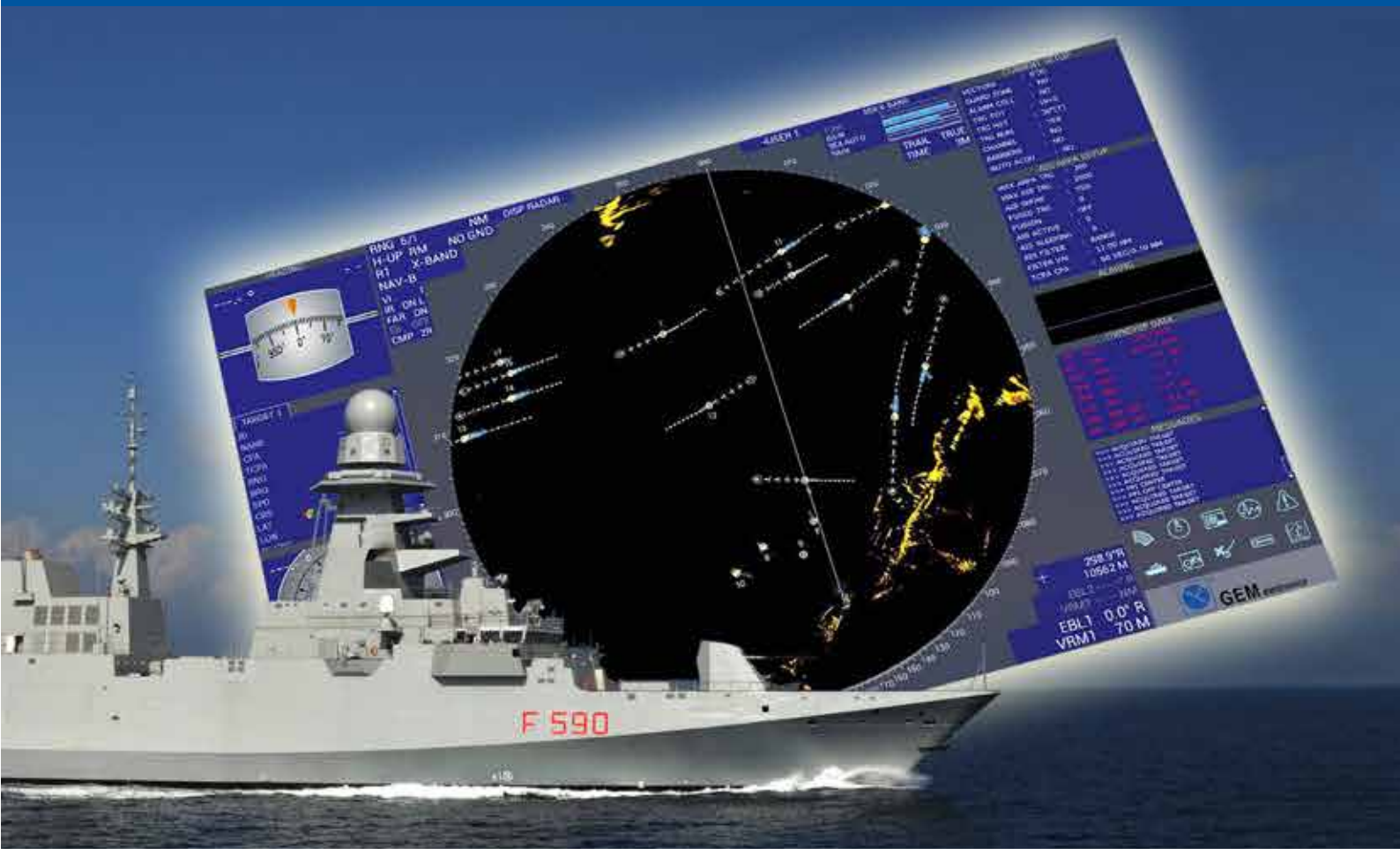
GEM elettronica

## X-BAND FULLY SOLID STATE

# SeaEagle-200N

UNIQUE INNOVATIVE DIGITAL

## NAVIGATION RADAR




Military & Defence

www.gemrad.com

**The Sea Eagle-200N is a new navigation radar of modern design based on Solid State Power Amplifier (SSPA) and digital technology. Suitable for use on Naval Units of any size and type, for missions that require a system with high operational performance and high reliability of operation.**
**The radar transmits in the X-band allocated to maritime radars and meets the requirements related to the occupation of the electromagnetic spectrum described in the ITU-R recommendations.**
**Transmission is available immediately after power up.**

## IMPROVED SAFETY AND SECURITY

Sea Eagle-200N can be considered as a family of radar designed with the strictest quality standards which uses the most advanced digital technologies able to ensure an high level of detection of small naval targets and excellent safety of the ship's conduct. It is fully compatible with the IMO resolution MSC.192 (79) and the related international standard IEC 62388 ed. 2. The radar system provides performance of Navigation, Surveillance and Control.

## INCREASED CAPACITY

The Sea Eagle-200N provides an high level of detection and automatic tracking of targets, with an high resolution and discrimination capacity, using a compact and light antenna. The radar employs a new generation of high performance coherent transmitter-receiver system, based on the frequency modulated pulse compression technique.

## OPEN ARCHITECTURE

The radar system has an open architecture that allows supporting different levels of integration when interfaced with the on-board system. It can meet various mission requirements through serial / analog and Ethernet interfaces.

## VERY HIGH RELIABILITY AND MAINTAINABILITY

The technological solutions adopted and the high quality of the components used guarantee the Sea Eagle-200N high reliability and long service life, low maintenance and low life cycle cost. The radar has been designed and built to operate reliably 24 hours operation all year around, with full operational performance even in the most adverse marine environmental conditions. An automatic test - BITE device and software facilitate an easy and efficient maintenance.

## CAPABILITY FOR SELF-DEFENCE

The system is able to interface with external self-defence systems, or with the Command & Control for the target designation function. The target designation message, containing the position and the kinematic data, can be sent by ship bus or by a point-to-point connection of the RS422 type.

## INTERFACE WITH ELECTRO-OPTICAL SYSTEMS

The system is able to interface, as an option, with external systems of vision (Daylight Camera, IR Camera) for the presentation in a special window, on the operator console, of the video coming from such systems.

## CONTROL CAPABILITIES

Sea Eagle-200N incorporates an operating system that provides remote control and monitoring of radar operation in the ships Command & Control room via communication link.

## INTERFACE WITH AIS SYSTEM

The system is also able to fully interface the AIS sensors, for a correct representation of the "maritime picture", consisting of cooperating targets, civil traffic and possible asymmetric threats. The message of the AIS apparatus can be received by ship bus or by a point-to-point connection of the RS422 type.

## PERFORMANCE HIGHLIGHTS

- High level of targets detection, with a high resolution and discrimination capacity, using a compact and light antenna;
- Automatic detection of small and large naval targets with Extraction of plot and tracking with automatic start of Track While Scan (TWS);
- Extensive multifunctional capacity of the display with: electronic charts (optional) and data overlay support; AIS targets fusion and information;
- Capability for easy integration with C4I assets;
- Local and remote operation;
- Innovative Human Machine Interface (HMI) with modern user-friendly windows based operation;
- Very High resolution LCD TFT Display;
- Easy installation with minimum amount of units and connecting waveguide and cables;
- High reliability with extensive automatic BITE;
- Improved Maintainability;
- Extensive growth capabilities;
- Compact, light weight and low power consumption system.

## ADOPTED TECHNOLOGIES

**GEM elettronica UNIQUE AND REVOLUTIONARY DESIGN OF ANTENNA GROUP WITH FULL SOLID STATE TRANSMITTER/RECEIVER RECOGNIZED FOR VERY HIGH RELIABILITY**

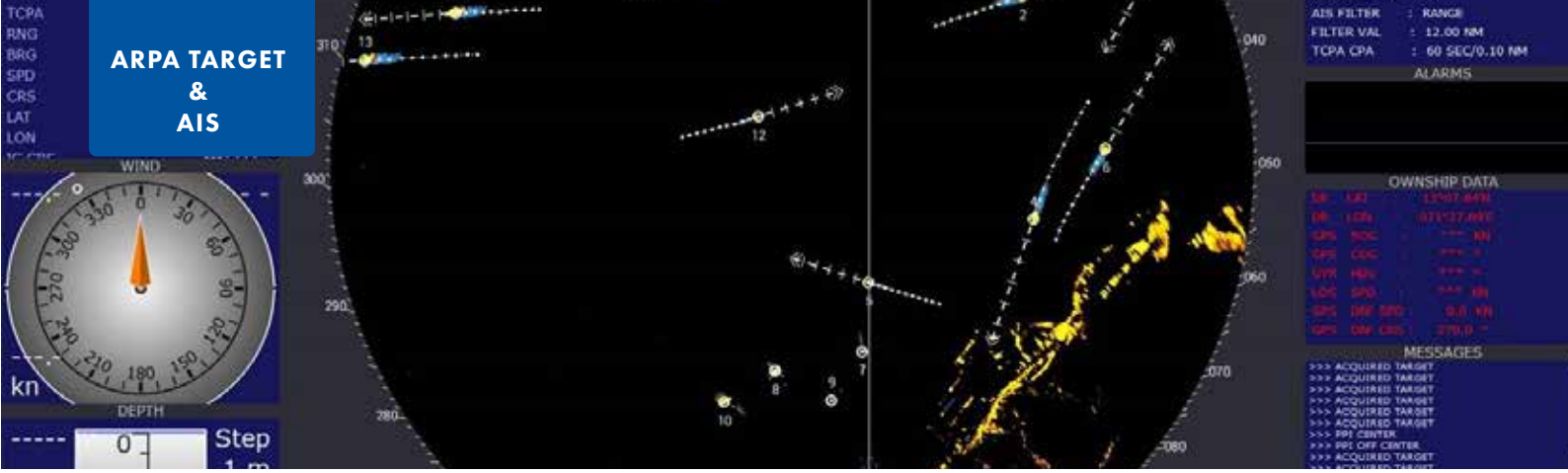
Radio Board Module

Radar Signal Processor

SSPA Module

## TRANSMISSION / RECEPTION

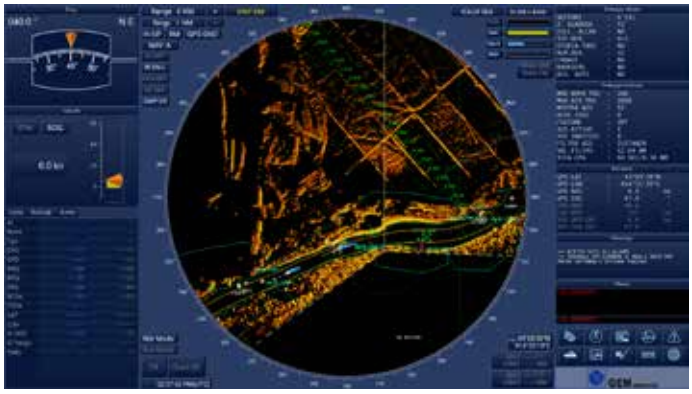
- Transmission through the use of a new generation of compact and light Solid State Amplifier (SSPA) module designed in house;
- Frequency Modulated Pulse Compression;
- Advanced Coherent Processing;
- Pulse Doppler Filtering;
- State-of-the-art digital signal processing and hardware reduction through the use of the latest generation of FPGA and DSP components;
- Radar features are fully configurable and reprogrammable by software (Software Defined Radar).




## Sea Eagle-200N performs advanced detection and tracking by a complete implementation of different processing technology:

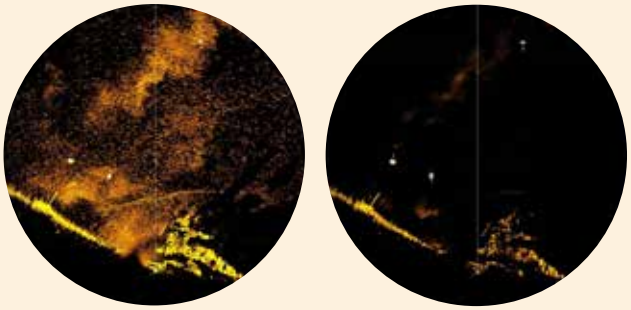
- Pulsed transmission with linear and non-linear chirp (frequency modulation);
- High range resolution and advanced coherent processing;
- Sampling of signals with high dynamic range A/D conversion;
- Doppler filtering for enhanced Signal/Noise ratio (subclutter visibility), to detect very small targets;
- Automatic high resolution CFAR processing (not Gaussian);
- Adaptive STC, pulse-to-pulse correlation; scan-to-scan correlation, with noise and clutter interference suppression;
- PRF stagger control to eliminate interference from other radar sources;
- Dimension plot filters;
- Extraction of plot and tracking with automatic start of Track While Scan (TWS);
- Automatic tracking of surface targets with ARPA functions with high precision performance in compliance with IMO regulations.

## DISPLAY UNIT



## SEAEAGLE SIGNAL PROCESSING ANTI-CLUTTER FEATURES

### ADAPTIVE CLUTTER REJECTION IN EXTREME RAIN AND SEA CONDITION



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### SCAN TO SCAN CORRELATION

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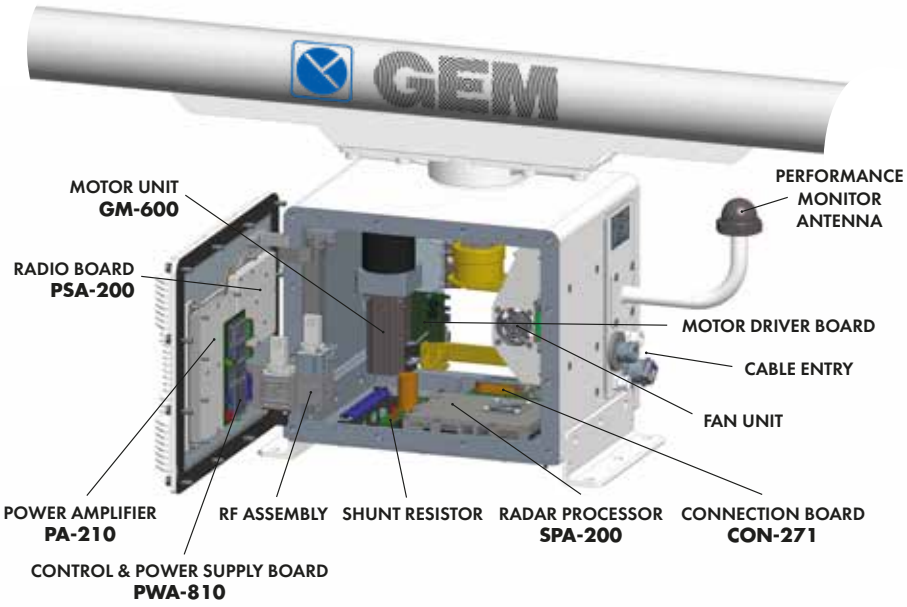
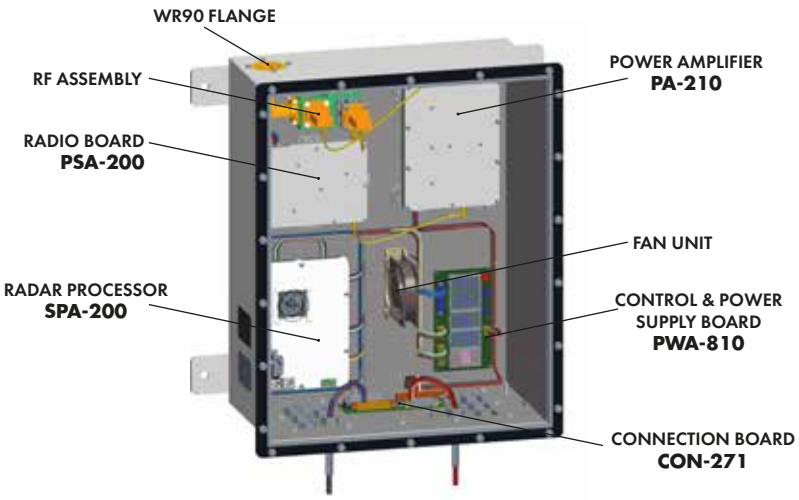
# SeaEagle-200N

## ANTENNA GROUP FOR UPMAST VERSION



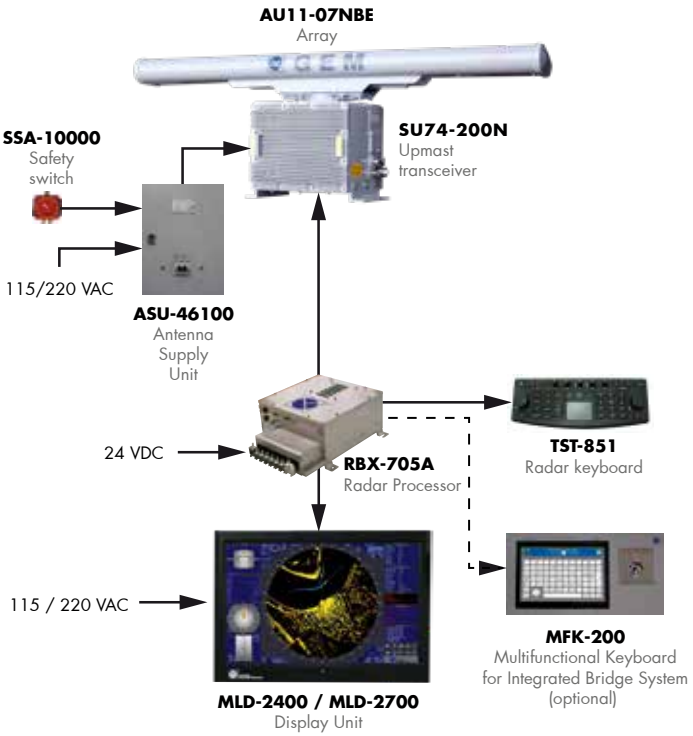

## ANTENNA GROUP FOR DOWNMAST VERSION

## TRANSMITTER-RECEIVER FOR DOWNMAST VERSION

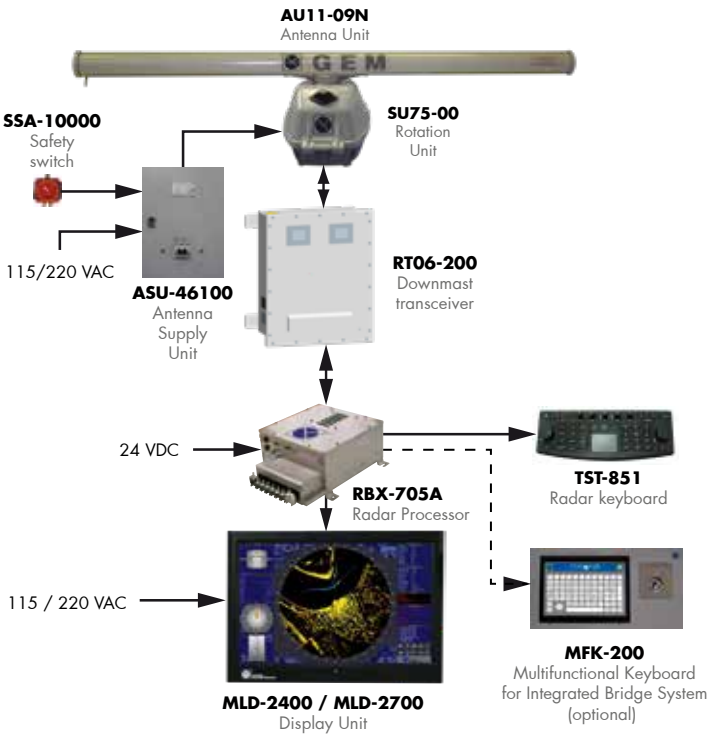



## RADAR PROCESSOR

## UPMAST VERSION




## DOWNMAST VERSION




## EQUIPMENT CONFIGURATION

| Item | Upmast version | | | Downmast version | | |
|---|---|---|---|---|---|---|
| Antenna Group | ASX-0690 | ASX-0790 | ASX-0990 | ASX-0680 | ASX-0780 | ASX-0980 |
| Antenna unit | AU11-06NBE | AU11-07NBE | AU11-09NBE | AU11-06NBE | AU11-07NBE | AU11-09NBE |
| Rotation unit | SU74-200N | | | SU75-00 | | |
| Transceiver | Embedded in antenna group | | | RT06-200 | | |
| Antenna supply | ASU-46100 | | | | | |
| Safety switch | SSA-10000 | | | | | |
| Radar processor | RBX-705A | | | | | |
| Display | MLD-2400 / MLD-2700 desktop or IBS or MLSA-2400 / MLSA-2700 Stand alone consoles | | | | | |
| Keyboard | TST-851 | | | | | |
| Trackball | T550B | | | | | |

## OPTIONAL FEATURES

- ***Dual system configuration***

The Sea Eagle-200N radar is available on request in the "Dual" X-Band configuration or combined with the S-Band radar Sea Eagle-200S solid-state model (in this system an ethernet switch unit is required). In case the Transceiver in operation has a failure, the processing software switch-over to Transceiver in standby automatically.

- ***Oil Spill Detection and Wave Height***

The Sea Eagle-200N radar, when equipped with the optional Model OSD-WH (Oil Spill Detection) processing unit, can detect areas contaminated by oil spills on the sea surface. The OSD operates in parallel with the radar system constructing a 2D scenario without affecting its operation in any way.

- ***DEICING System***

In areas where extremely low temperatures are recorded, it is recommended to use the deicing system that is activated remotely. The shutdown is automatic and makes the radar system operating ready to use in a very short time.

- ***GEM elettronica specific software applications***

GEM elettronica has developed specific software for Navigation, Long Range Surface Surveillance, Search and Rescue applications, Integrated Bridge Software and Command & Control Software.

## ANTENNA GROUP UNIT

Type: Slotted waveguide array

Beam width and sidelobe attenuation

| Radiation type | X-Band | | | S-Band |
|---|---|---|---|---|
| Length | 6 ft | 7.5 ft | 9 ft | 12 ft |
| Horizontal beam width | ≤1.25° | ≤1.05° | ≤0.85° | 1.8° |
| Vertical beam width | 23° | 23° | 23° | 25° |
| Sidelobe within ± 10° | ≤-27 dB | ≤-27 dB | ≤-27 dB | ≤-24 dB |
| Sidelobe outside ± 10° | ≤-30 dB | ≤-30 dB | ≤-30 dB | ≤-30 dB |
| Gain | ≥ 29 dB | ≥ 30 dB | ≥ 31 dB | ≥ 32 dB |

| | |
|---|---|
| Polarization | Horizontal |
| VSWR | ≤ 1.2:1 |
| Rotation | 16 rpm to 42 rpm (for high speed craft) |
| Wind load | Operational: 100 kn relative<br>Survival: 120 kn relative |
| Performance Monitor | Embedded in Antenna Group |
| Antenna Group Color | RAL 9003 White - RAL 7042 Grey |

## TRANSCEIVER UNIT

| | |
|---|---|
| RTX Type | Solid State Power Amplifier (SSPA) / Coherent two-channel receiver Superethero-dyne / Digital configuration with functions defined by the software (Software Defined Radar) / Pulse compression techniques |
| Output Power | 200W (equivalent to magnetron radar 25 Kw) |
| TX Frequency | X-Band from 9300 to 9500 MHz |
| Pulse repetition rate (PRR) | from 350 to 5000 Hz |
| Pulse width | from 0.05 µs up to 93 µs |
| Sector blanking | Available |
| Receiver | Coherent, two channel 16 bits sampling |
| Dynamic range | ≥ 130 dB (with RF STC) |
| Built-In Test Equipment (BITE) | Fully integrated in all modules, covering also RF parts |
| Reliability | Up to 160,000 hours (MTBF) |

## POWER SUPPLY

| | |
|---|---|
| Antenna Supply Unit (powering Antenna Group and Transceiver) | single phase 88 – 264 VAC, 47-63 Hz, 800W max |
| Radar Processor (powering keyboard and trackball unit) | 24 Vdc ± 10%, 100W max |
| Display unit | single phase 88 – 264 VAC, 47-63 Hz, 50 W max |

## DISPLAY UNIT

| | | |
|---|---|---|
| Type | color TFT LCD | |
| Diagonal size | 24" | 27" |
| Format | 16/9 | |
| Presentation mode | PPI (Plan Position Indicator) color raster scan with day / night palettes, user friendly MMI and symbols and colors as per IMO/IHO recommendations | |
| PPI effective diameter | ≥ 270 mm | ≥ 320 mm |
| Display resolution | 1920 x 1080 pixel | |
| Brilliance | 300 cd/m² | |
| Contrast ratio | 3000:1 | 1000:1 |
| Viewing angle | 89° in any direction (typical) | |
| Remote visibility | about 1.07 meters | about 1.08 meters |

## ENVIRONMENTAL CONDITIONS

Sea Eagle-200N is designed to operate in a reliable and continuous mode, with full operative performances, in the environmental conditions specified in the following table:

| Unit | Operating temperature | Protection grade |
|---|---|---|
| Antenna Group* | from - 25°C a to 55°C (storage from -28°C to +70°C) | IP66 |
| RTX | from -15°C to + 55°C (storage from -15°C to +70°C) | IP20 |
| Processor | | IP22 |
| Display unit | | |

| | |
|---|---|
| Relative Humidity | Sea Eagle is designed to maintain the expected reliability when it is exposed to a relative humidity of 95% to + 40°C |
| Salt Fog | IEC 60945 8.12 |
| Vibration | IEC 60945 8.7 |
| Shock | IEC-62388 (antenna only) |
| EMC/EMI | IEC 60945 9 & 10 |

** With optional anti-icing device (De-icer) extended temperature: from - 40°C to + 55°C*

| | |
|---|---|
| De-Icer | On: when temperature goes down to 1°C<br>Off: when temperature goes up to +3°C |

## RADAR PROCESSOR UNIT - MULTIFUNCTION

| | |
|---|---|
| Radar Presentation Features | Radar Only Operation – (Chart Radar Optional) |
| Presentation of own ship data | Symbol, position of own ship in latitude / longitude, speed and course |
| Minimum range | Better than 30 mt on 10 m² target (short range) |
| Range discrimination | Better than 30 mt on 10 m² target (short range) |
| Range Accuracy | 1% of the maximum range of the scale in use or 10 mt, whichever is the greater |
| Azimuth discrimination | Better than 2.5° (6' antenna) / 2.3° (7.5') / 2.0° (9') |
| Bearing Accuracy | ± 0.5° |
| Heating time | Not necessary |
| Indicator/Marks | Heading mark, North mark, bearing mark, Cursor, Range rings, VRM, EBL, Target trail, Acquisition zone |
| Presentation mode | Relative mode: HEAD UP/NORTH UP/ COURSE UP<br>True mode: NORTH UP/COURSE UP |

Range Scale

| Range (NM) | 0.0625 | 0.125 | 0.25 | 0.5 | 0.75 | 1.5 | 3 | 6 | 12 | 24 | 48 | 96 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RI (NM) | 0.03125 | 0.0625 | 0.125 | 0.125 | 0.125 | 0.25 | 0.5 | 1 | 2 | 4 | 8 | 16 |
| Number of rings | 2 | | | 4 | 6 | | | | | | | |

### ARPA functions

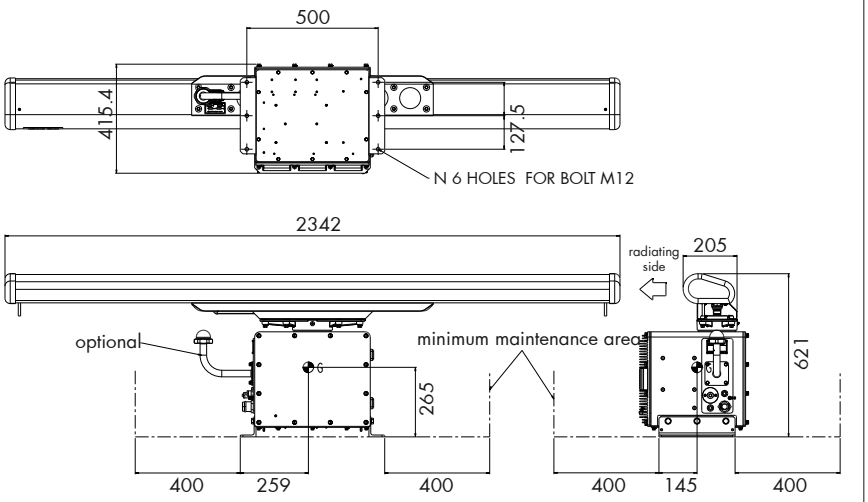
| | |
|---|---|
| | Tracking targets that maneuver rapidly at speeds up to 70 knots |
| N.° Target tracking and plots | Up to 250 targets and up to 1000 plots |
| Target initialization | Automatic or manual acquisition |
| Acquisition and tracking range | Up to 32 Nm of all acquired targets |
| Vector mode | True vector / Relative Vector |
| Target data refresh rate | One antenna scan |
| Acquisition area (Guard Zone) | 2 zone |
| Past Position Display | 8 points in the interval of up to 5 minutes |
| Parameter of Safe limit | Close Point of Approach (CPA) from 0.1 to 9.9 n.m. / Time of CPA (TPCA) from 1 to 90 minutes |
| Alarm indication | Mark on the display with Visible/Audible alarm |
| Trial Maneuver | Included |

### AIS function

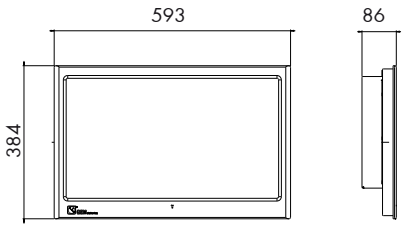
| | |
|---|---|
| AIS number | Up to 2000 AIS tracks |
| AIS information | Standard information: Ship name / Call sign / MMSI / COG / SOG / CPA / TCPA - Detail Information: Bearing/ Distance / Heading / Rate of Turn / Ship Position |
| AIS vector | Off or True / Relative variable from 1 to 120 minutes |
| Dangerous target detection parameter | CPA / TCPA |
| Radar map | 30.000 points |
| Output tracks to the on-board systems | Track time stamp (Universal Time Coordinate – UTC) / Label track / Status track / Track position (distance, BEARING NORTH/TRUE / World Geodetic Spherical model (WGS) 84 Track Latitude / WGS84 Track Longitude / Track speed / Track plot / Track speed / Track / Track quality according to STANAG 5516 / Associated plot. |
| Interfaces | 1) Physical interfaces:<br>Serial: 9 ports (IEC61162 - 2:2 ports, IEC61162 - 1:7 ports) / External alarm: 5 ports (3 60V 0.5, 2 250V 2A) / DVI output: 2 ports (DVI - D) / External LAN: 3 ports (10/100/1000 Mbit / s for radar control, interfaces IEC61162 - 450 or for remote setup, monitoring and control) / Impulsive input: 2 ports (TTL configurable, contact closure, 24V voltage) / Analog input: 3 ports: PILOT, ROT, RSA /<br>Output for ECDIS *: 1 port ACP, Trigger, Video with optional external module / Display: 2 ports (analog control brightness, RS232) / Keyboard: 1 port (RS232, USB connection) / Trackball: 1 USB / USB port: 4 ports (2 external, 2 reserved internal use)<br>*Option<br>2) NMEA sentences: (IEC61162 – 1/2, IEC61162 – 450)<br>Input: Speed: VHW, VBW, VLW / Gyro: HDG, HDT, HDM, THS, XDR / GPS: RMC, GLL, GGA, VTG, ZDA, DTM, GNS / Alarm: ALR / Echo: DBT, DPT, DIV / Wind: MWV, MWD / Bam: ACN, HBT / Pilot: ALA, APA, APB, ZDL / Rot: ROT /RSA: RSA<br>Output: TTM / TLL / GPT / TLB / TTD |
| Remote Control Capabilities | Least Fully-Remote and Local Control of Sea Eagle including at, but not only:<br>• Message on the real status of the Radar system, such as transmission On - Off / The real pulse width in use and the frequency of repetition of the pulses / levels of power transmitted in the interdicted sectors (blanked Sector) etc .../<br>• Health status output messages of all modules and key components (eg RAM), extended built-in test function that also covers components and radiofrequency devices.<br>• Using the Serial Port connection or LAN: Controlling the operating mode, such as Enable Transmission / Pulse-Width and Pulse Repetition<br>• Frequency / Offset of the sector with Peak Power Selection Transmitted in Each Sector / Track Inhibition Areas / Target Manual / Automatic Acquisition and Tracking, Radar Processing Parameters.<br>• Availability of analog (with optional external module) and digital Raw radar video / Capacity control functions of Log Ports and / or LAN Links |

# SeaEagle-200N

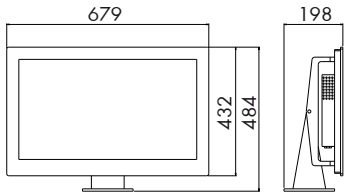
## X-BAND FULLY SOLID-STATE NAVIGATION RADAR



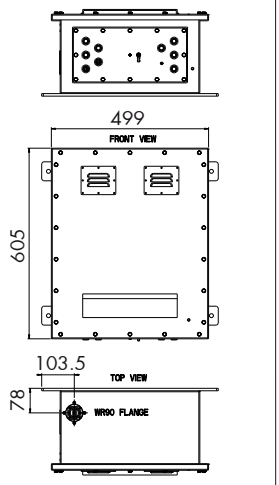

**ASX-0790** Kg. 74



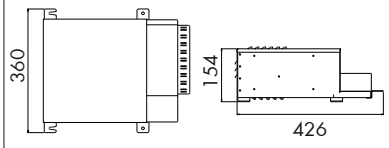

**MLD-2400** for IBS



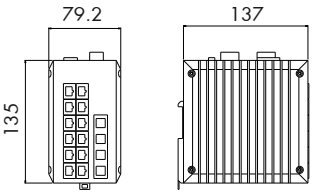

**MLD-2700** Desktop mounting



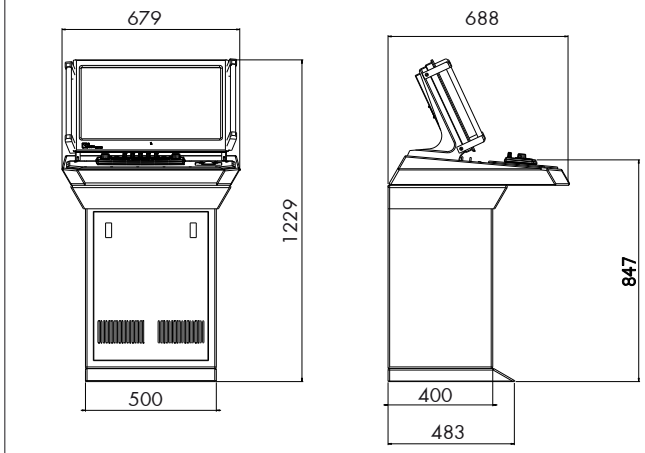

**RT06-200** Kg. 30



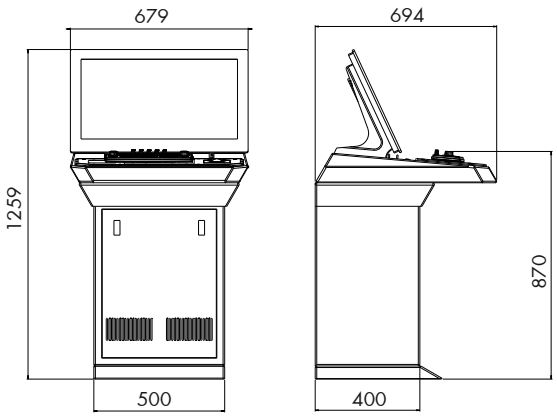

**RBX-705**




**Switch Ethernet 16 p.** Kg. 1.44

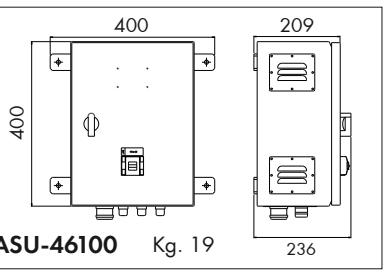



**MLSA-2400** (CONSOLE 24")

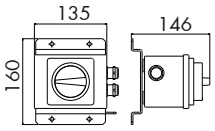



**MLSA-2700** (CONSOLE 27")

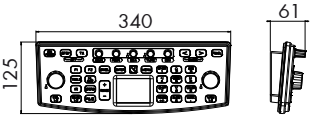
**STAND ALONE CONSOLE**



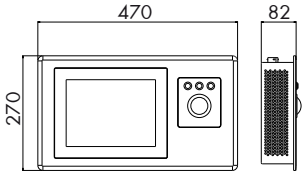

**ASU-46100** Kg. 19




**SSA-10000** Kg. 1.5




**TST-851** Kg. 5




**MFK-200** *(optional)* Kg. 7


GEM elettronica

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