X-BAND FULL SOLID STATE

SeaEagle-200N

GEM
elettronica

UNIQUE INNOVATIVE DIGITAL

NAVIGATION RADAR
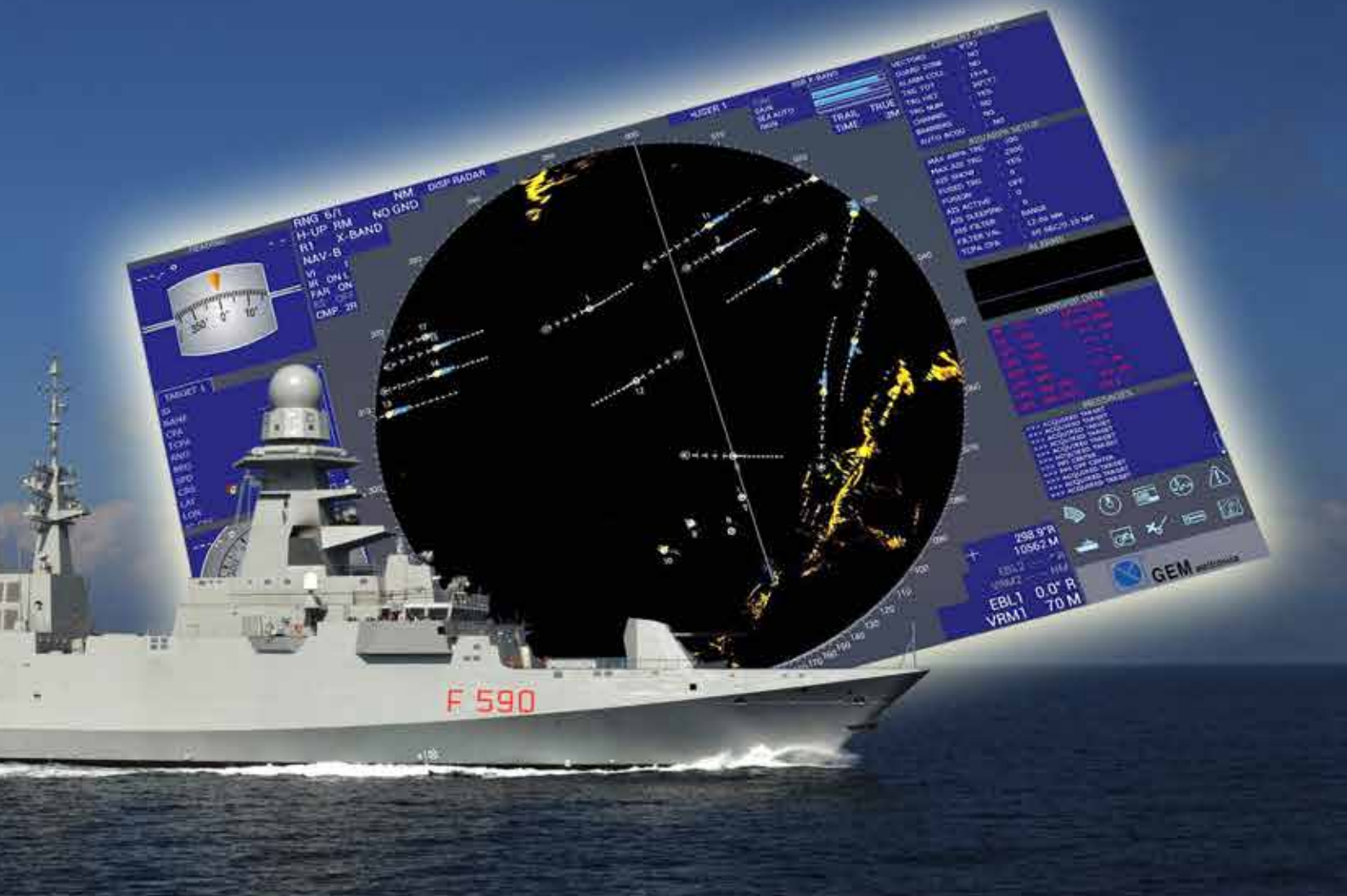
SeaEagle-200N

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 WAIS SYSTEM

The system is also able to fully interface the WAIS sensors, for a correct representation of the "maritime picture", consisting of cooperating targets, civil traffic and possible asymmetric threats. The message of the WAIS 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);

- LPI waveform configuration able to reduce drammatically the probability of interception by potential hostiles ESM systems (optional);

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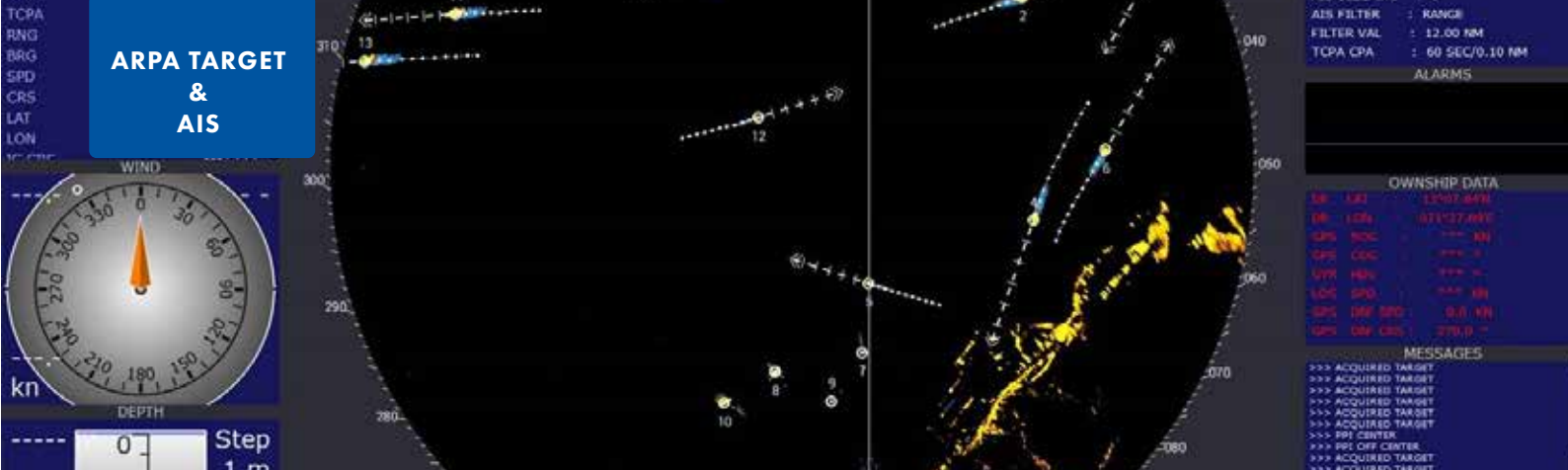
Sea Eagle-200N performs advanced detection and tracking by a complete implementation of different processing technology:

- 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
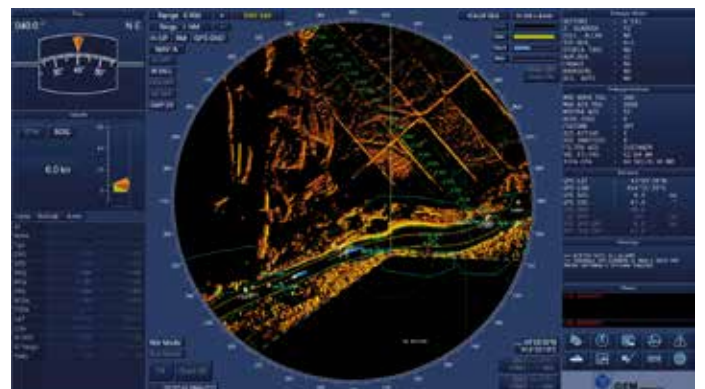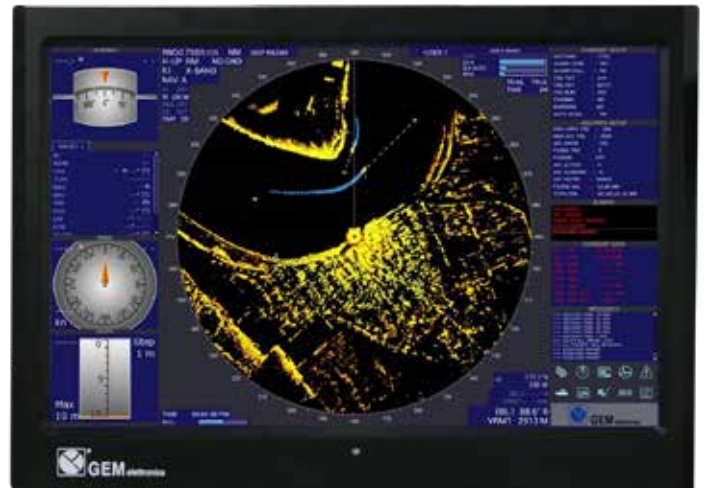
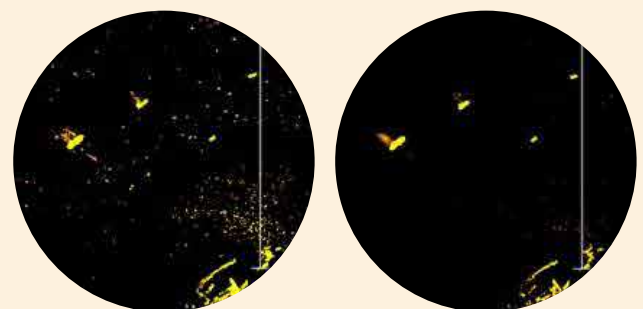## SEAEAGLE SIGNAL PROCESSING ANTI-CLUTTER FEATURES

ADAPTIVE CLUTTER REJECTION IN EXTREME RAIN AND SEA CONDITION
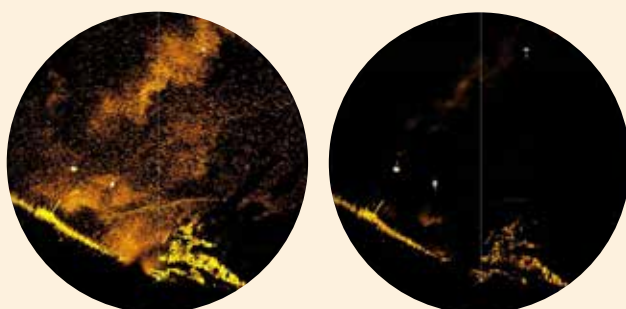
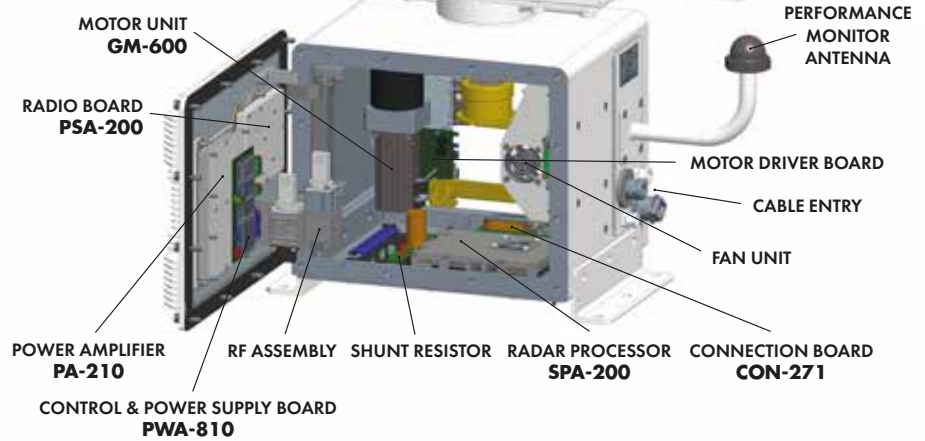NOT FILTERED   FILTERED
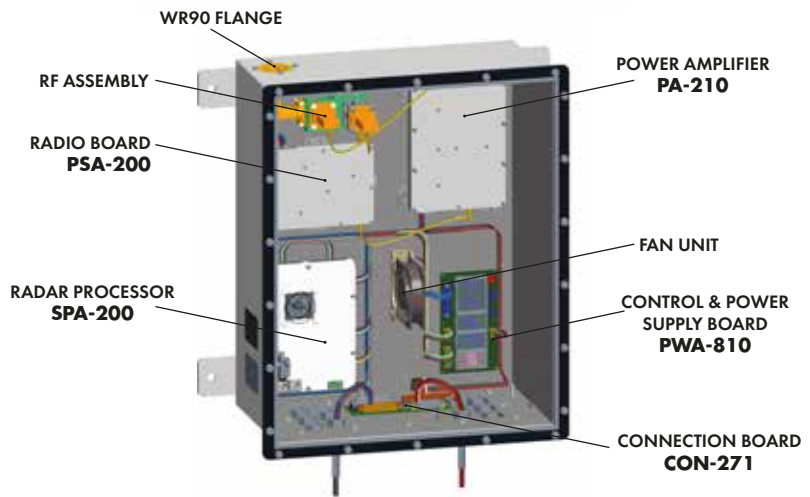
SCAN TO SCAN CORRELATION

NOT FILTERED   FILTERED

4

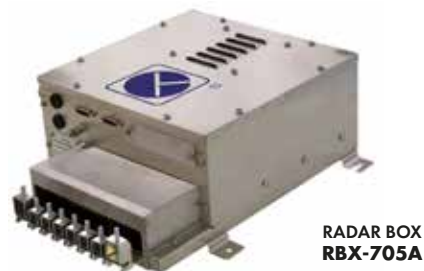**SeaEagle-200N**

ANTENNA GROUP FOR UPMAST VERSION

MOTOR UNIT **GM-600**

RADIO BOARD **PSA-200**

PERFORMANCE MONITOR ANTENNA

MOTOR DRIVER BOARD

CABLE ENTRY

FAN UNIT

POWER AMPLIFIER **PA-210**

RF ASSEMBLY

SHUNT RESISTOR

RADAR PROCESSOR **SPA-200**

CONNECTION BOARD **CON-271**

CONTROL & POWER SUPPLY BOARD **PWA-810**

ANTENNA GROUP FOR DOWNMAST VERSION

MOTOR DRIVER BOARD

MOTOR UNIT

CONNECTION BOARDS

PERFORMANCE MONITOR

RETENTION ROD

FLEXIBLE WAVEGUIDE

CAPTIVE SCREW

CABLE GLANDS

WR90 FLANGE

TRANSMITTER-RECEIVER FOR DOWNMAST VERSION

WR90 FLANGE

RF ASSEMBLY

POWER AMPLIFIER **PA-210**

RADIO BOARD **PSA-200**

FAN UNIT

RADAR PROCESSOR **SPA-200**

CONTROL & POWER SUPPLY BOARD **PWA-810**

CONNECTION BOARD **CON-271**

RADAR PROCESSOR

RADAR BOX **RBX-705A**

UPMAST VERSION

AU11-07NBE
Array

SSA-10000
Safety switch

SU74-200N
Upmast transceiver

115/220 VAC

ASU-46100
Antenna Supply Unit

24 VDC

RBX-705A
Radar Processor

TST-851
Radar keyboard

115 / 220 VAC

MLD-2400 / MLD-2700
Display Unit

MFK-200
Multifunctional Keyboard for Integrated Bridge System (optional)

DOWNMAST VERSION

AU11-09N
Antenna Unit

SSA-10000
Safety switch

SU75-00
Rotation Unit

115/220 VAC

ASU-46100
Antenna Supply Unit

RT06-200
Downmast transceiver

24 VDC

RBX-705A
Radar Processor

TST-851
Radar keyboard

115 / 220 VAC

MLD-2400 / MLD-2700
Display Unit

MFK-200
Multifunctional Keyboard for Integrated Bridge System (optional)

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 0SD-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.

• LPI Configuration* (Low Probability of Intercept)

LPI configuration is able to reduce dramatically the probability of interception by potential hostiles systems while ensuring, at the same time, the capability of target detection. The transmitter, thanks to its low power, wide bandwidth, frequency variability, and dedicated processing algorithms, makes interception by radar warning and electronic intelligence receivers very difficult.

For the LPI version of the Sea Eagle-200N radar an export authorization is required by the Italian Authorities

• 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
     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 Superetherodyne / 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		
Display unit		IP22

Relative Humidity   Sea Eagle is designed to maintain the expected reliability when it is exposed to a relative humidity of 95% to + 40°C
Vibration   IEC 60945 Ed.4
Shock   IEC-62388 (17.3.2) (antenna only)
*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
     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
     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.
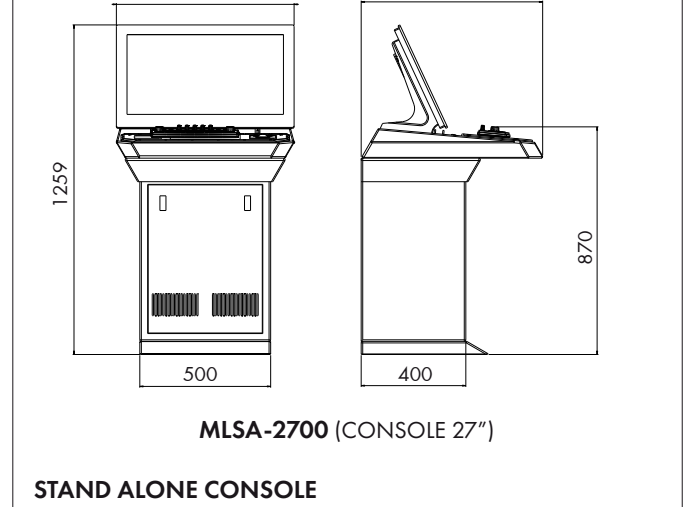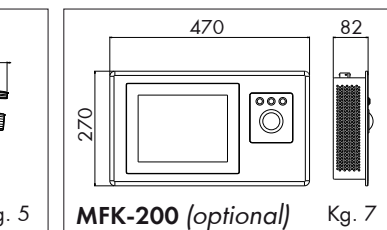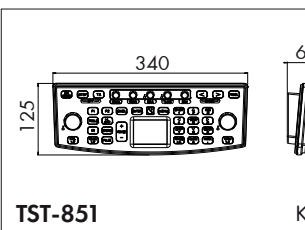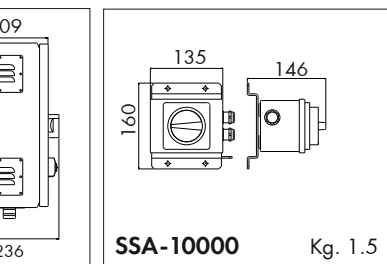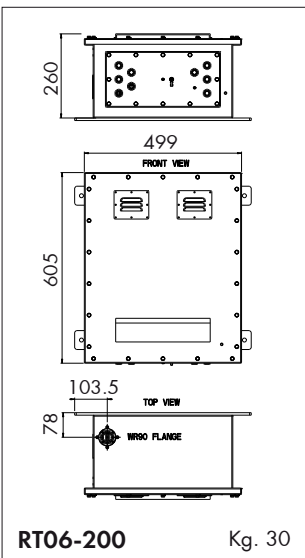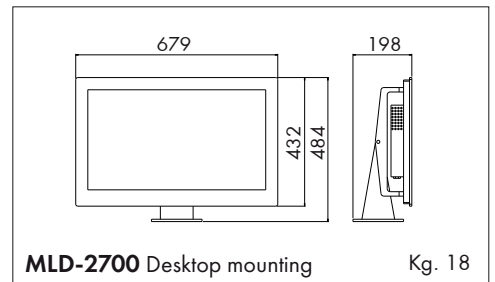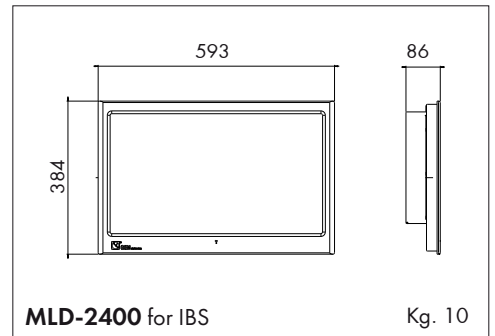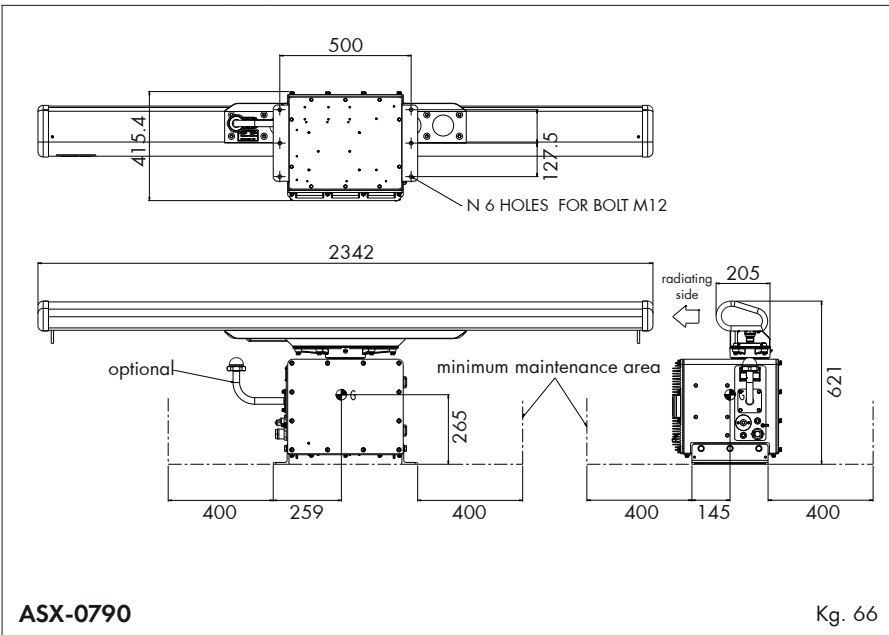
Interfaces   1) Physical interfaces:
Serial: 9 ports (IEC61162 - 2:2 ports, IEC61162 - 1:7 ports) / External alarm: 5 ports (3 60V 0.5, 2 250V 2A) / DVI output: 2 ports (DVI - D) / External LAN: 3 ports (10/100/1000 Mbit / s for radar control, interfaces IEC61162 - 450 or for remote setup, monitoring and control) / Impulsive input: 2 ports (TTL configurable, contact closure, 24V voltage) / Analog input: 3 ports: PILOT, ROT, RSA /
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)
*Option
2) NMEA sentences: (IEC61162 – 1/2, IEC61162 – 450)
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
Output: TTM / TLL / GPT / TLB / TTD

Remote Control Capabilities   Least Fully-Remote and Local Control of Sea Eagle including at, but not only:
  • 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 .../
  • Health status output messages of all modules and key components (eg RAM), extended built-in test function that also covers components and radiofrequency devices.
  • Using the Serial Port connection or LAN: Controlling the operating mode, such as Enable Transmission / Pulse-Width and Pulse Repetition
  • 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.
  • Availability of analog (with optional external module) and digital Raw radar video / Capacity control functions of Log Ports and / or LAN Links

ASX-0790 Kg. 66

N 6 HOLES FOR BOLT M12

radiating side

optional

minimum maintenance area

MLD-2400 for IBS Kg. 10

MLD-2700 Desktop mounting Kg. 18

RT06-200 Kg. 30

FRONT VIEW

TOP VIEW

WR90 FLANGE

RBX-705 Kg. 7

Switch Ethernet 16 p. Kg. 1.4

MLSA-2400 (CONSOLE 24")

ASU-46100 Kg. 19

SSA-10000 Kg. 1.5

MLSA-2700 (CONSOLE 27")

TST-851 Kg. 5

MFK-200 *(optional)* Kg. 7

STAND ALONE CONSOLE
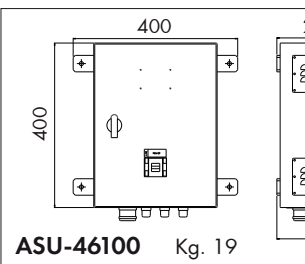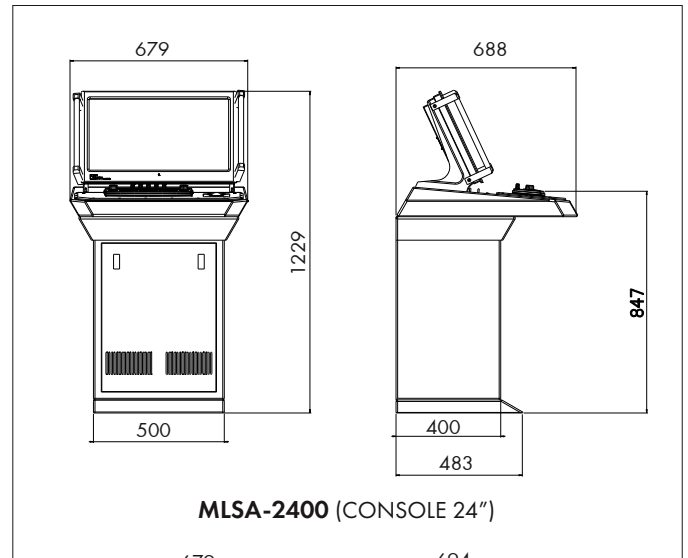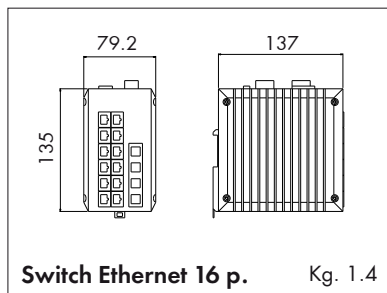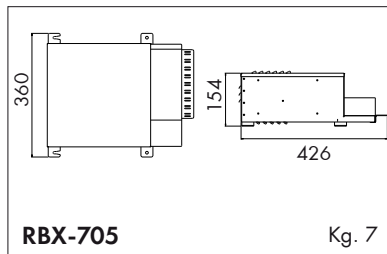
Surveillance & Security   **Guidance, Navigation & Positioning**   **Military & Defence**   **Marine Electronics**