SECTION 5
SYSTEM MODES
K-POS INTERFACE

System Modes

The K-Pos system can be used in one or more of the following modes:

- *Standby mode*
- *Joystick mode*
- *Auto Heading mode*
- *Auto Position mode*

Each of the modes is described in more detail in the following sections.

In addition to these modes, various tailored modes have also been developed to optimize vessel operation for a wide range of applications and types of vessels.

Standby Mode

The *Standby* mode is a waiting and reset mode in which the K-Pos system is in a state of readiness but in which no control of the vessel can be made using the K-Pos system.

Joystick Mode

In the Joystick mode, the operator controls the positioning of the vessel using the three-axis joystick (integrated joystick and rotate controller). The joystick commands the vessel to move in the alongships and athwartships directions (along the surge and sway axes), while rotating the joystick commands the vessel to rotate (the yaw axis).

The following functions are available in the *Joystick* mode:

- *Joystick Thrust Selection*

- *Reduced*: the maximum force is a specified preconfigured percentage of the achievable force from all thrusters.

- *Full*: increases the vessel's response to the movement of the joystick compared to the *Reduced* selection. The maximum force available from all the thrusters can be used.

• *Joystick Precision Selection*

- *General*: linear relation between movement of the joystick and force exerted by the thrusters.

- *High-Speed*: non-linear relation between movement of the joystick and force exerted by the thrusters. The precision is best at the upper end of the thrust scale.

- *Low-Speed*: non-linear relation between movement of the joystick and force exerted by the thrusters. The precision is best at the lower end of the thrust scale.

• *Environmental Force Compensation*

Joystick control can also be combined with environmental compensation in each of the three axes (surge, sway, yaw). The system then automatically compensates for the wind forces acting on the vessel by providing the thrusters with the necessary extra thrust in the appropriate direction. If position-reference system measurements are available, the system also performs automatic compensation for the calculated sea current and wave forces acting on the vessel.

• *Avoid Current Update*

When position-reference system measurements are available the system will calculate the unknown forces, including sea current and wave forces, which are acting on the vessel (collectively referred to as "current"). This calculation normally increases the system performance when entering automatic control.

However, there can be situations where the calculated "current" is no longer valid for the new operational condition. A typical example would be when entering automatic control after a period using thrusters to hold the vessel against a quay.

The *Avoid Current Update* function gives the operator the possibility to set the "current" to zero in any axis that is not under automatic control.
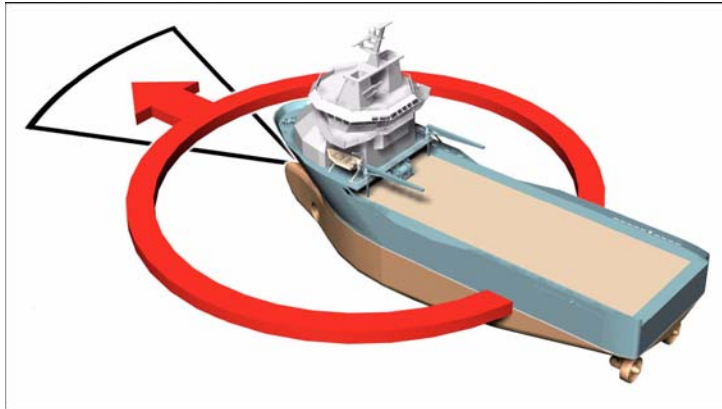
• *Rotation Center for Joystick Manoeuvring*

An alternative rotation center may be selected in order to rotate the vessel around either the fore or the aft when using the joystick rotate control.

The selected Rotation Center will also be active at entering *Auto Position* mode.

The *Joystick* mode can be combined with the *Auto Heading* mode.

Auto Heading Mode

In the *Auto Heading* mode, the system accurately keeps the vessel at the selected heading. The operator can use the following standard functions to control the vessel's heading:

• *Present Heading*, which maintains the vessel's current heading.

• *Change Heading*, which rotates the vessel to the specified heading. The following methods can be used to define the new heading:

- *Marked Heading* for marking the setpoint on the Posplot view using the trackball.

- *Change Heading Absolute* for defining the setpoint using absolute value.

- *Previous Heading* for defining the setpoint to be the last specified heading.

- *Change Heading Incremental* for defining the setpoint relative to the existing setpoint.

- *Heading Wheel with Buttons Dec, Set and Inc*, to increase / decrease the heading setpoint.

• *Minimum Power Heading*, which continuously updates the vessel's heading to obtain the heading which requires the lowest power consumption.

The following functions are also available in the *Auto Heading* mode:

• *Set ROT*

Enables the operator to specify the rate of turn (ROT) to be used by the system when rotating the vessel to a new heading.

• *Set ROT Acceleration*

Enables the operator to specify the acceleration/deceleration in the rate of turn at the start and finish of a commanded rotation.

• *Predefined Controller Gain Selection*

Allows the operator to select one of three predefined controller gain levels (High, Medium or Low), to adjust the vessel response.

• *Heading Warning and Alarm*

Allows the operator to specify warning and alarm limits for the heading deviation. The vessel's heading is monitored continuously by the system, and a message is given if the heading deviation limit is exceeded.

The *Auto Heading* mode is incorporated in the *Auto Position* mode to provide complete, automatic control of the vessel's heading and position.

Auto Position Mode

In the *Auto Position* mode, the system automatically maintains the heading and position of the vessel. The functions available for heading control are described under *Auto Heading* mode. The operator can use any of the following standard functions to control the vessel's position:

• *Present Position*, which maintains the present vessel position.

• *Change Position*, which moves the vessel to a new position specified by the operator. The following methods can be used to define the new position:

- *Marked Position* for marking the setpoint on the Posplot view using the trackball.

- *Change Position Absolute* for defining the setpoint using absolute coordinates.

- *Previous Position* for defining the setpoint to be the last specified position.

- *Change Position Incremental* for defining the setpoint relative to the existing setpoint. The operator can select either relative or true increments.

- *Change Position Range/Bearing* for defining the setpoint relative to the start position. The operator can select the start position to be either present setpoint or present position, and the bearing to be either true or relative.

The following functions are also available in the *Auto Position* mode:

• *Set Speed*

Enables the operator to specify the vessel speed when moving to a new position.

• *Set Acceleration*

Enables the operator to control the acceleration/deceleration of the vessel at the start and finish of a commanded change of position.

• *Position Warning and Alarm*

Allows the operator to specify warning and alarm limits for the position deviation. The vessel's position is monitored continuously by the system, and a message is given if the position deviation limit is exceeded.

• *Predefined Controller Gain Selection*

Allows the operator to select one of three predefined controller gain levels (High, Medium or Low), to adjust the vessel response.

• *Rotation Center*

Allows the operator either to select a predefined rotation center or to enter the required coordinates manually. The rotation center can even be defined outside the vessel itself.

The rotation center will be used when both the vessel heading and position are under automatic control.

If the selected Rotation Center is fore or aft it will also be active at entering *Joystick* mode.

Other modes

- *Follow Target mode*
- *Anchor Assist mode*
- *Autopilot mode*
- *ROT Pilot mode*
- *Auto Track (low-speed) mode*
- *Auto Track (move-up) mode*
- *Auto Track (high-speed) mode*
- *Track Line mode*

K-Pos Interface

Introduction

Several different types of interfaces are available for use with the K-Pos system. These include:
- Position-reference system interfaces
- Sensor interfaces
- Thruster/propeller interfaces
- Power plant interfaces
- Other interfaces

In addition to the interfaces listed in this section, other interfaces can be supplied to suit specific requirements.

For interfacing details, refer to the *K-Pos Interface Manual*.

Position-Reference System Interfaces and principles

A number of interfaces are available which take information from position-reference systems such as HPR and Artemis, and input this information to the K-Pos system.
Interfaces are available for the following position-reference systems:

	Signal types
Kongsberg HPR	Net/serial
Artemis	Serial
Lightweight Taut Wire	Analog/digital
Fanbeam	Serial
Kongsberg Radius	Serial
Kongsberg DGPS/DARPS	Serial

Sensor Interfaces

A number of interfaces are available which take information from sensors such as wind sensors and gyro compasses, and input this information to the K-Pos system. The number of sensor interfaces required depends on the type of redundancy used in the K-Pos system.

Interfaces are available for the following sensors:

	Signal types
Gyrocompass (NMEA-0183)	Serial
Vertical Reference Sensor	Serial/analog
KONGSBERG MRU D/2/H/5	Serial/analog
KONGSBERG Seapath	Serial

20/100/200/200RTK	
Wind	Serial
Draught	Serial
Doppler Log	Serial
DGPS Speed (NMEA-0183)	Serial
Rate of Turn Sensor (NMEA-0183)	Serial
Water Depth (NMEA-0183)	Serial

Thruster/Propeller Interfaces

The thruster/propeller/rudder interfaces required depends on the vessel's propulsion system.

The following interfaces are supplied as part of the standard K-Pos system:

	Signal types
Thruster Ready	Digital
Thruster Command (RPM, Pitch, Force or Load)	Analog/current
Thruster Feedback (RPM, Pitch, Force or Load)	Analog/current
Thruster Azimuth Command	Analog/current
Thruster Azimuth Feedback	
Rudder Ready	Digital
Rudder Azimuth Command	Analog/current
Rudder Azimuth Feedback	Analog/current

The following interfaces are also available:

	Signal types
Thruster Running	Digital
Thruster RPM/Pitch Reduced (by external system)	Digital
Clutch Status	Digital
Thruster RPM (pitch controlled unit)	Digital
Rudder in Zero	Digital
Azimuth/Rudder Ready	Digital

Note that if the K-Pos is part of an integrated system, then the information will be transferred to/from the KONGSBERG Thruster Control (K-Thrust) system via the dual Ethernet communication network.

Power Plant Interfaces

The power plant interfaces are necessary for power load monitoring and blackout prevention.

The following is a list of typical interfaces:

- Bus-tie Breaker
- Generator Power
- Generator Ready
- Thruster Breaker
- Thruster Load Feedback (Current/Power)
- Diesel Engine Fuel Rack

Note that if the K-Pos is part of an integrated system, then the information will be transferred from the KONGSBERG Marine Automation (K-Chief) system via the dual Ethernet communication network.

Other Interfaces

The following interfaces are also available:

	Signal types
Waypoint List	Serial
Waypoint to K-Pos	Serial
Waypoint from K-Pos	Serial
Riser Sensor ERA	Serial
Platform Master Clock	Net/serial
DP Alert Selector	Digital
Mooring Hawser Tension	Analog/current
Pipe Tension	Analog/current
Cable Tension	Analog/current
Plough Tension	Analog/current
Water Monitor	Analog/current
Dredge Arm Forces	Analog/current
Dredge Arm Positions	Analog/current
Gangway	Analog/current
Central Alarm System	Net/serial
CyberSea	Serial