OCTANS NANO

Product Specification

Document Revision History

Edition	Date	Comments
A	05/2017	Creation (evolution from G_ST_TSH_045 technical offer)

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1 INTRODUCTION

This document contains the OCTANS NANO product specifications.

It provides information on the OCTANS NANO performance, environmental and dynamic conditions of use.

System Design

OCTANS NANO is the smallest and most adept state-of-the-art 4 000 m depth rated attitude and heading reference system (AHRS). It is built on iXBlue's renowned fiber-optic gyroscope (FOG) technology and offshore instrumentation expertise. OCTANS NANO offers an outstanding price/performance solution, with rugged titanium housing, meeting the most challenging requirements of subsea applications.

OCTANS NANO provides true heading, roll, pitch, yaw, rates of turn and accelerations even in highly volatile environments.
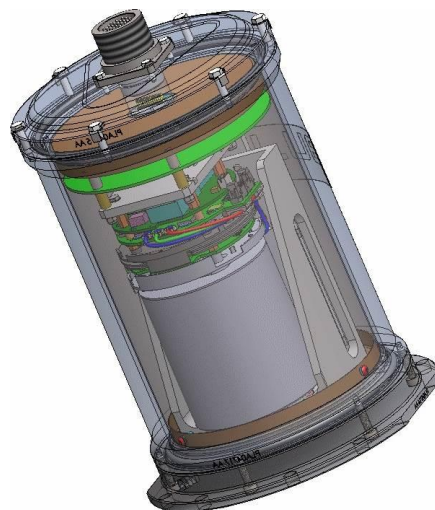
Figure 1: OCTANS NANO

More than 5,000 iXBlue inertial products are in use all over the world, especially in the oil & gas industry. OCTANS, ROVINS or PHINS are the markets standards, mostly for survey purpose. *OCTANS Nano* is designed to answer to the specific ROV navigation needs, with a focus on the size and price, while maintaining robustness, reliability and performances of the iXBlue technologies. OCTANS NANO has been chosen as preferred navigation gyrocompass by leading ROV manufacturers, service and rental companies.

iXBlue FOG   OCTANS NANO is built on iXBlue's trusted and unique ultimate-performance Fiber Optic Gyroscopes (FOG) technology: result of more than 30 years of research and development. iXBlue state-of-the-art FOG, strap-down technology, address the most demanding applications with performance from 0.1 deg/h to 0.001 deg/h. The lowest grade one, 0.1deg/h, is the threshold for a gyro for gyrocompassing: OCTANS Nano is able to find Geographical North autonomously, without any external aid (e.g. GPS/GNSS, acoustic …), in contrast to MEMS sensors, despite their performances level.

Because of iXBlue's full in house mastery of all key FOG components (optical fiber, coil winding, modulator, source and accelerometer) along with advanced digital modeling of potential environmental sensitivity, iXBlue fiber-gyroscopes are immune to temperature changes, magnetic perturbations as well as resilient to extreme shocks and vibrations.
Being a fully strap down system based on gyroscopes without any moving parts, OCTANS NANO requires no scheduled maintenance to provide the best performance during the full length of its lifetime.

Its modern design integrating state of the art technologies (Ethernet, Web GUI, high baud rate, …) allows easy installation and interfacing to most standard external sensors, vehicle control systems and industry software packages.
OCTANS NANO is designed in a single housing, embedding, iXBlue designed, sensors, electronic, algorithm and software. The need of interaction with operator is very limited, still OCTANS NANO is very versatile and easy to configure through its powerful and intuitive WEB Based Graphical User Interface accessible from any Web Browser

Due to the very high precision of its IMU, OCTANS NANO is subject to **export regulations.** See *General Information* document *(Ref.: MU-INS&AHRS-AN-007)* and *AHRS Interface Library (Ref.: MU-AHRS-AN-003))* for details.

2   PRODUCT DOCUMENTATION

OCTANS NANO belongs to the iXBlue inertial products family. The following documents provide information that will be helpful in using your product in the best possible manner:

- **OCTANS NANO Product Specification** *(Ref.: MU-OCTNANO-AN-010)* provides information about:
  - ❑ Product performance and settling time
  - ❑ Qualification standards and classification
  - ❑ Life cycle maintenance
- **OCTANS NANO Interface Control Document** *(Ref.: MU-OCTNANO-AN-011)* provides information about:
  - ❑ General interface specifications
  - ❑ Mechanical specifications
  - ❑ Electrical interface specifications
- **Inertial Products – General Information** *(Ref.: MU-INS&AHRS-AN-007)* provides information about:
  - ❑ Export Regulations
  - ❑ Warranty
  - ❑ Customer Support and iXBlue contacts
- **Inertial Products – Principles & Conventions** *(Ref.: MU-INS&AHRS-AN-003)* provides information about:
  - ❑ Abbreviations
  - ❑ Terminology
  - ❑ Behavior and operational principles
  - ❑ Geometrical conventions
- **Inertial Products – Installation Form** *(Ref.: MU-INS&AHRS-AN-004)*: this document is a link between the installation process and the configuration process. It contains blank tables to be filled in.
- **Inertial Products – Network Set-up Guide** (*Ref.: MU-INS&AHRS-AN-005*) provides information about network configuration.
- **Inertial Products, Marine applications – Web-based interface user guide** (*Ref.: MU-INSIII-AN-021)* provides information about:
  - ❑ How to perform the configuration of the product (which sensor is connected, to which port, …).
  - ❑ Operation: how to use the product.
- **AHRS – Interface Library** *(Ref.: MU-AHRS-AN-003)* provides information about all the input/output protocols that your product can use.
- **AHRS – Advanced Configuration** *(Ref.: MU-AHRS-AN-002)* provides all the configuration and monitoring commands which can be used during operation. These commands are sent directly through the repeater port.

- **Inertial Products – System Updater Tool User Guide** (*Ref.: MU-UPDTAPN-AN-001*) describes the procedure to update the OCTANS NANO firmware.
- **Inertial Products – IP Data Logger Tool User Guide** (*Ref.: MU-IPDATAPN-AN-001*) explains how to use the iXBlue data logger tool.
- **SEACON 26 PIN TI 1M Pigtail Cable - Product Description** (*Ref.: MU-PDCABLES-AN-009*): this document gives details about cable and pinout of the Seacon 26 pins Pigtail Cable.

The following *Application Note* can be useful for product installations:

- **Inertial Products – Application Note – Mechanical Integration of Inertial Systems** (*Ref.: MU-MECHAPN-AN-001*).

3 OCTANS NANO DATA

3.1 Data availability

OCTANS Nano belongs to the sensor type of equipment. As such, its aim is to measure some physical dimension, and display or broadcast its measurements.

OCTANS NANO provides the ROV control system with full navigation data:

- True North Heading
- Roll & Pitch
- Rates of turns and Accelerations (all three axis)
- Built In Test, Status data

Data output :

- Through Ethernet, or serial lines or both simultaneously
- Data flow are fully user configurable
- 60+ different output formats/messages are available to interface with navigation package and 3rd party equipment

The exhaustive list of output data and formats is detailed in the AHRS-Interface Library manual document *(Ref.: MU-AHRS-AN-003)*.

UTC/Time synchro

All data are accurately time stamped with respect to internal reference time (see below "Performance" section for accuracy details). OCTANS NANO internal clock can be synchronized with data coming from an external reference clock (i.e., GPS clock or autonomous external clock). In this case, internal reference time is synchronized with the input coming from the selected interface with appropriate protocol.

For more details on time synchronization setting refer to *Inertial Products, Marine applications – Web-based interface user guide (Ref.: MU-INSIII-AN-021)*.

3.2 External sensors

OCTANS NANO can uses external sensor data to improve its own estimates of computed data. The following external sensors can be connected to OCTANS NANO:

- Position (from manual input, GPS...)
- Speed (from manual input, VBW, VHW...)

OCTANS NANO can use position and speed sensors described above without any manual intervention, in a robust manner (no need for lever arm settings), thanks to its advanced Kalman Filter.

Alternatively, OCTANS NANO is able to operate with only a manual input position either at the start or during the navigation sequence.

For more details on:

- Electrical connection of the external sensors: refer to OCTANS NANO Interface Control Document (*Ref.: MU–OCTNANO–AN–012*)
- The configuration of the external sensors: refer to the *Inertial Products, Marine applications* – Web-based interface user guide (*Ref.: MU-INSIII-AN-021*).
- The available input protocols for external sensors: refer to *AHRS Interface Library (Ref.: MU-AHRS-AN-003).*

4 SPECIFICATIONS

4.1 Performance prerequisites

The performances listed hereafter are achieved under the following conditions (which complements the environmental conditions stated in section 6).

- Vehicle's motion does not exceed:

	Amplitude	Period (sinusoidal)
Heading	± 5°	15 s
Roll	± 25°	6 s
Pitch	± 15°	10 s

In applications where updates from external sensors are not available, OCTANS NANO, as any gyrocompass, despite the technology, requires Latitude and Velocity update.

- Position input:

When operated in standalone, the product requires a latitude position input accuracy better than 1° from real position.

- Speed input:

When operated in standalone, performance is achieved if the last received speed is better than 3 knots from real motion.

4.2 Equipment Data Dynamic Range

Heading	0° to 360°
Roll	-180° to +180°
Pitch	-90° to +90°
Roll/Pitch/heading rate	±250°/s
Geodetic Latitude	90° S to 90° N
Geodetic Longitude	180° E to 180° W
Linear Acceleration	±5 g

4.3 Navigation Data

Heading accuracy[1]
0.5° seclat (RMS)   8.7 mrad (RMS)   30 arc min seclat (RMS)
Attitude (Roll and Pitch or Vertical Reference) accuracy
0.1° (RMS)   2 mrad (RMS)   6 arc min (RMS)

For all products, with or without aiding

Dynamic stability[1]	Heading / Roll / Pitch rate accuracy: 0.0075 °/s

(1) *Seclat = 1/Cos(Latitude)*
(2) *According to the dynamics stated in the prerequisites in section 4.1.*

4.4 Input/Output

Baud rate	600 bauds to 460 kbauds
Data output rate	0.1 Hz to 200 Hz
Data input rate	Up to 5 Hz (1 Hz typical)
Time stamping accuracy	< 100 µs

	Serial (All)	Ethernet 1	Ethernet 2	Ethernet 3	Ethernet 4
Jitter	< 200 µs	< 400 µs	< 800 µs		
Fixed Latency	2.35 ms	2.95 ms	3.45 ms	3.95 ms	4.45 ms

	Input	Output	Configuration & Repeater	
Serial RS232/RS422[3]	2	2	1	
Ethernet[3]	4	5	1	
Max (Serial & Ethernet) [3]	4	5	1	
Pulse port	1	0	-	

Ethernet[3]	BASE 10/100 UDP / TCP client / TCP server / Web server
Pulse port	5 V (TTL level)
Input/ output formats	industry standards: NMEA 0183, ASCII, BINARY

(3) *All inputs and outputs are available on the Ethernet link. Output can be duplicated both on serial and Ethernet port.*

4.5   External sensors

	Available input for
POSITION (NMEA 0183)	1
SPEED (NMEA 0183)	1
UTC	1

4.6   Power supply

Power supply / consumption	24 V_{DC} (20 to 32 V) / 12 W [4]

(4)   *Typical value @ 24 V and ambient temperature. 15W over temperature and established voltage range*

4.7   Mechanical

For full details on interfaces (mechanical drawings, connectors pinout etc.), refer to OCTANS NANO Interface Control Document *(Ref.: MU-OCTANSUB-AN-002).*

Dimensions (Ø x h)	⌀178 mm x 237[5] mm (7.01 x 9.25 in)
Weight (Air / Water)	9.5 kg / 5 kg (20.94 / 11.02 lb)
Depth rating	4,000 m
Construction	Titanium
Connector	Seacon MINM-FCR-26#22

(5)   *Height without connector. Add 29 mm for the overall height*

4.8   Export

At the date of release of this "Product Specification", OCTANS NANO is:

- Free of Export control from France for a majority of countries,
- Free of ITAR components
- "ITAR Free" in regard to USA applicable laws and regulation Departement of State regulation, and controlled by USA Department of Commerce.

Note: OCTANS NANO HS/Commodity Code is 9014 8000 0000X.

Please contact iXBlue to get details on export conditions and license availability.

	Limitations
Rotation rate resolution[6][7]	3.6°/h
Acceleration resolution[6][7]	1 mg
Heading, Roll, Pitch resolution	0.1°
Acceleration saturation	± 5 g
Rotation rate saturation	250°/s
Post-processing data output	Available

(6)   Additional export restrictions may apply regarding the availability of raw IMU data (set to 0 in output telegrams).

(7)   Full resolution IMU data available with IMU option.

5   SETTLING TIME

5.1   Power up

Power up is automatic, as soon as current is applied to the system.

5.2   Restart or Power Down

Equipment can be restarted either through the Web MMI, in the maintenance menu or sending a start command. To power down the equipment, you need to disconnect it from power source.

5.3   Initialization: Alignment Phase

The system must be initialized before it will provide fully accurate information.
This initialization is requireds to input external sensor data, during several phases. Alternatively, manual setting up of position and speed is possible..

5.3.1   COARSE ALIGNMENT

"Coarse alignment" phase is the first step of the alignment of the product. The algorithm is seeking for gravity and north. The "Coarse alignment" can be performed at quay or at sea with GPS input but on DP. Refer to Principle & Conventions (Ref.: MU-INS&AHRS-AN-003) for further detail on the "coarse alignment" phase.

5.3.2   FINE ALIGNMENT

After the coarse alignment phase, OCTANS NANO is ready for navigation (free to move). The Kalman filter computes and estimates attitude with optimal accuracy.
OCTANS NANO switches to the "fine alignment" phase to get full accuracy on computed data by estimating the residual biases of accelerometers and gyroscopes. Refer to *Principle & Conventions (Ref.: MU-INS&AHRS-AN-003)* for further details on the fine alignment phase.

	Static or at sea
Data availability	5 min
Heading 0,5° seclat RMS 30 arc min seclat RMS	15 min

6 QUALIFICATIONS

Except where specifically stated, OCTANS NANO meets or exceeds the environmental conditions specified hereafter.

Temperature		
Operating	ISO 8728:2014(E), ISO1638:2014(E)	-20°C to +55°C
Transport and Storage	-40 °C to + 80 °C	
Vibration		
Vibration (Operational)	MIL-STD-167-1A type 1	
Vibration (Survival)	MIL-STD-810G, Figure 514.6E-1. Category 24	7.7 g rms 20-2000 Hz, 1 h/axis
Shock		
Shocks	IEC 60068-2-27: SURVIVAL : 30 g, 18 ms, terminal saw tooth OPERATION : 5 g, 11 ms terminal saw tooth	
Magnetic Field		
Operating	1 Gauss	
Water tightness		
Operation	4,000m (NFX 10-812 class B)	
Electrical insulation		
All lines to chassis	100 Mohms @250V	

7 LIFE CYCLE

7.1 Packaging, Handling, Storage, Transportation requirements

During storage and transportation, OCTANS NANO should be kept locked in its transportation case.

7.2 Auto-calibration

At each start up, and continuously while aided, OCTANS NANO is calibrating its internal gyroscopes and accelerometer sensors using external sensors information and its advanced Kalman Filter. Therefore there is no need to recalibrate the system periodically.

7.3 Built-in test

OCTANS NANO includes a Continuous Built-In Test (CBIT) that covers internal sensor status verification, system status and algorithm status. The Interface Library document details the complete list of parameters that are monitored. Refer to *AHRS-Interface Library (Ref.: MU-AHRS-AN-003)* for further detail.

7.4 Reliability & maintainability

Thanks to the technology used in its design, OCTANS NANO is a fully strapdown / solid-state equipment. It does not use any gas filled cavity that could leak nor any moving mechanical part that would wear out.

As a consequence, OCTANS NANO does not require any kind of preventive maintenance. The OCTANS NANO does not have any life limited parts and as such, OCTANS NANO has no predicted life limitation.

The entire OCTANS NANO is the Line Replacement Unit (LRU).

MTBF		
Operational	Based on in-the-field repair statistics	100,000 Hours

7.5 End-of-life product management

When the product is at the end of its life, it must be returned to iXBlue where it will be oriented to a treatment facility appropriated to WEEE.