</i>	1 battery sealed in plastic bag and one plastic bag per metal drum			

Primary lithium batteries

LS 33600LM

3.6V Primary lithium-thionyl chloride (Li-SOCl₂)

High energy

D-size bobbin cell

with low magnetic signature

For magnetism-sensitive applications requesting good voltage response and operating life in - 60°C/+ 85°C environments.



Key features

- High and stable operating voltage
- Low self-discharge rate
(less than 1% after 1 year of storage at + 20°C)
- Stainless steel construction
- Hermetic glass-to-metal sealing
- Built-in safety vent
- Non-flammable electrolyte
- Restricted for transport (Class 9)
- Typical magnetic signatures:
200 nT (2 mGauss) at 6 mm
10 nT (0.1 mGauss) at 127 mm
3 nT (0.03 mGauss) at 300 mm

Main applications

- Seismic surveying
 - Oceanographic instrumentation
 - Buoys
 - Scientific equipment
- etc...

Optional upon request

- Specific cell terminations
- Multi-cell battery packs

Cell size references

UM1 - R20 - D

Electrical characteristics

(typical values relative to cells stored for one year or less at + 30°C max.)

Nominal capacity		17.0 Ah
<i>(at 5 mA + 20°C 2.0V cut off. The capacity restored by the cell varies according to current drain, temperature and cut off).</i>		
Open circuit voltage	(at + 20°C)	3.67V
Nominal voltage	(at 0.7mA + 20°C)	3.6V

Pulse capability: Typically up to 400 mA (400 mA/0.1 second pulses, drained every 2 mn at + 20°C from undischarged cells with 10 µA base current, yield voltage readings above 3.0V. The readings may vary according to the pulse characteristics, the temperature, and the cell's previous history. Fitting the cell with a capacitor may be recommended in severe conditions. Consult Saft)

Continuous current permitting 50% of the nominal capacity to be achieved at + 20°C with 2.0V cut off.	250 mA
<i>(Higher currents possible, consult Saft)</i>	

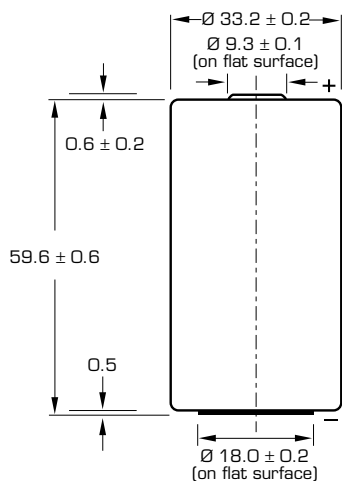
Storage	(recommended) (for more severe conditions, consult Saft)	+ 30°C (+ 86°F) max
---------	---	---------------------

Operating temperature range	- 60°C/+ 85°C (- 76°F/+ 185°F)
<i>(Operation above ambient T may lead to reduced capacity and lower voltage readings at the beginning of pulses. Consult Saft)</i>	

Physical characteristics

Diameter (max)	33.4 mm (1.32 in)
Height (max)	60.2 mm (2.37 in)
Typical weight	90 g (3.2 oz)
Li metal content	approx. 4.5 g

LS 33600LM



Dimensions in mm.

Storage

- The storage area should be clean, cool (not exceeding $+30^{\circ}\text{C}$), dry and ventilated.

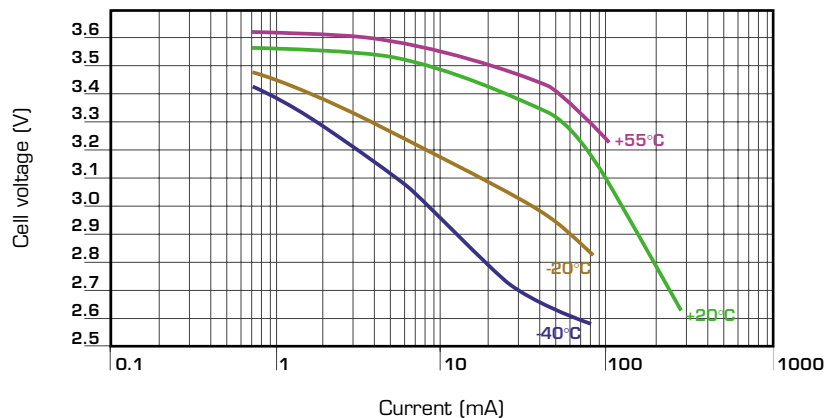
Warning

- Fire, explosion and severe burn hazard.
- Do not recharge, short circuit, crush, disassemble, heat above 100°C (212°F), incinerate, or expose contents to water.
- Do not solder directly to the cell.

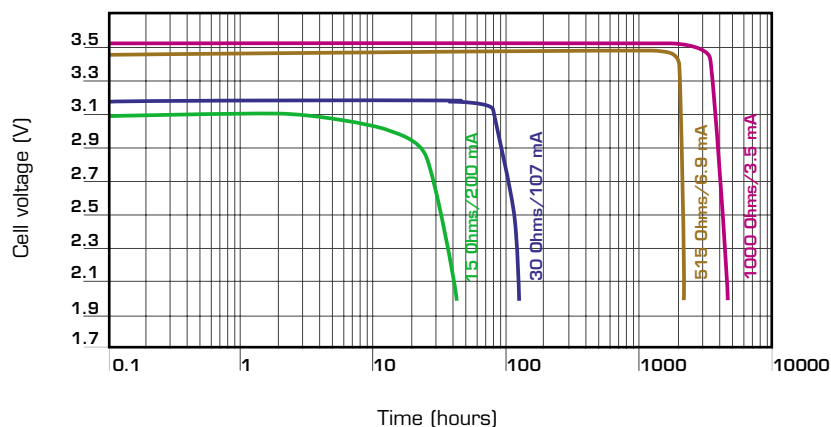
Saft

12, rue Sadi Carnot
93170 Bagnolet - France
Tel +33 1 49 93 19 18
Fax +33 1 49 93 19 69

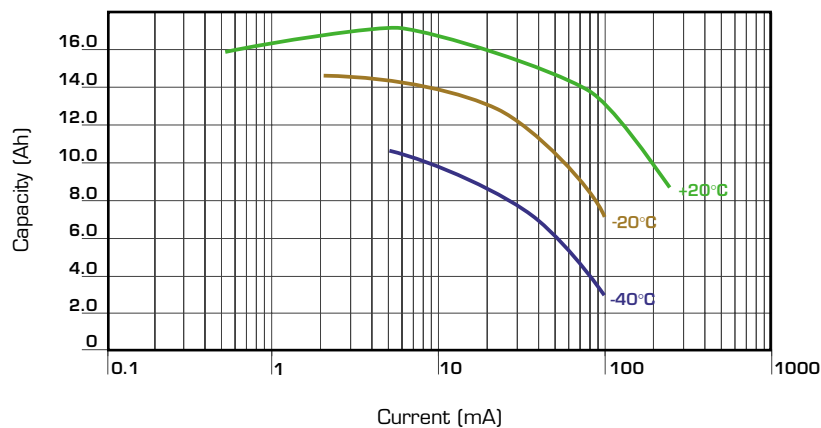
www.saftbatteries.com



Voltage plateau versus Current and Temperature (at mid-discharge)



Typical discharge profiles at $+20^{\circ}\text{C}$



Restored Capacity versus Current and Temperature (2.0V cut off)

Doc. N° 31039-2-0904
Published by the Communications Department

Information in this document is subject to change without notice and becomes contractual only after written confirmation by Saft. For more details on primary lithium technologies please refer to Primary Lithium Batteries Selector Guide Doc N° 31048-2-0604. Photo credit: Saft. Produced by Arthur Associates

Société anonyme au capital de 31 944 000 €
RCS Bobigny B 383 703 873







Material/Product Safety Data Sheet **(MSDS-PSDS)**

LS/LSG/LSH/LST Products	Lithium/Thionyl chloride single cells and multi-cell battery packs
Revision 9 Date 02/2009	

1. Identification of the Substance or Preparation and Company				
Product	Primary Lithium/Thionyl chloride unit cells and multi-cell battery packs (Li-SOCl₂)			
Production sites	Saft Ltd. River Drive Tyne & Wear South Shields NE33 2TR – UK Ph. :+44 191 456 1451 Fax :+44 191 456 6383	Saft Rue Georges Leclanché BP 1039 86060 Poitiers cedex 9 France Ph. :+33 (0)5 49 55 48 48 Fax :+33 (0)5 49 55 48 50	Saft America Inc 313 Crescent Street Valdese NC 28690 – USA Ph. :+1 828 874 4111 Fax :+1 828 874 2431	Saft Batteries Co., Ltd Zhuhai Free Trade Zone Lianfeng Road Zhuhai 519030 Guangdong Province China Ph. : +86 756 881 9318 Fax : +86 756 881 9328
www.saftbatteries.com (section “Contact”)				
Emergency contact	+1 (703) 527 3887 (CHEMTREC US Service Center) within the USA : 800 424 9300			

2. Hazards Identification
<p>Do not short circuit, recharge, puncture, incinerate, crush, immerse, force discharge or expose to temperatures above the declared operating temperature range of the product. Risk of fire or explosion. The Lithium-Thionyl chloride batteries described in this Safety Data Sheet are sealed units which are not hazardous when used according to the recommendations of the manufacturer.</p> <p>Under normal conditions of use, the electrode materials and liquid electrolyte they contain are not exposed to the outside, provided the battery integrity is maintained and seals remain intact. Risk of exposure only in case of abuse (mechanical, thermal, electrical) which leads to the activation of safety valves and/or the rupture of the battery container. Electrolyte leakage, electrode materials reaction with moisture/water or battery vent/explosion/fire may follow, depending upon the circumstances.</p>

3. Composition & Information on Ingredients				
Each cell consists of a hermetically sealed metallic container containing a number of chemicals and materials of construction of which the following could potentially be hazardous upon release.				
Ingredient	Content	CAS No.	CHIP Classification	
Lithium (Li)	3.5-5%	7439-93-2		 F; R14/15 C; R34 R14/15, R21,R22, R35, R41, R43 S2, S8, S45



Thionyl chloride (SOCl ₂)	40-46%	7719-09-7			C; R14, R21, R22, R35, R37, R41, R42/43 S2, S8, S24, S26, S36, S37, S45
Aluminum chloride anhydrous (AlCl ₃)	1-5%	7446-70-0			R14, R22, R37, R41, R43. S2, S8, S22, S24, S26, S36, S45
Carbon (C _n)	3-4%	1333-86-4			NONE KNOWN
Amount varies depending on cell size.					





4. First Aid Measures	
Inhalation	Remove from exposure, rest and keep warm. In severe cases obtain medical attention.
Skin contact	Wash off skin thoroughly with water. Remove contaminated clothing and wash before re-use. In severe cases obtain medical attention.
Eye contact	Irrigate thoroughly with water for at least 15 minutes. Obtain medical attention.
Ingestion	Wash out mouth thoroughly with water and give plenty of water to drink. Obtain medical attention.
Further treatment	All cases of eye contamination, persistent skin irritation and casualties who have swallowed this substance or been affected by breathing its vapours should be seen by a Doctor.

5. Fire Fighting Measures	
CO ₂ extinguishers or, even preferably, copious quantities of water or water-based foam, can be used to cool down burning Li- SOCl ₂ cells and batteries, as long as the extent of the fire has not progressed to the point that the lithium metal they contain is exposed (marked by deep red flames). Do not use for this purpose sand, dry powder or soda ash, graphite powder or fire blankets. Use only metal (Class D) extinguishers on raw lithium.	
Extinguishing media	Use water or CO ₂ on burning Li-SOCl ₂ cells or batteries and class D fire extinguishing agent only on raw lithium.

6. Accidental Release Measures	
Remove personnel from area until fumes dissipate. Do not breathe vapours or touch liquid with bare hands. If the skin has come into contact with the electrolyte, it should be washed thoroughly with water. Sand or earth should be used to absorb any exuded material. Seal leaking battery and contaminated absorbent material in plastic bag and dispose of as Special Waste in accordance with local regulations.	



7. Handling and Storage	
Handling	Do not crush, pierce, short (+) and (-) battery terminals with conductive (i.e. metal) goods. Do not directly heat or solder. Do not throw into fire. Do not mix batteries of different types and brands. Do not mix new and used batteries. Keep batteries in non conductive (i.e. plastic) trays.
Storage	Store in a cool (preferably below 30°C) and ventilated area, away from moisture, sources of heat, open flames, food and drink. Keep adequate clearance between walls and batteries. Temperature above 100°C may result in battery leakage and rupture. Since short circuit can cause burns, leakage and rupture hazard, keep batteries in original packaging until use and do not jumble them.
Other	Lithium-Thionyl chloride batteries are not rechargeable and should not be tentatively charged. Follow Manufacturers recommendations regarding maximum recommended currents and operating temperature range. Applying pressure on deforming the battery may lead to disassembly followed by eye, skin and throat irritation.

8. Exposure Controls & Personal Protection				
Occupational exposure standard		Compound	8hr TWA	15min TWA
		Sulfur dioxide	1 ppm	1 ppm
		Hydrogen chloride	1 ppm	5 ppm
	Respiratory protection	In all fire situations, use self-contained breathing apparatus.		
	Hand protection	In the event of leakage wear gloves.		
	Eye protection	Safety glasses are recommended during handling.		
	Other	In the event of leakage, wear chemical apron.		

9. Physical and Chemical Properties	
Appearance	Cylindrical or prismatic shape
Odour	If leaking, gives off a pungent corrosive odour.
pH	Not applicable
Flash point	Not applicable unless individual components exposed
Flammability	Not applicable unless individual components exposed
Relative density	Not applicable unless individual components exposed
Solubility (water)	Not applicable unless individual components exposed
Solubility (other)	Not applicable unless individual components exposed



10. Stability and Reactivity	
Product is stable under conditions described in Section 7.	
Conditions to avoid.	Heat above 100 (150°C for the LSH 20-150 cells and the battery packs assembled from them) or incinerate. Deform. Mutilate. Crush. Pierce. Disassemble Recharge. Short circuit. Expose over a long period to humid conditions.
Materials to avoid	Oxidising agents, alkalis, water. Avoid electrolyte contact with aluminum or zinc.
Hazardous decomposition Products	Hydrogen (H ₂) as well as Lithium oxide (Li ₂ O) and Lithium hydroxide (LiOH) dust is produced in case of reaction of <i>lithium metal</i> with water. Chlorine (Cl ₂), Sulfur dioxide (SO ₂) and Disulfur dichloride (S ₂ Cl ₂) are produced in case of thermal decomposition of <i>Thionyl chloride</i> above 140°C. Hydrochloric acid (HCl) and Sulfur dioxide (SO ₂) are produced in case of reaction of <i>Thionyl chloride</i> with water at room temperature. Hydrochloric acid (HCl) fumes, Lithium oxide, (Li ₂ O), Lithium hydroxide (LiOH) and Aluminum hydroxide (Al(OH) ₃) dust are produced in case of reaction of <i>Lithium tetrachloroaluminate (LiAlCl₄)</i> with water.

11. Toxicological Information	
Signs & symptoms	None, unless battery ruptures. In the event of exposure to internal contents, corrosive fumes will be very irritating to skin, eyes and mucous membranes. Overexposure can cause symptoms of non-fibrotic lung injury and membrane irritation.
Inhalation	Lung irritant.
Skin contact	Skin irritant
Eye contact	Eye irritant.
Ingestion	Tissue damage to throat and gastro-respiratory tract if swallowed.
Medical conditions generally aggravated by exposure	In the event of exposure to internal contents, eczema, skin allergies, lung injuries, asthma and other respiratory disorders may occur.

12. Ecological Information	
Mammalian effects	None known if used/disposed of correctly.
Eco-toxicity	None known if used/disposed of correctly.
Bioaccumulation potential	None known if used/disposed of correctly.
Environmental fate	None known if used/disposed of correctly.

13. Disposal Considerations	
Do not incinerate, or subject cells to temperatures in excess of 100°C. Such abuse can result in loss of seal, leakage, and/or cell explosion. Dispose of in accordance with appropriate local regulations.	



14. Transport Information

Note : when manufacturing a new battery pack, one must assure that it is tested in accordance with the UN Model Regulations, Manual of Tests and Criteria, Part III, subsection 38.3

Label for conveyance	For the single cell batteries and multicell battery packs that are non-restricted to transport (non-assigned to the Miscellaneous Class 9), use lithium batteries inside label. For the single cell batteries and multicell battery packs which are restricted to transport (assigned to Class 9), use Class 9 Miscellaneous Dangerous Goods and UN Identification Number labels. In all cases, refer to the product transport certificate issued by the Manufacturer.
UN numbers	UN 3090 (shipment of cells and batteries <i>in bulk</i>) UN 3091 (cells and batteries <i>contained in equipment or packed with it</i>)
Shipping names	Lithium Metal Batteries
Hazard classification	Depending on their lithium metal content, some single cells and small multicell battery packs may be non-assigned to Class 9 (Refer to Transport Certificate)
Packing Group	II
IMDG Code	3090 (Li batteries) 3091 (Li batteries contained in equipment or packed with it)
CAS	
EmS No.	F-A , S-I
Marine pollutant	No
ADR Class	Class 9

15. Regulatory Information

Regulations specifically applicable to the product:

- ACGIH and OSHA: see exposure limits of the internal ingredients of the battery in section 8.
- IATA/ICAO (air transportation): UN 3090 or UN 3091
- IMDG (sea transportation) : UN 3090 or UN 3091
- Transportation within the US-DOT, 49 Code of Federal Regulations

Risk phrases	Lithium (Li)	R14/15 R21 R22 R35 R41 R42/43	Reacts violently with water, liberating extremely flammable gases. Harmful in contact with skin. Harmful if swallowed. Causes burns. Risk of serious damage to eye. May cause sensitization by inhalation and skin contact.
	Thionyl chloride (SOCl ₂)	R14 R22 R35 R37 R41 R42/43	Reacts with water. Harmful if swallowed. Causes burns. Irritating to respiratory system. Risk of serious damage to eye. May cause sensitization by inhalation and skin contact.
	Aluminum chloride anhydrous (AlCl ₃)	R14 R22 R37 R41 R43	Reacts with water. Harmful if swallowed. Irritating to respiratory system. Risk of serious damage to eye. May cause sensitization by skin contact.



Safety phrases	Lithium (Li)	S2 S8 S45	Keep out of reach of children Keep away from moisture In case of incident, seek medical attention.
	Thionyl chloride (SOCl ₂)	S2 S8 S24 S26 S36 S37 S45	Keep out of reach of children. Keep away from moisture. Avoid contact with skin. In case of contact with eyes, rinse immediately with plenty of water. Wear suitable protective clothing. Wear suitable gloves. In case of incident, seek medical attention.
	Aluminum chloride anhydrous (AlCl ₃)	S2 S8 S22 S24 S26 S36	Keep out of reach of children. Keep away from moisture. Do not breathe dust. Avoid contact with skin. In case of contact with eyes, rinse immediately with plenty of water. Wear suitable protective clothing.
UK regulatory references	Classified under CHIP		

16. Other Information

This information has been compiled from sources considered to be dependable and is, to the best of our knowledge and belief, accurate and reliable as of the date compiled. However, no representation, warranty (either expressed or implied) or guarantee is made to the accuracy, reliability or completeness of the information contained herein.

This information relates to the specific materials designated and may not be valid for such material used in combination with any other materials or in any process. It is the user's responsibility to satisfy himself as to the suitability and completeness of this information for his particular use.

Saft does not accept liability for any loss or damage that may occur, whether direct, indirect, incidental or consequential, from the use of this information. Saft does not offer warranty against patent infringement.

Edition 9 – February 2009

Signature


Nicolas Paquin
Lithium Product Manager



8.6 Safety precautions

(See chapter 4.7 for safety precautions)



9. SENSORS

Contents

9. SENSORS.....	9-1
9.1 Wind sensor, Young.....	9-1
9.2 Relative Humidity	9-4
9.3 Current profiler (<i>Supplied by customer</i>)	9-6
9.4 OCEANOR Wavesense	9-9
9.5 Air pressure.....	9-12
9.6 Air temperature	9-17
9.7 Wind sensor, Gill.....	9-19
9.8 Electronic compass.....	9-22
9.9 Sensor configuration table	9-24

9. Sensors

9.1 Wind sensor, Young

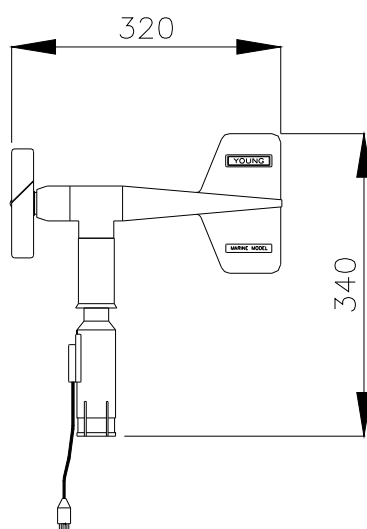
Manufacture	Young
Model	04106-19, Wind monitor JR-MA
Function	Wind speed and direction measurement
Enclosure	Original

FUNCTIONAL DESCRIPTION

The Wind Monitor measures horizontal wind speed and direction. Originally developed for ocean data buoy use, it is rugged a corrosion resistant yet accurate and light weight. The main housing, nose cone, propeller, and other internal parts are injection moulded U.V. stabilized plastic. Both the propeller and vertical shafts use stainless steel precision grade ball bearings. Bearings have light contacting teflon seals and are filled with a low torque wide temperature range grease to help exclude contamination and moisture.

Propeller rotation produces an AC sine wave signal with frequency proportional to wind speed. This AC signals is induced in stationary coil by a six pole magnet mounted on the propeller shaft. Three complete sine wave cycles are produced for each propeller revolution.

Vane position is transmitted by a 10K ohm precision conductive plastic potentiometer, which requires a regulated excitation voltage. With a constant voltage applied to the potentiometer, the output signal is an analogue voltage directly proportional to wind direction angle.



A sketch of the wind sensor



LOCATION/INSTALLATION

The wind sensor is located at the sensor carrier arm at the mast top.

- Place the sensor with the mounting house on the pipe.
- Adjust (twist) the mounting house until the junction box facing south (180°).
- Connect the pigtail to the mast cable
- Finally tighten band clamp.

MAINTENANCE

A check of the sensor bearings is recommended before every deployment. Normal service interval for this sensor is 6 months. For service the sensor should be replaced and the old sensor brought to the workshop for renewal of bearing and possible other parts.

CALIBRATION

No calibration needed.

Fugro OCEANOR

User Manual – The SEAWATCH Midi Buoy

9. Sensors



SPARE PARTS

See the Instruction Manual.

INTERFACING

The wind sensor has two different output signals. Wind speed is connected to GENI's (Wavesense) frequency input and wind direction is connected to an analogue input.

For more details see attached sensor configuration table in chapter 9.9.

TECHNICAL DATA

Manufacturer and model: Young Model 04106-19, JR MA.

WIND SPEED SPECIFICATION SUMMARY

Range:	0 to 60 m/s (130 mph), gust survival 100 m/s (220 mph).
Sensor:	13 cm diameter 4-blade helicoid propeller moulded of polypropylene.
Pitch:	29.4 cm air passage per revolution.
Distance constant:	2.0 m (6.6 ft) for 63% recovery.
Threshold sensitivity:	1.0 m/s (2.5 mph).
Transducer:	Centrally mounted stationary coil, 2K Ohm nominal DC resistance.
Transducer output:	AC sine wave3 signal induced by rotating magnet on propeller shaft. 40 mV p-p at 100 rpm. 4.0 V p-p at 10,000 rpm.
Output frequency:	3 cycles per propeller revolution (0.147 m/s per Hz).

WIND DIRECTION (AZIMUTH) SPECIFICATION SUMMARY

Range:	360° mechanical, 352° electrical (8° open).
Sensor:	Balanced vane, 21 cm (8 in) turning radius.
Damping ratio:	0.3
Delay distance:	0.8 m (2.6 ft) for 50% recovery.
Threshold sensitivity:	1.7 m/s (3.8 mph) at 10° displacement
Transducer:	Precision conductive plastic potentiometer, 10K ohm resistance (±20%), 1% linearity' life expectancy 50 million revolutions, rated 1 watt at 40°C, 0 watts at 125°C.
Transducer excitation requirement:	Regulated DC voltage, 15 VDC max
Transducer output:	Analogue DC voltage proportional to azimuth angle with regulated excitation voltage applied across potentiometer.

For further specifications, maintenance and calibration see the manual enclosed with the sensor.



9.2 Relative Humidity

Manufacture	VAISALA
Model	HMP 155
Function	Relative humidity
Enclosure	FO

FUNCTIONAL DESCRIPTION

The HMP 155 probe is designed for the measurement of relative humidity and air temperature. Humidity measurement is based on the capacitive thin film polymer sensor HUMICAP 180R.

LOCATION/INSTALLATION

The Humidity sensor is located at the sensor carrier arm at the mast top.

- Insert the sensor through the profile hole from below.
- Attach the threaded sleeve by screwing to the sensor from above.
- Connect the pigtail to the mast cable.

CALIBRATION AND MAINTENANCE

Calibration and maintenance of the probes should be performed at regular intervals, depending on the conditions of use and desired accuracy. The recommended calibration interval is 6 months.

For further information see the manual enclosed with the sensor.

SPARE PARTS

See the Operating Manual

INTERFACING

The humidity sensor is analog and is connected to the AD converter.

For more details see attached sensor configuration table in chapter 9.9.

Fugro OCEANOR

User Manual – The SEAWATCH Midi Buoy

9. Sensors



TECHNICAL DATA

Performance

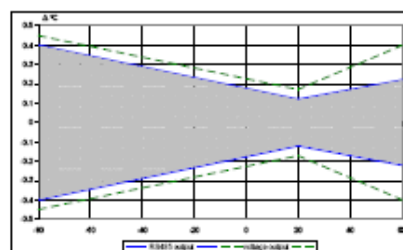
RELATIVE HUMIDITY		
Measurement range	0 ... 100 %RH	
Accuracy (incl. non-linearity, hysteresis and repeatability) at		
+15 ...+25 °C (+59 ...+77 °F)	±1 %RH (0 ... 90 %RH)	
	±1.7 %RH (90 ... 100 %RH)	
-20 ...+40 °C (-4 ...104 °F)	±(1.0 + 0.008 x reading) %RH	
-40 ...-20 °C (-40 ...-4 °F)	±(1.2 + 0.012 x reading) %RH	
+40 ...+60 °C (+104 ...+140 °F)	±(1.2 + 0.012 x reading) %RH	
-60 ...-40 °C (-76 ...-40 °F)	±(1.4 + 0.032 x reading) %RH	
Factory calibration	±0.6 %RH (0 ... 40 %RH)*	
uncertainty (+20 °C /+68 °F)	±1.0 %RH (40 ... 97 %RH)*	
* Defined as ±2 standard deviation limits. Small variations possible, see also calibration certificate.		
Recommended humidity sensor	HUMICAP®180R(C)	
Response time at +20 °C in still air with a sintered PTFE filter		
63 %	20 s	
90 %	60 s	
TEMPERATURE		
Measurement range	-80 ...+60 °C (-112 ...+140 °F)	
Accuracy with voltage output at		
-80 ...+20 °C	±(0.226 - 0.0028 x temperature) °C	
+20 ...+60 °C	±(0.055 + 0.0057 x temperature) °C	
passive (resistive) output		
according to IEC 751 1/3 Class B	±(0.1 + 0.00167 x temperature) °C	
RS485 output		
-80 ...+20 °C	±(0.176 - 0.0028 x temperature) °C	
+20 ...+60 °C	±(0.07 + 0.0025 x temperature) °C	
Accuracy over temperature range (opposite)		
Temperature sensor	Pt100 RTD 1/3 Class B IEC 751	
Response time with additional temperature probe in 3 m/s air flow		
63 %	<20 s	
90 %	<35 s	
OTHER VARIABLES		
dewpoint/frost point temperature,		
wet bulb temperature, mixing ratio		

General

Operating temperature range	-80 ...+60 °C (-112 ...+140 °F)
Storage temperature range	-80 ...+60 °C (-112 ...+140 °F)
Connection	8-pin male M12 connector
Connection cables	3.5, 10, and 30 m
Cable material	PUR
Wire size	AWG26
Service cables	USB connection cable MI70 connection cable
Additional T probe cable length	2 m
Housing material	PC
Housing classification	IP66
Sensor protection	sintered PTFE
Weight (probe)	86 g
Electromagnetic compatibility: Complies with the EMC standard EN61326-1, Electrical equipment for measurement control and laboratory use - EMC requirement for use in industrial locations	

Inputs and outputs

Operating voltage	7 ...28 VDC*
*Note: minimum operating voltage 12 V with 0 ... 5 V output and 16 V with 0 ... 10 V output, probe heating, chemical purge or XHEAT.	
Outputs	
voltage output	0 ... 1 V, 0 ... 5 V, 0 ... 10 V
resistive Pt100 (4-wire connection)	
RS485	
Average current consumption (+15 VDC, load 100 kOhm)	
0 ... 1 V output	<3 mA
0 ... 10 V output	<0.5 mA
RS485	<4 mA
during chemical purge	max. 110 mA
with warmed probe	max. 150 mA
Settling time at power-up	
voltage output	2 s
RS485	3 s





9.3 Current profiler (*Supplied by customer*)

Manufacture	Nortek
Model	Aquadopp, 400 MHz
Function	Water velocity measurement
Enclosure	Original

FUNCTIONAL DESCRIPTION

The Aquadopp profiler measures the current profile in water using acoustic Doppler technology. It is designed for stationary applications and can be deployed on the bottom, on a mooring rig, on a buoy or on any other fixed structure. It is a complete instrument and includes all the parts required for a self contained deployment with data stored to an internal data logger. Typical applications include coastal studies, online monitoring and scientific studies in rivers, lakes, and channels.

The Aquadopp profiler uses three acoustic beams slanted at 25° to accurately measure the current profile in a user selectable number of cells. The internal tilt and compass sensors tell the current direction and the high-resolution pressure sensor gives the depth—and the tidal elevation if the system is fixed mounted.

LOCATION/INSTALLATION

The sensor is placed in the well on the buoy float and is always in contact with water. Attaching the sensor is done from above.

1. Slide the sensor holder clamp onto the upper part of the sensor.
2. (position of the clamp will decide the depth of the sensor into the water.)
3. Fasten the sensor with hose clamp (x2).
4. The sensor with holder is now ready for installation.
5. Put the sensor slightly into the well and connect the subsea cable to the sensor.
6. Push the sensor fully into the well until it stops.
7. Fasten the Torque screws on top of holder with special tool.

Note!

When mounting the current profiler, be sure that mark (→) is aligned with the marks on the sensor/sensor holder/sensor well.

For more details see the photo in the chapter 3.4.7

CALIBRATION

See the User Guide.

MAINTENANCE

Remove growth from sensor surface at regular intervals. For more maintenance details see the user Guide enclosed with sensor.



SPARE PARTS

See the User Guide.

SETTINGS

The Aquadopp current profiler and Geni has to be set up with the same configuration in order to function properly together.

Start with setting up the Aquadopp corrent profiler:

1. Connect a PC to the current profiler by the supplied RS 232 cable, and connect the power supply to the cable
2. Open the AquaPro program on the supplied CD, and connect by selecting *Communication > Serial Port* and specify the correct com-port and baud rate (9600)
3. Use the existing configuration files by selecting *Deployment > Planning > Load from Instrument*
4. Update any parameters that are to be changed and finish by selecting OK (please refer to the Aquadopp manual for more information on each parameter)
5. Select *On-Line > Start Data Collection* from the menu
6. Check that the Aquadopp is transmitting data at the correct interval by selecting *Communication > Terminal Emulator*. Tick the Binary checkbox and leave window open. Check that the leading byte is A5 for each incoming data string, as the Geni uses this to identify incoming data.
7. Disconnect the current profiler and reconnect it to the buoy

Then set up the configuration files for Geni2000 by using GeniCfg:

1. Download the existing config files from the buoy by using gLink (please refer to the Geni2000 manual for more information).
2. Open the GeniCfg program and select Edit existing configuration under Expert Level Commands (generally avoid using the expert level commands as it may seriously disturb your measurements).
3. Select the folder where the existing configuration files are stored and select Select.
4. Select Next to open the Sensor configuration (Step 2 of 6) screen.
5. Mark the aquadopp entry under Current and select Edit.
6. The Geni expects one measurement series while the sensor has power, so set Duration and MEASURE_TIMEOUT so there is only time for one measurement series (typically leave at least 1.5 times the interval set up on the aquadopp)
7. Update all fields to correspond with the changes made when setting up the current profiler. This typically involves changing only the Channels pane and the Scheduling pane, all other settings should be left as they are. It is possible to add and remove channels, but make sure that the channels are following this order for N cells:

```
Temperature
CurrentSpeedCell1
...
CurrentSpeedCellN
CurrentDirectionCell1
...
CurrentDirectionCellN
```

Use the Move Up and Move Down buttons to align new cells in this order.

8. Select OK when all updates are made.
9. Select Next until the Data telegram configuration (Step 5 of 6) opens.
10. Mark the telegram containing Aquadopp parameters under Current and select Edit.



11. Move any added channels from the All list to the Current list by marking them and selecting Add. Use the settings from an existing current profile channel when selecting Low Limit, High Limit and Number of bits.
12. When finished, select OK and repeat as necessary for all telegrams.
13. Select OK and Finish and upload the new configuration files to the buoy.

INTERFACING

The current profiler uses the RS232 standard and communicates with the Wavesense.

For more details see attached sensor configuration table in chapter 9.9.



9.4 OCEANOR Wavesense

Manufacturer	Fugro OCEANOR
Model	OCEANOR Wavesense 3
Function	Heave, Roll and Pitch measurements
Enclosure	Original

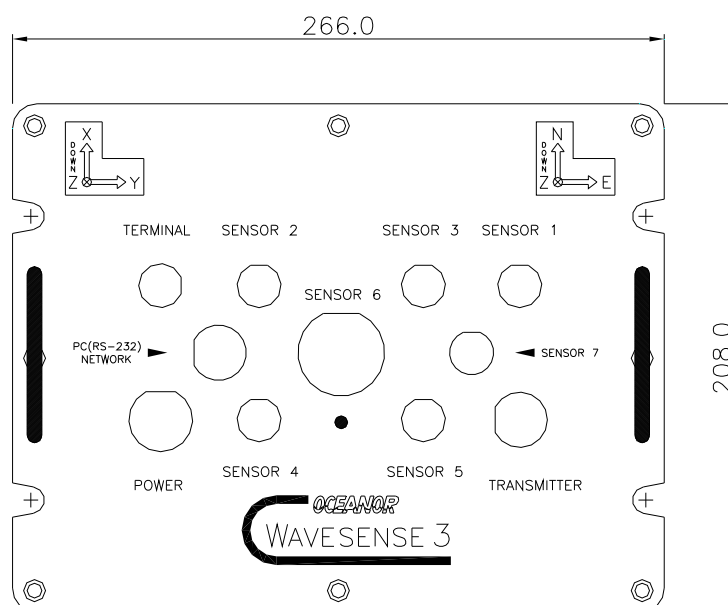
FUNCTIONAL DESCRIPTION

The Wavesense is a robust integrated wave sensor and data-logger designed for operation in remote locations, intended for use with battery and solar panel power. It features a high-end 32-bit processor and large internal storage capacity. Extreme mechanical robustness is achieved by use of robust aluminium housing, high quality connectors, components with extended temperature range and no moving parts. A recognised real-time operating system and modular C++ application software take care of software reliability.

Wavesense is closely related to the Oceanor Geni data logger. In fact it shares most parts, but it is equipped with an additional wave sensor board. It is mechanically different due to the mounting requirements of the wave sensor board.

The data logger functionality of Wavesense is covered in Chapter 6. More details about the Wavesense may be found in the Wavesense Users Manual.

The sensors working principle is the common inertial sensor working principle. Accelerometers, rate gyros and magnetometers are mounted orthogonally to provide the basic data. These data is then used as input to algorithms, which calculates Heave, Roll, Pitch, Surge, Sway and Compass time series. Significant wave height, wave direction, wave period and a number of other statistical parameters are then found from these time series.



A sketch of the sensor



LOCATION/INSTALLATION

The Wavesense is attached to the electronic module bracket at the top of the central cylinder using M6x20 (x4) screws

The sensor is labelled with the sensor axis definitions on the housing. These define the sensor oriented co-ordinate system, X, Y and Z, as well as how the sensor should be mounted in terms of North, East and Down. The software in the sensor assumes that the X-axis of the sensor is pointed towards what is defined as the North direction of the buoy, the Z-axis directly down and the Y-axis will then point in the East direction of the buoy. It is important that these directions are followed.

Care should be taken to mount the sensor in a mechanical stable way, vibrations must be avoided and the sensors Z-axis should point exactly vertically when the buoy is floating on the (still) water.

SETTINGS

No settings necessary, the unit is configured through the geniCfg configuration program.

MAINTENANCE

The Wavesense normally does not need any maintenance. The housing should not be opened outside the factory, (should only be opened with guidance from Oceanor personnel).

The lithium battery which maintains the Real Time Clock has a shelf life of one year. If the Wavesense is not connected to any external power, the battery will be discharged after one year. Return the Wavesense to Fugro OCEANOR workshop for battery replacing.

Use the special transport box delivered by Fugro OCEANOR **during all transportation.**

CALIBRATION

The unit should be returned to the factory every 3 years to have the calibration checked.

SPARE PARTS

Fuse on P013 IO board:

- Fuse 4A slow, 5x20 mm, 1500A breaking capacity
- Fuse 1A fast, 5x20 mm, 1500A breaking capacity

INTERFACING

The wave sensor is an integral part of Wavesense and has no external connections.



TECHNICAL DATA

Specifications

Range:

Period	1 – 30 seconds
Heave	Not limited
Relative position east and north	Not limited
Heading	0 – 360 deg.
Roll	0 – 90 deg.
Pitch	0 – 90 deg.

Static accuracy (rms):

Acceleration	0.02 m/s ²
Angular rate	0.03 deg./s
Heading	0.5 deg.
Roll	0.1 deg.
Pitch	0.1 deg.

Dynamic accuracy (rms):

Heading	0.5 deg.
Roll	0.2 deg.
Pitch	0.2 deg.
Heave	0.1 m
Relative position east and north	0.1 m

For further information see the Wavesense Users Manual enclosed with the sensor.

9.5 Air pressure

Manufacturer	Vaisala
Model	PTB 330 A
Function	Barometer
Enclosure	Original

FUNCTIONAL DESCRIPTION

Vaisala BAROCAP® Digital Barometer PTB330 is a new generation barometer, designed for a wide range of high-end atmospheric pressure measurement.

The pressure measurement of the PTB330 is based on the Vaisala in-house, silicon capacitive, absolute pressure sensor - the Vaisala BAROCAP® Sensor. It provides high measurement accuracy and excellent long-term stability.

The PTB330 series features extremely high accuracy. Class A barometers for the most demanding applications are fine-adjusted and calibrated against a deadweight tester. Class B barometers are adjusted and calibrated using electronic working standards. All the PTB330 barometers come with a NIST traceable, factory calibration certificate.



Digital Barometer PTB330



LOCATION/INSTALLATION

The barometer is a separate unit mounted on the battery cover plate inside the buoy. The environmental barometric pressure is fed to the barometer through a water trap by a plastic tube from an air pressure inlet on the top of the sensor carrier arm (**see the assembly drawing for more details at the end of the chapter**).

Connections:

- Plastic tube (hose) from the air inlet through the water trap to the barometer
- Cable from the barometer to the Wavesense/GENI.

MAINTENANCE

Before deployment check the following for water and salt:

- Air inlet
- Water trap
- Tubes and fittings

If any water or salt is found, the parts have to be disassembled, cleaned in fresh water and then dried.

The air pressure sensor cannot be serviced/maintained in any way by others than Vaisala corp. or their local dealers. To set up a new sensor from factory settings, do the following:

- 1) Run windows program "Terminal" located in windows group "Accessories". Connect the air pressure sensor to a serial port.
- 2) Choose the following communication parameters from sub-menu "Communications" under main menu "Settings".
 - 4800 Baud
 - 7 data bits
 - Even parity
 - 1 stop bits
- 3) Type ? and press <Enter> button to get sensor set-up.
- 4) Enter the following command to change communication parameters:

```
seri 9600 N 8 1 F <Enter>
```

- 5) Enter the following command to set correct output interval:

```
intv 30 <Enter>
```

- 6) Enter the following command to set correct averaging interval:

```
avrg 60 <Enter>
```

- 7) Enter the following command to turn of echoing:



`echo off <Enter>`

- 8) Enter the following command to save the setup:

`reset <Enter>`

- 9) The new communication parameters will now be used so change the settings used in 2) to the following:

9600 Baud
8 data bits
No parity
1 stop bits

- 10) Type SEND and press <Enter> button to get one sensor pressure value. For further information read the Operating Manual for the sensor. If there is no response from the sensor, check that the right serial port is used and check set-up of communication parameters again.

If the air pressure sensor communicates without problems with the PC, the cable between the GENI and the sensor ought to be checked. This can be done by resistance measurements through the cable.

The pressure sensor may also be checked directly through the GENI, as described in section 5.3.3; terminal mode of the GENI. the following commands may be used:

<code><?><CR></code>	sensor set-up is displayed
<code><SEND><CR></code>	single measurement
<code><R><CR></code>	continuous pressure measurements
<code><S></code>	stops whatever is going on in the air pressure sensor.

Check the displayed air pressure from the sensor in question against a reference measurement. Match means that the sensor is OK, while a large mismatch (more than 0.2 hPa) indicates that calibration of the sensor is necessary.

The air pressure port must be maintained every time the buoy is accessible. This is done by unscrewing the top nut of the port and removes the housing. Inspect the metal ball filter that appears very carefully. Any signs of corrosion should lead to replacement of this filter.

When the air pressure port has been inspected/upgraded the housing should be treaded back on and fastened with the top nut.

CALIBRATION

See the User's Guide for PTB330 Series Digital Barometers.

SPARE PARTS

None.



INTERFACING

The Air Pressure Sensor uses the RS232 standard communication.

For more details see attached sensor configuration table in chapter 9.9.

Fugro OCEANOR

User Manual – The SEAWATCH Midi Buoy

9. Sensors



TECHNICAL DATA

Performance

Barometric pressure range 500 ... 1100 hPa		
	Class A	Class B
Linearity*	±0.05 hPa	±0.10 hPa
Hysteresis*	±0.03 hPa	±0.03 hPa
Repeatability*	±0.03 hPa	±0.03 hPa
Calibration uncertainty**	±0.07 hPa	±0.15 hPa
Accuracy at +20 °C (+68 °F) ***	±0.10 hPa	±0.20 hPa

Barometric pressure range 50 ... 1100 hPa		
	Class B	
Linearity*	±0.20 hPa	
Hysteresis*	±0.08 hPa	
Repeatability*	±0.08 hPa	
Calibration uncertainty**	±0.15 hPa	
Accuracy at +20 °C ***	±0.20 hPa	

Temperature dependence****		
500 ... 1100 hPa		±0.1 hPa
50 ... 1100 hPa		±0.3 hPa

Total accuracy -40 ... +60 °C (-40 ... +140 °F)		
	Class A	Class B
500 ... 1100 hPa	±0.15 hPa	±0.25 hPa
50 ... 1100 hPa		±0.45 hPa

Long-term stability		
500 ... 1100 hPa		±0.1 hPa/year
50 ... 1100 hPa		±0.2 hPa/year

* Defined as ±2 standard deviation limits of endpoint non-linearity, hysteresis or repeatability error.

** Defined as ±2 standard deviation limits of inaccuracy of the working standard including traceability to NIST.

*** Defined as the root sum of the squares (RSS) of endpoint non-linearity, hysteresis error, repeatability error and calibration uncertainty at room temperature.

**** Defined as ±2 standard deviation limits of temperature dependence over the operating temperature range.

Operating environment

Pressure range	500 ... 1100 hPa, 50 ... 1100 hPa
Temperature range	
operating	-40 ... +60 °C (-40 ... +140 °F)
with local display	0 ... +60 °C (+32 ... +140 °F)

Inputs and outputs

Supply voltage	10 ... 35 VDC
Supply voltage sensitivity	negligible
Typical power consumption at +20 °C (U _{in} 24 VDC, one pressure sensor)	
RS-232	25 mA
RS-485	40 mA
U _{out}	25 mA
I _{out}	40 mA
display and backlight	+20 mA
Serial I/O	RS232C, RS485/422
Pressure units	hPa, mbar, kPa, Pa inHg, mmHg, mmHg, torr, psia
	Class A Class B
	0.01 hPa 0.1 hPa
Resolution	
Settling time at power-up (one sensor)	4 s 3 s
Response time (one sensor)	2 s 1 s
Acceleration sensitivity	negligible
Pressure connector	M5 (10-32) internal thread

Pressure fitting	barbed fitting for 1/8" I.D. tubing or quick connector with shutoff valve for 1/8" hose
Maximum pressure limit	5000 hPa abs.
Compliance	EMC standard EN61326-1:1997+ Am1:1998 + Am2:2001: Industrial Environment

Mechanics

Housing material	G AlSi10 Mg (DIN 1725)
Housing classification	IP65
Weight	1 - 1.5 kg

Analog output (optional)

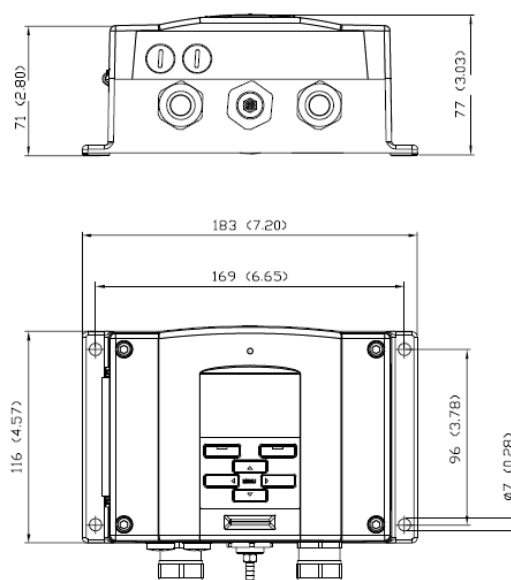
Current output	0 ... 20 mA, 4 ... 20 mA
Voltage output	0 ... 1 V, 0 ... 5 V, 0 ... 10 V
Accuracy at pressure range	500 ... 1100 hPa 50 ... 1100 hPa
at +20 °C	±0.30 hPa ±0.40 hPa
at -40 ... +60 °C	±0.60 hPa ±0.75 hPa

Accessories

Serial interface cable	19446ZZ
USB-RJ45 serial connection cable	219685
Software interface kit	215005
Wall mounting kit	214829
Outdoor installation kit (weather shield)	215109
Installation kit for pole or pipeline	215108
Power supply module	POWER-1
Temperature compensated analog output module	AOUT-1T
Isolated RS-485 module	RS485-1

Dimensions

in mm (inches)



For further information see the User's Guide enclosed with the sensor.



9.6 *Air temperature*

Manufacture	Omega engineering
Model	905-44031
Function	Air temperature measurement
Enclosure	Oceanor

FUNCTIONAL DESCRIPTION

The air temperature is measured by a sensor built around a thermistor element, embedded in a casing designed for air temperature measurements specifically. The thermistors are trimmed so that their resistance at 25°C is sufficient close to 10 kΩ to give deviations of maximum $\pm 0.1^\circ\text{C}$ when the elements are interchanged. This allows sensors to be interchanged without configuring the data acquisition unit. A sun radiation screen protects the thermistor element, and the sensor needs only 0.5 m/s of wind to adjust to a correct output.

LOCATION/INSTALLATION

The air temperature sensor is located at the sensor carrier arm at the mast top.

- Attach the sensor to the tube on the profile and fasten the set screw on the sensor.
- Connect the mast cable to the sensor.
-

MAINTENANCE

This sensor normally does not need any maintenance.

- Do not expose to temperatures above 100°C.

CALIBRATION

None.

SPARE PARTS

Sun radiation screen.

INTERFACING

The Air Temperature sensor is analog and is connected to the AD converter.

For more details see attached sensor configuration table in chapter 9.9.

Fugro OCEANOR

User Manual – The SEAWATCH Midi Buoy

9. Sensors



TECHNICAL DATA

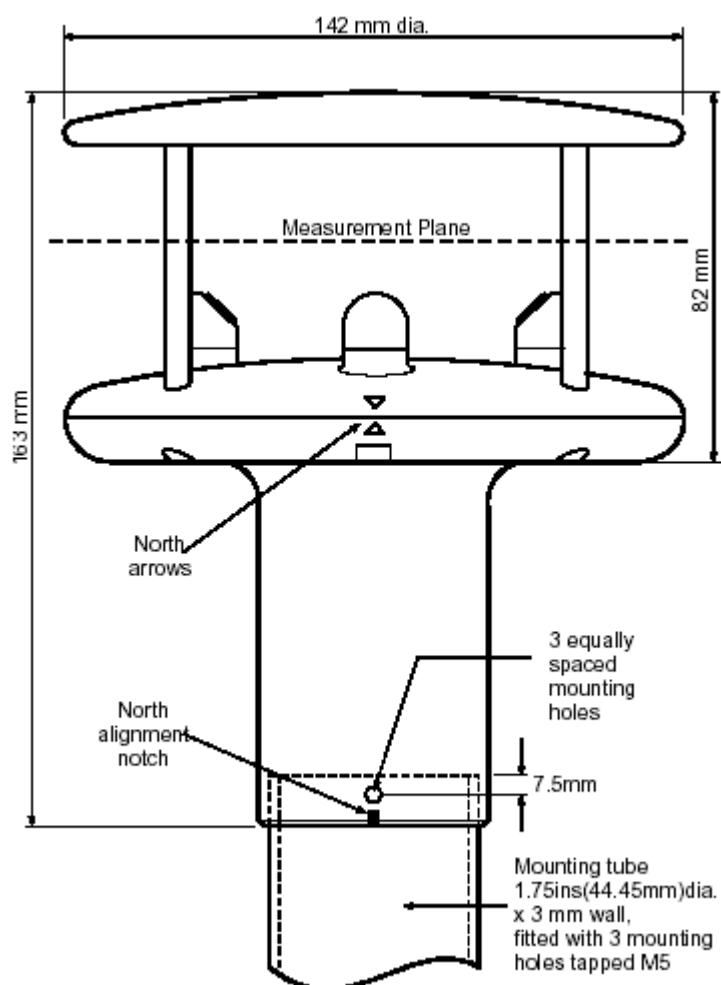
Resistor R_t	10 000 ohm
Measuring rang	-30 to +75°C
Accuracy.....	$\pm 0.1^\circ\text{C}$
Resolution	0.025°C
Time Constant	6 minutes in air
Sensor Output	Voltage

9.7 Wind sensor, Gill

Manufacture	Gill
Model	WindSonic
Function	Wind speed and direction measurement
Enclosure	Original

FUNCTIONAL DESCRIPTION

The Gill WindSonic wind sensor is a very robust, lightweight unit with no moving parts, outputting wind speed and direction. The sensor measures the times taken for an ultrasonic pulse of sound to travel from the North transducer to the South transducer, and compares it with the time for a pulse to travel from S to N transducer. Likewise times are compared between West and East, and E and W transducer.



The Gill WindSonic showing alignment and mounting details

LOCATION/INSTALLATION



The wind sensor is located at the mast sensor holder at the mast top with three M5 screws.

The wind sensor uses the compass in the buoy to determine wind direction. Therefore, it is important to align the north mark for the wind sensor with the north mark on the mast connector inlet and on the sensor carrier arm.

MAINTENANCE

If there is any build up of deposit on the unit, it should be gently cleaned with a cloth, moistened with soft detergent. Solvents should not be used, and care should be taken to avoid scratching any surfaces. The unit must be allowed to defrost naturally after being exposed to snow or icy conditions, do NOT attempt to remove ice or snow with a tool.

Do NOT remove black “rubber” transducer caps.

There are no moving parts or user-serviceable parts requiring routine maintenance. Opening the unit or breaking the security seal will void the warranty and the calibration. In the event of failure, prior to returning the unit to your authorised Gill distributor, it is recommended that:

1. All cables and connectors are checked for continuity, bad contacts, corrosion etc.
2. A bench test is carried out as described in Section 12.1 in the sensor manual (from supplier).
3. You contact your supplier for advice.

CALIBRATION

No calibration needed.

SPARE PARTS

See the Sensor Manual.

INTERFACING

The wind sensor has a RS-232 output signal and power to the sensor is supplied from one of the dedicated outputs on the Geni(Wavesense).

For more details see attached sensor configuration table in chapter 9.9.



The sensor needs to be configured when it is new. Power-on the sensor using the debug program on the Geni. Connect to the sensor using the debug program on the Geni. Use 9600 as baud rate initially as this is the factory value. The following settings should be changed from the factory values:

Enter “*” to make the sensor enter configuration mode.

Enter:

“M5<enter>” (Use NMEA protocol)

“B2<enter>” (Use 4800 baud, change baud rate on Geni terminal emulator)

“B<enter>” (Confirm baud rate change)

“Q<enter>” (enter measurement mode, leave the terminal emulator and power off the sensor)

TECHNICAL DATA

Output

Units of measure: Metres/second (m/s)

Output frequency: 1

Parameters: Polar - Speed and Direction Polar

Wind Speed

Range: 0 – 60 m/s

Accuracy: $\pm 4\%$ (20m/s)

Resolution: 0.01 m/s

Wind Direction

Range: 0 - 359°

Accuracy: $\pm 3^\circ$ (20m/s)

Resolution: 1°

Output format: NMEA 0183 version 3

Sensor version: WindSonic Option 1

Environmental

Moisture protection: IP65

Temperature Operating: -35°C to +70°C

Storage: -40°C to +90°C

Humidity Operating: <5% to 100%

EMC: BS EN 50081-1: 1992 (Emissions class B)

BS EN 50082-1: 1997 (Immunity)

Standards: Manufactured within ISO9001 quality system

Power requirement: 9 – 30 V DC, 40mA

Mechanical

Size / weight: 142mm diameter x 160mm 0.5kg

Mounting: Pipe mounting 1.75 inches (44.45mm) diameter

Material: External - Acrylate Styrene Acrylonitrile, Polycarbonate blend.

For further specifications, maintenance and calibration see the manual enclosed with the sensor.



9.8 Electronic compass

Manufacture	Precision Navigation, Inc
Model	TCM 2.5
Function	North/south orientation
Enclosure	Oceanor, plastic (polycarbonate) box

FUNCTIONAL DESCRIPTION

The TCM2.5 is high accuracy electronic compass module that can give an X-Y-Z reading with an accuracy of 1 degree. The use of 3 single-axis magnetometers and a 2-axis tilt sensor allow the TCM2.555 to be gimballed electronically without the requirement for any mechanical moving parts. This advanced electronic gimbaling allows for tilt ranges of up to +/-50 and provides superior performance over the entire tilt range in real world conditions. The TCM2.5 also uses advanced electronics and correction algorithms to counter the effects of hard and soft iron, enabling it to maintain a high degree of accuracy in even the most demanding environments.

The compass is used as reference for the wind sensor.

LOCATION/INSTALLATION

The Compass is located in a plastic box on the electronic module bracket. (see chapter 3.4.5).

- Mount the compass box to the battery cover plate using M4 (x4) screws.
- Connect the pwr/comm. cable to Wavesense/GENI.

Note!

When mounting the compass box, be sure that North mark (→N) is aligned with the north mark on the battery cover plate.

MAINTENANCE

This sensor does not need any maintenance.

CALIBRATION

See the User's manual enclosed with the Compass.

SPARE PARTS

None.

Fugro OCEANOR

User Manual – The SEAWATCH Midi Buoy

9. Sensors



INTERFACING

For more details see attached sensor configuration table in chapter 9.9.

TECHNICAL DATA:

Performance Specifications

Parameter	Typical		Units
Heading Specifications			
Accuracy over tilt range	0.8°		Deg RMS
Resolution	0.1°		
Repeatability [1]	0.1°		
Max Dip Angle	85°		Deg
Magnetometer Specifications			
Calibrated Field Measurement Range	± 80		µT
Magnetic Resolution	± 0.05		
Magnetic Repeatability	± .1		
Tilt Specifications			
Pitch Accuracy	0.2°		Deg RMS
Roll Accuracy	0.2°		
Tilt Range	± 50°		Deg
Tilt Resolution	0.1°		
Tilt Repeatability [1]	0.1°		Deg RMS
Calibration			
Hard Iron Calibration	Yes		
Soft Iron Calibration	No		
Mechanical Specifications		TCM2.5	TCM2.6
Dimensions (L x W x H)	6.4 x 5.1 x 1.4	3.4 x 4.3 x 1.3	cm
Weight	20	12	grams
Mounting Options	Screw Mounts/Standoffs horizontal		
Connector for RS-232	10-pin	9-pin	
I/O Specifications			
Latency from Power-On	< 210*		mSec
Latency from Sleep Mode	< 1		
Maximum Sample Rate	8		samples/sec
RS-232 Communication Rate	300 to 115200		baud
Output Formats	TCM2 ASCII Protocol		
Power Specifications		TCM2.5	TCM2.6
Supply Voltage	5 V (regulated) 6 to 18 (unregulated)	3.6 ± 5 V (unregulated)	
Current Draw	Max:	22	22
(continuous output)	Typ:	<20	<20
Idle Mode		18	18
Sleep Mode		0.6	0.6
Environmental Specifications			
Operating Temperature	– 20 to 70		°C
Storage Temperature	– 40 to 85		
Shock	2500 G's per MIL-STD-810F		
Vibration	Qualified to MIL-STD-810F		
Humidity	Non-condensing/Qualified to MIL-STD-810F		

[1] Repeatability is based on statistical data at ±3 sigma limit about the mean

* Other options may be available.

Table 25: TCM2.5/2.6 Specifications

For further specifications, maintenance and calibration see the User's Manual



9.9 *Sensor configuration table*

Sensor	Power line	I_O line	Com port	AD channel	Baud rate	Wavesense
Current profiler	3	-	8	-	9600 N 8 1	Sensor 3
Iridium modem with GPS	8	-	3	-	19200 N 8 1	Transmitter
VHF radio	11	-	6		19200 N 8 1	Sensor 6
GSM modem	8	-	3	-	9600 N 8 1	Transmitter
Air pressure	5	-	10		9600 N 8 1	Sensor 4
Air temperature	-	-	-	16+	-	Sensor 6
Air humidity	1	-	-	10+	-	Sensor 6
Wind, Gill	4	-	15	-	4800 N 8 1	Sensor 6
Wind, Young	-	-	-	Dir: 2+ Speed: 20+	-	Power
Compass	2	-	7	-	9600 N 8 1	Sensor 2
Ah-counter	-	-	11	-	2400 N 8 1	Power



10. OPERATION

Contents

10. Wavesense – integrated datalogger and wave sensor.....	10-1
10.1 Introduction.....	10-1
10.2 Connecting to the Wavesense.....	10-1
10.2.1 Alternative 1: Serial Line.....	10-1
10.2.2 Alternative 2: Network connection	10-2
10.2.3 gLink Terminal Mode settings.....	10-2
10.3 Frequent tasks.....	10-3
10.3.1 Viewing system status in real time.....	10-3
10.3.2 Data and configuration up/down load	10-4
10.3.3 Load a new configuration.....	10-5
10.3.4 Download data files	10-6
10.4 Diagnosing the system in case of problems	10-6

10. Wavesense – Integrated datalogger and wave sensor

10.1 Introduction

The information in this section is intended for information about the most basic operations of the buoy data logger, Wavesense. For more comprehensive information, please refer to the Wavesense Users Manual.

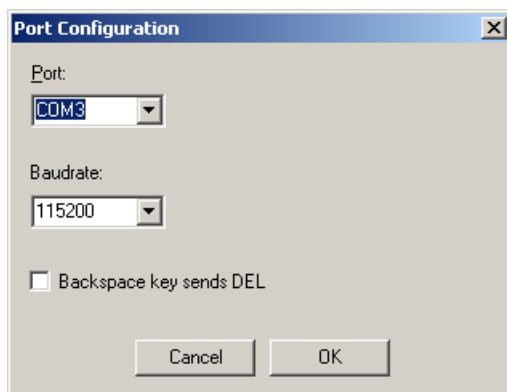
10.2 Connecting to the Wavesense

10.2.1 Alternative 1: Serial Line

The program for communicating with the Wavesense from a PC, via a serial line is called **gLink**. Normally the format of the serial line is RS-232, but in some cases the line from Wavesense may also be RS-422 making a 422-232 adapter necessary. The default serial port used by gLink is COM1, but this may be changed using the File -> Setup menu or by selecting the icon



This brings up the dialog:



The correct baudrate is 115200 and the Backspace key sends DEL should be unchecked. (The Wavesense 2000 uses 19200 baud and Backspace key sends DEL checked)

In fact when data transfer is not needed, any terminal program may be used. gLink is only needed for file up/down load. The default settings for the serial port are:

- 115200 baud
- no parity
- 8 databits
- 1 stopbit.

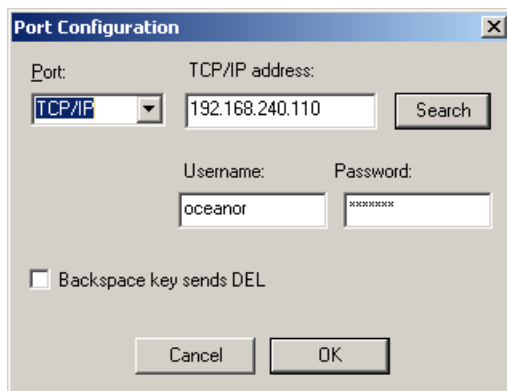
When the PC is connected, the user is required to log into the Wavesense. The user is prompted by the string 'login' from the Wavesense. Enter 'oceanor<CR>' and enter 'oceanor'



as password. Once logged in the user may look at the latest measurements, run diagnostic programs or transfer data.

10.2.2 Alternative 2: Network connection

The Wavesense may also be connected to a 10/100base-TX Ethernet. Also in this case **gLink** may be used to connect to the Wavesense from a PC. Select TCP/IP in the setup dialog:



First time the Wavesense is connected the TCP/IP network address is not known. The Wavesense obtains its network address using DHCP. The DHCP server may be the standard network server when both the Wavesense and the PC is connected to a larger network, or in case the only equipment is the PC and the Wavesense, a network switch having DHCP server capabilities. To find the network address, press the Search button. This will populate a list of all Wavesense's in the network. The process takes some time, be patient! Finally enter 'oceanor' as both Username and Password.

10.2.3 gLink Terminal Mode settings

The gLink terminal window is shown in the Figure below. The buttons on the main toolbar perform the tasks (from left to right):



Copy selected text to clipboard. Menu: "Edit" "Copy". Keyboard: <Alt>e -> c .



Paste selected text from clipboard. Menu: "Edit" "Paste". Keyboard: <Alt>e -> p.



Print text in terminal window to default printer. Menu: "File" "Print. Keyboard: <Alt>f -> p.



Set terminal size variables in Linux terminal driver to actual size of gLink window. It is required to be on the command line of the Wavesense to do this, on the 'oceanor@geni... prompt. The window size of the terminal window may be varied freely. **Very important feature!** Menu: "Edit" "Size". Keyboard: <Alt>e -> s.



Change to file transfer mode (more about this in the next section). Menu: "Mode" "File Transfer". Keyboard: <Alt>m -> f. Requires connection to a serial port or network address.



Change to data reception mode. This mode is detailed in the Wavesense Users Manual. Menu: "Mode" "Data Reception". Keyboard: <Alt>m ->d. Requires connection to a serial port.



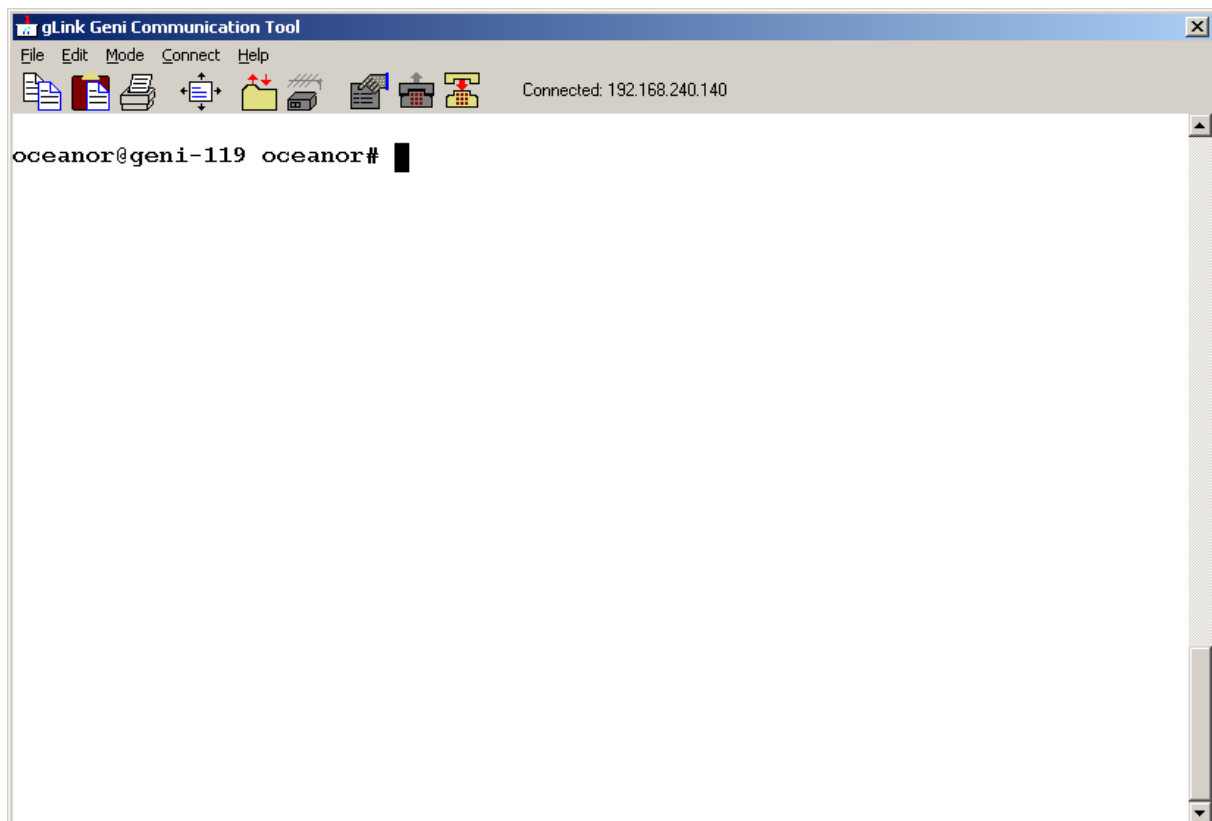
Setup port configuration options. Used to select serial port or network address as discussed above. Menu: "File" "Setup". Keyboard: <Alt>f -> s. **Requires no connection** to a serial port or network address (use the disconnect button).



Connect to a serial port or network address. Automatically performed on startup and after setup port configuration. Menu: "Connect" "Connect". Keyboard: <Alt>c -> c. Requires no connection to a serial port or network address.



Disconnect from the current connection. Menu: "Connect" "Disconnect". Keyboard: <Alt>c -> d. Requires connection to a serial port or network address.



10.3 Frequent tasks

10.3.1 Viewing system status in real time

To view the collected data in real time, connect a PC (or terminal) to the WAVESENSE via a serial port or via a network connection. From the command line prompt (oceanor@geni...) enter:

```
menu<cr>
```




this starts the menu program which at any time show the last measurement for all parameters in the database, various system messages and a list of processes running on the system. There are a number of options in the program which can be used by pressing keys:

TAB Change to next window
+ Expand current window
- Shrink current window
DOWN Move cursor to the next line
UP Move cursor to the previous line
c Chat with serial sensor
a Monitor analog sensor
x Start/stop data acquisition

Commands in the process window

s Start data acquisition for the current process
i Stop data acquisition for the current process
r Restart the current process
t Terminate the current process
1 Enable more output for the current process
0 Disable more output for the current process
f Toggle filter to show only messages for current process

Commands in the log window

e Empty all log files
f Toggle filter. If filter is enabled only the messages from the current process is shown

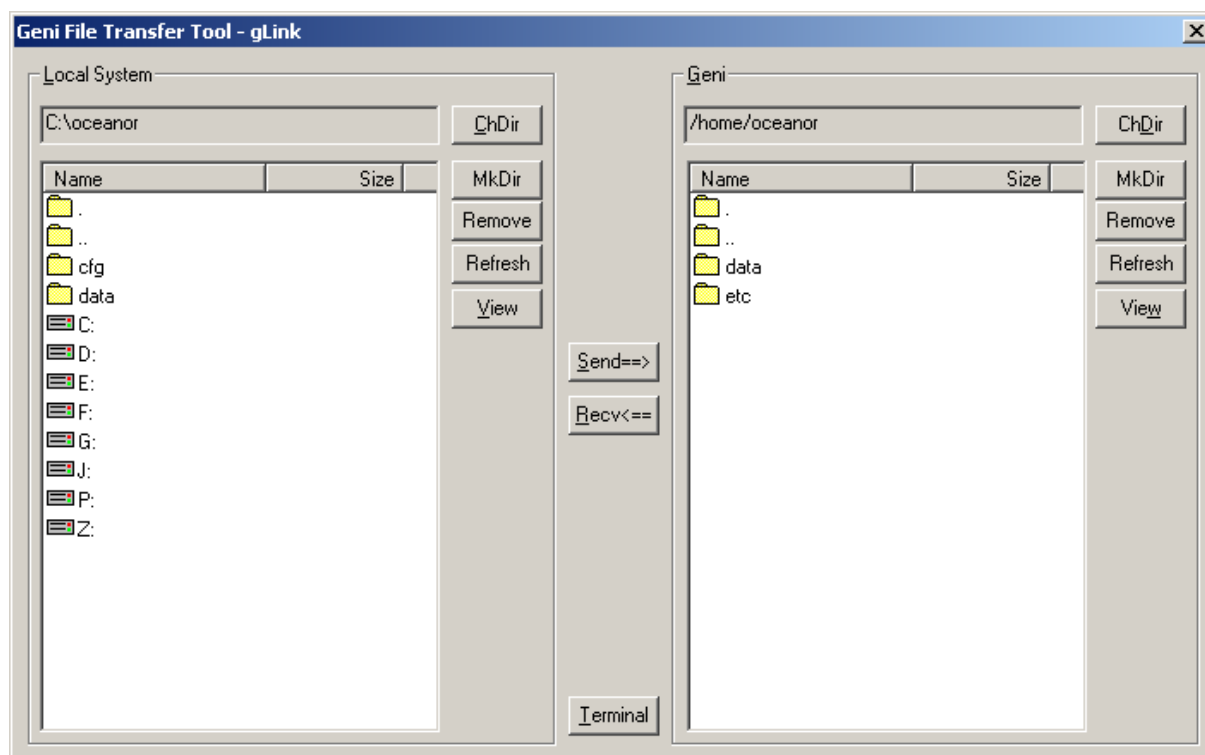
Commands in the parameter window

s Start data acquisition for the process sampling the current parameter
1 Enable more output for the process sampling the current parameter
0 Disable more output for the process sampling the current parameter

10.3.2 Data and configuration up/down load

The gLink program has three modes, terminal mode, file transfer mode and data reception mode. In the terminal mode it acts as a standard terminal emulator, enabling the user to log in to the Wavesense. In file transfer mode it acts as a file transfer utility, enabling up/down load of data, program and configuration files. Data reception mode is used when gLink is running on a PC connected to a GSM or UHF modem in the data reception. To switch to file transfer mode, select 'Mode' and then 'File Transfer' in the gLink menu. Note that you have to be on the command line of the Wavesense to do this, that is on the 'oceanor@geni...' prompt.

The file transfer dialog is intuitive and presents a tree view of both the PC and Wavesense file systems, see the figure below.



Note that you may move in the directory trees by double clicking on the directory names, to move upward in the tree, double clicking on the '..' directory. To go back to terminal mode again, press the 'Terminal' button.

Logging in as oceanor means that your initial directory is /home/oceanor. There are a large number of other directories on the Wavesense. These all belong to the system and should not be changed. (the oceanor user have no permission anyway). Also they are located on a different storage medium and take up no space which could be used for data.

10.3.3 Load a new configuration

The system has a set of configuration files. These files completely describe how the system should operate. The software is in principle identical in all Wavesense systems. The set of configuration files are generated using the GeniCfg tool, described in the Wavesense Users Manual. When configuration files have been changed, they should be uploaded to the Wavesense using the file transfer dialog as described above. The configuration files must be located in:

/home/oceanor/etc

All configuration files are located in this directory. When new files have been generated (using GeniCfg) they should be copied to this directory (remember to backup the old ones!) To use the new configuration files it is required to stop and start the data acquisition to load the new configuration. This is done by pressing <x> in menu (answer yes), waiting a few seconds and pressing <x> once more.



10.3.4 Download data files

All data files generated are located in:

/home/oceanor/data

The files are typically named NNN.pff, where NNN is a number. The actual number on the files will vary from system to system and is further described in the Wavesense Users Manual. During service, the files should be copied to a PC using the file transfer dialog and the files deleted.

10.4 Diagnosing the system in case of problems

The most important tool in diagnosing problems is the system message log file, /var/log/messages. If you contact Fugro OCEANOR technical support regarding problems, it is likely they will ask for this file. The directory /var/log also contains backups of older versions of this file, as well as other log files. During service, the files should be copied to a PC. The files should not be deleted but emptied using the menu program.



11. MISCELLANEOUS

Contents

11. MISCELLANEOUS.....	11-1
11.1 Flash light	11-1



11. Miscellaneous

11.1 Flash light

Manufacturer	Sealite
Model	SL07.4nm.Y
Function	Flash light
Enclosure	Original

FUNCTIONAL DESCRIPTION

Fugro Oceanor have introduced a new flashlight marker on their oceanographically measuring buoys. The unit is build up around a light source consisting of 20 ultra- high intensity yellow LEDs, and is specially designed for use on the top of a moored buoy.

Once installed, operation of the SL07 4nm light requires no operator intervention. The flash characters are factory-set, and the unit is supplied ready for immediate operation.

The unit is sealed using an advanced ultrasonic weld, enabling a rugged and completely waterproof seal capable of prolonged and deep immersion. Another benefit of the lantern is the tough polycarbonate lens, specifically designed for use with LEDs, and incorporates an environment friendly spike – deterring unwelcome bird life.

The light is meeting IALAs recommendation of sight range, 4 nautical miles, and as Oceanor's standard the characteristic is set to 5 quick flash every 20 seconds.

The light is equipped with day night switch, and after darkness a microprocessor will check the characteristic settings, then wait approximately 1 minute before start flashing to the set code.

LOCATION

The flash light is located at the sensor carrier arm at the mast top.

MAINTENACE

None.

SPARE PARTS

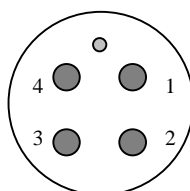
None.

ELECTRICAL CONNECTIONS FOR SL07

Normally the lamp is delivered with a 4-pin Subconn plug on a 30-cm pigtail.

The connection on the plug is as follows:

Pin 1 (Black)	+12V
Pin 2 (Orange)	0V
Pin 3 (Red)	Not connected
Pin 4 (Violet)	Not connected



Subconn 4. View against plug

TECHNICAL DATA SL07

Flash characteristics	IALA (set to FL(5) 20s)
Light source	20 ultra-high intensity LEDs
Light colour	Yellow
Voltage input	12 volts
Mounting	4 mounting holes (suits 5 mm bolts)
Lens	Optical polycarbonate LED lens with bird spike
Base	UV stabilised polycarbonate compounds
Dimensions	135 mm diameter base / 145 mm height
Environmental	Ambient temperature range -30° to +85°C, Humidity 0 to 100%
Mass	300 g



12. CABLING

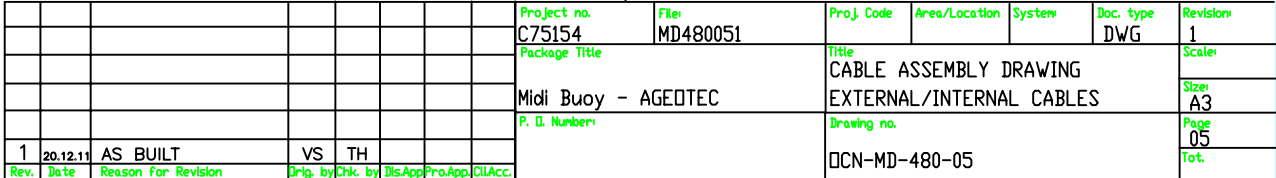
Contents

12. CABLING	12-1
12.1 Internal / External cabling	12-1
12.2 Internal cabling	12-2
12.3 External cabling	12-3
12.4 Cable connections for Junction box / Power Management Unit	12-4



12. Cabling

12.1 Internal / External cabling



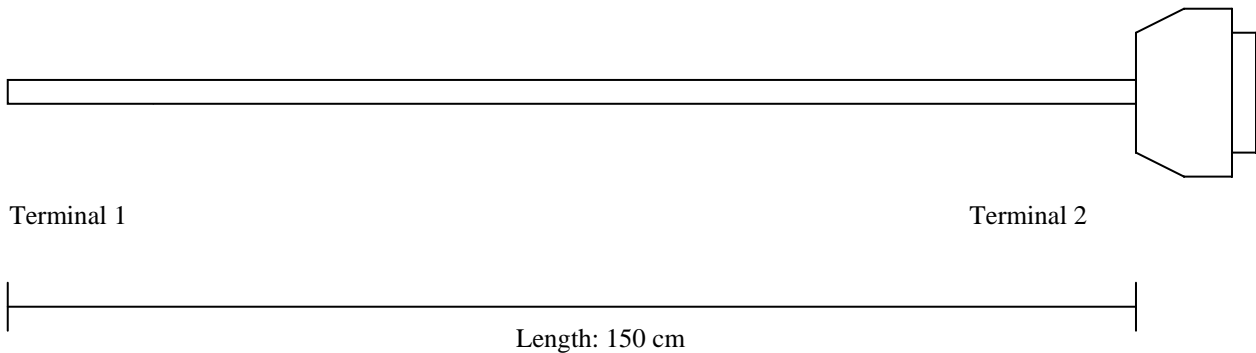


12.2 Internal cabling



Oceanographic Company of Norway A/S

CABLE NO.: 101140	REVISION: 001
DESCRIPTION: Sign. Cable for SATEL Radio	PREPARED BY: Trond Hagen
DEPARTMENT/SECTION: Engineering & Production	CHECKED BY: V.S.
DATE: 09.11.2006	DRAWING NO.:

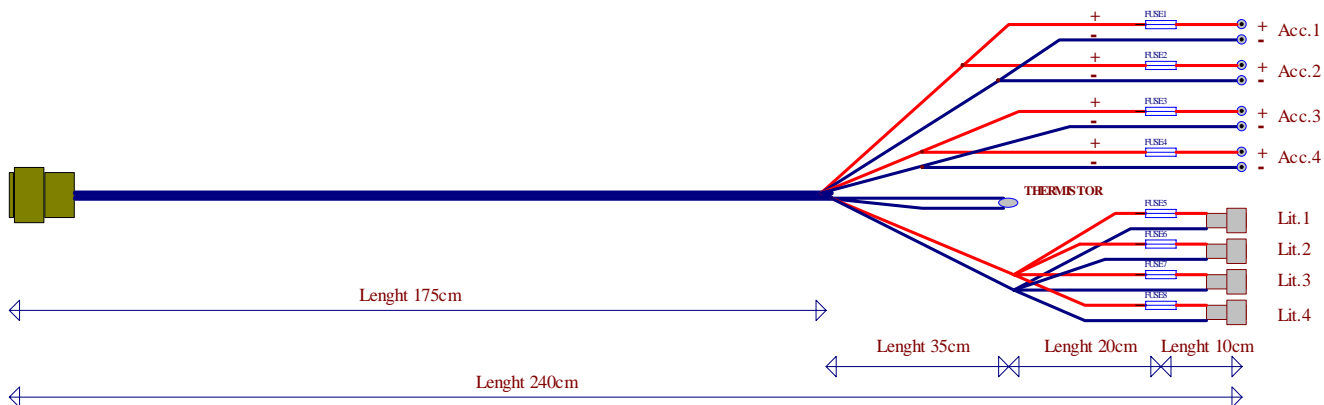


Notes:

Pin configuration			
Terminal 1: Junction box	Signal:	Notes:	Terminal 2: D-Sub 15pin, male
Wire to junction box	PWR+		1,14,15
	-		
Wire to junction box	GND		7,8
	-		
Wire to junction box	Tx/Rx		9
Wire to junction box	Rx/Tx		11
Wire to junction box	Setup (GND)		12

Material List			
Item	Description	Manufacturer	Supplier
Term.1	Junction box		
Term.2	D-Sub 15pin, Male		ELFA
Cable	7 x 0.5mm LiYCY		NEK Kabler, NORWAY

CABLE NR.: 101207	REVISION: 001
DESCRIPTION: Battery cable, 4 Acc. + 4Lit. + Thermistor	PREPARED BY: Trond Hagen
DEPARTMENT/SECTION: Engineering & Production	CHECKED BY: V.S.
DISTRIBUTION:	DRAWING NR.:
INFO: * P = MALE S = FEMALE	DATE: 16. Mars. 2009



Term. 1, Connector:
851 36RG 16-08 S 50
Mill- connector:

Term. 2 :
Cable lug/termistor

Fuse1=10AT Fuse5=10AT
Fuse2=10AT Fuse6=10AT
Fuse3=10AT Fuse7=10AT
Fuse4=10AT Fuse8=10AT

Description of terminals:

Term. 1 851 36RG 16-08 S 50, Mill connector	Term. 2 Cable clamp
A	Cable lug Acc + (1/2)
B	Cable lug Acc + (3/4)
C	Cable lug Acc - (1/2)
D	Cable lug Acc - (3/4)
E	Lit+ Connector1 Connector2 Connector3 Connector4
F	Thermistor
G	Lit- Connector1 Connector2 Connector3 Connector4
H	Thermistor

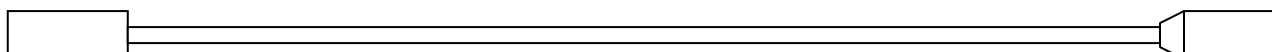
Material List			
OCEANOR Part No.	Description	Specification	Recommended supplier
N/A	Terminal 1	MIL 851 36RG 16-08 S 50	Souriau / T&G Elektro
N/A	Terminal 2	Cable lug + termistor+AMP	AMP-180924-0, Farnell order code 964827
N/A	Cable	ØL-FLEX wire cable: Minimum 8 Wire x 1.5mm2	Miltronic
N/A	Heat shrink tubes	Appropriate dimension.	
N/A	Label	Appropriate labels.	

*) The thermistor is mounted in the cable lug.



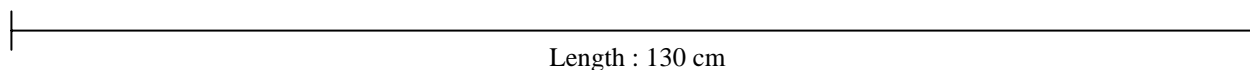
Oceanographic Company of Norway A/S

CABLE NR.: 101125	REVISION: 001
DESCRIPTION: ON/OFF cable, Inductive sensor on lid - on/off conn. PMU	PREPARED BY: Trond Hagen
DEPARTMENT/SECTION: Engineering & Production	CHECKED BY: V.S.
DISTRIBUTION:	DRAWING NR.:
INFO: * P = MALE S = FEMALE	DATE: 29. Mars. 2006



Term. 1 :
Inductive sensor (LID)
(M8 Detector w/cable, 181-1794 NO = Normally open)

Term. 2 :
MIL. conn.



Length : 130 cm

Description:

Power cable with MIL spec. connector.
Total length: 100 cm.

Notes:

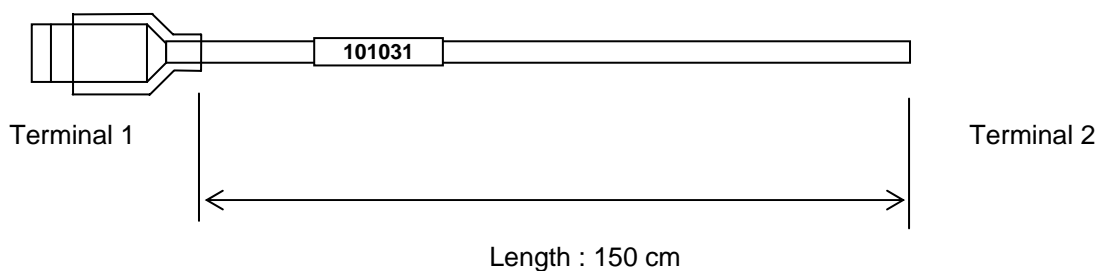
The connector end shall be covered with heat shrink tubes.
Labels at the end.

Description of terminals:

Term. 1: Inductive sensor (M8 Detector)	Signal:	Term. 2: 851 36RG 08-04 P
Brown	+Vs	C
Blue	0V	B
Black	Output	A
		D

Material List			
OCEANOR Part No.	Description	Specification	Recommended supplier
N/A	Inductive sensor	IFRM 08P1701/L (181-1794)	RS-Components AS
N/A	Terminal 2, Male	MIL 851 36RG 08-04 P	Souriau / T&G Elektro
N/A	Cable	Multi wire cable: Minimum 3 Wire x 0.22 mm ²	
N/A	Heat shrink tubes	Appropriate dimension.	
N/A	Label	Appropriate label.	

CABLE NO.: 101031	REVISION: 002, 27.01.05
DESCRIPTION: Power Cable. 851-36RG-12-10-P-50 to Power unit.	PREPARED BY: AH
DEPARTMENT/SECTION: Seawatch	CHECKED BY: VS
DATE: 08.06.04	DRAWING NO.:



Description:

Signal cable with MIL spec. connector.
Total length: 150 cm.

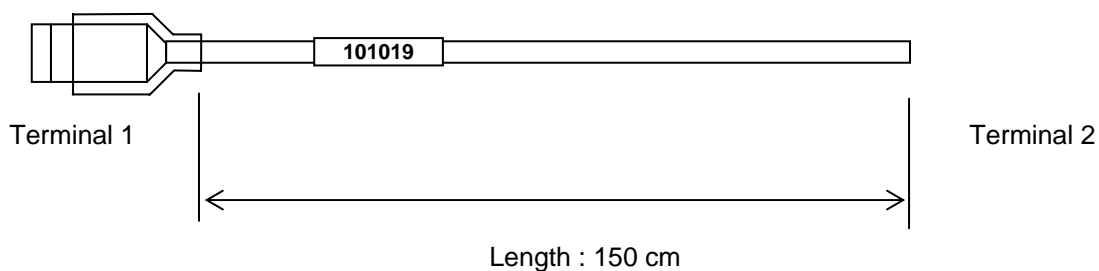
Notes:

The connector ends shall be covered with heat shrink tubes.

Pin configuration			
Terminal 1: 851 36RG 12-10P 50	Signal:	Notes:	Terminal 2: No connector.
A	Power Supply		
B	Power Supply		
C	Power Supply		
D	Power Supply		
E	Power Supply		
F	Power Supply		
G	Power Supply		
H	Power Supply		
J	Power Supply		
K	Power Supply		

Material List			
OCEANOR Part No.	Description	Specification	Recommended supplier
N/A	Terminal 1, Male	MIL 851 36RG 12-10 P 50	Souriau / T&G Elektro
N/A	Terminal 2	No connector	
N/A	Cable	PFSK multi wire cable: Minimum 10 Wire x 0.5mm2 Shielded.	
N/A	Heat shrink tubes	Appropriate dimension.	
N/A	Label	Appropriate labels.	

CABLE NO.: 101019	REVISION: 002, 30.08.04
DESCRIPTION: Power Cable. 851-36RG-12-2-P-50 to Power unit	PREPARED BY: AH
DEPARTMENT/SECTION: Seawatch	CHECKED BY: VS
DATE: 08.06.04	DRAWING NO.:



Description:

Signal cable with MIL spec. connector.
Total length: 150 cm.

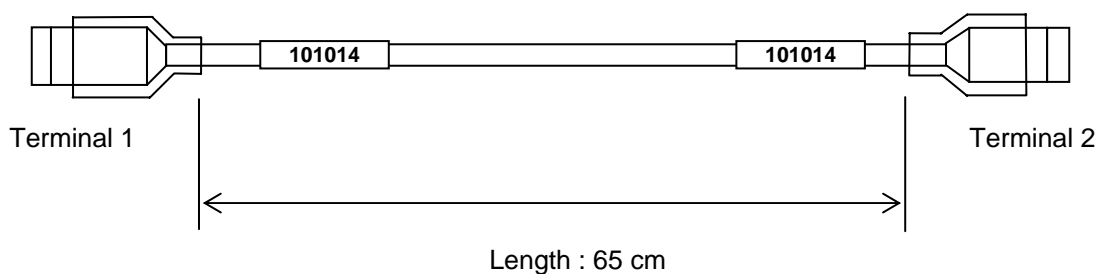
Notes:

The connector end shall be covered with heat shrink tubes.

Pin configuration			
Terminal 1: 851 36RG 12-2 P 50	Signal:	Notes:	Terminal 2: No connector.
A	Power supply		
B	Power supply		

Material List			
OCEANOR Part No.	Description	Specification	Recommended supplier
N/A	Terminal 1, Male	MIL 851 36RG 12-2 P 50	Souriau / T&G Elektro
N/A	Terminal 2	No connector	
N/A	Cable	PFSK multi wire cable: (Minimum 2 Wire x 1.5mm ²)	
N/A	Heat shrink tubes	Appropriate dimension	
N/A	Label	Appropriate label.	

CABLE NO.: 101014	REVISION: 002, 24.08.04
DESCRIPTION: Power Cable. Power Unit to GENI2000	PREPARED BY: AH
DEPARTMENT/SECTION: Seawatch	CHECKED BY: VS
DATE: 08.06.04	DRAWING NO.:



Description:

Power cable with MIL spec. connectors.
Total length: 65 cm.

Notes:

The connector ends shall be covered with heat shrink tubes.
Labels at both ends.

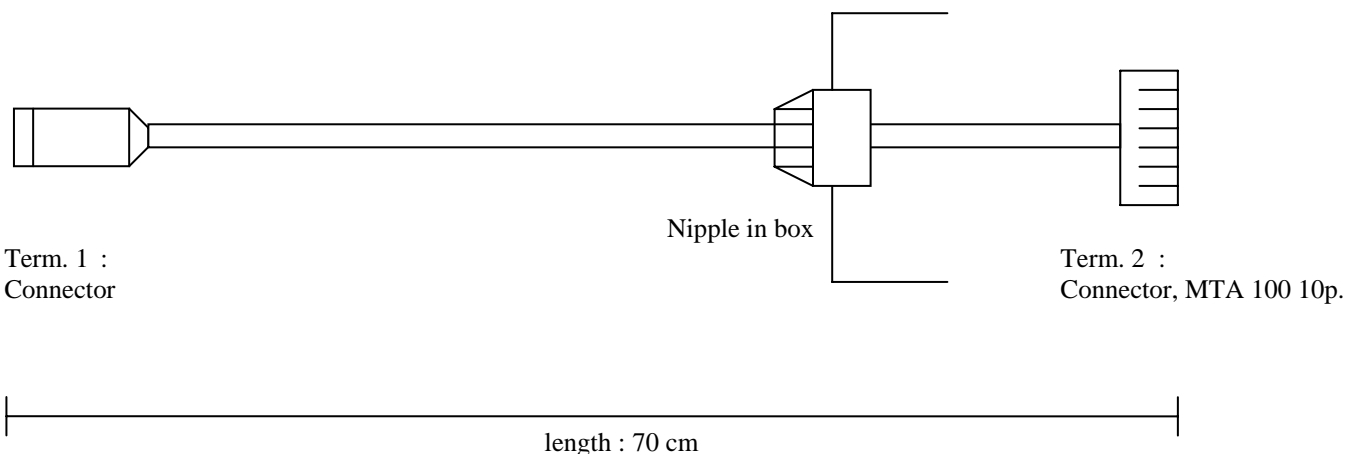
Pin configuration			
Connector 1: 851 36RG 14-15 P 50	Signal:	Notes:	Connector 2: 851 36RG 14-15 P 50
A	Power Supply		A
B	Power Supply		B
C	Power Supply		C
D	Power Supply		D
E	Power Supply		E
F	Power Supply		F
G	Power Supply		G
H	Power Supply		H
J	Power Supply		J
K	Power Supply		K
L	Power Supply		L
M	Power Supply		M
N	Power Supply		N
P	Power Supply		P
R	Power Supply		R

Material List			
OCEANOR Part No.	Description	Specification	Recommended supplier
N/A	Terminal 1, Male	MIL 851 36RG 14-15 P 50	Souriau / T&G Elektro
N/A	Terminal 2, Male	MIL 851 36RG 14-15 P 50	Souriau / T&G Elektro
N/A	Cable	PFSK multi wire cable: Minimum 15 Wire x 0.75 mm2 Shielded.	
N/A	Heat shrink tubes	Appropriate dimension.	
N/A	Label	Appropriate label.	

OCEANOR

Oceanographic Company of Norway A/S

CABLE NR.: 100251	REVISION: 001
DESCRIPTION: Signal/PWR cable, Geni – Compass.	PREPARED BY: Trond Hagen
DEPARTMENT/SECTION: Engineering & Production	CHECKED BY: V.S.
DISTRIBUTION:	DRAWING NR.:
INFO: * P = MALE S = FEMALE	DATE: 18. jan. 2005



Description:

Signal cable with MIL spec. connector.
Total length: 70 cm.

Notes:

The connector end shall be covered with heat shrink tubes.

Pin configuration

Terminal 1: 851 36RG 10-7 P 50	Signal:	Notes	Terminal 2: Connector, compass
A	GND		3
B			
C			
D	POWER		2
E	T2.Tx		4
F	T2.Rx		5
G			

Material List

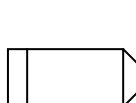
OCEANOR Part No.	Description	Specification	Recommended supplier
N/A	Terminal 1, Male	MIL 851 36RG 10-7 P 50	Souriau / T&G Elektro
N/A	Terminal 2	No connector	
N/A	Cable	Multi wire cable: Minimum 4 Wire x 0.34mm ² Shielded.	
N/A	Heat shrink tubes	Appropriate dimension	
N/A	Label	Appropriate label	

OCEANOR

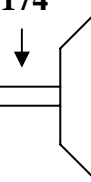
Oceanographic Company of Norway A/S

CABLE NR.: 100174	REVISION: 001
DESCRIPTION: Comm. Cable – GENI (Wavesense)	PREPARED BY: Trond Hagen
DEPARTMENT/SECTION: Engineering & Production	CHECKED BY: V.S.
DISTRIBUTION:	DRAWING NR.:
INFO: * P = MALE S = FEMALE	DATE: 28. sept. 2004

Labelling:
100174



Labelling:
100174



Term. 1 :
Connector:
SOU 851 36G 10 – 07 P 50
All mil – connectors: shrinkage

Term. 2 :
Connector:
9pin D-sub (MALE)
House: ELFA
DPPK 9-JS

length : 130 cm

Description of terminals:

Term. 1 SOU 851 36G 10 – 07 P 50	Term. 2 9pin D-sub (MALE) w/DPPK 9-JS
A	5,7
B	-
C	-
D	9
E	3
F	2
G	-

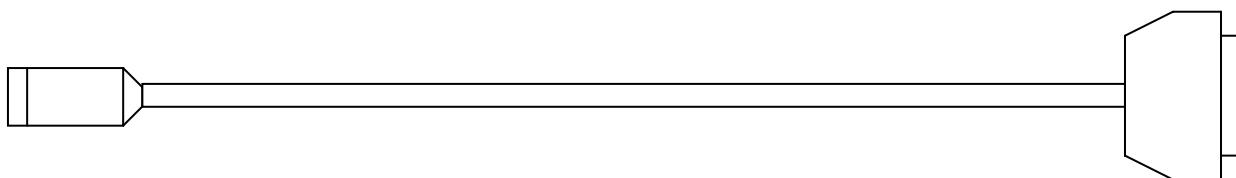
Material List

Item	Description	Manufacturer	Supplier
Term.1	851 36G 10-07 P 50	T&G Elektro	
Term.2	D-Sub 9pin, Male		
Cable	7 x 0.5mm LiYCY	NEK	NEK Kabler, NORWAY



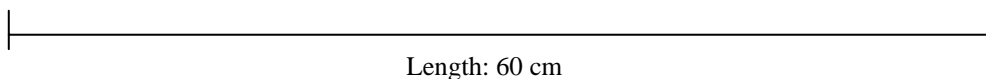
Oceanographic Company of Norway A/S

CABLE NO.: 101227	REVISION: 001
DESCRIPTION: Transmitter cable, GENI/Wavesense - GSM	PREPARED BY: Trond Hagen
DEPARTMENT/SECTION: Engineering & Production	CHECKED BY: V.S.
DATE: 24.02.2010	DRAWING NO.:



Terminal 1

Terminal 2



Length: 60 cm

Notes:

Pin configuration			
Connector 1: 851 36G 12-10 P 50	Signal:	Notes:	Connector 2: D-Sub 9pin, male
A	PWR+		9
B	GND		5
C			
D			
E			
F			
G			
H	Tx		3
J	Rx		2
K			

Material List			
Item	Description	Manufacturer	Supplier
Term.1	851 36G 12-10 P 50	T&G Elektro	
Term.2	D-Sub 9pin, Male		
Cable	7 x 0.5mm LiYCY	NEK	NEK Kabler, NORWAY

Cable nr.: 101211

D

C

B

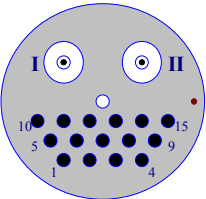
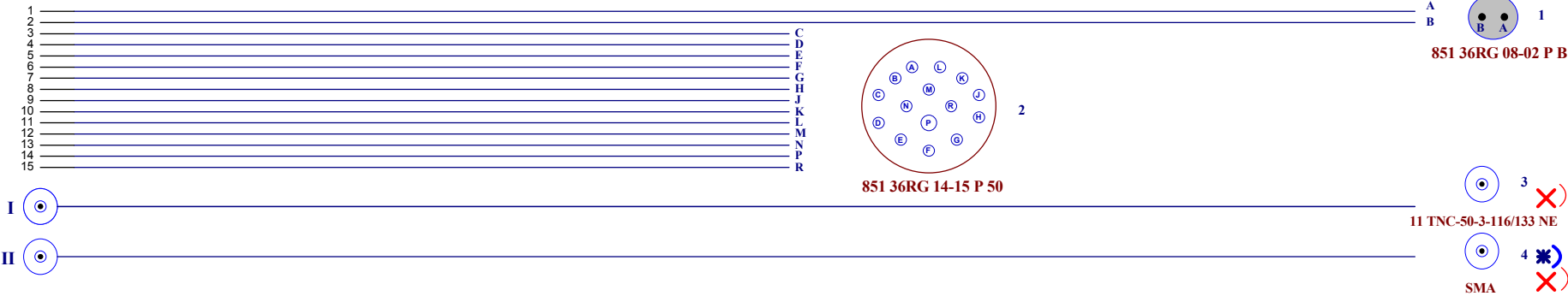
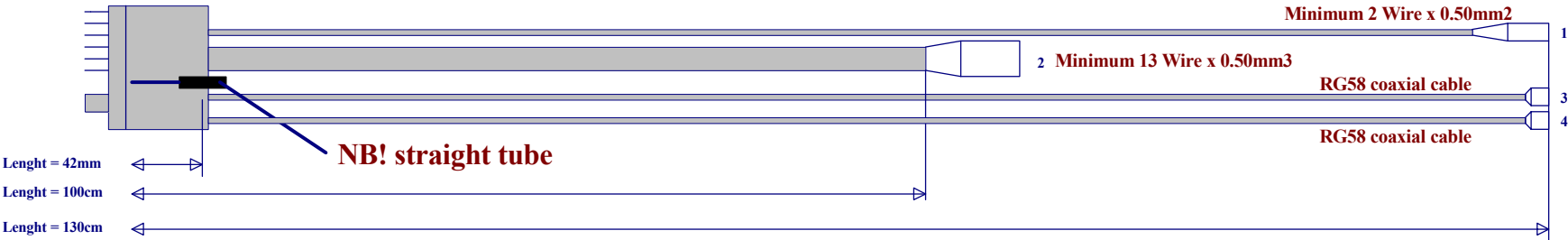
A

D

C

B

A



4 ✖ SMA con. not mount to SYRIA & OMAN

3, 4 ✖ N.C. Spare for Turkmenistan

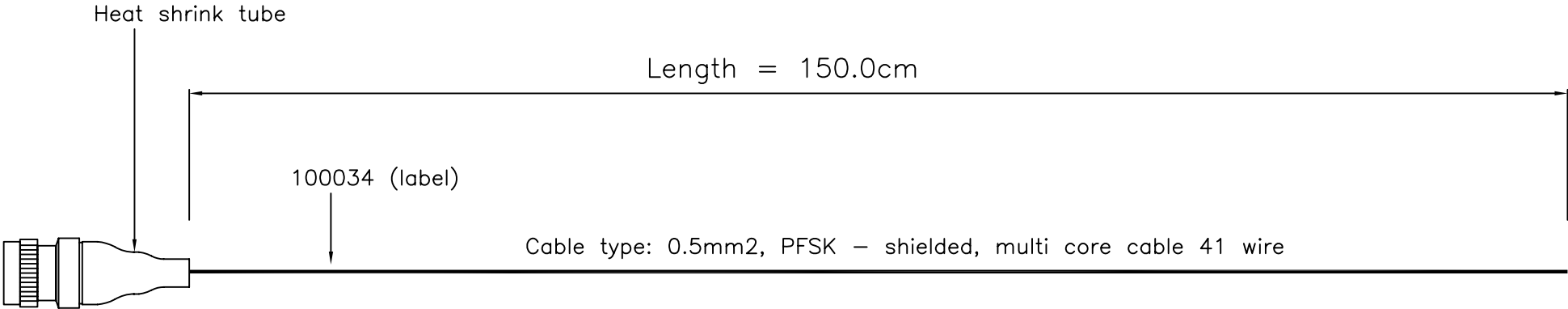
Rev.	Date	Comment	Design by
1			

Error : LOGO.BMP file not found. Oceanographic Company of Norway ASA Pir-Senteret, N-7462 Trondheim, Norway	
Drawing no.	
Revision 1 1 date: 12-Apr-2011	Size A3
File: P:\Business\Kabler\101211 Lokkonnektor Venezuela.sch	
Sheet 1 of 1	

The entire ownership and copyright of this drawing is the property of OCEANOR A/S

Etendomsrett og opphavsrett til denne tegning tilhører i sin helhet OCEANOR A/S

1	2	3	4	5	6	7	8
---	---	---	---	---	---	---	---



SOU T&G 851 36RG 20-41 P 50
TO GENI (SENSORS)

CABLE No. 100034

TO ROW TERMINAL
INSIDE THE JUNCTION BOX
(underside of the cylinder lid)

All pins shall be connected

										Item no. Numbers Name				Material				Weight					
										<div>OCEANOR</div> <div>Oceanographic Company of Norway A/S</div>													
										Project no.		File: md236181		Proj. Code		Area/Location		System		Doc. type DWG		Revision: 1	
										Package Title				Title CABLE ASSEMBLY DRAWING				Scale: -					
										WAVESCAN BUOY				CABLE GENI 41p - JUNCTION BOX				Size: A3					
										P. O. Number:				Drawing no.				Page 18					
1	14.08.04	AS BUILT			VS	AH												Tot.					
A	14.06.04	ISSUED FOR CONTROL			VS	AH																	
Rev.	Date	Reason For Revision			Orig. by	Chk. by	Dis.App.	Pro.App.	CUAcc.														

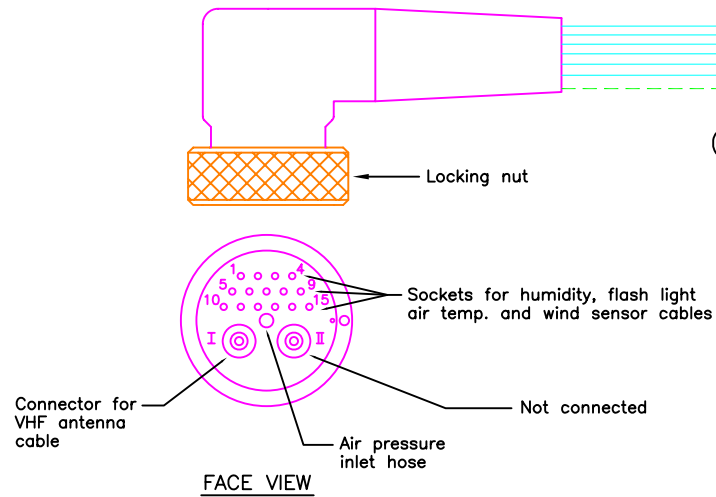


12.3 External cabling

The drawing remain OCEANOR's exclusive property. They are submitted only for the purpose agreed upon and may not be used for any other purpose. Copies or other reproductions may only be made for the purpose agreed upon. Neither originals or reproductions may be transmitted or otherwise made accessible to a third party.

12345678

MAST CONNECTOR—FEMALE




CABLE NO.150189

HOSE FOR BATTERY VENTILATION Length=2.7m

- MCIL4F, Length=2.4m FOR FLASH LIGHT
- MCIL5F, Length=2.4m FOR RELATIVE HUMIDITY
- 9p Gill, Length=2.7m FOR WIND—GILL
- MCIL6F, Length=2.5m FOR WIND—YOUNG
- LEMO 6P, Length=2.6m FOR AIR TEMP. SENSOR
- N-Connector for VHF, Length = 2.7m

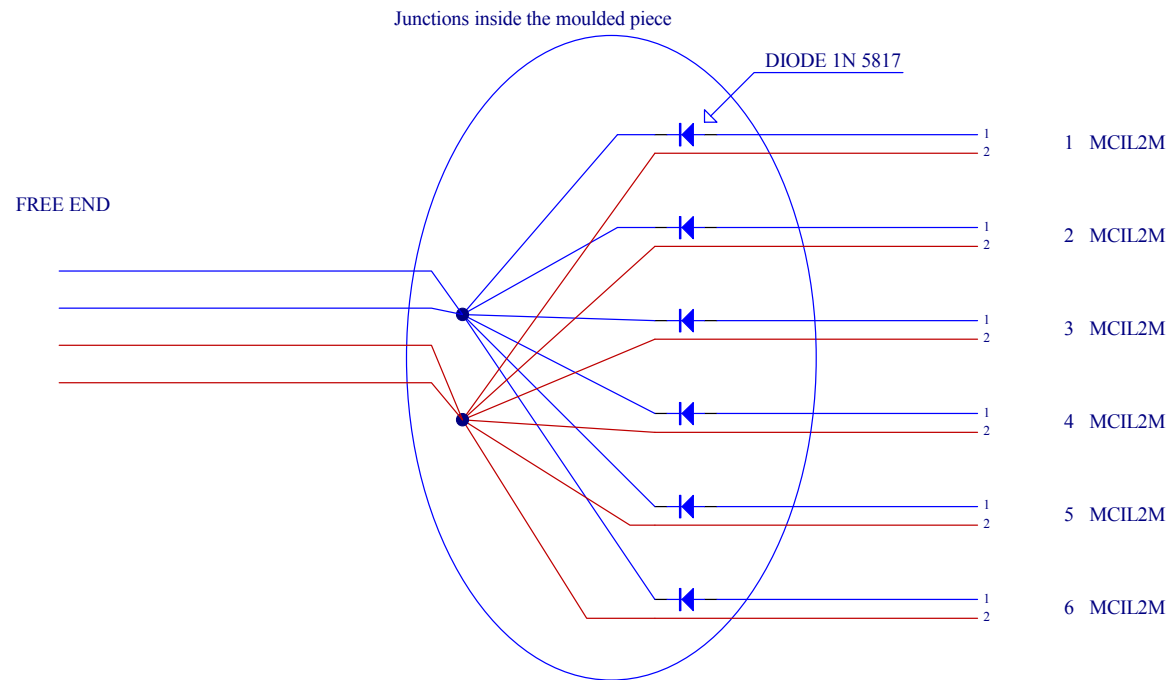
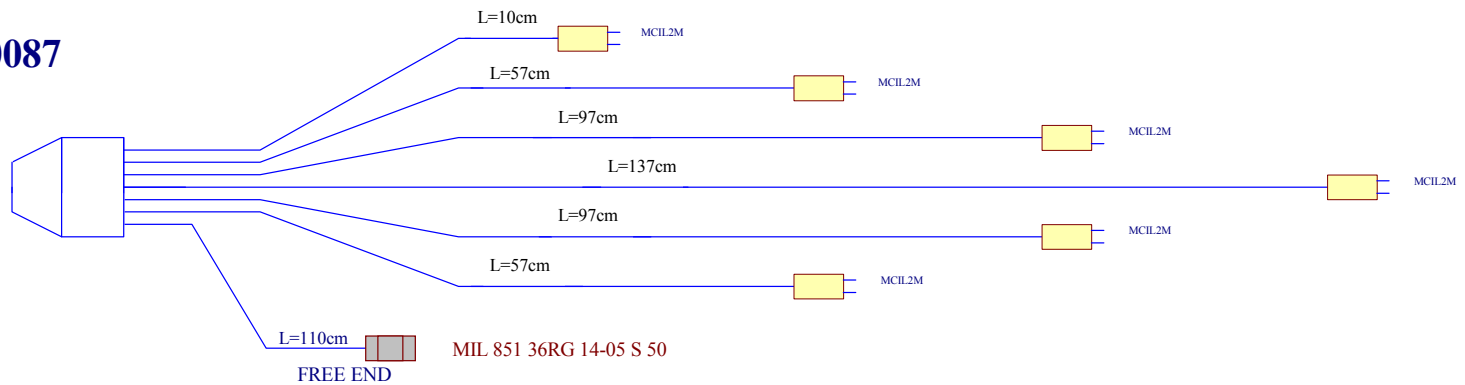
MAST CONNECTOR—FEMALE

- | | | |
|----|---------------------|---------------------------|
| 1 | 1 PWR | FLASH LIGHT, SL07 |
| 2 | 2 GND | |
| 3 | 1 PWR | |
| 4 | 2 GND | RELATIVE HUMIDITY, HMP155 |
| 5 | 4 SIGNAL (humidity) | |
| 6 | 3 PWR | |
| 7 | 1,2 GND | WIND—GILL |
| 8 | 5 Tx | |
| 9 | 7 Rx | |
| 10 | 2 WD EXCIT | |
| 11 | 1,6 GND | WIND—YOUNG |
| 12 | 4 WD signal | |
| 13 | 3 WS signal | |
| 14 | 1 | |
| 15 | 2 | AIR TEMP. SENSOR — OMEGA |
| I | VHF ANTENNA | |
| II | NC | |

Item no. Numbers Name			Material			Weight	
 FUGRO OCEANOR			FUGRO OCEANOR Pir-Senteret N-7462 Trondheim, Norway Phone: +47 73 545200 www.oceanor.com				
File:		Proj. Code	Area/Location	System	Doc. type	Revision	
MD480061					DWG	1	
H. Midi Buoy		Title				Scale	
		CABLE ASSEMBLY DRAWING MAST CABLE					
		Drawing no.				Size	
		DCN-MD-480-06				A3	
						Page	
						06	
						Tot.	

Rev.	Date	Reason for Revision	Orig. by	Chk. by	DisApp	ProApp	ClAcc.
1	20.12.11	AS BUILT	VS	TH			

CABLE NO.: 150087



SW-mini BUOY
SOLAR PANEL CABLE

Error - LOGO BMP file not found.
Oceanographic Company of Norway ASA
Pir-Senteret, N-7462 Trondheim, Norway

Drawing no.

Revision
1 1
date: 1-Jun-2007

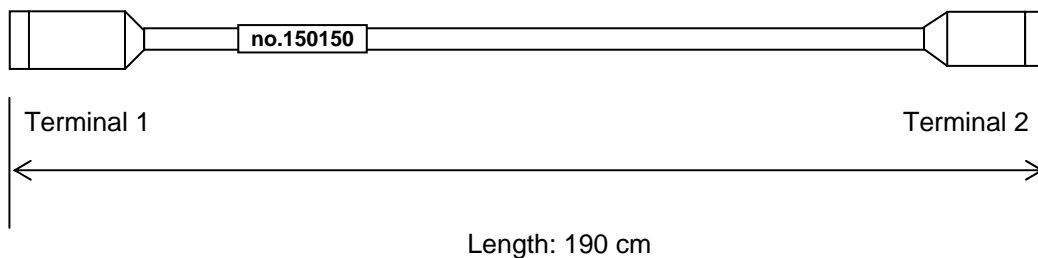
Size
A3

Sheet 1 of 1

Rev.	Date	Comment	Design by
1	21.02.07	INITIAL DESIGN	TH

File:
P:\Business\Kabler\Solar cable.sch

CABLE NO.: 150150	REVISION: 001
DESCRIPTION: Subsea cable for current profiler	PREPARED BY: TH
DEPARTMENT/SECTION: Seawatch mini	CHECKED BY: VS
DATE: 12.06.2009	DRAWING NO.:



Cable description:

Term.1: 851 36RG 10-07 P 50

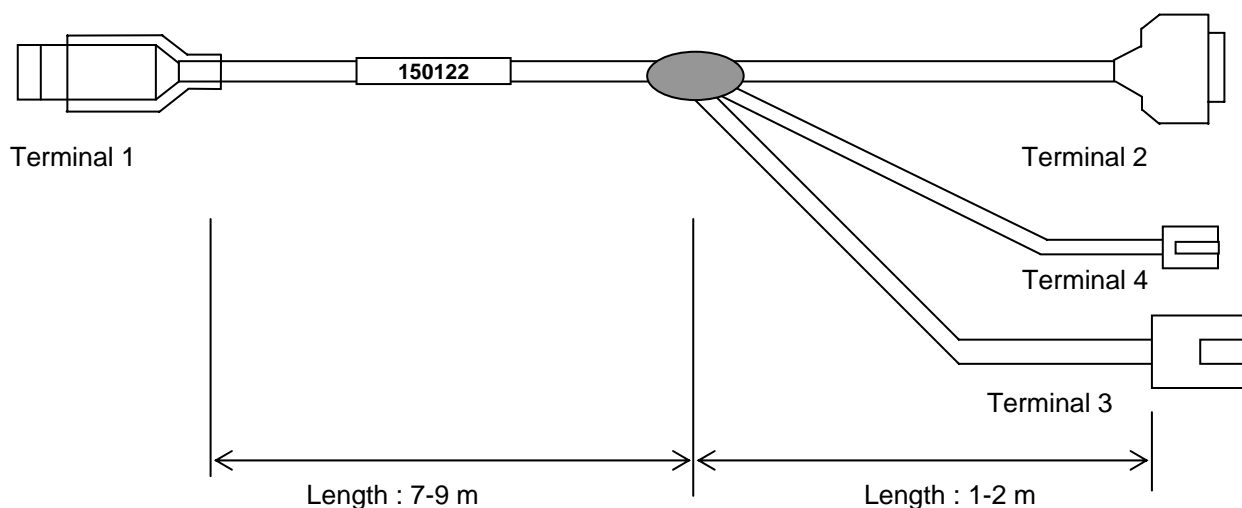
Term.2: MCIL 8 M

Notes:

Pin configuration			
Connector 1: 851 36RG 10-07 P 50	Signal:	Notes:	Connector 2: MCIL 8 M
A	GND		1,5
D	PWR		2
F	Rx	Tx	3
E	Tx	Rx	4

Material List			
OCEANOR Part No.	Description	Specification	Recommended supplier
N/A	Terminal 1, Male	851 36RG 10-07 P 50	
N/A	Terminal 2, Male	MCIL 8 M	
N/A	Cable	PUR cable Min. 4X0.3mm2	

CABLE NO.: 150122	REVISION: 001
DESCRIPTION: Com./Charge – cable, Field PC.	PREPARED BY: TH
DEPARTMENT/SECTION: SeaWatch	CHECKED BY: VS
DATE: 23.09.08	DRAWING NO.:



Description:

Transmitter cable.
Total length: 8-10 m.

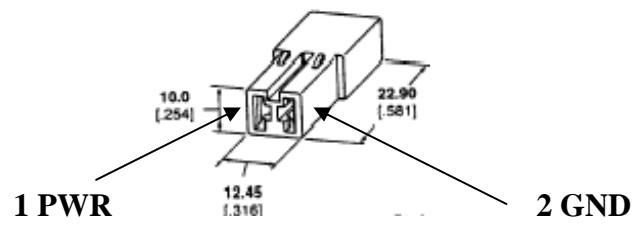
Notes:

The connector ends shall be covered with heat shrink tubes.

Pin configuration				
Terminal 1: IMPULS-PMCIL12MP	Signal:	Terminal 4: RJ45 8pin	Terminal 2: 9 pin D-SUB Female	Terminal 3: Receptacle housing 2way, AMP *)
1,2	PWR			1
3,4	GND		5	2
5	GND			
6 } Shortcut	GPIO7			
7	COM.0Tx		2	
8	COM.0Rx		3	
9	ETX+	1		
10	ETX-	2		
11	ERX+	3		
12	ERX-	6		

Material List			
OCEANOR Part No.	Description	Specification	Recommended supplier
N/A	Terminal 1, Male	IMPULS-PMCIL12MP	
N/A	Terminal 2, Male	9 pin D-SUB MALE	Farnell: Order Code: 135-4899
N/A	Terminal 3	Receptacle housing 2way AMP	Farnell: Order Code: 964-736
	Terminal 4,	RJ45	
N/A	Cable	Signal cable : 12x0.5mm2	
N/A	Heat shrink tubes	Appropriate dimension	
N/A	Label	Appropriate labels.	

*) Description Terminal 3

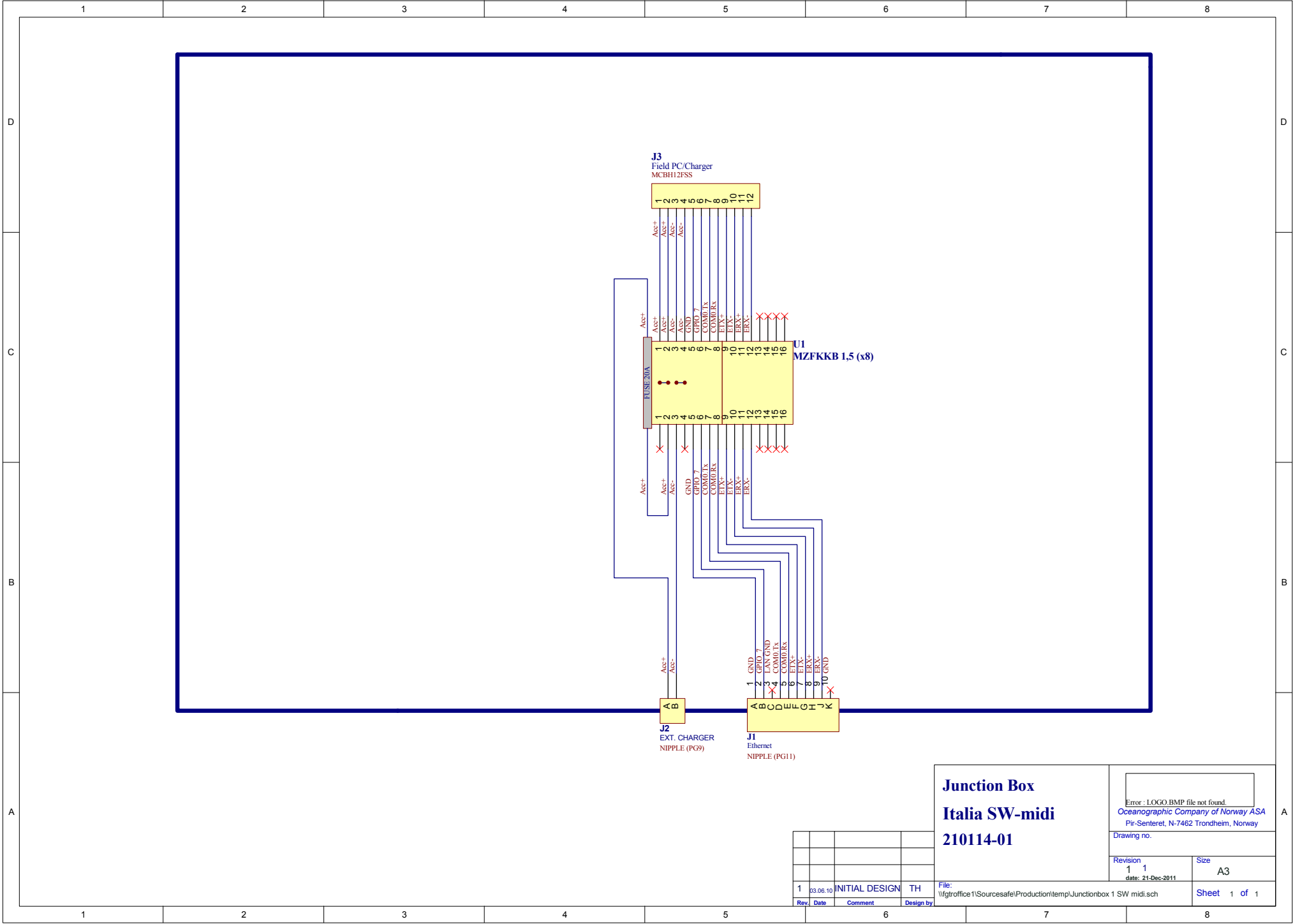




12.4 Cable connections for Junction box / Power Management Unit

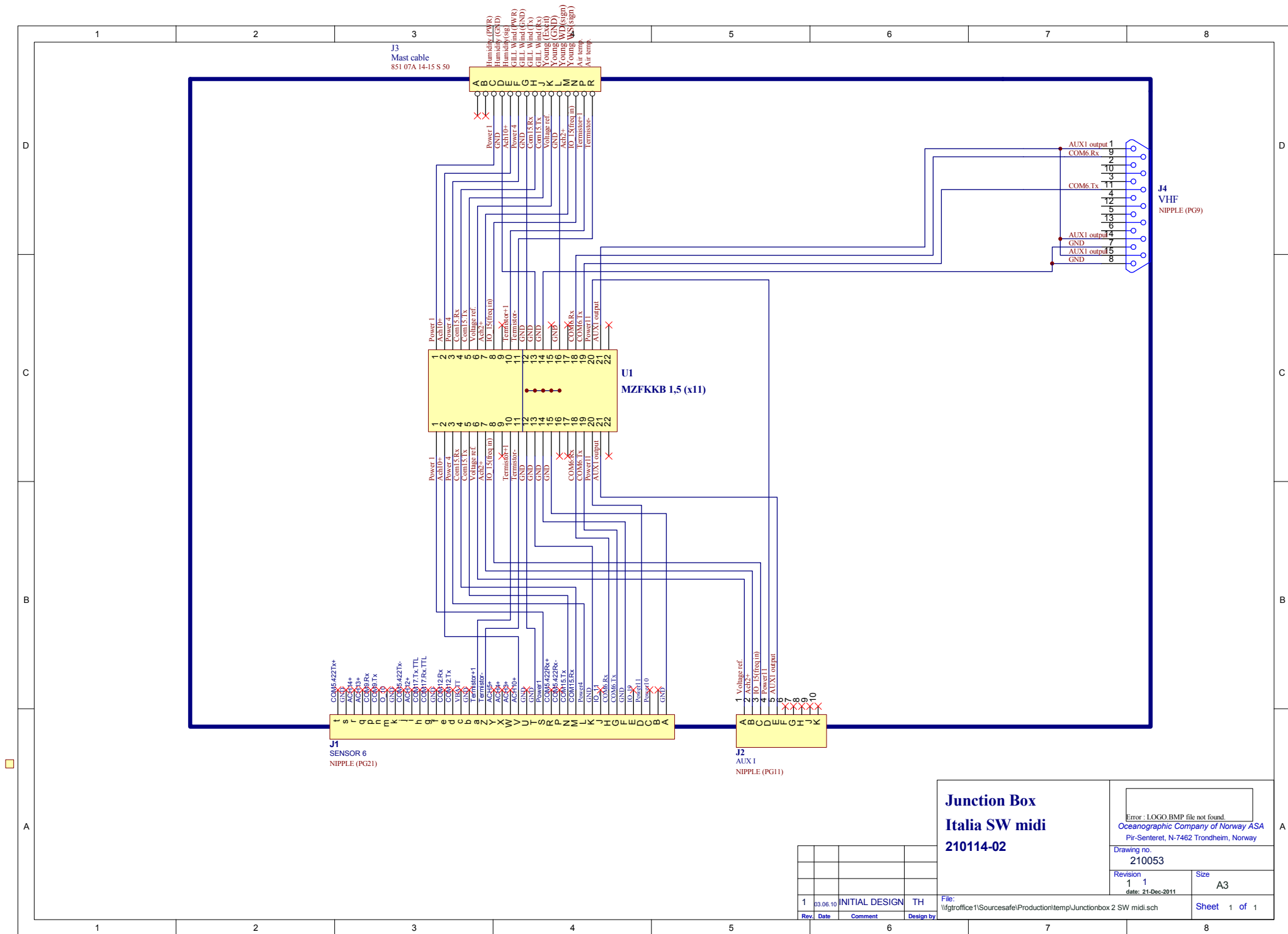
Power management unit s.no. 197; frontpanel connection

Connector	Terminal no.	Designator	Description
FLASHLIGHT 851-8-2S	A	Light	Separately controlled power output
	B	GND	Power ground (load-)
BATTERY 851-16-8P	A	Battery 1+	Battery pack 1 +
	B	Battery 1+	Battery pack 1 +
	C	Battery 1-	Battery pack 1 -
	D	Battery 1-	Battery pack 1 -
	E	Battery 2+	Battery pack 2 +
	F	NTC +	Battery temperature sense +
	G	Battery 2-	Battery pack 2 -
	H	NTC -	Battery temperature sense -
SOLAR PANEL 851-14-5P	A	Charger 1+	Solar panels +
	B	Charger 1+	Solar panels +
	C	GND	Solar panels -
	D	GND	Solar panels -
	E	N.C.	
EXT. CHARGER 851-12-2S	A	Battery 1+	External charger +
	B	Battery 1-	External charger -
ON/OFF 851-8-4S	A	S2 Black	Output
	B	S1 Blue	GND (0V)
	C	S3 Brown	+Vs
	D	N.C.	
AUX2 851-12-3S	A	N.C.	
	B	N.C.	
	C	N.C.	
GENI POWER 851-14-15S	A	WDIR	Voltage ref. (AUX1)
	B	WDIR	Sign. In (AUX1)
	C	N.C.	
	D	N.C.	
	E	N.C.	
	F	N.C.	
	G	COM 11 TX	RS-232 DTE TX
	H	COM 11 RX	RS-232 DTE RX
	J	WSPEED	Speed from wind sensor (AUX1)
	K	GND	Power ground (load-)
	L	N.C.	
	M	N.C.	
	N	N.C.	
	P	Load+	Unregulated power+ (load+)
	R	GND	Power ground (load-)
AUX1 851-12-10S	A	WDIR	Voltage ref. (GENI POWER)
	B	WDIR	Sign. in (GENI POWER)
	C	WSPEED	Speed from wind sensor (GENI POWER)
	D	AUX 1 ctrl	Ctrl. Input for VHF
	E	AUX 1 output	Power output for VHF
	F	N.C.	
	G	N.C.	
	H	N.C.	
	J	N.C.	
	K	N.C.	



1	03.06.10	INITIAL DESIGN	TH
Rev.	Date	Comment	Design by

Junction Box Italia SW-midi 210114-01		<div></div> <p>Error : LOGO.BMP file not found.</p> <p><u>Oceanographic Company of Norway ASA</u> <u>Pir-Senteret, N-7462 Trondheim, Norway</u></p> <p>Drawing no.</p>	
Revision 1 1 date: 21-Dec-2011		Size A3	
File: \\fgtroffice1\Sourcesafe\Production\temp\Junctionbox 1 SW midi.sch		Sheet 1 of 1	





13. PART LIST

Contents

13. PART LIST	13-1
13.1 Part list – Mechanical	13-1
13.2 Part list – Sensors, Electronic Modules etc.	13-2
13.3 Part list – Internal Cables	13-3
13.4 Part list – External Cables	13-3



13. Part list

13.1 Part list – Mechanical

Description	Dim.	Qty.	Material or Model
Floating body	ø1900 x 1179	1	Form filled polyethylene
Buoy lid	ø712 x 90	1	Form filled polyethylene
Mast with bottom/top brackets	ø40 x 7	3	Glass fibre, L=2.5m
Sensor carrier arm	ø580x250	1	Aluminium, AA 5052, Tegn. ocn-md-428-15, R.2
Mounting plate for buoy lid	ø570 x 4	1	Aluminium, AA 5052
O-ring, lid	614.60x10	1	EPDM Svamp
O-ring, float	630.50x10	1	EPDM Svamp
Screws for buoy lid	M8 x 30	12	A4, MRT-TT
Electronic module bracket	ø570 x 6	1	Aluminium, AA 5052
Rod (bolt)	ø12/M8 x 285	3	AISI 316 L
Battery holder	500x500x100	1	Aluminium, AA 5052
Battery cover plate	ø570 x 3	1	Aluminium, AA 5052
Anchor hold frame+clamps	620	1	AISI 316 L
Rod (bolt)	ø16/M16	4	AISI 316 L, L=230
Protection lid for gas/power/comm.	ø75 x 35	3	POM
O-ring for protection lid	49.5 x 3	3	Oceanor
Adapter with gas valve		1	Oceanor/SMC
Lifting ring		1	AISI 316 L
Cover for subsea inlets		3	Titanium, gr2
Cover for subsea well		3	1x large, 2x small
Zinc anode	250 g	8	Mounted on mooring frame
Passiv radar reflector	ø50 x 570 mm	3	Mobri, S2

Fugro OCEANOR

User Manual – The SEAWATCH Midi Buoy

13. Part list



13.2 Part list – Sensors, Electronic Modules etc.

Part No.	Description	Dim.	Qty.	Manufacture/Model
400030	Wavesense 3		1	FO, 11p
-	Current profiler		1	Nortek, 400 MHz, Supplied by Customer.
-	Holder for current profile		1	FO
311047	Air humidity		1	Vaisala, HMP 155
311010	Air temperature		1	Omega/FO
311004	Air pressure		1	Vaisala, PTB 330 A
002061	Air pressure inlet		1	FO
311024	Wind		1	Gill, Windsonic
311020	Wind		1	R.M.Young, 04106-19
319001	Compass		1	PNI, TCM 2.5
319023	GPS Receiver		1	Navman/FO, Jupiter 31
400016	Power Management Unit (PMU)		1	Oceanor, PMU-S.nr.197
321035	GSM Modem		1	Cinterion, MC35i
322021	Dual GSM/GPS antenna		1	planTec, K70EAR
321024	VHF Radio		1	Satel, 3ASd – 142.0 MHz
322033	VHF Radio antenna		1	VHFS-U, Trans Voice
390002	Flash light		1	Sealite, SL07
230000	Lead acid battery (62 Ah)		4	Powersafe, 12V 62F
230340	Lithium battery		2	SAFT, 14V 272 Ah
235015	Solar panel		6	Solara, SM 60 M/S
170059	Power on/off switch		1	Fugro Oceanor
210114	Junction box mounted below the lid		1	Fugro Oceanor, 210114-1
210114	Junction box mounted on battery cover plate		1	Fugro Oceanor, 210114-2
-	Connector for field PC/charging		1	Subconn, MCBH12FSS



13.3 Part list – Internal Cables

(For further information, see the chapter 12.2 Internal cables)

13.4 Part list – External Cables

(For further information, see the chapter 12.3 External cables)



14. SPARE PART LIST

Contents

14. SPARE PART LIST	14-1
14.1 Fugro OCEANOR's tool box.....	14-1



14. Spare part list

A detailed spare part list may be provided by Fugro OCEANOR on request.

14.1 Fugro OCEANOR's tool box

Description	Dim.	Qty.	Model/Manufacture
Tool, 8mm power on/off switch		2	Tamperproof hexagon wrench
Tool for protection lid mounted on buoy lid		1	
Special screw for buoy lid	M8 x 30	4	Torx 45 screw, MRT-TT-A4
Tool for torx screw M8 x 30, MRT-TT		1	Tx 45
Torx set screw wrench		1	T9 - T40
Special screw for solar panel M5 x 15, MRT-TT		8	MRT-TT A4 M5X15 T20 BUMAX
Special screw for lid-well M6 x 12, MRT-TT		2	MRT-TT A4 M6X12 T30 BUMAX
Hexagon screw		6	M6x12
Battery charger		1	Multi XS 7000/12V -7A, CTEK
Communication / battery charge cable	10m	1	Cable no.: 150122
Socket set screw wrench		1	1.5 – 6 mm
Tool for mast connector locking nut		1	
Lubricant for screws		1	Nova lube 120g

Fugro OCEANOR

User Manual – The SEAWATCH Midi Buoy

14. Spare part list



Fugro OCEANOR's Tool Box



15. TROUBLESHOOTING

Contents

15. TROUBLESHOOTING	15-1
---------------------------	------



15. Troubleshooting

The following chapter lists common Q&A situations encountered with our systems:

Why are the data on the receiving station wrong after I updated the configuration files on the buoy?

It might not be a problem with the buoy. Please make sure that you read the data file with an up-to-date mdb-file made from the configuration files currently installed on the buoy. When the configuration files are updated, one may have changed the structure of the transferred data files, typically if a parameter has been deleted or renamed or if one have changed anything in the transferred telegram. The mdb-file maps where Station Guard or PffExport can find the corresponding data bits each data parameter. If this happens, it is also advisable to move the existing pff-file with the old mdb-file to a different location and let the receiving station create a new pff-file with data from the new setup only. This will happen automatically. Generally, one should always create a new pff number every time an old pff-file is changed.

Why does the wave parameter hmax suddenly drop to 0?

The parameter hmax must identify about 40 distinct waves above a certain amplitude to be able to calculate hmax. If it cannot identify enough waves, hmax drops to 0. Typically, this happens when there are low-wave conditions, and as an approximation, hmax can be calculated from hm0 ($h_{max} \approx 1.8 \cdot h_{m0}$).