Technology

(A useful servant, a dangerous master)

Spoofing and other hazards

23rd July 2025

Tech Adoption: To do or not to do; a pre-historic dilemma !

Source Credit :YouTube / Tiny Film

Turning the clock back a bit:

- MV Zenobia : Ro-Ro/ GRT 10,000 / Built by Kockums Varv AB Shipyard, Sweden.
- Maiden Voyage: Enroute to Athens , steering problems experienced and vessel listing to port. Inspection revealed the list caused by ballast pumped into tanks. Same corrected.
- Further, enroute to Cyprus, on 2nd June 1980, again list develops. Investigation reveals, computerized pumping system was pumping excess water into the side ballast tanks due to a software error, making the list progressively worse up to 45 Degrees.
- Despite 'Tech driven fault ' known, maintenance engineers called in, problem remained unresolved, and vessel capsized on 7th June 1980

Source Credit :Wikipedia

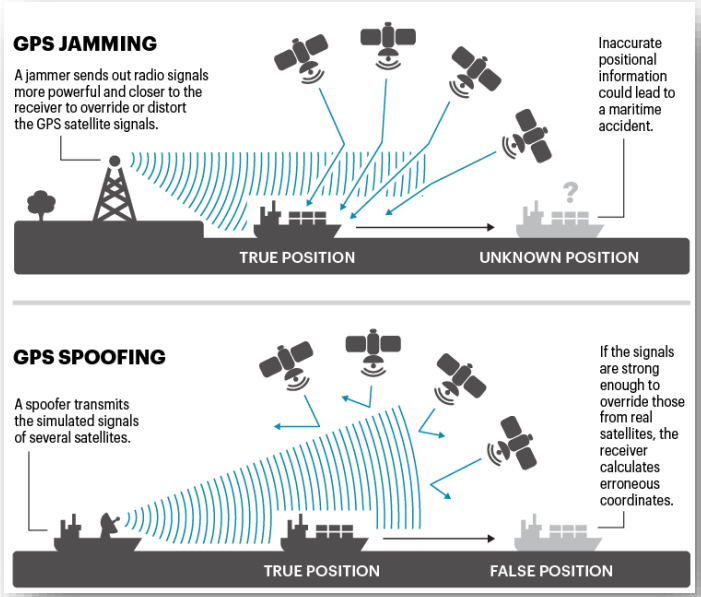
Attack Surface: External systems– GPS SPOOFING AND JAMMING

➢ **Jamming causes the GPS receiver to DIE !**

(Local Jammer transmits powerful signals to override/ interfere with true GNSS Satellite Signals)

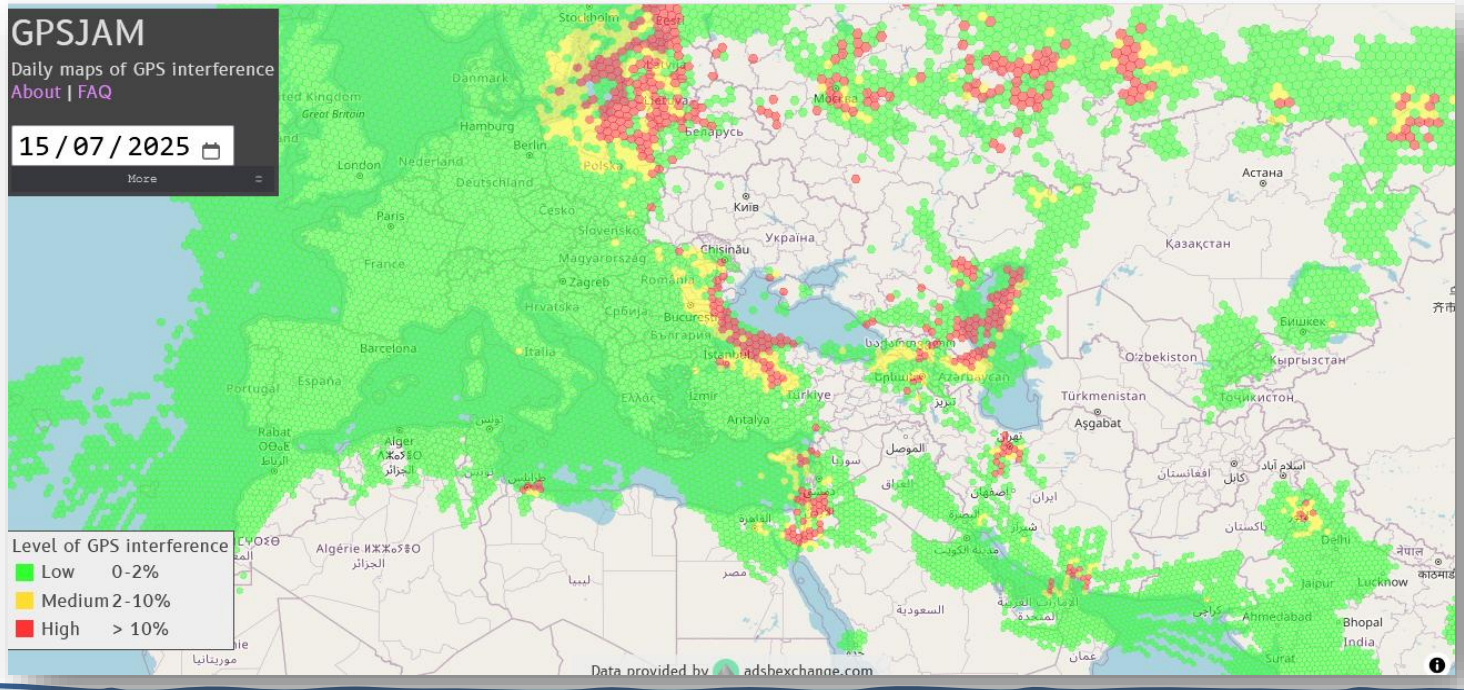
➢ **Spoofing causes the GPS receiver to LIE!**

(Local Spoofer transmits simulated signals of GNSS Satellites which are in line sight)



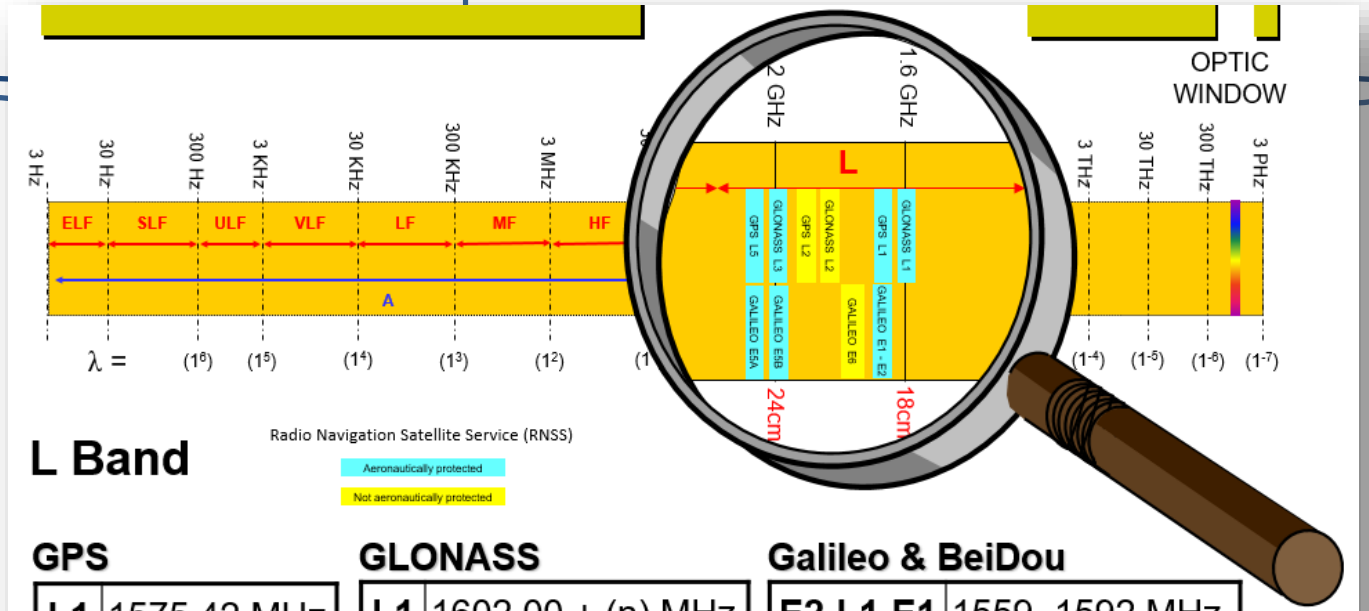
Source Credit : Screenshot from 'Fortune'

Attack Surface: External systems– GPS SPOOFING AND JAMMING



Source Credit : https://gpsjam.org/

Frequencies -



GPS	
L1	1575.42 MHz
L2	1227.60 MHz
L5	1176.45 MHz

GLONASS	
L1	1602.00 + (n) MHz
L2	1246.00 + (n) MHz
L3	1207.14 MHz

Galileo & BeiDou	
E2-L1-E1	1559–1592 MHz
E5A-E5B	1164–1215 MHz
E6	1260–1300 MHz

Source Credit : Screenshot from 'PBN - Europe'

A snapshot of the situation:

	Jamming	Spoofing
Cause	GNSS jamming primarily targets the L1 frequency band, commonly used by older GPS equipment.	Transmitting false signals with the purpose to feed the receiver with manipulated data.
Alert from equipment?	Yes. The affected equipment will have the alarm on. Crew will be aware of the "jamming" so to take corrective actions.	Spoofing may go unnoticed: equipment does not raise alarms, and the vessel's course and track may be adjusted based on false/manipulated position data.
What if "jamming"/"spoofing" happens?	Vessels that are jammed will have: a) lost positions & alarms, b) AIS does not transmit correct position c) gyro & other associated equipment get affected	Vessels that are spoofed are susceptible to: Collisions; groundings or higher fuel usage
Solutions?	GPS receiver to automatically "jump" to a different frequency band(s) when jamming is detected.	Change to equipment that sends alerts when spoofing is detected.

Source Credit : Inputs from Radio Holland

Speculated Risk Levels

	Jamming	Spoofing
Single Constellation / Single Frequency	High Risk	High Risk
Single Constellation / Multi Frequency	Moderate / High Risk	Moderate / High Risk
Multi Constellation / Single Frequency	High Risk	Moderate / High Risk
Multi Constellation / Multi Frequency	Lowered Risk	Lowered Risk

Source Credit : Personal Research

CMMI MARITIME POTPOURRI 2025

		Constellation / Frequency Bands	Ad. Features
Sing. Const. / Sing. Freq.	Various GPS Rx	GPS L1	None
Sing. Const. / Mul. Freq.	Very few GPS Rx	GPS L1 & L2	Freq. change in jamming
Mul. Const. / Sing. Freq.	Furuno GP 170	GPS/ GLONASS/ QZSS/ SBAS: L1	Integrity check.
Mul. Const. / Mul. Freq.	JRC JLR-41	GPS/ GLONASS/ QZSS/ SBAS: L1 BeiDou: B1 Galileo: E1	Jamming and Spoofing Detection THD, Roll, Pitch, Heave, measurement. Touchscreen
Mul. Const. / Mul. Freq.	NSR NGC-3000	GPS L1/L2 GLONASS L1/L2 BeiDou :B1/B2, Galileo E1/E5b	THD & ROT
Mul. Const./ Mul. Freq.	SAAB R6	GPS: L1, L2, L5 GLONASS: G1, G2, G3 BeiDou: B1i, B1C, B2a, B2b, B2i, B3i Galileo: E1, E5a, E5b, E6 QZSS: L1, L2, L5, L6 , NavIC : L5	Advance Jamming and Spoofing Detection & Mitigation. THD, ROT and Roll, Pitch, Heave etc with optional Inertial Measurement Units

Source Credit : Self researched/ Maker declarations

Immediate ‘Indian Jugaad’ *(* No Marine approvals)*

Xiaomi 12S Pro

Released 2022, July 07
203g / 204g, 8.2mm thickness
Android 12, MIUI 13
128GB/256GB/512GB storage, no card slot

0.4%
996,420 HITS

164
BECOME A FAN

6.73"
1440x3200 pixels

50MP
4320p

8/12GB RAM
Snapdragon 8+ Gen 1

4600mAh
120W 50W

COMMS		
	WLAN	Wi-Fi 802.11 a/b/g/n/ac/6e, dual-band, Wi-Fi Direct
	Bluetooth	5.2, A2DP, LE, aptX HD, aptX Adaptive
	Positioning	GPS (L1+L5), GLONASS (L1), BDS (B1I+B1c+B2a), GALILEO (E1+E5a), QZSS (L1+L5), NavIC (L5)
	NFC	Yes
	Infrared port	Yes
	Radio	No
	USB	USB Type-C 2.0, OTG

Samsung Galaxy A12 (India)

Released 2021, August 12
205g, 8.9mm thickness
Android 11, up to Android 13, One UI 5.1
64GB/128GB storage, microSDXC

0.1%
445,509 HITS

25
BECOME A FAN

6.5"
720x1600 pixels

48MP
1080p

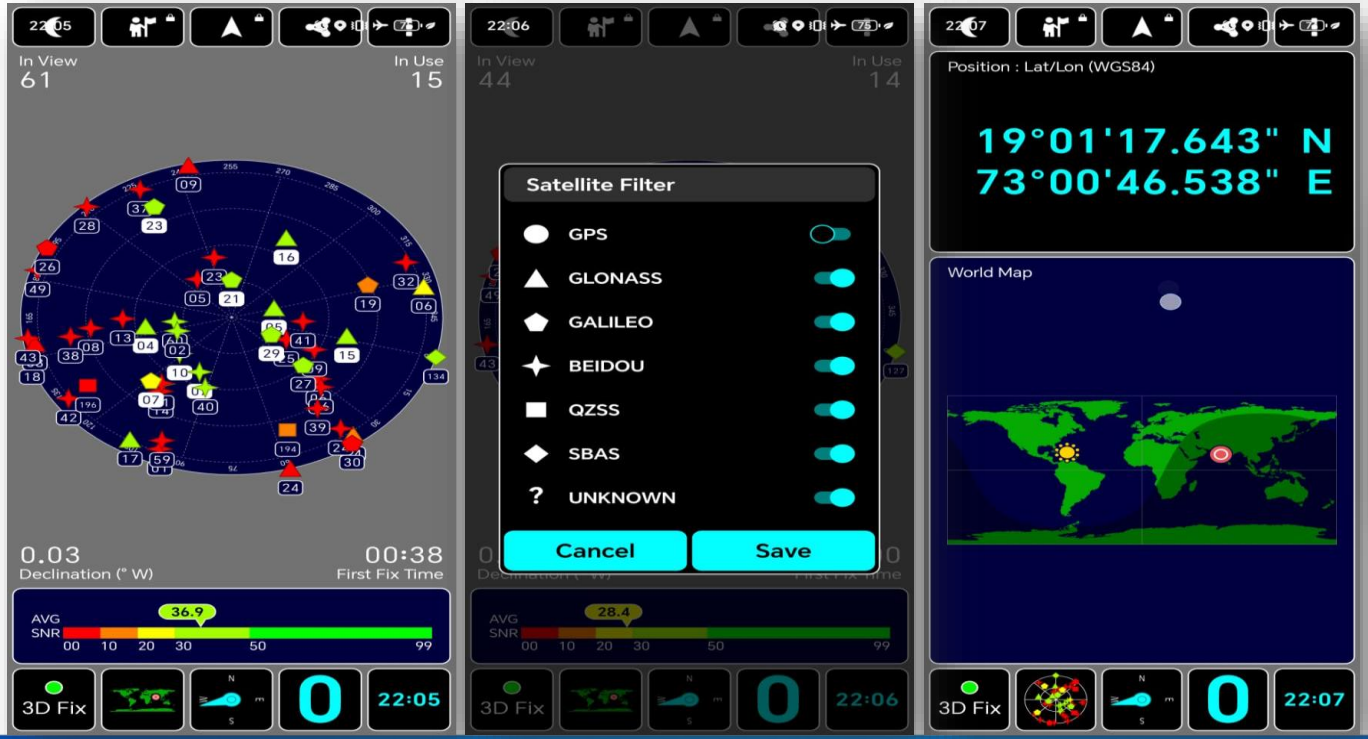
4/6GB RAM
Exynos 850

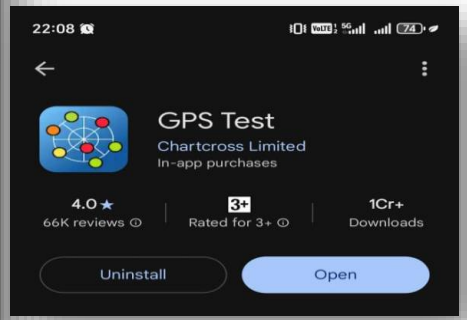
5000mAh
15W

COMMS		
	WLAN	Wi-Fi 802.11 b/g/n, Wi-Fi Direct
	Bluetooth	5.0, A2DP, LE
	Positioning	GPS, GLONASS, GALILEO, BDS
	NFC	No
	Radio	FM radio, RDS, recording
	USB	USB Type-C 2.0

Source Credit : Personal Research

Android – GPS Test *(By Chartcross Ltd.)*





Source Credit : Personal Research

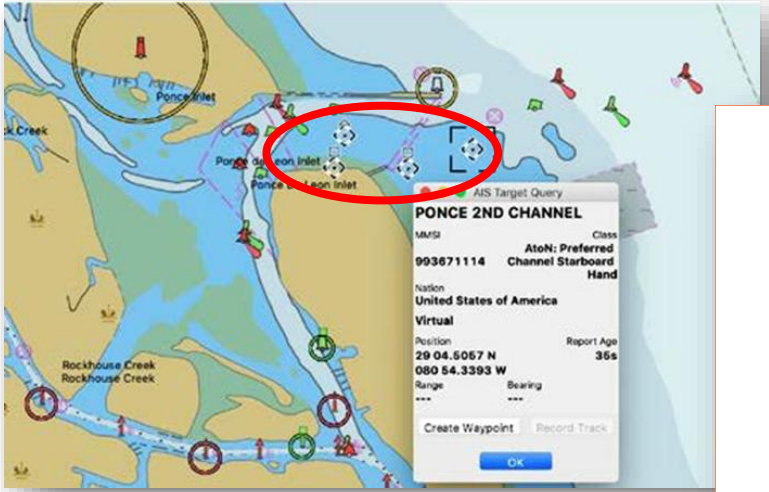
Attack Surface: External - AIS SPOOFING

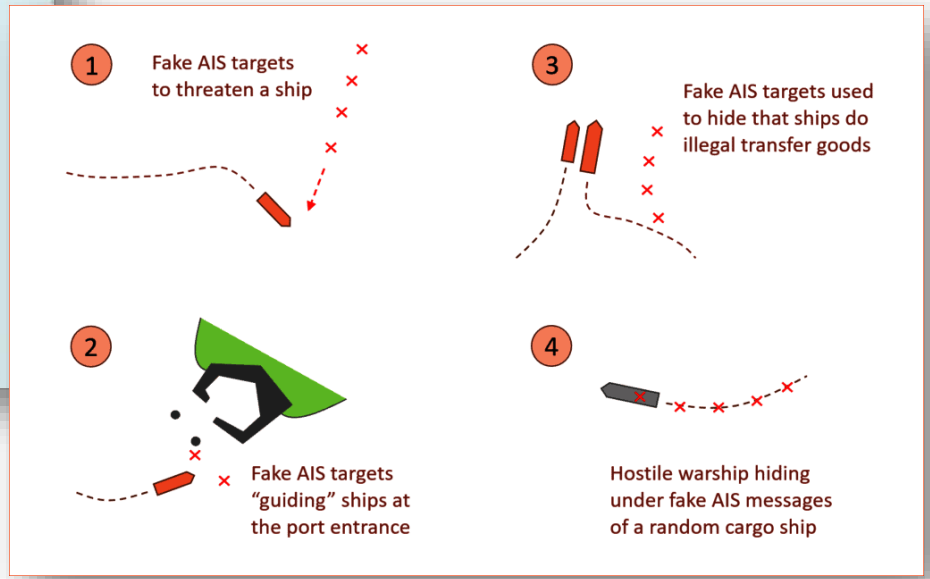
Challenges with AIS

- Lack of validity checks: No geographic validation information meaning that it is possible for a bad actor to send an AIS message from any location while purporting to be in another location.
- Lack of timing checks: AIS messages contain no time stamp verification information meaning that a cyber-attacker can replay valid AIS information at a later time of their choosing.
- Lack of authentication: The AIS protocol provides no mechanism to authenticate the sender, thus anyone with the ability transmit an AIS packet can impersonate any other AIS device.
- Lack of integrity checks: AIS messages are transmitted in an unencrypted and unsigned form; this makes it simple for an interloper to intercept and/or modify transmissions

Source Credit : Gary Kessler Associates

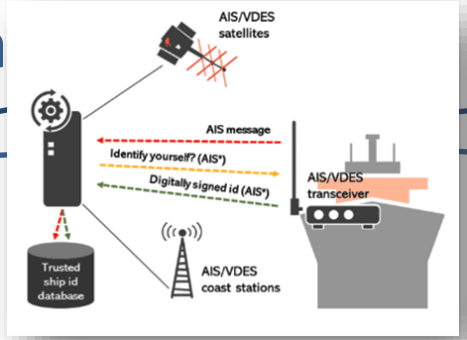
AIS SPOOFFED: FALSE – TARGET & AtoN CHANNEL





Source Credit : STERNULA AS/ Gary Kessler Associates

AIS Spoofing – Mitigating Mea

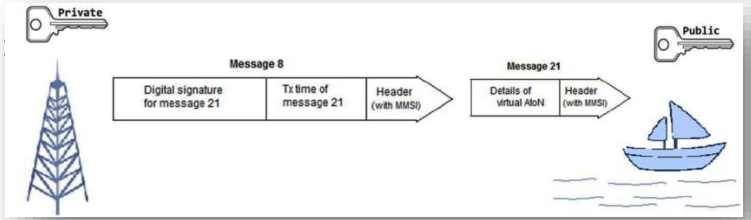


Mitigating measures planned:

- MSC 109 approved a revision of the performance standards (AIS) (Resolution MSC.74(69)) to prevent tampering of a ship's information.
- IMO's Sub-Committee on Navigation, Communications, Search and Rescue have proposed inclusion of VDES in Chapter V/19.2.4 and MSC 111 (2026) shall bring VDES into force by 1st Jan 2028
- VDES is a digital communication system that operates over the very high frequency (VHF) band to provide secure and reliable data exchange. *(IALA & IHO is also working on Guidelines for VDES).*
- *Performance standards for VDES expected by 2027*

- **VDES – VHF Data Exchange Scheme** includes 4 components

1. Automatic identification system (AIS)
2. Application specific message (ASM)
3. Terrestrial component for VHF data exchange (VDE-TER)
4. Satellite component for VHF data exchange (VDE-SAT)

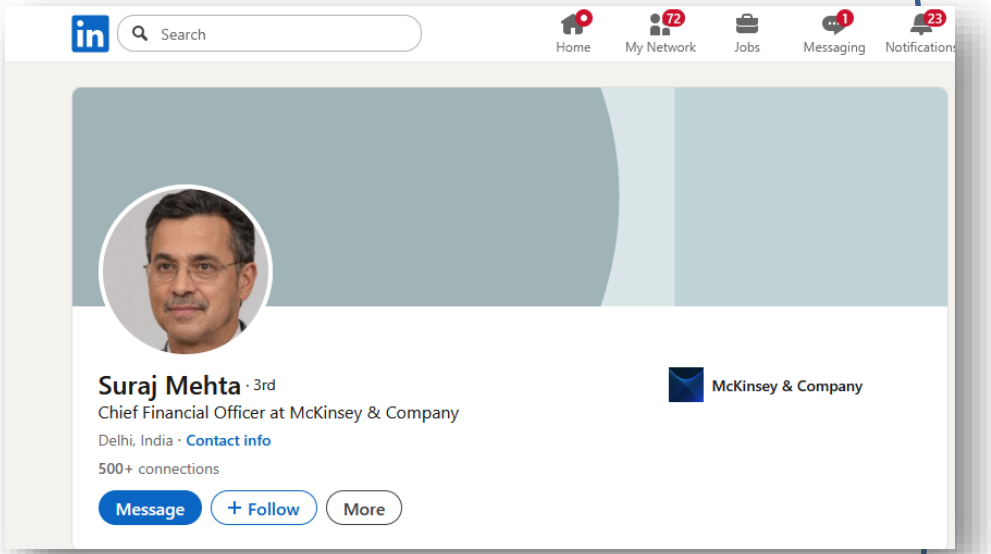


Source Credit : IALA / IMO – MSC & NCSR / STERNULA AS

Cyber Frauds – Social Engineering

https://this-person-does-not-exist.com/en

https://stylesuxx.github.io/steganography/

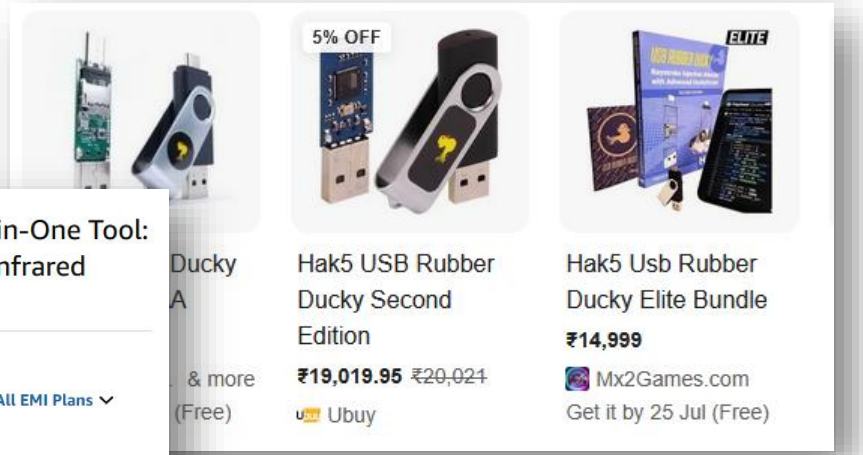


Source Credit : As trained in Cyber Security course by C.E.M.S.- Mumbai

Cyber Frauds – Rubber Ducky & Flipper Zero

Available globally & in India

(Also on 24 month / EMI ☺ !!)



Source Credit : As trained in Cyber Security course by C.E.M.S.- Mumbai

Cyber Frauds – Juice Jacking !!

Source Credit : As trained in Cyber Security course by C.E.M.S.- Mumbai

SAAB TransponderTech

NAVIGATE WITH CONFIDENCE

R6 NAV PRO Compass

High-Accuracy Position and Motion Monitoring with Inertial Support

R6 NAV PRO Compass

High-Accuracy Position and Motion Monitoring with Inertial Support

The R6 NAV PRO Compass system redefines maritime navigation, delivering cutting-edge accuracy and navigational safety for professional mariners.

- Top-tier accuracy for position, speed, course, heading, and rate of turn.
- IMO type-approved DGNSS and THD for enhanced navigation.
- Advanced jamming and spoofing detection and mitigation for robust integrity.
- Dual 61162-450 networks interfaces for easy integration and redundancy.
- Multi-function display for combined installation with R6 Supreme AIS system.
- MED B (Wheelmark), UKCA, CCS.

A powerful DGNSS Compass

The powerful DGNSS sensor/compass delivers exceptional precision navigation required for ports and docking operations, while its advanced integrity protection ensures resilience against jamming and spoofing interference, providing secure and uninterrupted positioning.

The built-in web interface can be used for optional configuration and control.

INTUITIVE USER INTERFACE AND SEAMLESS INTEGRATION

The R6 CDU (Control and Display Unit) combines the high quality display with a user-friendly design to simplify operations with intuitive controls. Its 7-inch sunlight-readable touch display presents clear, precise data, and supports central dimming.

Precise ship position and movements displayed on the R6 CDU as well as distributed to ECDIS, ARPA or other systems onboard the ship over standardized network and serial interfaces.

It supports up to 4000 waypoints and 128 routes, each accommodating a maximum of 128 waypoints.

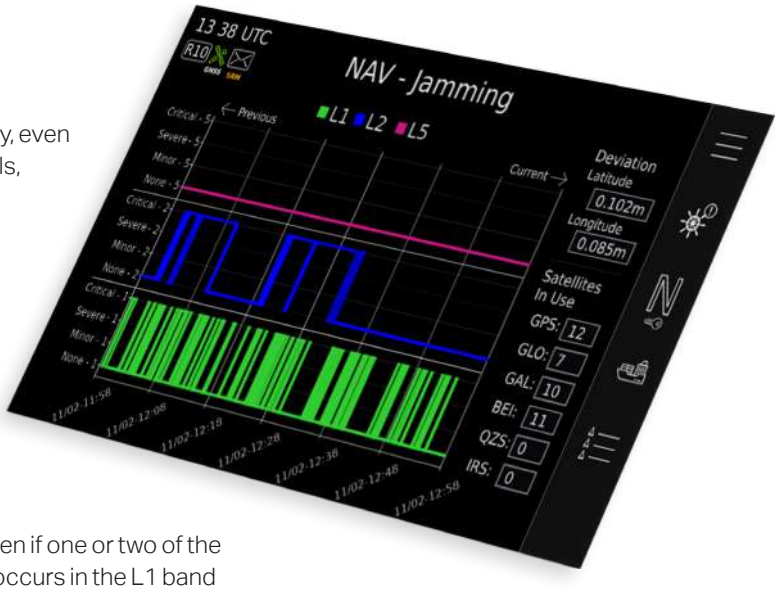
ROBUST AND PRECISE POSITIONING

- Multi-GNSS Reception, supporting GPS, Galileo, Glonass, BeiDou, QZSS and NavIC (IRNSS) for global coverage and redundancy.
- Multi-Frequency Capability, operating across L1, L2, and L5 bands for improved accuracy and reliability.
- Corrections supported: SBAS, IALA Beacon, Atlas L-band, Galileo HAS, and local RTK services to ensure precise positioning.

DYNAMIC MOTION MONITORING:

Provides high accuracy data on position, speed, heading, course, rate of turn, roll/pitch, and heave for reliable navigation, with an optional Inertial Measurement Unit (IMU) for enhanced motion tracking and certified as Transmitting Heading Device, THD.

Protection against GNSS Jamming and Spoofing



Assured PNT in the primary type-approved DGNSS system is key, even under interference. While GNSS jamming disrupts satellite signals, spoofing delivers deceptive positions and is harder to detect.

JAMMING DETECTION

The R6 NAV PRO Compass actively monitors and mitigates interference to ensure navigation integrity under all conditions. It detects jamming in the L1, L2, and L5 frequency bands separately in four levels: None, Minor, Severe, and Critical. Severe levels will trigger an alarm.

MITIGATION AND NAVIGATION CONTINUITY

With the R6 NAV PRO Compass, a valid position is maintained even if one or two of the frequency bands L1, L2 or L5 are jammed. While most jamming occurs in the L1 band leaving single-band receivers more vulnerable, jamming on all frequency bands are highly unlikely.

SPOOFING DETECTION

The R6 NAV PRO Compass utilizes the fixed baseline of the two antennas to detect spoofing attempts when fake signals indicate that both antennas occupy an identical position. A deviation from the expected baseline triggers an alert, ensuring the system flags the spoofing interference.

Combined AIS and GNSS installation

The multi-function R6 CDU supports combined installation with both R6 Supreme AIS and R6 NAV systems, reducing the number of displays on the bridge. Any combination of R6 AIS and R6 NAV systems is fully type-approved.

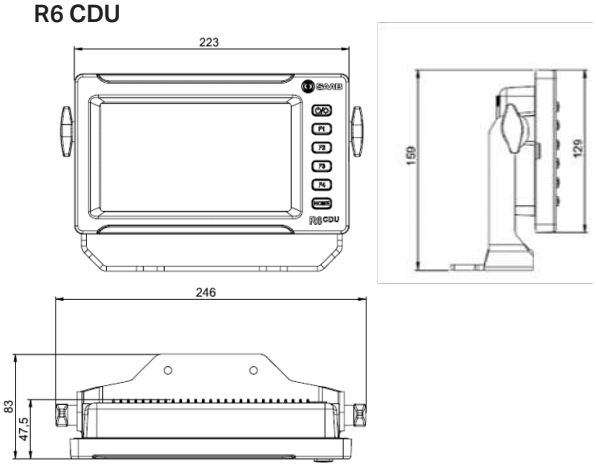
Position and Motion Accuracy

	POSITION (RMS)						MOTION (RMS)			
	Default	SBAS	IALA Beacon	Galileo HAS	Atlas H10	RTK	ROT	HDG	Roll/pitch	Heave
R6 NAV PRO Compass	1.2 m	0.3 m	0.3 m	0.1 m	0.04 m	1 cm		0.02°		
R6 NAV PRO Compass + IMU	1.2 m	0.3 m	0.3 m	0.1 m	0.04 m	1 cm	0.1°/min	0.02°	0.5°	5 cm

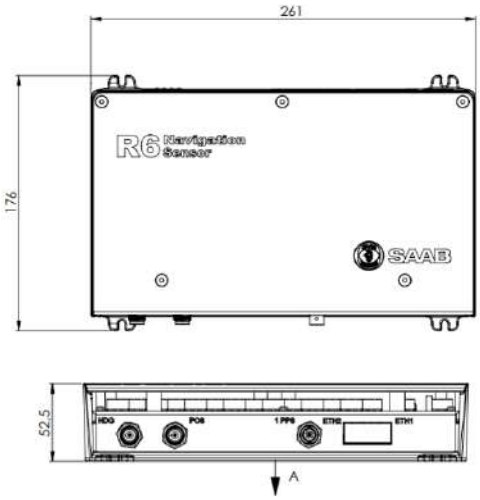
Technical Specifications

Positioning / Dynamic Motion Monitoring	
Supported systems	GPS*: L1, L2, L5 GLONASS: G1, G2, G3 BeiDou: B1i, B1C, B2a, B2b, B2i, B3i Galileo: E1, E5a, E5b, E6 QZSS: L1, L2, L5, L6 NavIC (IRNSS): L5
Corrections supported	SBAS, IALA Beacon, Galileo HAS, Atlas subscription, RTK
Position Accuracy (RMS 67% / 2DRMS 95%)	Uncorrected: 1.2 m / 2.5 m SBAS/IALA Beacon: 0.3 m / 0.6 m Galileo HAS: 0.1 m / 0.2 m Atlas subscription: 4 cm / 8 cm RTK: 8 mm + 1 ppm / 15 mm + 2 ppm
Speed Accuracy (RMS)	1 cm/sec
Rate of Turn accuracy (RMS)	0.1°/min
Heading* (RMS)	< 0.02° @ 5.0 m antenna separation < 0.01° @ 10.0 m antenna separation
Channels	1.100+
Sensitivity	-142 dBm
Update rate	Up to 10 Hz
GNSS Fix	60s/30s typical (Cold/Warm)
Heading Fix	10s typical (Hot Start)
Timing (1PPS) accuracy	20 ns
IALA Beacon Receiver	
Dual receiver	Manual- or Automatic- tuning
Frequency	283.5 to 325.0 kHz
MSK Bit Rates	50, 100, 200 bps
Cold Start Time	< 1 minute typical
Reacquisition	< 2 seconds typical
Sensitivity	25 µV/m for 6 dB SNR @ 200 bps
Inertial Measurement Unit, IMU	
Pitch/Roll (RMS)	< 0.5°
Heave (RMS)	< 5 cm
Gyro Bias Instability	≤ 1.2°/hr
Angular Random Walk	≤ 0.08°/√hr
Data interfaces	
IEC 61162-1/2	RS-422 Input output
IEC 61162-450	Dual Ethernet RJ45
Alert Relay	0.1-5A, 30VDC, 150W
Bridge alert management	IEC 62923-1/-2
GNSS	2x 50 Ohm (TNC), 5 VDC
1PPS Out	5 VDC (BNC)
RTK protocols supported	ROX, RTCM v3.1, CMR, CMR+
Environmental	
Operation temperature	-15°C to +55°C
Storage temperature	-30°C to +80°C
Power supply	
Input Voltage	12-24VDC
Power consumption, system	18 W, with IMU
Dimensions/Weight	
Navigation Sensor	261x53x176 mm / 1900 g
CDU	223x129x48 mm / 1500 g
IMU Unit	205x135x53 mm / 1100g

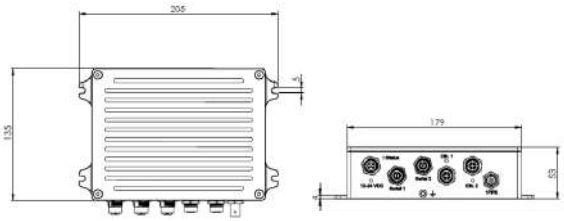
R6 CDU



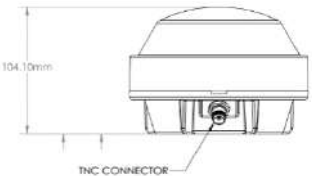
R6 NAV PRO Compass sensor



I6 IMU



A43 DGNSS Antenna



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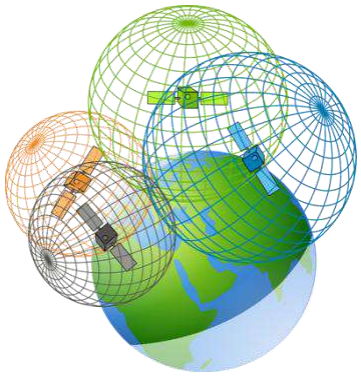
Specifications subject to change without notice.
R6 NAV PRO Compass – EN – ver. 1
Doc ID: PM GEN 25-0078-A

saab.com/maritime

NGC-3000

GNSS COMPASS

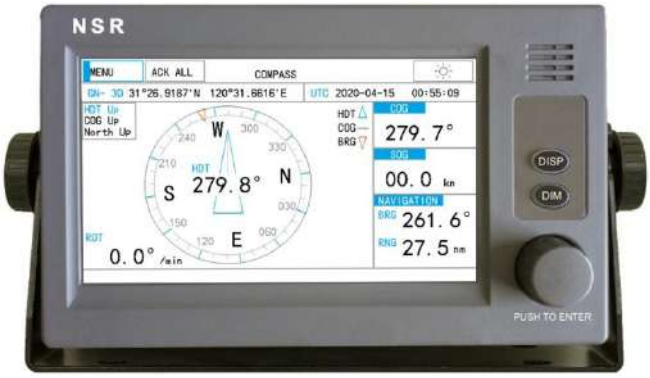
- Highly accurate heading of 0.4 ° RMS
- Full GNSS with GPS, Beidou, GLONASS, Galileo
- Both THD (transmitting heading device) and GNSS
- Large LCD, 7 inch/color, touch screen operation
- Highly accurate SOG，COG，ROT and position
- Multi outputs of RS422 & LAN
- Up to five display modes available
- Compliant with IMO MSC.116(73) for THD
- Maintenance-free design



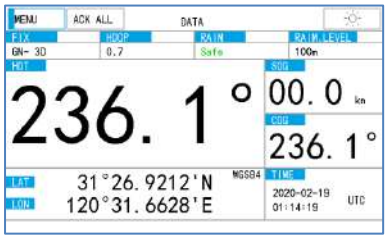
ANTENNA UNIT

NEW

PROCESSOR UNIT

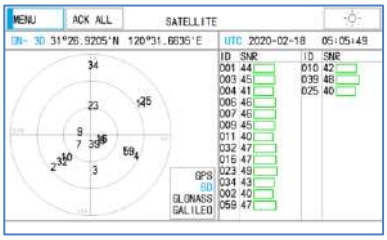


DISPLAY UNIT

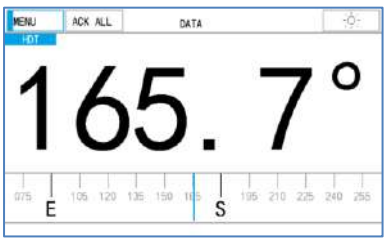


DATA (NAV DATA)

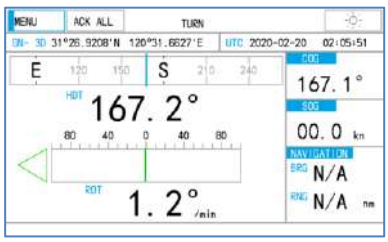
PLOTTER



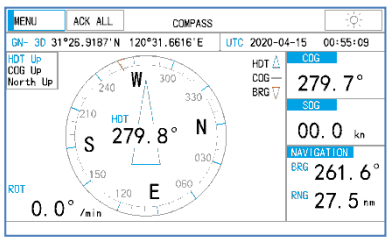
SATELLITE



DATA (HEADING)



TURN



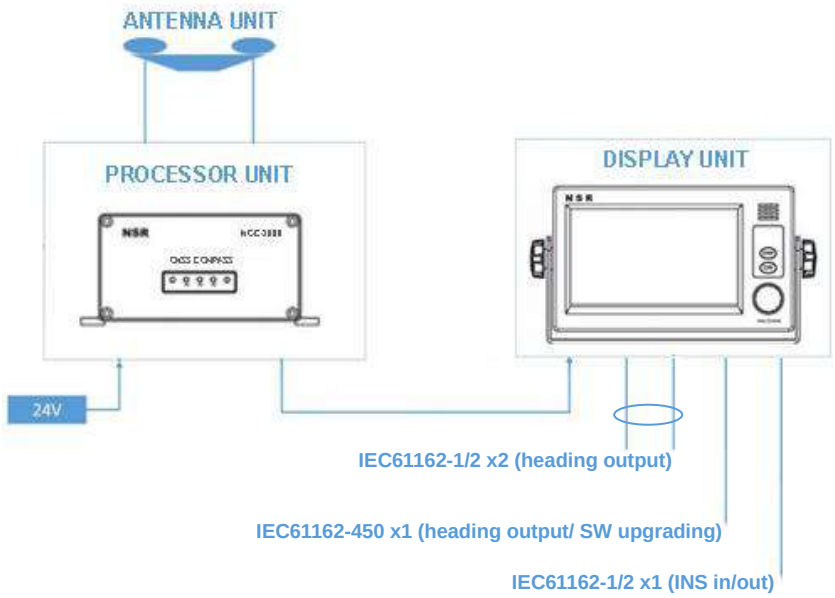
COMPASS

GPS BEIDOU GLONASS GALILEO TOUCH SCREEN

SPECIFICATIONS

- **GENERAL**
  - Heading accuracy: 0.4° RMS
  - Heading resolution: 0.1°
  - Tracking rate of turn: 45/sec
  - Tracking acceleration: 1G
  - Pitch/roll angle: ±60°
  - Receiving frequencies: GPS L1/L2, BDS B1/B2, GLONASS L1/L2, Galileo E1/E5b
  - Position accuracy: 1.5m
  - Speed accuracy: 0.03m/s
  - Position fixing time: <30s
  - Data output rate: max 20Hz
- **DISPLAY**
  - Display system: 7 inch, color LCD, touch screen operation, 154(W)×87(H) mm
  - Resolution: 800 x 480 dots
  - Display mode: DATA (Heading, NAV data), PLOTTER, TURN, COMPASS, SATELLITE
- **INTERFACE**
  - Output ports: 2 IEC-61162-1 Ed4, Ed5, NMEA 1.5, 2.0, 2.3
1 IEC-61162-450 LAN, RJ45 connector
  - Transmission speed: 4800/9600/19200/38400 bps (selectable)
  - INS in/out: ACN, ALC, ALF, HBT
  - Data sentences (selectable): HDT, THS, ROT, RMC, GGA, VTG, ZDA, DTM, GLL, GST, ALC, ALF, HBT, RTE, WPL
- **POWER SUPPLY:** DC24V 500mA (range DC12-36V)
- **ENVIRONMENTAL CONDITION**
  - Temperature range: -20℃~+55℃ operational
-30℃~+70℃ storage (Antenna)
  - IP grade: IP22 (Processor unit & Display unit),
IP66 (Antenna unit)
  - Compass safe distance: 1.15m (standard)
- **DIMENSION:** 174 (W) ×81 (H) ×160 (D) mm (Processor unit)
264 (W) ×145 (H) × 80 (D) mm (Display unit)
810 (W) ×107 (H) × 160 (D) mm (Antenna unit)

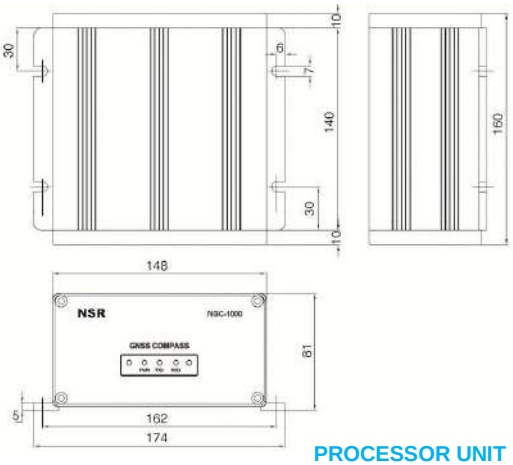
SYSTEM DIAGRAM



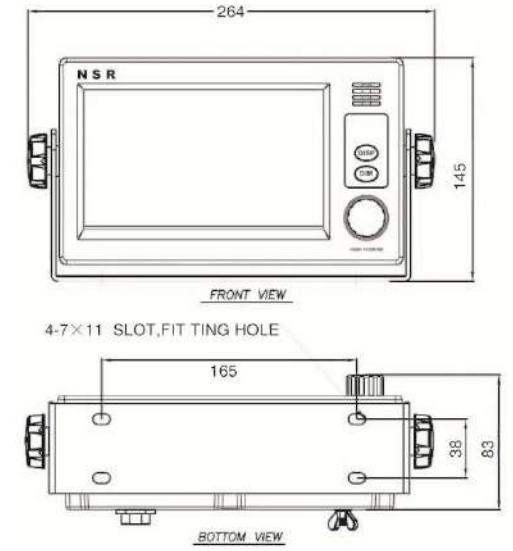
EQUIPMENT LIST

- **STANDARD**
  - Processor unit NGC-3000P 1 pc
  - Display unit NGC-3000D 1 pc
  - Antenna NGA300 2 pc
  - Accessories 1 set
- **OPTIONS**
  - Flush Mount Brackets for display unit NFB700 1 pc

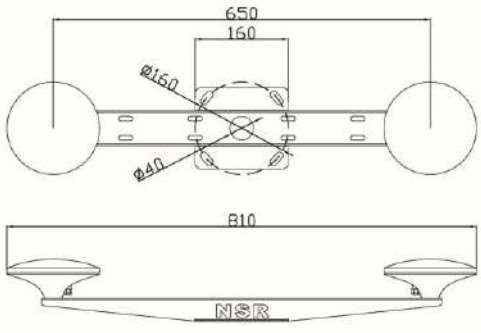
SIZE DIMENSION



DISPLAY UNIT



ANTENNA UNIT



GNSS Compass

JLR-41

- High-accuracy positioning and heading data
- Support multi-GNSS sensor
- Spoofing / jamming detection function available[1]
- Supports rolling, pitching, rate of turn and heaving measurements
- IMO type-approved Transmitting Heading Device (THD) and Satellite Positioning System (GPS)
- Excellent visibility and operability with 6.5-inch high-brightness color touch panel LCD

Sensor
JLR-4101

Display Unit
NWZ-1680

RMS

Category

All vessel types

Deepsea

Workboats

Fishing

Yaching

[1] A separate license is required to enable the spoofing/jamming detection function.

JRC Japan Radio Co., Ltd.

Features

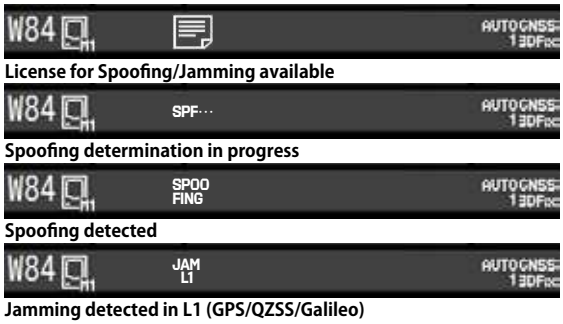
The GNSS Compass JLR-41 is a heading sensor that uses GNSS (Global Navigation Satellite System) to determine the ship's heading. The Sensor is more accurate and smaller than our previous JLR-21 sensor.

- High-accuracy and stability
- Spoofing/jamming detection function
- High-reliability by the multi-GNSS receivers (GPS/Galileo/GLONASS/BeiDou/SBAS/QZSS)
- High-visibility 6.5-inch large color LCD
- Enhanced attitude measurement functions (rolling, pitching, heaving)
- Provided with many graphic display modes
- Short static period (standard 2 minutes or less)
- Improve operability by touch panel and abundant menus
- Easy-to-understand descriptive display

Spoofing/Jamming Detection Function

The new GNSS Compass JLR-41 has a spoofing/jamming detection function feature. When spoofing/jamming is detected, it notifies the user with a pop-up, icon, and buzzer. This can contribute to safe and secure navigation.

Spoofing/Jamming Detection **Example of Icon Display**

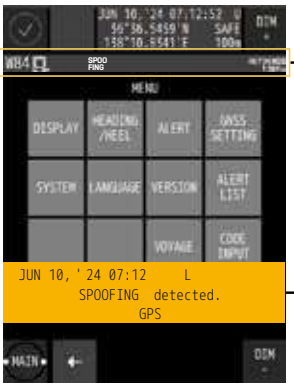


License for Spoofing/Jamming available

Spoofing determination in progress

Spoofing detected

Jamming detected in L1 (GPS/QZSS/Galileo)



Status Area
Displays the status of the equipment or system with the icon.

Notification by Popup

[1]A separate license is required to enable the spoofing/jamming detection function.

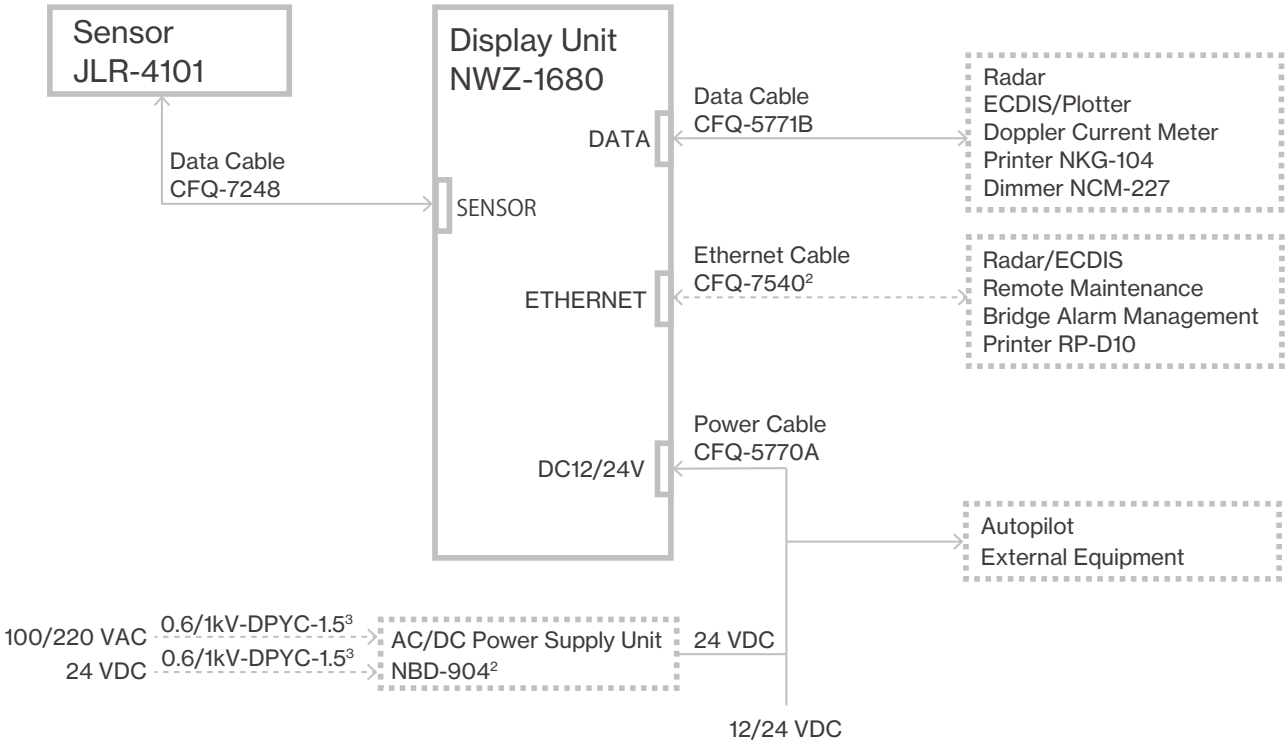
Multi-GNSS Sensor

The newly designed multi-GNSS sensor can simultaneously receive GPS, Galileo, GLONASS, BeiDou, and QZSS data, enabling highly accurate positioning without the use of beacons or SBAS, thereby ehhancing orientation performance.

6.5-inch Large Color LCD

The new GNSS Compass JLR-41 combined with our trusted 6.5-inch color touch panel display will providing you with the comfort of an intuitive operational approach.

System Diagram



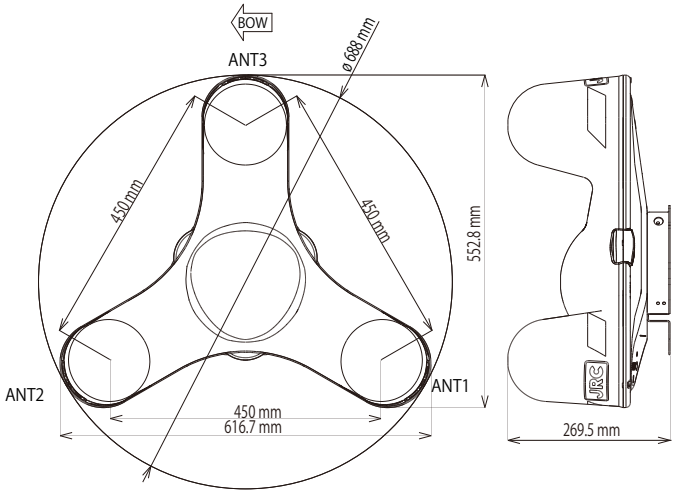
²Option

³Shipyard Arrangements

Tec Specs

Sensor RoHS

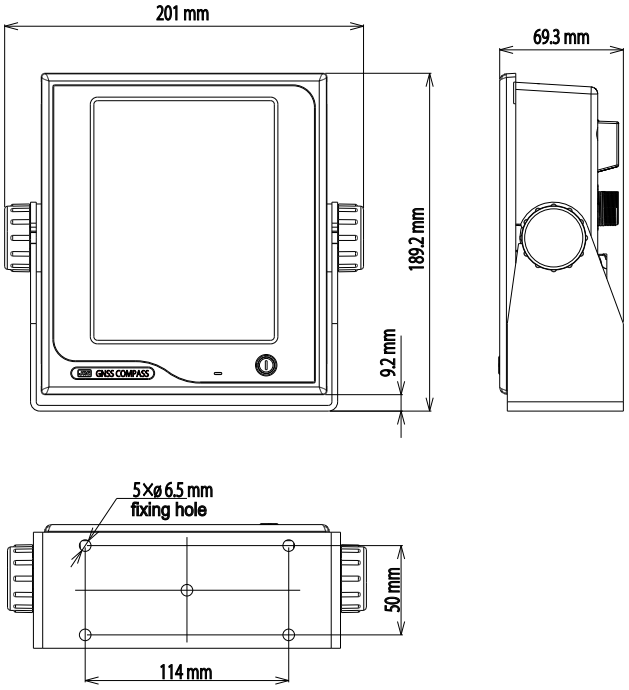
JLR-4101 Mass: Approx. 5.3 kg (11.67 lbs)



Display Unit RoHS

NWZ-1680 Mass: Approx. 1.8 kg (3.97 lbs)

*including Base Kits



Specifications

Sensor	JLR-4101
Receiver System	GPS/Galileo/GLONASS/BeiDou/SBAS/QZSS
Receiver Type	GPS+QZSS: 15 ch, SBAS: 1 ch, Galileo+GLONASS or Galileo+BeiDou: 10 ch
Receiving Frequency	1575.42 MHz (GPS/Galileo/SBAS/QZSS), 1598.063-1605.375 MHz (GLONASS), 1561.098 MHz (BeiDou)
Course Accuracy	0.25° RMS
Attitude Accuracy (Roll)	0.4° RMS
Attitude Accuracy (Pitch)	0.4° RMS
Attitude Accuracy (Heaving)	5 cm RMS
Course Resolution	0.1°/0.01°
Speed Resolution	0.1 kn/0.01 kn
Attitude Resolution	0.1°
Tracking Rate of Turn	45°/sec
Start-up Time	Less than 2 minutes (warm start fix, typically 30 seconds)
SBAS Receiver	WAAS, MSAS, EGNOS
Positional Accuracy	Multi-GNSS (PPP positioning): 1.8 m (2DRMS) (HDOP ≦ 4 SA OFF), multi-GNSS (non-PPP positioning): 4 m (2DRMS), DGPS: 4 m (2DRMS), SBAS: 4 m (2DRMS), GPS or GPS+QZSS: 5 m (2DRMS), GLONASS: 10 m (2DRMS), Galileo: 6 m (2DRMS), BeiDou: 10 m (2DRMS)
Spoofing/Jamming	Can be detected (license require)
Display	**NWZ-1680**
Display Unit	6.5-inch TFT color touch panel LCD, 640x480 dots (VGA)/Brightness: 800 cd/m²
Display Modes	Heading, navigation information, plot, analog, highway, satellite information, waypoint information, beacon text, navigation aid
Power	12/24 VDC (+30 %, -10 %)
Power Consumption	Less than 14 W (including sensor)
Interface	
Port	IEC 61162-1: (input) 1 port, (output) 2 ports IEC 61162-2: (output) 1 port LAN (IEC 61162-450): 1 port Sensor through (IEC 61162-1): (output) 2 ports Dry contact: (input) 1 port, (output) 3 ports
NMEA 0183 Version	Ver1.5/2.1/2.3/4.0
NMEA 0183 Input Sentence	ACK, ACN, DDC, HBT, POS
NMEA 0183 Output Sentence	AGL, ALC, ALF, ALR, ARC, DDC, DTM, GBS, GGA, GLL, GNS, GRS, GSA, GST, GSV, HBT, HDT, HRM, MSS, RMC, POS, ROT, THS, VTG, ZDA
Environmental Conditions	
Operating Temperature	Sensor: -25 to +55 ℃ , Display Unit: -15 to +55 ℃
Storage Temperature	Sensor: -25 to +70 ℃ , Display Unit: -25 to +70 ℃
Degree of Protection	Sensor: IP56, Display Unit: IP56

In the Box	
Sensor	JLR-4101
Display Unit	NWZ-1680
Power Cable	CFQ-5770A
Data Cable	CFQ-7248
Data Cable	CFQ-5771B
Instruction Manual	English: P00011567
Bridge Card	English: P00022759

Option			
Data Cable (30 m)	CFQ7248-30	Base Kits	MPBX50347
Extension Cable (10 m)	CFQ7249-10	Select Switch	NCZ-777
Extension Cable (20 m)	CFQ-7249	Select Switch	NCZ-1537B
Junction Box	NQE-7720	Junction Box	CQD-10
Beacon Connecting Cable	CFQ-7250	Output Buffer	NQA-4351
Installation Trestle	P00004089	Printer	NKG-104
Bird Repellent Rod	P00015258	Printer	RP-D10
Power Cable	CFQ-5770D	External Dimmer Unit	NCM-227
Data Cable (10 m)	CFQ-5771D	AC/DC Power Supply Unit	NBD-904
Ethernet Cable (15 m)	CFQ-7540	Conversion Cable	P00014414

• Specifications may be subject to change without notice.

For further information, contact:

JRC Since 1915 Japan Radio Co., Ltd.
URL https://www.jrc.co.jp/eng/

Tatsumi Office: 7-32, Tatsumi 1-chome, Koto-ku, Tokyo 135-0053, Japan
Telephone: +81-3-5534-1205
Facsimile : +81-3-5534-1199

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ISO9001, ISO14001 Certified

2024.12 CAT.No.Y14-235 (No.885-1-0) MK

FURUNO

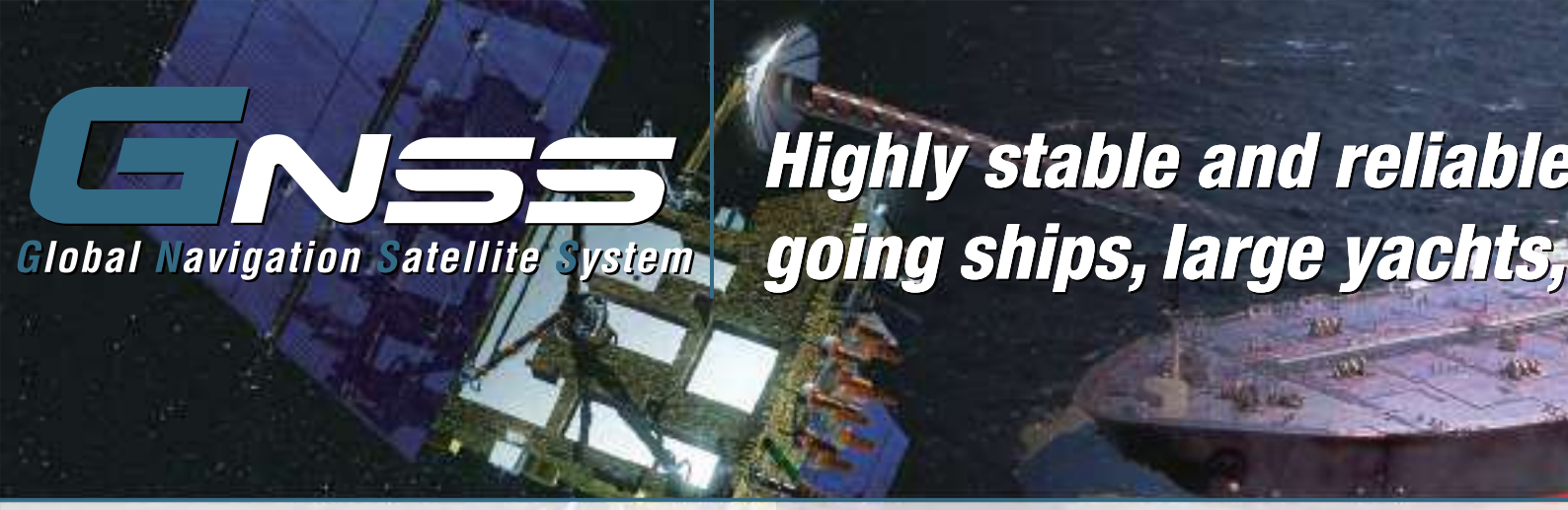
GNSS

Global Navigation Satellite System

Model:

GP-170

www.furuno.com



GNSS

Global Navigation Satellite System

Highly stable and reliable going ships, large yachts,

▶Full compliance with IMO Performance Standards and IEC Testing Standards

High performances for Radar, AIS, ECDIS, Autopilot, Eco Sounder, other Sensors for Navigation and Communication Equipment

Function	IMO Perf. Standard	IEC Test Standard
GPS	MSC.112 (73)	IEC61108-1
GLONASS	MSC.113 (73)	IEC61108-2
DGNSS	MSC.114 (73)	IEC61108-4
MULTI (*)	MSC.115 (73)	---
Alert Management	MSC.302 (87)	IEC62923-1/-2

* Combined GPS/GLONASS

▶Newly designed GPS chip and antenna unit deliver enhanced stability and precision in position fixing

Enhanced noise rejection capabilities are incorporated in the GPS receiver chip, delivering high level of tolerance towards multi-path mitigation. Also, the tolerance towards multi-path mitigation is enhanced when the antenna unit is used.

▶Augmentation to enhance precision by utilizing SBAS (Satellite-Based Augmentation System), DGNSS (Differential Global Navigation Satellite System) and SLAS (Sub-meter Level Augmentation Service)

▶10 Hz position update rate (position updated every 0.1 second) making steady own ship position tracking possible

▶USB port available on the front panel

Routing data, menu setting, user setting can be exported/imported through USB jump drives

▶Dual configuration for back-up purpose to ensure system availability

Information about waypoints, route and other data set by the operators on one unit can be shared with the other units for functional back-up

▶BAM (Bridge Alert Management) ready

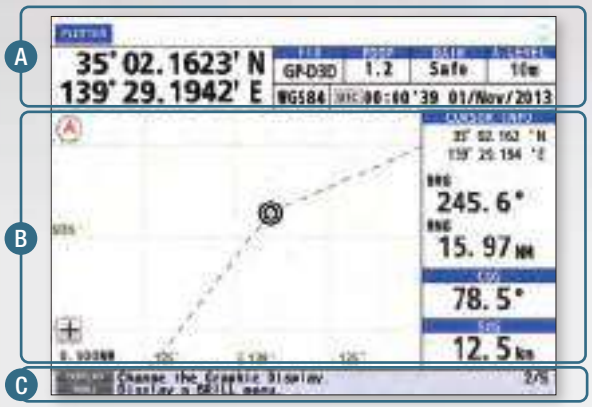
Meets the specific requirements for alerts and interconnection with Bridge Alert Management in IMO MSC.302 (87)

▶LAN interface for efficient network integration into a bridge system

The GP-170 is fully Light Weight Ethernet (IEC 61162-450) compatible

▶Variety of display modes available: Plotter, Course, Highway, Data and Integrity

- A Positioning Display, Icon Display Area.
- B Main Display Area. Please refer to each of the display modes for details.
- C Action Guidance and Alert Display Area (under alert situation, the information about the most imminent alert is displayed).



▶5.7" color LCD (with 640 x 480 pixels) for data visualization

▶Simplified menu operation

The operator can navigate through the menu tree either by pressing the cursor pad or pressing the corresponding numbers on the numeric keypad to the menu items

▶Enhanced route planning/management function available

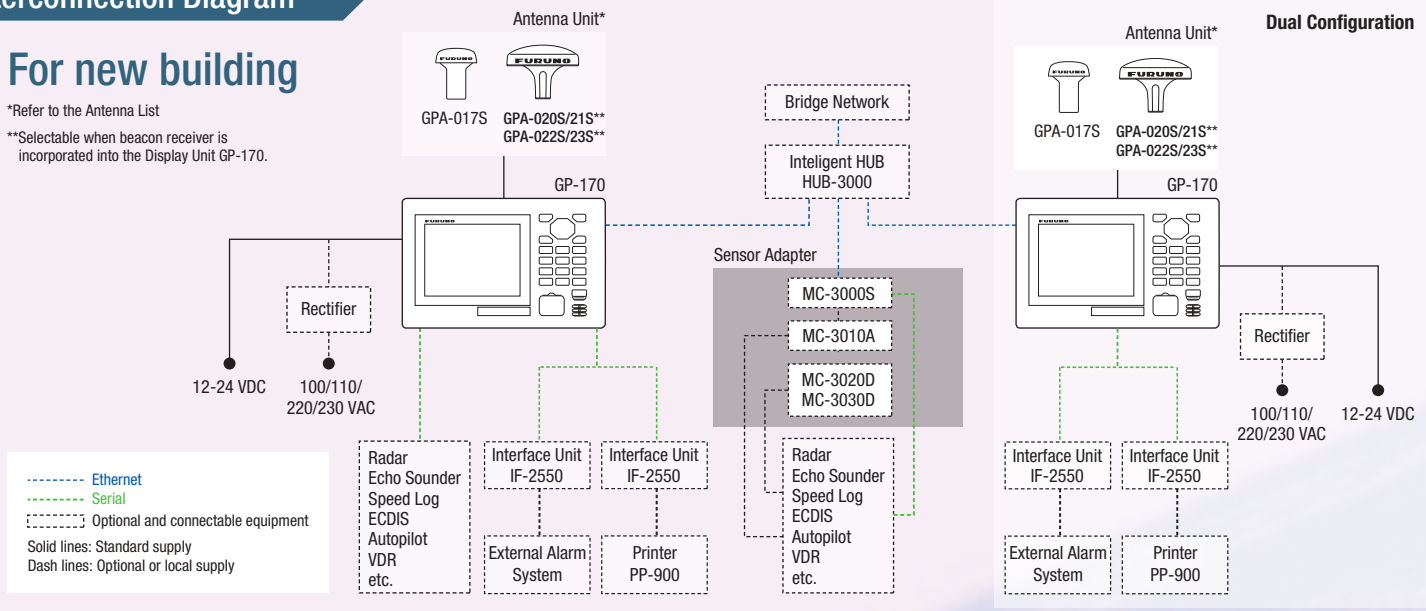
- Comprehensive range of voyage information to be incorporated in routes
- Streamlined route creation through combination with an external PC (GPX format)
- Sharing the active route information with ECDIS to supplement the ECDIS route monitoring capability

Interconnection Diagram

For new building

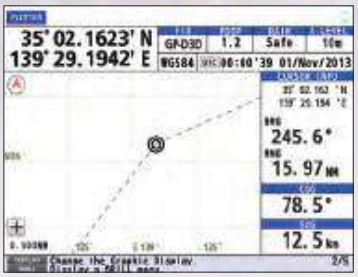
*Refer to the Antenna List

**Selectable when beacon receiver is incorporated into the Display Unit GP-170.



position fixing system for ocean ferries and commercial vessels

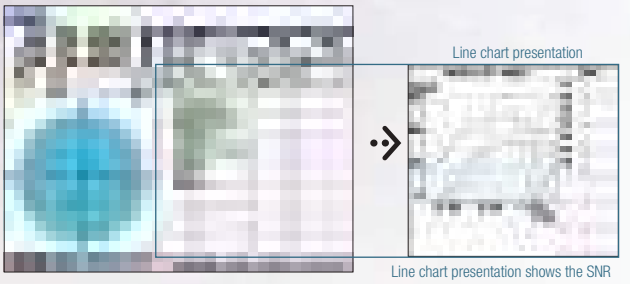
Plotter



Information to be displayed

- Simplified plotter display
- Cursor information
- Contextual menu
- SOG/COG data boxes

Integrity



Line chart presentation shows the SNR and satellite angles for the past six hours.

Information to be displayed

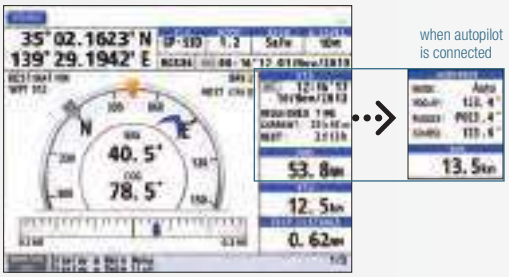
- Skyplot presentation of currently viewable satellites
- Status on GNSS/SBAS satellite signal reception; including signal strength/signal to noise ratio (in bar/line charts)
- Elevation angles of the available satellites
- Detailed information about the beacon stations

Highway

Information to be displayed

- Course information
- SOG/COG data boxes
- User-preset cross track limit of deviation (XTE)
- Own ship gauge, showing the attitude of the ship, including pitch, roll and heave

Course



Information to be displayed

- Graphical presentation of course information, including current waypoint, bearing to the destination, COG, XTE
- Estimated Time of Arrival data box, including required time to reach the current/next waypoints and range to the waypoint*

  *when autopilot is connected, the following information is shown in the data boxes: Autopilot status data box, including mode, ship's heading, rudder angle, and COG, and SOG data box.
- Velocity to destination
- Trip distance data

Data

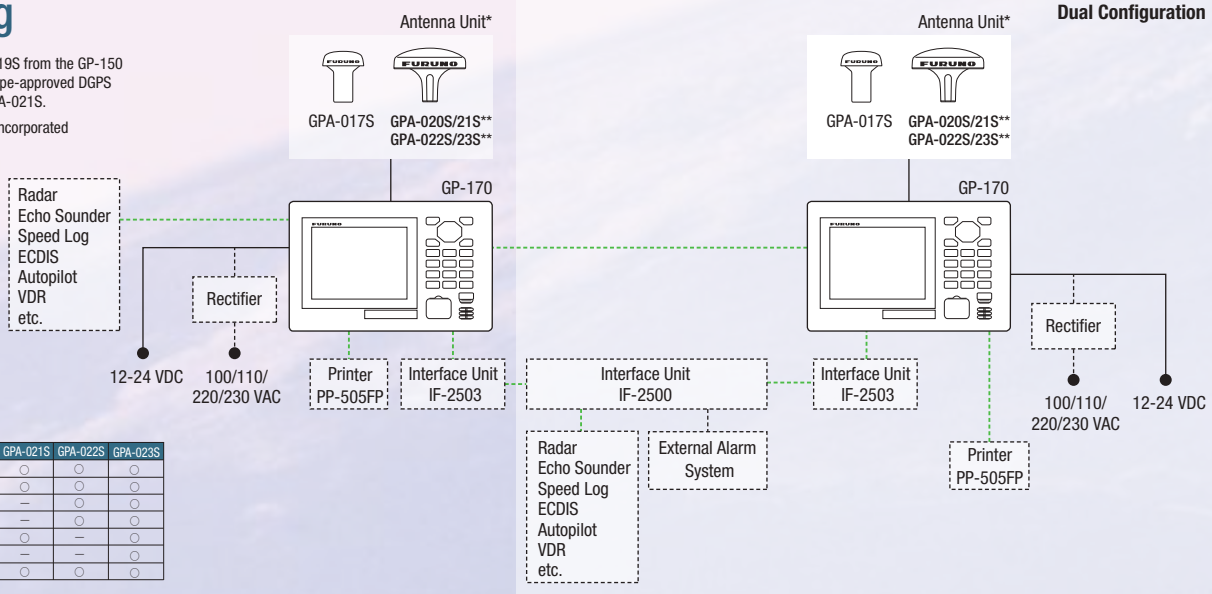
Information to be displayed

- Navigation data boxes configurable according to the needs of the operators

For retrofitting

* Refer to the Antenna List. The GPA-019S from the GP-150 previously installed can be used. If type-approved DGPS is required, please replace it with GPA-021S.

** Selectable when beacon receiver is incorporated into the Display Unit GP-170.



Antenna List

	GPA-017S	GPA-019S	GPA-020S	GPA-021S	GPA-022S	GPA-023S
GPS	○	○	○	○	○	○
QZSS	○	○	○	○	○	○
GLONASS	–	–	–	–	○	○
Multi	–	–	–	–	○	○
DGPS	–	–	–	○	–	○
DGLONASS	–	–	–	–	–	○
SBAS	○	○	○	○	○	○

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Catalogue No. CA000002668

ANNEX 17

RESOLUTION MSC.401(95)
(Adopted on 8 June 2015)

PERFORMANCE STANDARDS FOR MULTI-SYSTEM SHIPBORNE RADIONAVIGATION RECEIVERS

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

RECALLING ALSO resolution A.886(21), by which the Assembly resolved that the functions of adopting performance standards for radio and navigational equipment, as well as amendments thereto, should be performed by the Maritime Safety Committee on behalf of the Organization,

RECOGNIZING the need for performance standards for multi-system shipborne radionavigation receiver equipment in order to ensure that ships are provided with resilient position-fixing equipment suitable for use with available radionavigation systems throughout their voyage,

TAKING INTO ACCOUNT present performance standards for shipborne radionavigation receivers as laid down in resolutions MSC.112(73), MSC.113(73), MSC.114(73), MSC.115(73), MSC.233(82) and MSC.379(93),

HAVING CONSIDERED the recommendation made by the Sub-Committee on Navigation, Communications and Search and Rescue at its second regular session,

1 ADOPTS the Performance standards for multi-system shipborne radionavigation receivers, the text of which is set out in the annex to the present resolution; and

2 RECOMMENDS Governments to ensure that multi-system shipborne radionavigation receivers installed on or after 31 December 2017, conform to performance standards not inferior to those specified in the annex to the present resolution.

ANNEX

PERFORMANCE STANDARDS FOR MULTI-SYSTEM SHIPBORNE RADIONAVIGATION RECEIVERS

1 INTRODUCTION

1.1 Global Navigation Satellite Systems (GNSS), some of which are currently recognized as components of the World-Wide Radio Navigation System (WWRNS) by the Organization, are space-based systems that provide World-wide Position, Velocity and Time (PVT) determination services. Each GNSS space segment is composed of up to 30 satellites per constellation, which may be deployed in several orbital planes and orbit types. The spacing of satellites in orbit is normally arranged such that a minimum of four satellites will be in view to users, World-wide. Each satellite transmits signals that can be processed by receiver equipment to establish a three-dimensional position with a Position Dilution Of Precision (PDOP) ≤ 6 or Horizontal Dilution Of Precision (HDOP) ≤ 4, to ensure that the position information can be reliably used for navigation purposes.

1.2 Terrestrial radionavigation systems use signals from ground-based transmitting stations to determine PVT information. Signals received from at least three stations should be processed by receiver equipment to establish a two-dimensional position.

1.3 Augmentation systems use ground-based or space-based transmitters to provide augmentation data to improve accuracy and integrity for specific service areas (such as navigation in harbour entrances, harbour approaches and coastal waters).

1.4 The introduction of multi-system shipborne navigation receiver performance standards will allow the combined use of current and future radionavigation as well as augmentation systems for the provision of position, velocity and time data within the maritime navigation system.

1.5 A multi-system receiver using navigation signals from two or more GNSS, with or without augmentation, provides improved position, velocity, and time data. An improved resistance to intentional and unintentional radio frequency interference is achieved when two or more independent or frequency diverse radionavigation systems are used. Such a combined approach also provides redundancy to mitigate the loss of a single system.

1.6 Receiver equipment, capable of combining measurements from multiple GNSS and an optional terrestrial radionavigation system, with or without augmentation, to form a single resilient PVT solution, can be used for navigation purposes on ships of speeds not exceeding 70 knots. Such equipment should, in addition to the general provisions contained in resolution A.694(17)[1], comply with the minimum performance standards as stated in this document.

1.7 It is the intention of these performance standards to define the minimum requirements, without defining the approach taken.

1.8 The multi-system shipborne radionavigation receiver determines, as a minimum, the position, course over ground (COG), speed over ground (SOG) and timing either for navigation purposes or as input to other shipboard functions. This information should be available during static and dynamic operations.

[1] Refer to Publication IEC 60945.

1.9 The performance standards allow the application of different methods and techniques for the provision of PVT data and related integrity information. Where guidelines dealing with the harmonized provision of PNT data as well as integrity monitoring of PNT system in use and provided data products have been approved by the Organization, these should be applied.

2 RECEIVER EQUIPMENT (MODULE A)

2.1 The term "multi-system shipborne radionavigation receiver equipment" (hereafter referred to as "the equipment") as used in these performance standards includes all the components and units necessary for the system to properly perform its intended functions. The equipment should include the following minimum components and capabilities:

.1 antennas capable of receiving all radionavigation signals required to support the functionality of the receiver equipment;

.2 receiver(s) and processor(s) capable of processing the radionavigation signals required to support the functionality of the receiver equipment;

.3 means of accessing the computed PVT information (e.g. display of latitude, longitude, COG, SOG, time, sources; and the phase(s) of navigation currently supported[2]);

.4 interface for supplying data controlling/ configuring the receiver;

.5 display;

.6 raw data output, for the provision of additional information, such as range measurements and GNSS's navigation data;

.7 indication of the quality and reliability of the computed and distributed PVT data to the user; and

.8 indication of radionavigation system(s) currently used for the PVT information to the user.

2.2 The design of the antennas should be suitable for fitting at a position(s) on the ship which provides a satisfactory environment for the reception of all required radionavigation signals. Multi-path and electromagnetic compatibility (EMC) effects should be taken into consideration.

2.3 The equipment should be designed to:

.1 mitigate interference from authorized out-of-band sources; and

.2 provide a means of:

.1 integrity monitoring for each PVT source employed (e.g. RAIM, CAIM)[3]; and

.2 multi-source autonomous integrity monitoring[4].

[2] The requirements for the different phases of navigation are set out in resolutions A.915(22) and A.1046(27).

[3] Resolution A.915(22).

[4] Multi-source integrity monitoring is envisioned to be a cross-check between independent PVT sources.

3 OPERATIONAL AND FUNCTIONAL REQUIREMENTS (MODULE B)

The equipment should:

3.1 Operate using civil access navigation signals of at least two independent GNSS recognized by the Organization as part of WWRNS, provided in the radionavigation satellite service (space-to-Earth) frequency bands designated in article 5 of the Radio Regulations[5];

3.2 Provide PVT data with the necessary level of resilience and integrity, whether it is used directly as input to other equipment, or provided for use within Integrated Navigation Systems (INS);

3.3 Where terrestrial radionavigation system(s) signals are provided and used in the protected frequency bands, have the possibility to operate using terrestrial radionavigation system(s) signals provided in the protected frequency bands;

3.4 Have the facilities to process augmentation data, in accordance with the appropriate methods[6];

3.5 Provide the facility for the user to select or deselect radionavigation and augmentation signals;

3.6 Be capable of processing the above signals and combining to provide a single PVT solution, including:

.1 position information of the consistent common reference point[7] in latitude and longitude, referenced to an implementation of an International Terrestrial Reference Frame (ITRF)[8], with coordinates in degrees and minutes to a precision reflective of the accuracy of the position information, up to four (4) decimal places;

.2 COG of the consistent common reference point[7] in degrees to a precision reflective of the accuracy of the calculated course information, relative to true north, up to one decimal place;

.3 SOG of the consistent common reference point[7] in knots to a precision reflective of the accuracy of the calculated speed information, up to two decimal places; and

.4 time, referenced to UTC (BIPM[9]), to one tenth of one second;

---

5 "Radio Regulations" means the Radio regulations annexed to, or regarded as being annexed to, the most recent Convention of the International Telecommunication Union which is in force at any time.

6 e.g. Recommendation ITU-R M.823, RTCM 10410, or other relevant standards , already existing or still to be developed in particular for Satellite Based Augmentation System (SBAS) adoption.

7 A single consistent common reference point for all spatially related information. For consistency the recommended reference location should be the conning position, according to the resolution MSC 252(83).

8 For example, the World Geodetic System 1984(WGS 84) used by GPS, Earth Parameters 1990 (from Russian "Parametry Zemli" 1990) (PZ-90) used by GLONASS, the Galileo Terrestrial Reference Frame (GTRF) or the China Geodetic Coordination System (CGCS2000) used by BDS.

9 Bureau International de Poids et Mesures.

3.7 Be capable of providing the PVT solution to the required accuracy[10] within:

.1 5 min where there is no valid satellite almanac data (cold start);

.2 1 min where there is valid satellite almanac data (warm start); and

.3 2 min, when subjected to a power interruption or loss of signals of < 60 s;

3.8 Provide time in UTC;

3.9 Be capable of meeting the requirements for the phases of navigation outlined in resolution A.1046(27);

3.10 Be capable of generating a new PVT solution at least once every 0.5 s for high-speed craft (HSC) in compliance with speed requirements as in paragraph 1.6 above and at least once every 1 s for conventional vessels;

3.11 Be capable of assessing whether the performance of the PVT solution (e.g. accuracy and integrity) meets the requirements for each phase of navigation[11]. An *alert* should be provided when such assessment cannot be determined;

3.12 Provide a caution if after 2 s for HSC or 3 s for conventional vessels, equipment is unable to assess the current achieved performance (e.g. accuracy and integrity) with respect to each navigation phase;

3.13 Provide a warning, if after 5 s for HSC or 7 s for conventional vessels, new PVT data has not been calculated. Under such conditions the last known position and the time of last valid fix, with the explicit indication of the state so that no ambiguity can exist, should be output until normal operation is resumed;

3.14 If it is not possible to provide a new position update at the next scheduled update, output the last plausible position, SOG, COG, and the time of the last valid fix, with indication of this state so that no ambiguity can exist, until position update is resumed;

3.15 Provide an indication of augmentation status, including:

.1 the receipt of augmentation signals;

.2 the validity of the signals received;

.3 whether augmentation is applied to the position in the PVT solution; and

.4 the identification of the augmentation signal(s);

3.16 Provide the following information, in alphanumerical form, for the final PVT solution and for each individual source when requested, to a local display (or a separate interfaced display):

.1 position;

.2 COG and SOG;

.3 time;

.4 the PVT solution source(s);

[10] Resolution A.1046(27).
[11] Resolution A.1046(27).

.5 the assessment of the navigation phase(s) for which performance requirements are supported;

.6 the identification of the augmentation signal(s) applied to the position solution; and

.7 any alert information.

4 INTERFACING AND INTEGRATION (MODULE C)

The equipment should:

4.1 Provide the following interfaces in accordance with the relevant international standards:[12]

.1 at least one interface from which the PVT solution should be available in the WGS 84 (i.e. including position information, COG, SOG, time, PVT source(s) (available and used), assessment of phase(s) of navigation for which performance requirements are met, and augmentation information) can be provided. Means may be provided for transforming the computed position based upon WGS 84 into data compatible with the datum of the navigational chart in use;

.2 at least one interface from which data from all available sources can be provided (e.g. to an Integrated Navigation System (INS) for enhanced assessment of PVT information which should be available in WGS 84);

.3 an interface for *alert* management (i.e. with the Bridge Alert Management (BAM); and

.4 facilities to accept the input of augmentation signals from at least one source;[13]

4.2 Be capable of operating satisfactorily under normal interference conditions, consistent with the requirements of resolution A.694(17)[14], and taking into account the typical electromagnetic and radio frequency spectrum environment on board and from outside a vessel;

4.3 Ensure that no permanent damage can result from an accidental short circuit or grounding of the antenna or any of its input or output connections or any of the inputs or outputs.

5 DOCUMENTATION (MODULE D)

Documentation for the equipment should be provided, preferably in an electronic format, and should include:

5.1 Operating manuals, which should contain an overall function description including:

.1 the multi-system concept and the benefits and limitations of using GNSS and terrestrial radionavigation systems and augmentation (i.e. as source(s) for the PVT solution);

12 Refer to Publication IEC 61162.

13 Recommendation ITU-R M.823.

14 Refer to resolution A.694(17) and IEC 60945.

.2 a statement on which GNSS and terrestrial radionavigation systems and augmentation(s) are supported (i.e. as sources for the PVT solution);

.3 a statement on which navigation phase(s) are supported and by which PVT source(s);

.4 user guidance for receiver adjustments necessary to achieve the navigation phase requirements;

.5 an explanation of the method used for the applied indicators and thresholds;

.6 an explanation of the fusion process and input selection for multiple systems; and

.7 a description of possible failures and their effects on the receiver equipment;

5.2 Installation manuals, which should contain:

.1 details of the components and the interconnections between them;

.2 details of interfaces and connections for data input/output, and interconnection diagrams;

.3 configuration options and commissioning instructions;

.4 power supply and earthing arrangements; and

.5 recommendations on the physical layout of equipment, including antenna mounting requirements and necessary space for installation and maintenance;

5.3 Familiarization material, which should explain all configurations, functions, limitations, controls, displays, alerts, indications and standard operator checks of the equipment;

5.4 A failure analysis,[15] at the functional level, which should verify that the equipment is designed using safe design principles and ensuring that the equipment includes "fail-to-safe" actions. The failure analysis should consider the impact of all failure modes (e.g. those caused by electrical, component, radiofrequency interference or jamming, etc.); and

5.5 Information which should support maintenance of the equipment.

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[15] Publication IEC 60812.

ANNEX 23

RESOLUTION MSC.570(109)
(adopted on 6 December 2024)

PERFORMANCE STANDARDS FOR A UNIVERSAL SHIPBORNE AUTOMATIC IDENTIFICATION SYSTEM (AIS)

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

RECALLING ALSO resolution A.886(21), by which the Assembly resolved that the functions of adopting performance standards and technical specifications, as well as amendments thereto, shall be performed by the Maritime Safety Committee on behalf of the Organization,

RECALLING FURTHER resolution MSC.74(69), annex 3, by which the Committee adopted the *Recommendation on performance standards for a universal automatic identification system (AIS)* to improve the safety of navigation,

TAKING INTO ACCOUNT resolution A.1192(33), by which the Assembly urged Member States and all relevant stakeholders to promote actions to prevent illegal operations in the maritime sector by the "dark fleet" or "shadow fleet",

RECOGNIZING the need for measures to prevent unauthorized entry or tampering of the ship's identity information in shipborne automatic identification systems (AIS),

HAVING CONSIDERED, at its 109th session, the recommendation made by the Sub-Committee on Navigation, Communications and Search and Rescue at its eleventh session,

1 ADOPTS revised *Performance standards for a universal shipborne automatic identification system (AIS)*, set out in the annex to the present resolution;

2 RECOMMENDS that Governments ensure that AIS equipment conforms to performance standards not inferior to those specified in:

.1 the present resolution if the equipment is installed on:

.1 new ships for which the building contract is placed on or after 1 January 2029, or in the absence of the contract, the keel of which is laid or which are at a similar stage of construction on or after 1 January 2029; or

.2 ships other than those ships prescribed in sub-paragraph .1 above, all installations of the specified type, having a contractual delivery date on or after 1 January 2029, or in the absence of a contractual delivery date to the ship, actually delivered to the ship on or after 1 January 2029; or

.2 annex 3 to resolution MSC.74(69) if the equipment is installed on ships other than those prescribed in paragraph 2.1 above.

ANNEX

PERFORMANCE STANDARDS FOR A UNIVERSAL SHIPBORNE AUTOMATIC IDENTIFICATION SYSTEM (AIS)

1 Scope

1.1 These performance standards specify the requirements for the universal AIS.

1.2 The AIS should improve the safety of navigation by assisting in the efficient navigation of ships, protection of the environment, and operation of vessel traffic services (VTS), by satisfying the following functional requirements:

.1 in a ship-to-ship mode for collision avoidance;

.2 as a means for littoral States to obtain information about a ship and its cargo; and

.3 as a VTS tool, i.e. ship-to-shore (traffic management).

1.3 The AIS should be capable of providing to ships and to competent authorities information from the ship, automatically and with the required accuracy and frequency, to facilitate accurate tracking. Transmission of the data should be with the minimum involvement of a ship's personnel and with a high level of availability.

1.4 The installation, in addition to meeting the requirements of the Radio Regulations, applicable ITU-R Recommendations and the general requirements as set out in resolution A.694(17), should comply with the following performance standards.

2 Functionality

The system should be capable of operating in a number of modes:

.1 an "autonomous and continuous" mode for operation in all areas. This mode should be capable of being switched to/from one of the following alternate modes by a competent authority;

.2 an "assigned" mode for operation in an area subject to a competent authority responsible for traffic monitoring such that the data transmission interval and/or time slots may be set remotely by that authority; and

.3 a "polling" or controlled mode where the data transfer occurs in response to interrogation from a ship or competent authority.

3 Capability

3.1 The AIS should comprise:

.1 a communication processor, capable of operating over a range of maritime frequencies, with an appropriate channel selecting and switching method, in support of both short- and long-range applications;

.2 a means of processing data from an electronic position-fixing system which provides a resolution of one ten-thousandth of a minute of arc and uses the WGS-84 datum;

.3 a means to automatically input data from other sensors meeting the provisions as specified in paragraph 6.2;

.4 a means to input and retrieve data manually;

.5 a means of error checking the transmitted and received data; and

.6 built-in test equipment (BITE).

3.2 The AIS should be capable of:

.1 providing information automatically and continuously to a competent authority and other ships, without involvement of ship's personnel;

.2 receiving and processing information from other sources, including that from a competent authority and from other ships;

.3 responding to high-priority and safety-related calls with a minimum delay; and

.4 providing positional and manoeuvring information at a data rate adequate to facilitate accurate tracking by a competent authority and other ships.

4 User interface

To enable a user to access, select and display the information on a separate system, the AIS should be provided with an interface conforming to an appropriate international marine interface standard.

5 Identification

For the purpose of ship and message identification, the ship's Maritime Mobile Service Identity (MMSI) should be used.

6 Information

6.1 The information provided by the AIS should include:

.1 Static:

- IMO number[1]
- Call sign and name
- Length and beam
- Type of ship
- Location of position-fixing antenna on the ship (aft of bow and port or starboard of centreline)

[1] In accordance with *IMO ship identification number scheme* adopted by the Organization (resolution A.1117(30)). If not required to have an IMO number, an official flag State number may be used (refer to Recommendation ITU-R M.1371 for the entry of an official flag State number).

.2 Dynamic:

- Ship's position with accuracy indication and integrity status
- Time in UTC [2]
- Course over ground
- Speed over ground
- Heading
- Navigational status (e.g. NUC, at anchor, etc. - manual input)
- Rate of turn (where available)
- Optional - Angle of heel (where available)[3]
- Optional - Pitch and roll (where available)[3]

.3 Voyage-related:

- Ship's draught
- Hazardous cargo (type)[4]
- Destination and ETA (at master's discretion)
- Optional - Route plan (waypoints)[3]

.4 Short safety-related messages

.5 Equipment Identification message[5]

6.2 Information update rates for autonomous mode

The different information types are valid for a different time period and thus need a different update rate:

- Static information:	Every 6 minutes and on request
- Dynamic information:	Dependant on speed and course alteration according to table 1
- Voyage-related information:	Every 6 minutes, when data has been amended and on request
- Safety-related message:	As required

[2] Date to be established by receiving equipment.

[3] Field not provided in basic message.

[4] As required by a competent authority.

[5] The AIS equipment should broadcast a unique manufacturer equipment identification number, which should also be physically marked on the equipment.

TABLE 1

Type of ship	Reporting interval
Ship at anchor	3 minutes
Ship 0-14 knots	12 seconds
Ship 0-14 knots and changing course	4 seconds
Ship 14-23 knots	6 seconds
Ship 14-23 knots and changing course	2 seconds
Ship > 23 knots	3 seconds
Ship > 23 knots and changing course	2 seconds

Ship Reporting Capacity – the system should be able to handle a minimum of 2,000 reports per minute to adequately provide for all operational scenarios envisioned.

6.3 Security

A security mechanism should be provided to detect disabling and to prevent unauthorized alteration of input or transmitted data. To protect against unauthorized dissemination of data, the IMO guidelines (Guidelines and Criteria for Ship Reporting Systems[6]) should be followed. A change to the IMO ship identification number in the equipment should only be possible by an authorized manufacturer's agent.

7 Permissible initialization period

The installation should be operational within 2 minutes of switching on.

8 Power supply

The AIS and associated sensors should be powered from the ship's main source of electrical energy. In addition, it should be possible to operate the AIS and associated sensors from an alternative source of electrical energy.

9 Technical characteristics

The technical characteristics of the AIS such as variable transmitter output power, operating frequencies (dedicated internationally and selected regionally), modulation and antenna system should comply with the appropriate ITU-R Recommendations.[7]

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[6] Resolution MSC.433(98).

[7] ITU-R M.1371 series refer.