



TECHNICAL SPECIFICATION Nº I-ET-XXXX.XX-5524-941-XXX-001

CLIENT: PETROBRAS E&P PAGE 1 of 8

PROGRAM: MASTER

AREA: FLOATING PRODUCTION UNITS

TITLE: **PERMANENT RESERVOIR MONITORING SYSTEM – SPREAD MOORING - FPSO SCOPE** NP-2


**REVISION INDEX**

REV.	DESCRIPTION AND/OR REVISED PAGES
0	ORIGINAL
A	Changed number of 19" racks on instrument room without changing the required footprint

	REV. 0	REV. A	REV. B	REV. C	REV. D	REV. E
DATE	18-OCT-18	19-FEB-20				
DESIGN						
EXECUTION						
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## 1. Introduction

### 1.1. Objective

The objective of this document is to describe a Permanent Reservoir Monitoring (PRM) System, define the requirements, identify the interfaces and scope of services for the FPSO to host a PRM system. This technical specification is applicable to Spread Mooring anchored FPSOs.

### 1.2. References

[1] PETROBRAS request for information (RFI) for seismic acquisition services using permanent or semi-permanent technology for the reservoir monitoring. This reference is only for PETROBRAS internal use.

### 1.3. Acronyms

<b>CCR</b>	Central Control Room
<b>HVAC</b>	Heating, Ventilation and Air Conditioning
<b>NAS</b>	Network Attached Storage
<b>PRM</b>	Permanent Reservoir Monitoring
<b>STP</b>	Shielded Twisted Pair

### 1.4. Definitions

<b>FPSO CONTRACTOR</b>	The Company contracted by PETROBRAS to supply and operate the leased FPSO.
<b>RISER CONTRACTOR</b>	The Company contracted by PETROBRAS to supply flexible risers.
<b>PRM CONTRACTOR</b>	The Company contracted by PETROBRAS to supply the PRM system.
<b>PETROBRAS</b>	Oil operator that uses the PRM system for reservoir management. Any information to be exchanged with PETROBRAS related to this specification shall be addressed to geophysical acquisition group.
<b>PARENT DOCUMENT</b>	FPSO GTD (General Technical Description) or similar document that includes this technical specification in the scope of the FPSO CONTRACTOR.

## 2. PRM System Overview

A PRM System uses permanently installed cables on the seabed with embedded sensors (geophones/accelerometers and hydrophones) to provide seismic data during the lifetime of the field.

The System comprises equipment installed on the FPSO and subsea, composed by:

- FPSO
  - PRM equipment – receives the signal from subsea sensors and converts it to be recorded on the NAS.
  - Operation and Quality control workstation.
  - NAS – Seismic data storage.
  - UPS – Provides power supply in event of power failure.

- Junction Boxes.
- Deck cable.
- Subsea
  - Sensors – Geophones/Accelerometers and Hydrophones.
  - Seismic Cables - Connect sensors and distribution units.
  - Distribution Units – Interface between umbilical and sensor cables.
  - Umbilical – Connection between topside and subsea.

Refer to schematics on Figure 1 for system diagram.

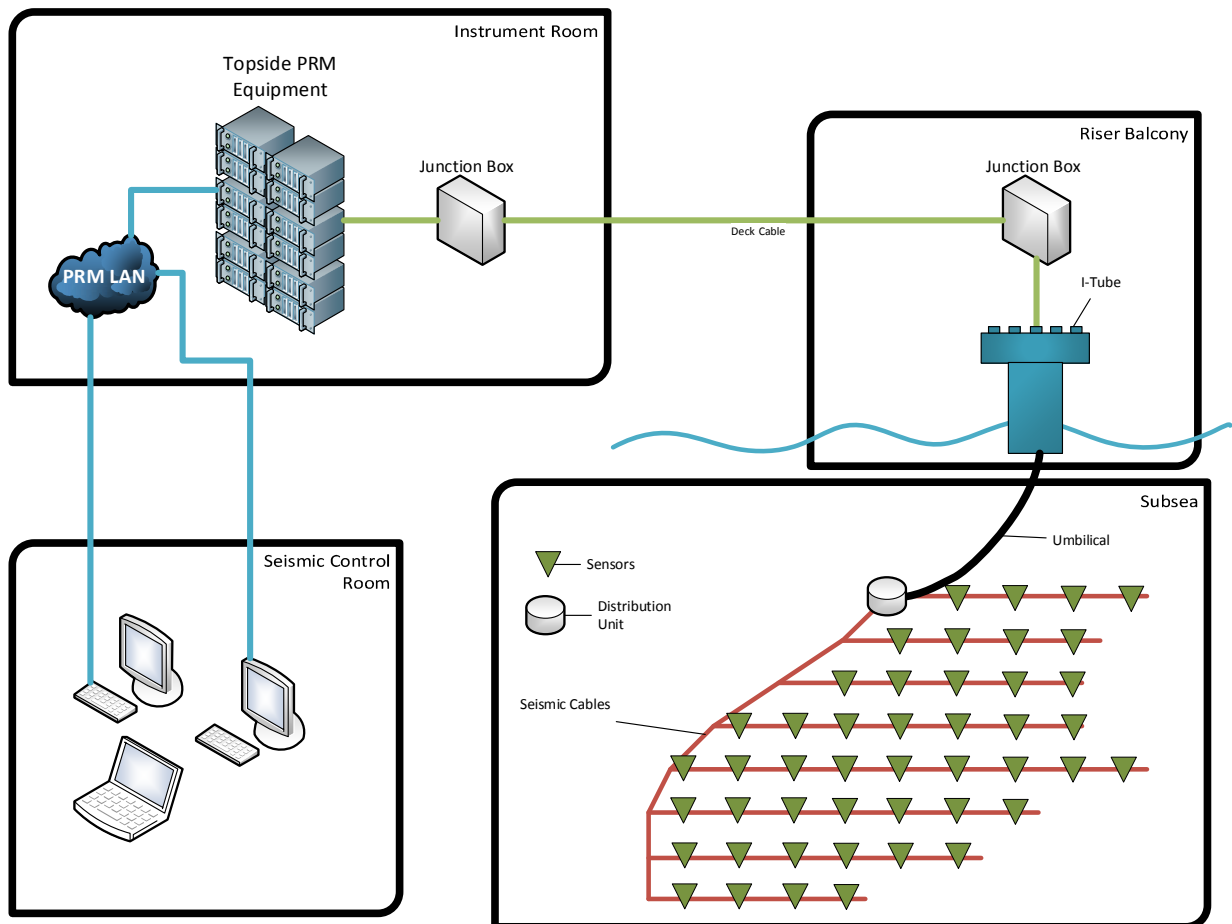



Figure 1 – PRM components schematics.

There are two types of PRM equipment on the market, optical and electrical. On the optical systems, there are only passive equipment on the subsea and a large number of optical fibers goes through deck cables and umbilical. On the electrical system, the equipment on the subsea needs power supply going through electrical wires that compose the deck cables and umbilical in conjunction with a small number of optical fibers for equipment communication and data transmission. Each PRM system has its own minimum requirements. On this document it was considered the scenario to attend to optical technologies.

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### 3. PRM Requirements

#### 3.1. Equipment Location

##### 3.1.1 Instrument room

The instrument room will be used to house the panels that contain the recording system including lasers (for optical system) or power cabinets (for electrical system). FPSO CONTRACTOR can install these cabinets in the E-House or in a dedicated room.

FPSO CONTRACTOR shall provide enough space to accommodate eight 19" cabinets with dimensions of 220 x 60 x 100cm (H x W x L) each, with elevated floor for all of them. Circulation space of 80 cm in the front and rear of the cabinets shall be provided. Each cabinet weights approximately 500 kg. Wall space for up to two junction boxes for deck cable interfacing shall be provided, totaling 100 x 80 x 50 cm (H x W x D).

##### 3.1.2 Seismic Control Room

The seismic control room will be used to accommodate the workstations where operators (seismic observers) and Petrobras representative will perform the project control and data QC. It is important that the instrument room and the seismic control room be located in different environment for noise isolation purpose. FPSO CONTRACTOR may optionally install this equipment in the CCR or in a dedicated room.

FPSO CONTRACTOR shall provide enough space to accommodate one table for operator workstation, with dimensions of 1m x 2m (W x L). An additional space for a 19" cabinet with dimensions of 100 x 60 x 90 cm (H x W x L) and for one cabinet with dimensions of 200 x 60 x 90 cm (H x W x L) shall be provided.

##### 3.1.3 Riser Balcony

FPSO CONTRACTOR shall provide space for one umbilical slot and up to two junction boxes. These junction boxes shall be installed up to 1m from the I-tube. The junction box dimensions required are 100 x 80 x 50 cm (H x W x D). FPSO CONTRACTOR shall submit to PETROBRAS for comments/information junction box position relative to I-tube.

#### 3.2. HVAC System

FPSO CONTRACTOR shall provide cold air to the cabinets.


The maximum total thermal load is 30 kW for eight cabinets and for one cabinet the maximum is 15 kW. The temperature inside the room should be kept between 10 °C and 30 °C, and the humidity between 40 and 60%.

#### 3.3. Power Supply

Power supply shall be provided by contractor considering:

##### 3.3.1 Instrument Room

- the required power for PRM system on the instrument room is 30 kW.
- voltages shall consider triphase 220VAC.
- Normal generation systems for PRM equipment. Only emergency lighting shall be fed by

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essential load following lighting contractor criteria.

- PRM UPS systems shall be incorporated and fed by normal electrical systems.
- Power shall be delivered at location of cabinets.

### 3.3.2 Seismic Control Room

- 220VAC power outlets for the operation workstations UPS, 5kW total

### 3.4. Communication and Cabling

#### 3.4.1 Instrument Room

- DECK CABLE – FPSO CONTRACTOR shall provide cable routing trays between riser balcony junction boxes and instrument room junction boxes for 1 optical cables with 504 fibers, 26,66 mm diameter.
- GPS CABLE – FPSO CONTRACTOR shall provide cable with raw GPS signal from FPSO GPS antenna to the instrument room.
- OPTICAL LAN CABLE – FPSO CONTRACTOR shall provide an optical cable with, at least, two pairs from Petrobras telecom room to the instrument room. This optical cable shall be terminated in 19" optical distribution panel in both sides, including fiber optic to RJ-45 converters.
- WIRELESS NETWORK LINK – FPSO CONTRACTOR shall provide routing from antenna deck to the instrument room for one coaxial cable and one STP cable to be used on an omnidirectional 20 km range wireless network link equipment.


#### 3.4.2 Seismic Control Room

FPSO CONTRACTOR shall provide:

- For each of the two operation workstation:
  - 03 220VAC power outlet;
  - 03 PETROBRAS LAN outlets for each workstation;
  - 02 STP LAN cable for PRM Ethernet switch
- 01 VHF base station.

### 3.5. System Diagram

The diagram on Figure 2 is for illustrative purpose only to represent the components and interconnections of the topside PRM system.

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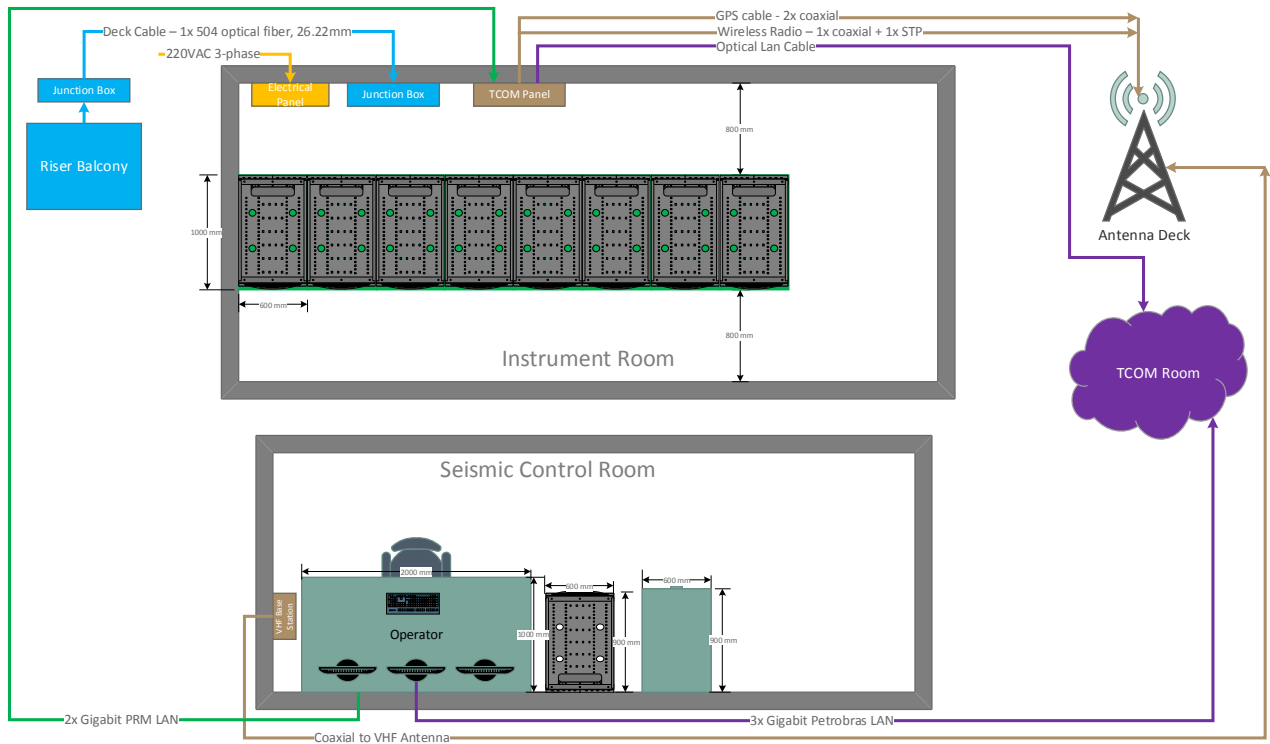


Figure 2 – Topsides PRM system interconnection diagram and requirements


## 4. Scope of Supply

### 4.1. FPSO CONTRACTOR

FPSO CONTRACTOR shall provide the items below. Refer also to the requirements on the other items on this specification.

- 19" cabinets space provisioning, fixation points and installation (Item 3.1.1).
- Deck Cable installation.
- High reliability raw GPS signal to PRM instrument room (PRM cabinet).
- Telecommunication cables supply and installation.
- Junction boxes installation.
- Specified Power Supply (item 3.3).
- Specified HVAC (item 3.2).
- Proper infrastructure for one wireless antenna (item 3.4.1).
- VHF base station for communication between boats.
- Provide information of locations and other requirements for PRM contractor.

FPSO CONTRACTOR shall take into account that PRM equipment may be not available for shipyard installation before the FPU starts production. FPSO CONTRACTOR shall provide at any time with no cost to PETROBRAS the installation, integration and commissioning of PRM equipment according to the scope above whenever requested by PETROBRAS, including while

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the FPU is offshore. PETROBRAS will request to CONTRACTOR this offshore installation and integration work with at least three months in advance.

FPSO CONTRACTOR shall also take in account that the deck cable and junction box installation might be supervised by PRM CONTRACTOR personel.

**4.2. PRM CONTRACTOR**

PRM CONTRACTOR shall provide:

- 19” cabinets.
- Topside PRM equipment and its installation on cabinets.
- UPS for PRM equipment.
- PRM optical, network and electrical cable supply and installation (including cabling between cabinets, and excluding cabinets power supply and network cables going outside PRM cabinets).
- Junction boxes.
- Electrical and optical splices for PRM cables.
- Wireless Network equipment and antennas.