



JP4000 Joystick Control System

Introduction

The JP4000 is a new and innovative solution for mega-yachts (as well as for multi-purpose vessels) covering mooring, docking and low-speed manoeuvring, to make operations more safe and comfortable. The JP4000 has been designed especially for those ship owners who highly appreciate the safety of manoeuvring and full control over vessel motion, irrespective of weather conditions and the area available for manoeuvring.

Modern technology, combined with the latest achievements in the field of dynamic positioning, make the JP4000 Joystick Autopilot system an ideal solution for your vessel, allowing you to discover the full potential of your super-yacht and to enjoy its manoeuvrability.

The JP4000 has been specifically designed for yacht and workboat applications when free manoeuvring in limited space is required; it conforms to the requirements set for Dynamic Positioning Systems of the ABS DPS-0, DPS-1 and DNV-AUT classes. Please note that the system is not intended for use on any DP (Dynamic Positioning) classed vessel as an approved solution for dynamic positioning. In such a case, the range of Navis IVCS/NavDP4000 series products has to be considered.

The JP4000 is recommended for vessels of up to 60 meters in length (LOA).



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When a yacht is moving forward at high speed, the JP4000 acts as the autopilot, providing the vessel heading control by using rudder (-s) or track control by using an external track controller. In the autopilot mode the thrusters and the main propulsion are not affected. The AP4000 autopilot is an integral part of the JP4000 system

The joystick control modes of the JP4000 enable the ship's master to steer the yacht freely in any direction by manually setting the required fore-and-aft and transverse forces and rotation moment necessary with the help of the 3-axis joystick. The system calculates the amount of thrust to be allocated for every actuator, to replace conventional controls with the joystick at low speeds.

The JP4000 also provides semi-automatic heading control, which means that the system automatically holds the heading while the ship's master controls fore-and-aft and transverse vessel motion; in this case there is no need to compensate for possible vessel rotation, which can occur as a result of the operator's actions.

The 'Hold Position' and 'Anchor Watch' control modes are optional. In these modes the system automatically holds the vessel in a pre-set position, at the same time controlling its heading.



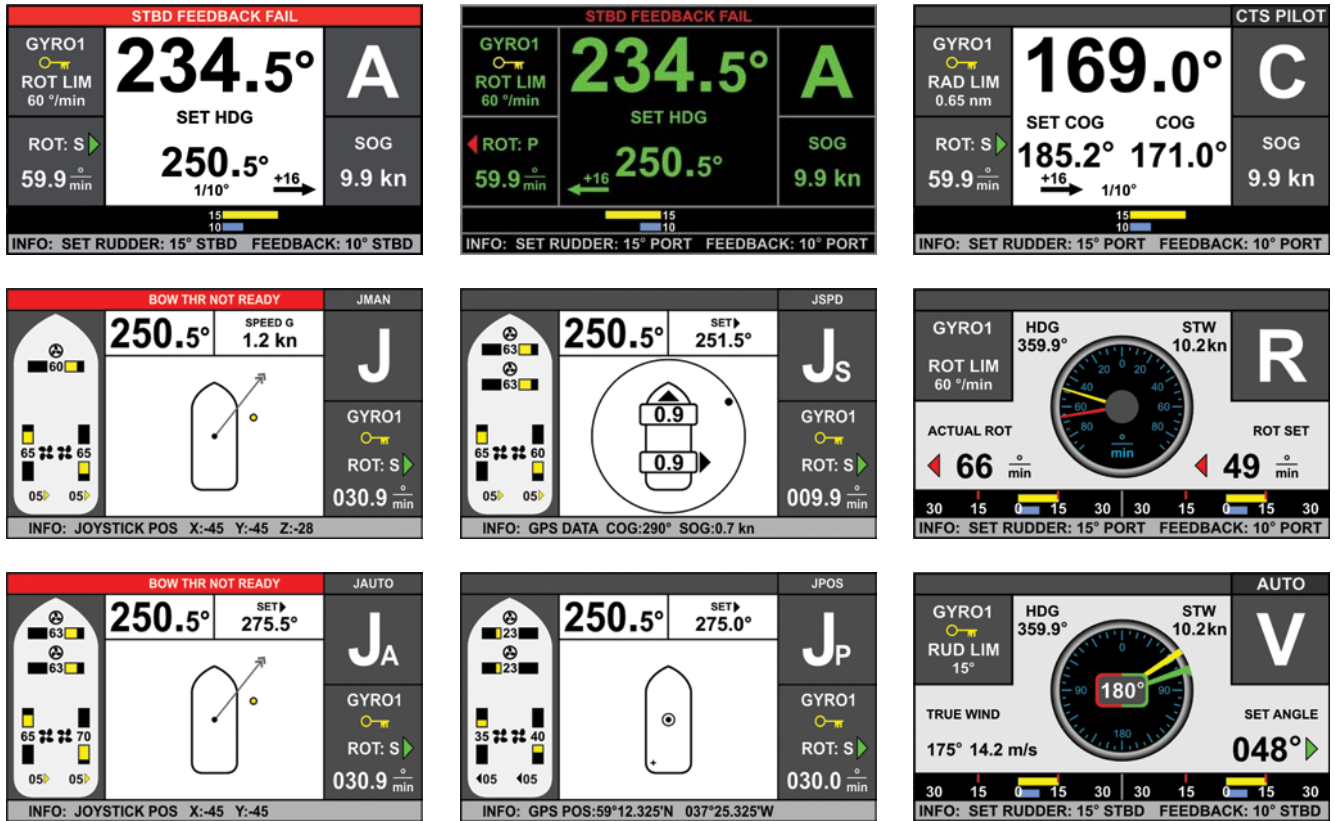
The main advantages of JP4000

- The system is very easy to learn and operate
- Precise ship dynamics algorithms are among the best in the market
- The system offers extensive functionality with a wide array of options
- Several hardware configurations are available
- The JP4000 can be connected to the majority of standard steering/thruster/engine control interfaces.
- The built-in 'Auto Tune' mode makes it possible to adapt the autopilot performance to the hydrodynamic parameters of any vessel, regardless of its displacement and dimensions.

System overview

The JP4000 presents you with a useful set of information on its 6.5 inch high-resolution color anti-glare LCD display. Particular attention has been paid to offering simple and intuitive operation of the system.

All information is clearly shown in easy to read pages, including, alarms, heading set and heading steered, the commanded and the actual rudder angle, the commanded and the actual thruster directions and magnitudes.



Examples of JP4000 mode screens



JP4000 main control panel

Operation modes of the JP4000

Autopilot control modes:

Auto	Automatic heading control.
Track	The system controls vessel motion on straight legs (ECDIS or ECS can be used as the external track controller in this mode, TCS Category A).
AutoNAV	The JP4000 controls vessel motion on straight legs and receives navigation data from an external source like ECDIS (TCS Category C).
Dodge	Direct manual control of synchronized rudders using the rotary knob on the operator unit or via an external wheel.
Override	Direct manual control of synchronized rudders using external over-ride devices (tiller, jog lever). (Option)
CTS Pilot	The vessel stays on a pre-set Course Over Ground (COG). Wind and current force and direction are ignored.
River Pilot	Turns are performed using a pre-set Rate of Turn (ROT) value.
Wind Vane (for sailing me-ga-yachts only)	Steering is performed by setting the relative wind angle.

Joystick control modes:

Joystick Manual	In this mode the yacht is controlled in the fore-and-aft and transverse directions using the joystick. The yacht's heading is also controlled manually.
Joystick Auto Heading	This mode is used for manual joystick-controlled fore-and-aft and traverse steering while the heading is kept automatically.
Speed Control & Auto Heading	This mode is used for fore-and-aft and traverse steering with automatic heading control. The longitudinal and transverse speeds are set by the joystick. The knob is used to set a new heading value (pre-set heading).
Hold Position	This mode is used to keep the vessel in position automatically in open sea conditions, while docking/manoeuvring, or near a drilling rig etc. All the connected thrusters/actuators are used. (Option)
Anchor Watch	This mode automatically positions the vessel within an area with pre-defined coordinates. A specified set of thrusters providing the mode is used to reduce fuel consumption. (Option)

JP4000 Interfaces:

Main Engine and Thrusters interface:

- Proportional control via 0...10V, ± 10 V or 4...20 mA control signal.

Steering Gear interfaces:

- Solenoid valves, 24V DC (up to 3A load current).
- Proportional valves - 0...10 V, ± 10 V or 4...20mA control signal.
- Proportional rudder control (steering gears with follow-up steering control system) - 0...10 V, ± 10 V or 4...20mA control signal.

Sensor interfaces (NMEA):

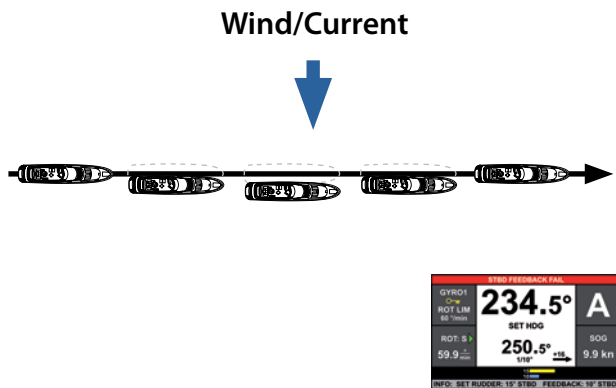
- Gyrocompass (recommended, 10 Hz output required).
- Magnetic or fluxgate compass.
- DGPS receiver (high resolution NMEA output is recommended for 'Hold Position' control mode).
- Log (water referenced).
- External ECS or ECDIS for 'Track Control'.
- Windsensor for the 'Windvane' control mode.

Autopilot control modes



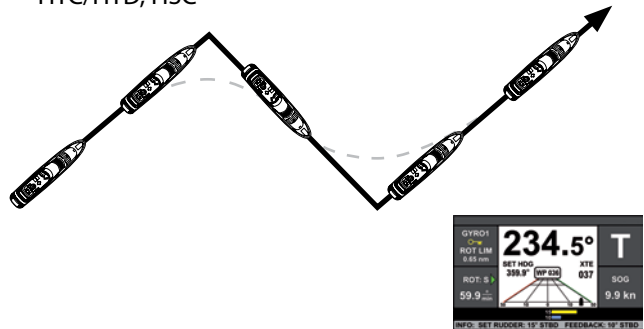
Auto

In the 'Auto' mode the ship's heading is controlled automatically with minimum rudder activity



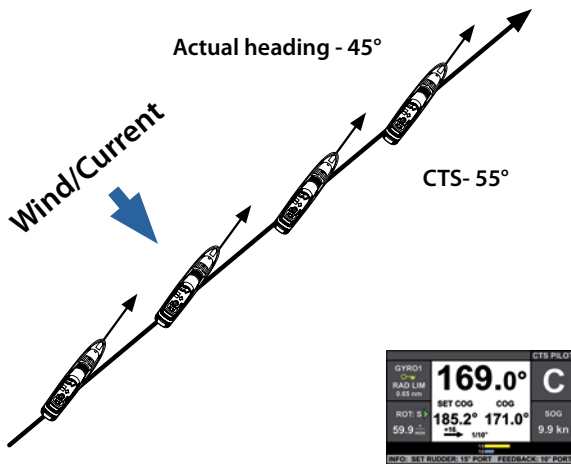
Track/AutoNav

In 'Track/AutoNav' modes the JP4000 automatically controls the vessel heading on straight legs and turns between waypoints using NMEA messages from Category A or Category C track control system (ECS/ECDIS/Chart Plotter) Supported NMEA messages: APB, BWC, HTC/HTD, HSC



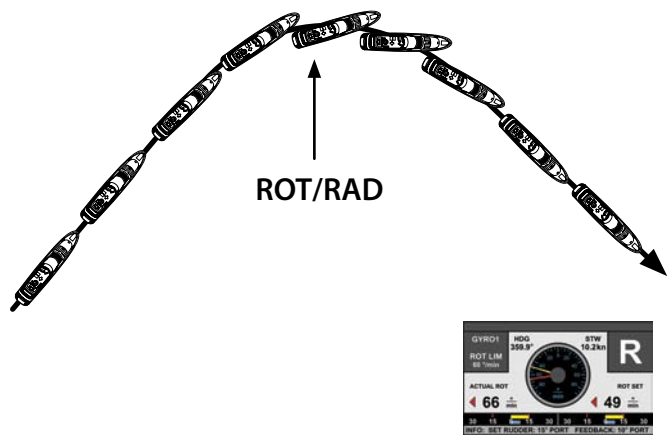
CTS Pilot

The 'CTS' mode allows the vessel to stay on a pre-set course over ground. The drift/wind force and direction are not taken into account.



River Pilot

In 'River Pilot' mode, turns are performed by a pre-set 'Rate of Turn' value using an external ROT tiller or the knob in the control panel.



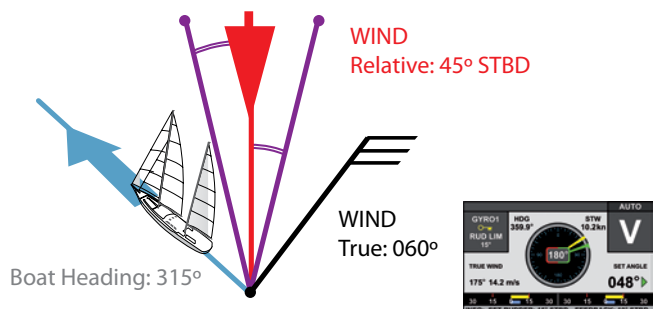
Dodge/FFU Override/FFU

In 'Dodge'/'FFU'/'FFU Over-ride' modes the heading can be corrected manually using the external over-ride devices (rotary knob on the JP4000 control panel, over-ride tiller, jog lever, etc.). These modes are optional.



Windvane (for sailing yachts)

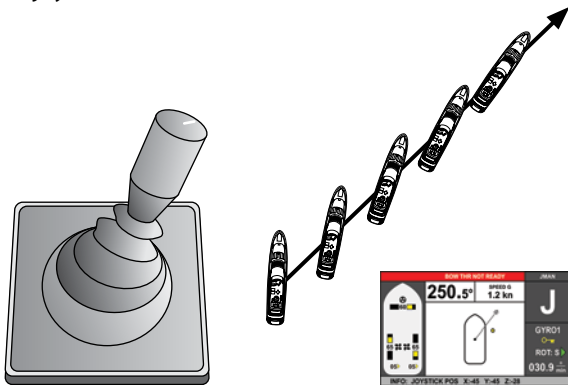
The 'Windvane' mode allows the sailing yacht to steer by setting the relative wind angle.





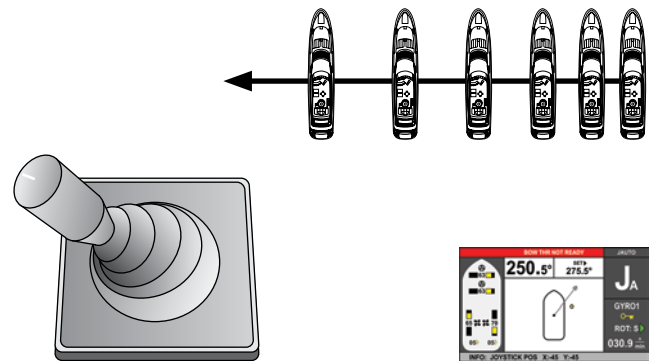
Joystick Manual

The low-speed 'Joystick Manual' control mode provides you with the variety of ways to control your yacht motion. The yacht's heading and position are set by the 3-axis joystick.



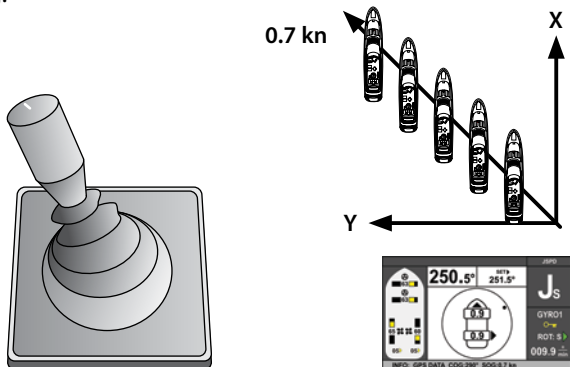
Joystick Auto-Heading

By switching to the 'Joystick Auto-Heading' mode you can control the yacht's position in the fore-and-aft and traverse directions while the heading will be fixed (the 3rd axis of the joystick is ignored).



Speed Control and Auto-Heading

In this mode you can steer the yacht in the fore-and-aft and traverse directions with pre-set speed and heading. The 3-rd axis of the joystick will be ignored. The joystick in this mode is used to set the speed in longitudinal (axis X) and transverse (axis Y) directions. The encoder on the main panel is used to set a new heading.



Hold Position (Option)

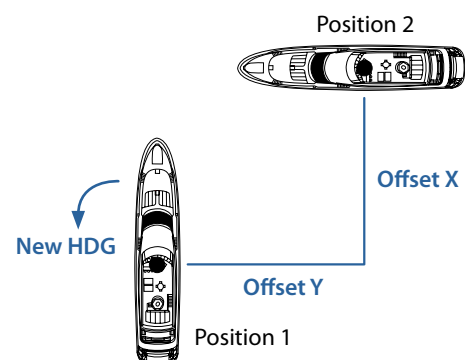
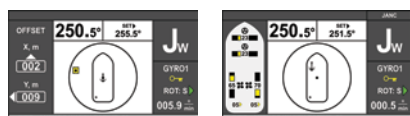
The completely automatic 'Hold Position' mode keeps the yacht in a pre-selected position with a pre-set heading with high accuracy. Propulsion is controlled by the JP4000 to keep the vessel's position fixed. The 'Hold Position' mode is used for station keeping in open sea, while performing precise manoeuvring in docks/marinas etc. The joystick is used to set the position offset in metres (axis X and Y). The main panel encoder is used to set a new heading value. The 3rd axis of the joystick is ignored.

All the yacht's active propulsion is used to maintain position.



Anchor Watch (Option)

As compared to the 'Hold Position' mode, only a pre-defined set of the yacht's thrusters/actuators (with their power limitations pre-defined as well) is used in 'Anchor Watch' to keep the vessel in position.



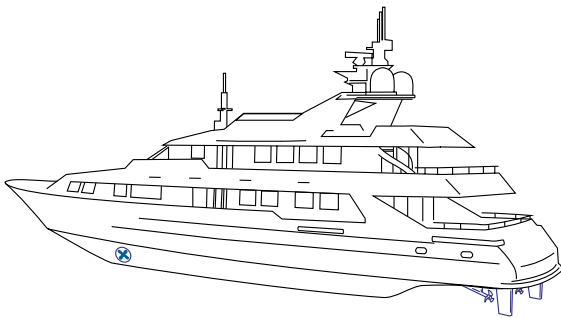
Thruster configuration

The nine standard configurations of propulsion shown in the pictures make it possible to obtain full control over your yacht both in the autopilot and joystick control modes.

When the system is being custom-designed for you, we create a precise mathematical vessel dynamics model that takes into account all of the hydrodynamic parameters and characteristics of your yacht's propulsion units.

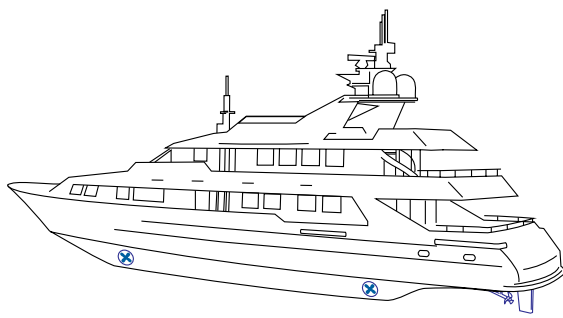
This allows you to obtain full control over the potential of the yacht and to maximize fuel reduction in all low speed modes.

J1



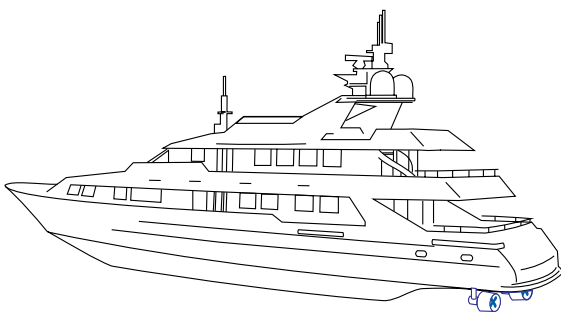
- Two propellers. Either CPP or FPP with reverse clutch.
- Two rudders (Linked or Independent).
- Bow tunnel thruster.

J2



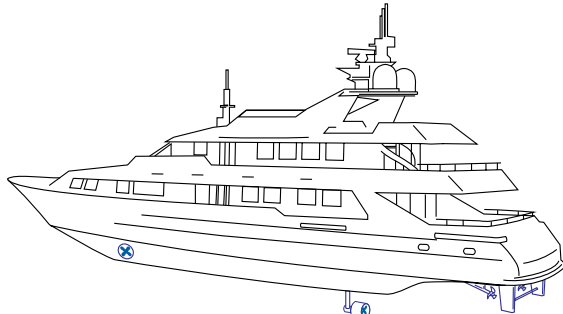
- One propeller (CPP only).
- Single rudder.
- Bow tunnel thruster
- Stern tunnel thruster

J3



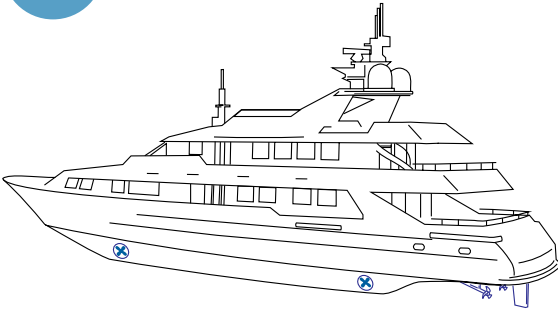
- Two stern azimuth thrusters or Z-drives

J4



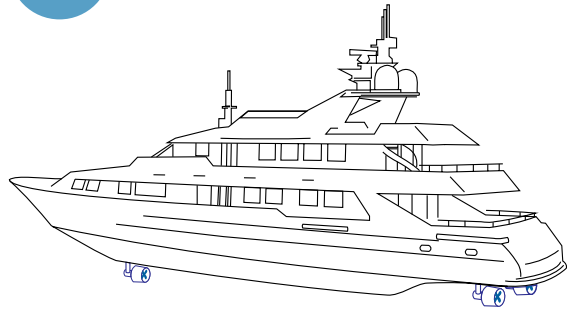
- Two propellers. Either CPP or FPP with a reverse clutch.
- Two Independent or linked rudders.
- Bow tunnel thruster
- Stern azimuth thruster (conventional or re-tracktable)

J5



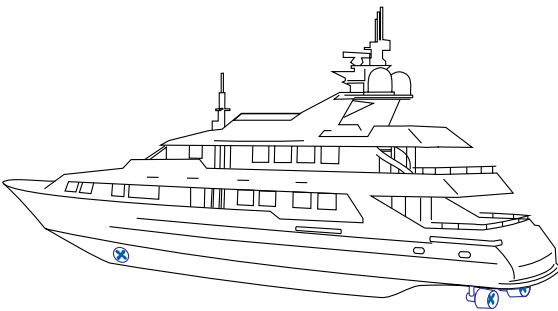
- Two propellers. Either CPP or FPP with a reverse clutch.
- Single rudder.
- Bow tunnel thruster
- Stern tunnel thruster

J6



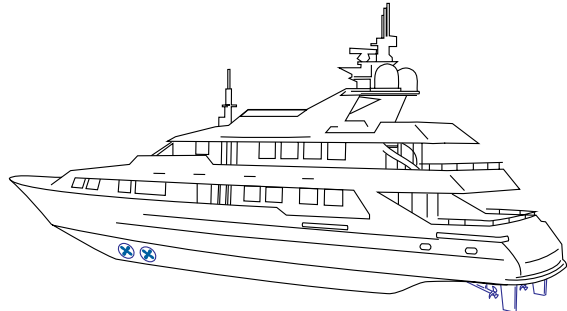
- Two stern azimuth thrusters or Z-Drives (CPP or FPP).
- Bow azimuth thruster (conventional or retractable)

J7



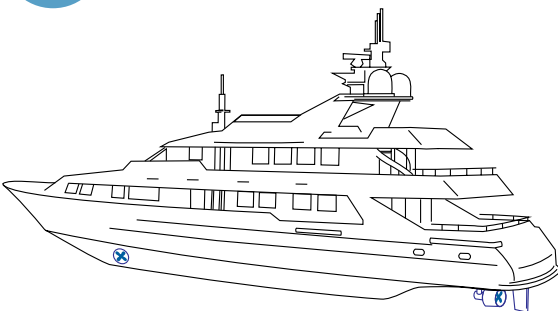
- Two stern azimuth thrusters or Z-Drives.
- Bow tunnel thruster

J8



- Two propellers. Either CPP or FPP with a reverse clutch.
- Two rudders (Linked or Independent).
- Bow tunnel thruster 1
- Bow tunnel thruster 2

J9



- Single rudder
- Bow tunnel thruster
- Stern azimuth thruster

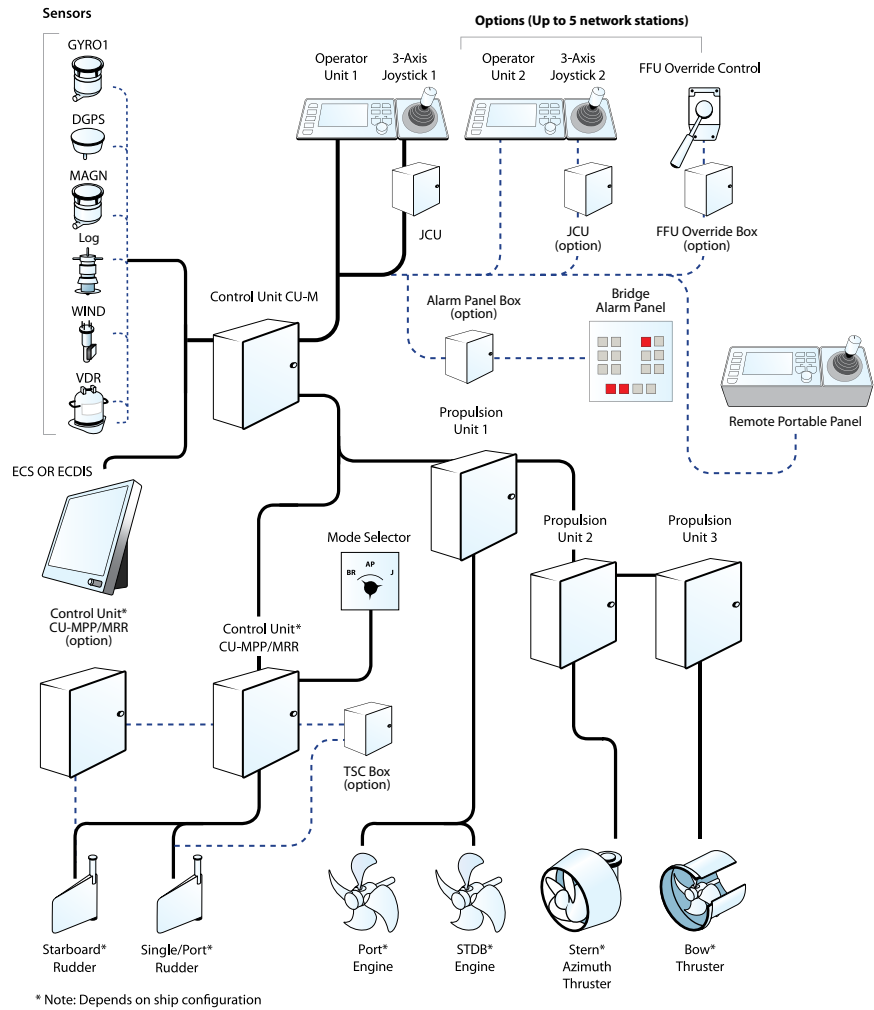
System configuration

JP4000 delivery set

- JP4000 operator unit
- 3-axis joystick
- Propulsion Unit (-s)
- Control Unit (-s)
- Mode Switch Selector
- Documentation Set
- Spare parts set

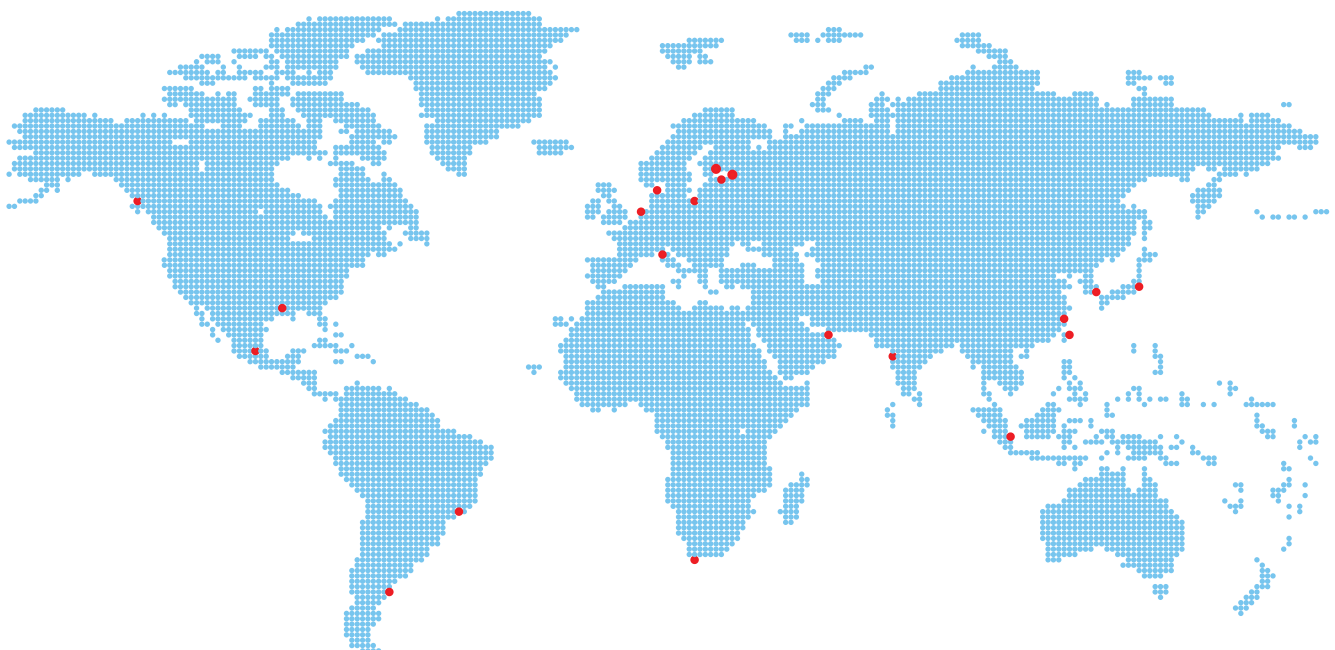
JP4000 Options

- 'Hold Position' and 'Anchor Watch' control modes
- Additional operator unit (-s), including 3-axis joystick (-s)
- IP-67 protected portable control panel including display and joystick



Service and Support

Wherever you are on the globe, Navis Engineering offers you a comprehensive package of technical support 24/7 x 365 days a year. The combination of extensive built-in diagnostics, hot-line support, a network of service agents with Navis Engineering certified field service engineers, and service centres with senior engineers ready to fly to your vessel within 24 hours, no matter where it is located, ensures a timely response to any technical problem.



Power Supply:

24 VDC +30% ... -25%
 APH4000 power supply is backed up with a +12V battery

Operating and Storage Conditions:

Operating Conditions:

Temperature – -25..+75°C
 Humidity – Up to 95% at 25°C
 Up to 75% at 45° C

Storage Conditions:

Temperature – -30..+75°C
 Humidity – Up to 98% at 25°C
 Up to 75% at 45° C

Sensor Input & Output

Input:

Heading

Gyro compass or SAT compass \$--HDT, \$--THS (10Hz input is required)

Position and Speed

DGPS or SAT compass \$--GGA, \$--VTG
 (High position resolution for LAT/LON is recommended)

ECDIS/ECS (Track Control mode)

TCS Category A. - \$--APB, \$--BWC
 TCS Category C. - \$--HTC/\$--HTD or \$--HSC

Wind

\$--MWV(R), \$--MWV(T), \$--MWD, \$--VWR For Sailing Yachts in Wind Vane control mode

Output:

\$AGHTD, \$AGRSA, \$AGHDT

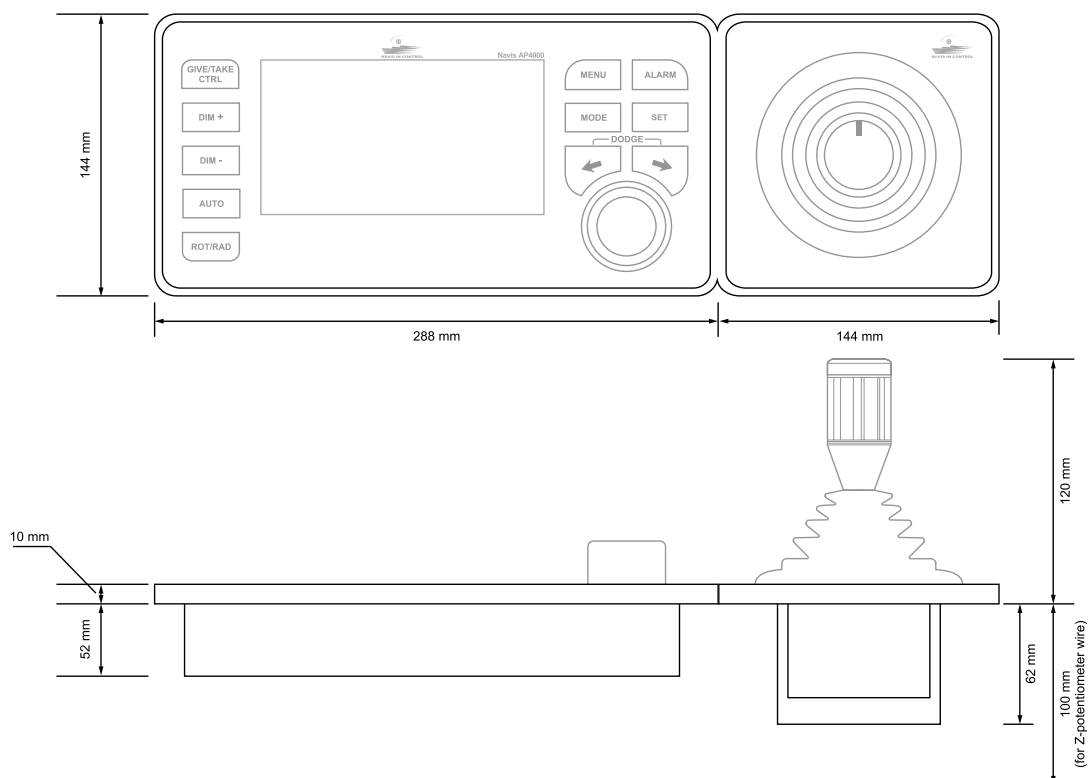
Input and Output data communicates via standard serial protocol (RS422/RS232).

Display characteristics:

- Technology – Wide VGA
- Pixel resolution – 800*480
- Active display area – 143.4 (H) x 79.2 (V) mm
- Contrast ratio – 400:1
- Viewing angle (typical) 75 deg (left/right) and 70 deg. (up/down)
- Backlighting – adjustable

Operator Unit Technical Data:

- Dimensions 288*288*54 (without knob and rear connectors) mm
- Power Supply Voltage – 24 V +30%...-25%, (APH4000 is backed up with +12 V Battery)
- Electrical isolation – Isolation from computing core and external ports.
- Isolation Voltage: 1000V
- Data Exchange Interfaces CAN 2.0B, transmission rate up to 500kb/sec
- Acoustic alarm not less than 75dB (A) pressure at a distance of 1 meter.
- Protection level: IP67 on top, IP22 rear side.



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