

<b>WinFrog Device Group:</b>	<b>Output</b>
<b>Device Name/Model:</b>	<b>Simrad SDP21 WP</b>
<b>Device Manufacturer:</b>	<p><b>KONGSBERG SIMRAD AS</b>  DYRMYRGATA 35, P.O. BOX 483  3601 KONGSBERG NORWAY  Phone: 47 32 28 50 00; Fax: 47 32 73 59 87  E-mail: <a href="mailto:WebOffice@kongsberg.simrad.com">WebOffice@kongsberg.simrad.com</a>  <a href="http://www.kongsberg-simrad.com/">http://www.kongsberg-simrad.com/</a></p> <p><b>KONGSBERG SIMRAD INC.</b>  7250 LANGTRY STREET  HOUSTON TX 77040-6625, U.S.A.  Phone: 1 713 934 8885; Fax: 1 713 934 8886</p>
<b>Device Data String(s) Output to WinFrog:</b>	N/A
<b>WinFrog Data String(s) Output to Device:</b>	NMEA string: \$PRTNW (Proprietary)
<b>WinFrog .raw Data Record Type(s):</b>	450

**DEVICE DESCRIPTION:**

Kongsberg Simrad Dynamic Positioning (SDP) control systems integrate control of the vessel’s propulsion systems via inputs from positioning systems, gyrocompasses, wind speed and direction monitoring equipment, and any other sensors that can assist with the automatic positioning of the vessel.

Commands to the thrusters can be based on two main types of systems. The first version has conventional cabling of signals to and from thrusters, while the second version has dual net communication. These commands control the dynamic positioning system, thruster control, power management and other vessel control systems.

Many of Kongsberg’s Dynamic Positioning (DP) systems are based on common hardware and software. Following is a list of current WinFrog drivers having outputs to Simrad DP systems:

- SIMRAD 301 DP
- SIMRAD 701 DP
- SIMRAD 702 WP
- **SIMRAD SDP21 WP**
- SIMRAD SDP24
- SIMRAD SDP600

The SDP21 system has two (2) consoles, with one (1) control unit for all the thrusters. The ‘WP’ indicates that WinFrog outputs waypoint information to the unit. This driver also outputs the vessel position to the DP system.

## DEVICE CONFIGURATION INSTRUCTIONS (WinFrog Suggested):

Baud Rate: 4800

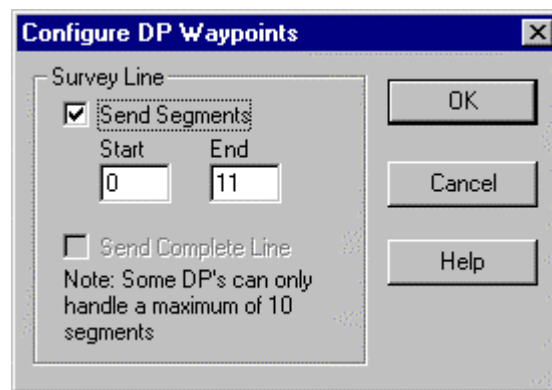
Data Bits: 8

Stop Bits: 1

Parity: None

### WINFROG I/O DEVICES > CONFIG OPTIONS:

The SIMRAD SDP21 WP device is added to WinFrog from the OUTPUT device types. The DP OUTPUT data item is added along with the SIMRAD SDP21 WP device. The following dialog box appears for configuring output data via the Configure > I/O Devices > Configuration command. This dialog box will also appear if you highlight the SIMRAD SDP21 WP device in the I/O Devices Window, then right-click and choose Configure Device.



The following items are configurable within this dialog box:

#### Survey Line:

Enter the survey line segments, of the active survey line, in the Start and End boxes, then select the Send Segments checkbox. When the OK button is clicked to exit the dialog box, the survey line segments are sent to the DP system. This command will send a MAXIMUM of 11 line segments (i.e. Survey Line Points 'Segment 0' to 'Segment 11'). Refer to Configuration Details for more information on the raw data logging and data output strings associated with the Simrad SDP21 WP driver.

The above procedure must be repeated every time you wish to send Line Segments (and vehicle position data) to the DP system. The device must be added to a vehicle before any data transfer occurs.

#### Data Checks:

Prior to attempting to send the specified line nodes, several checks are performed, including the validity of the segments selected. The tests are as follows:

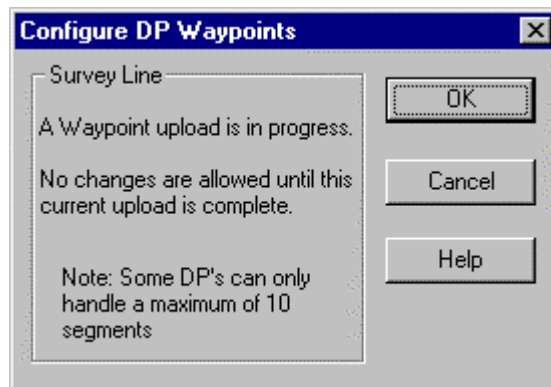
- Is there a valid line selected for the respective vehicle?
- Is the start segment  $\geq 0$ , the first node in any line?

- Is the end segment > the start segment?
- Is the start segment > the last line node?
- Is the end segment > the last line node?
- Is the span of the segments selected greater than the maximum allowed (by the software) of 10. Note that presently this driver works with 11 line segments or 12 line segment waypoints or nodes.

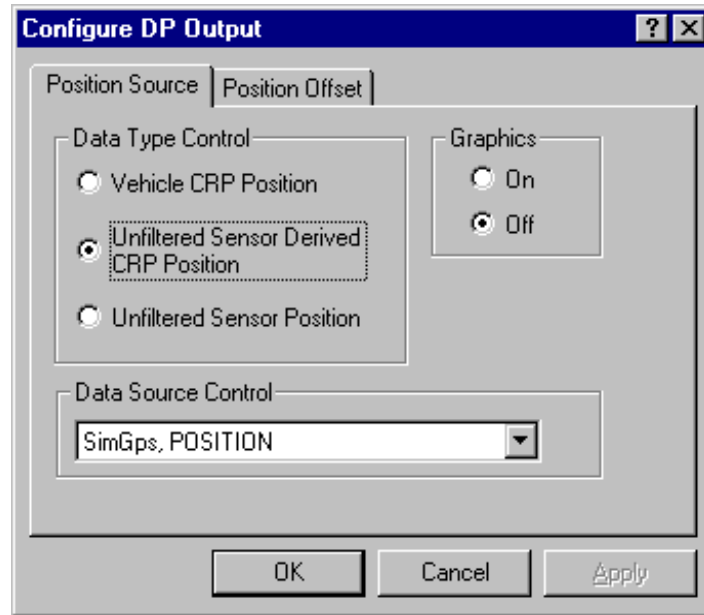
If the answer to any of the above is negative, the waypoint download is aborted.

**WINFROG VEHICLE TEXT WINDOW > CONFIGURE VEHICLE DEVICES > DEVICE > EDIT OPTIONS:**

The SIMRAD SDP21 WP, DP OUTPUT is added to the vehicle with the DP system in use. This vehicle must also be tracking the Survey Line for which you intend to send the relevant line data, to the DP system. If a Survey Line is not enabled, or the device is not added to the vehicle, no line segment data will be transferred. The dialog box below will appear when you attempt to configure the device, and send data to the vehicle. This will not change until a tracking line is enabled and the device is added to the vehicle.



When the SIMRAD SDP21 WP, DP OUTPUT item is edited from the Configure Vehicle Devices dialog box, the Configure DP Output dialog box appears. The **Position Source** and the **Position Offset** folders must be configured from here. These items configure the vehicle position output as described in the type 450 record under Configuration Details.



### Position Source:

Three items need to be configured in this folder: Data Type Control, Graphics, and Data Source Control.

### Data Type Control:

In Data Type Control, there are three options to choose from: Vehicle CRP Position, Unfiltered Sensor Derived CRP Position, and Unfiltered Sensor Position.

Choose the **Vehicle CRP Position** for filtered position updates referenced to the vehicles' Central Reference Point (CRP). The offset input under the Position Offset folder is added to the CRP position.

The **Unfiltered Sensor Derived CRP Position** is the same as the above only unfiltered data is output. With this option, filtering can be performed within the DP unit.

The **Unfiltered Sensor Position** outputs unfiltered positions from the positioning sensors' location. The offset input under the Position Offset folder is added to the sensors raw position.

### Data Source Control:

The data source depends on the Data Type Control that was selected. If the *Vehicle CRP Position* is chosen, the Data Source Control will automatically be set to VEHICLE, CRP POSITION, and the primary positioning sensor data will be used. If either the *Unfiltered Sensor Derived CRP Position* or the *Unfiltered Sensor Position* is chosen in the Data Type Control, then the positioning sensor can be chosen from the dropdown list under Data Source Control. Here a

secondary positioning sensor can be chosen. It is important to note that the *Unfiltered Sensor Derived CRP Position* is based on the chosen sensor, however the data is related to the CRP. Note that the SimGps, POSITION is used in this dialog as an example only.

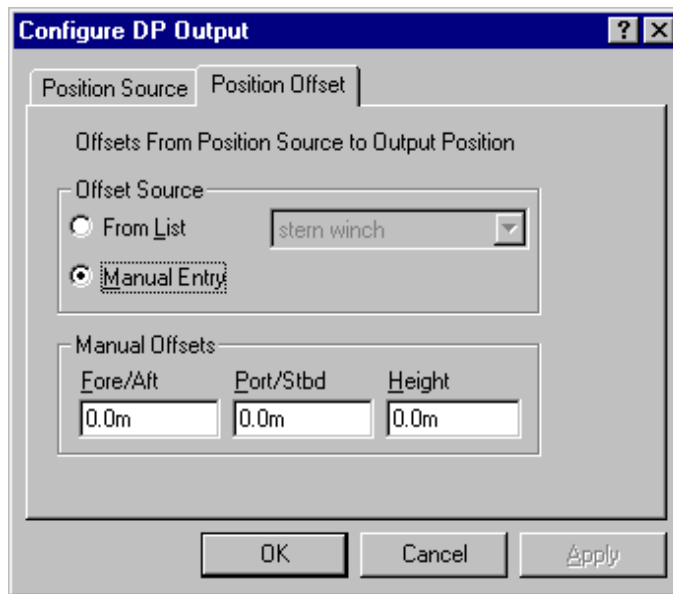
**Graphics:**

Turning on the Graphics will display the device name and a square at the location of the Simrad SDP21 WP position output. This position (grid) can be found in the type 450 record in the fields shown under the Configuration Details section of this document.

It is advisable to have this option turned on so the position output location can be visually referenced from the Graphics Window.

**Position Offset:**

The 'Offsets From Position Source to Output Position' can be configured in the Position Offset folder. This means that any offset input here will be applied to the position output from the Position Source folder options listed above.



**Offset Source:**

The Offset Source can be chosen from the list of offsets for the vehicle, or the Manual Entry can be used.

**Manual Offsets:**

If Manual Entry is chosen under the Offset Source, the offsets must be input here. Offsets are input similar to all offsets in WinFrog.

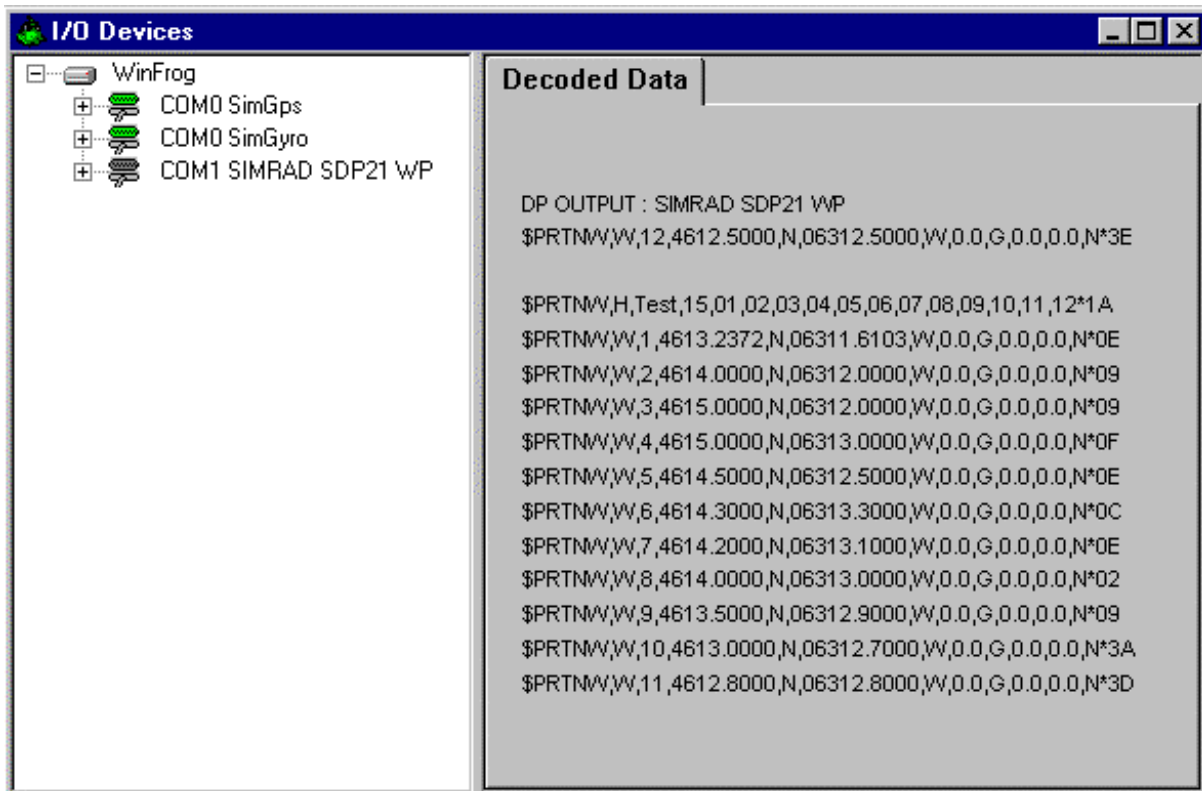
## CONFIGURATION DETAILS:

Interfacing to the DP system should only be performed under the supervision of the vessels' electrician or other qualified person as designated by the Captain. After interfacing, all systems should be thoroughly checked prior to operation. First check that the correct data is being output from WinFrog, and then check for the input at the DP system.

### Raw Data Logging and Data Output Strings:

The following I/O Device Window displays the (\$PRTNW) data output from the Simrad SDP21 WP driver when:

1. A line with 15 Line Segment Waypoints (0 to 14) is enabled for the Vehicle with the Simrad SDP21 WP driver attached.
2. Twelve Line segments (0 to 11) are output from WinFrog as shown in the Configure DP Waypoints Window in this document.
3. SimGps and SimGyro devices have been added to WinFrog for sample data output. Actual operation will have other position and heading inputs.



Some items to notice in the first output line include:

- The first line output has an 'H' after the string identifier.
- The 'Test' field is followed by the total number of line segment nodes in the line being sent.
- This is then followed the segment numbers where the '01' stands for line segment '00', in the WinFrog Line File.

When the survey line waypoint (node) data is sent from WinFrog to the Simrad SDP21 DP system, the position of the vessel-as described in the Position Source section of this document-is recorded in the type 450 raw record. This record is described in the WinFrog User's Guide (Appendix B) and is as follows:

**In WinFrog:**

```
sprintf(rawStr, "450,%s,%.2f,%.8f,%.8f,%.8f,%.8f,%.3f,%.3f,%.3f,%.8f,%.8f\n",name,
           fixTime,centreLat,centreLon,
           waypointX,waypointY,desiredBrg,desiredSpeed,desiredRange,
           currentX,currentY);
```

**Raw 450 Record:**

```
450,SIMRAD SDP21 WP,980437502.29,46.22148557,-63.19405810,
484583.43330372,5121844.24644184,0.000,0.000,0.000,0.00000000,0.00000000
```

Where:

980437502.29, is the time of the last position,  
46.22148557,-63.19405810, is the latitude and longitude of the vessel position,  
484583.43330372,5121844.24644184, is the position (Grid) of the line segment waypoints,

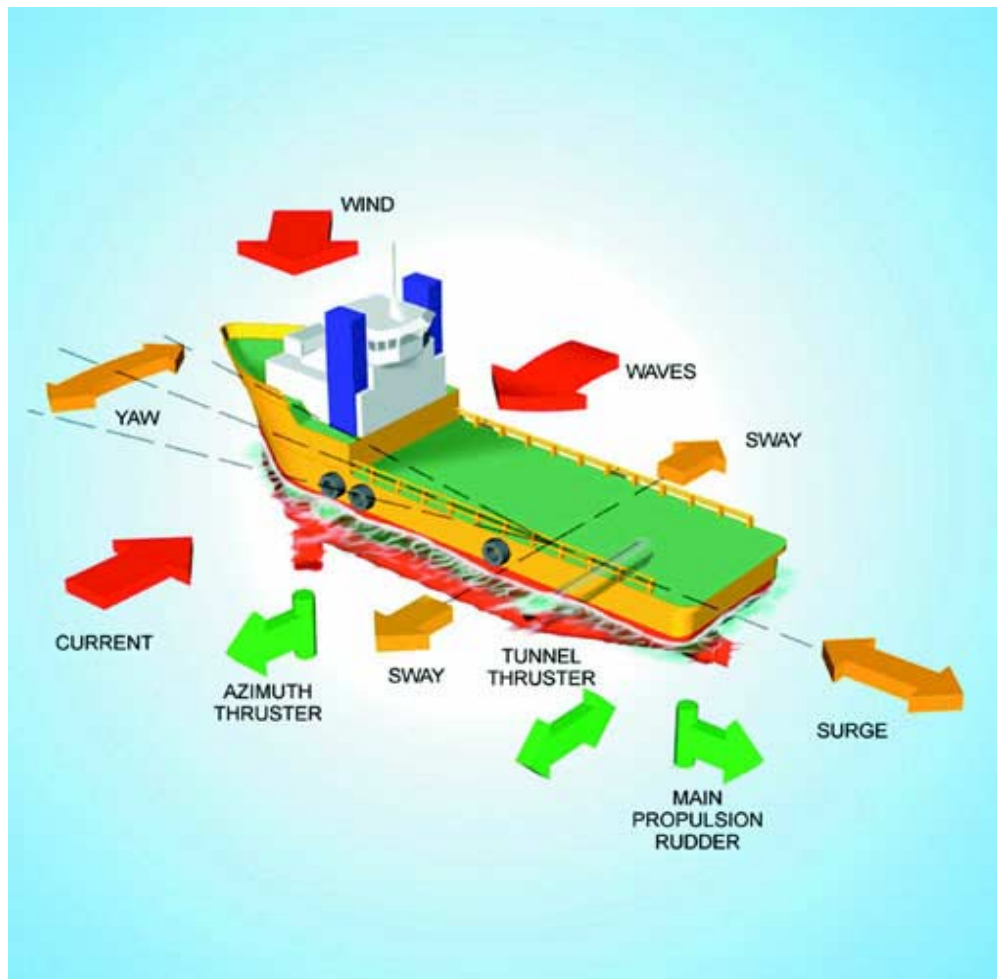
and,

no other data fields are recorded for the Simrad SDP21 WP device.

It is important to note that one (1) line segment waypoint position is sent to the raw file every second. Therefore if the Raw data is being recorded 'AT EVENTS', then the eventing must be set at one second to record all the data. A better option is to record raw data 'WITH EVENTS'. By recording in this manner, all of the line segment waypoint positions will be recorded in the raw file.

### External Forces on the DP System:

A sea going vessel is subject to wind, wave and current forces. The wind sensor measures wind speed and direction. The vessel's response to wave and current forces is sensed, and the thrust required to counteract these forces is accurately calculated. The DP system controls the vessel's motion in the three horizontal degrees of freedom - SURGE, SWAY and YAW. Vessel movements are measured by the Gyro Compass and the position reference systems. Reference system readings are corrected for roll and pitch using readings from the Vertical Reference Sensor.

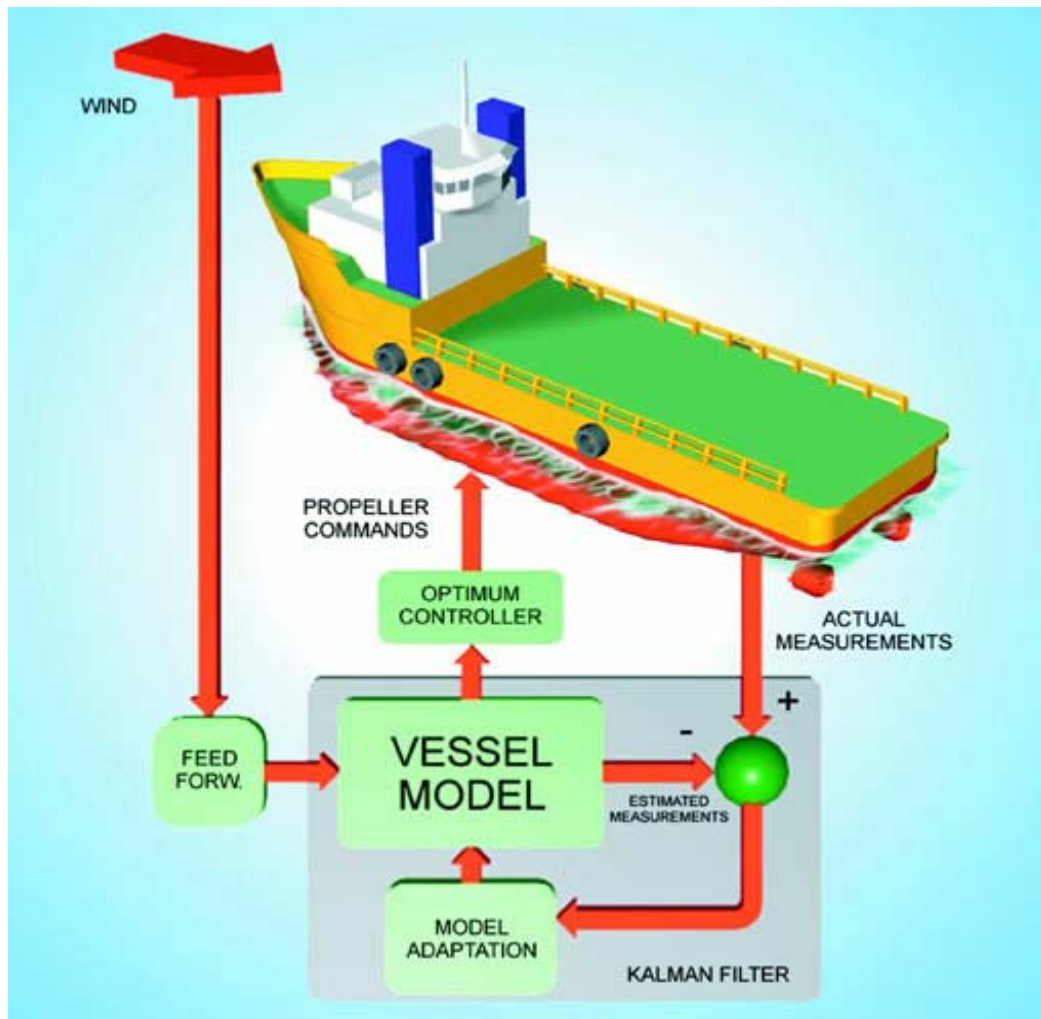


**Forces and Counter Forces on a Ship**



Mathematical modeling and Kalman filtering techniques improve noise filtering of all measurements, which reduces thruster modulation and wear.

- Optimum controller and wind feed- forward signals assure accurate positioning
- Mathematical modeling provides dead reckoning control mode
- Ease of operation
- Simultaneous use of all position reference systems with weighting for optimum combination
- On-line DP-capability analysis



**Mathematical Modeling and Kalman Filtering**