WinFrog Device Group:	**Output**
Device Name/Model:	**Nautronix DP**
Device Manufacturer:	**Nautronix Ltd (Head Office)** 108 Marine Tce, Fremantle, Western Australia, 6160 Phone: +61 8 9430 5900 Fax: +61 8 9430 5901 info@nautronix.com.au **Nautronix Inc. (San Diego)** 12131 Community Road Poway, California, 92064 Phone: +1 858 679 5500; Fax: +1 858 679 5501 info@nautronix.com Other offices in Aberdeen, Singapore, and Houston.
Device Data String(s) Output to WinFrog:	**Long Format:** Date, Time, Beacon Number, X-distance to Tracking Point, Y-distance to Tracking Point, Temp Depth, Pitch, Roll, Heading. **Short Format:** Date, Time, Beacon Number, X-distance to Tracking Point, Y-distance to Tracking Point.
WinFrog Data String(s) Output to Device:	Nil
WinFrog .raw Data Record Type(s):	Type 450

DEVICE DESCRIPTION:

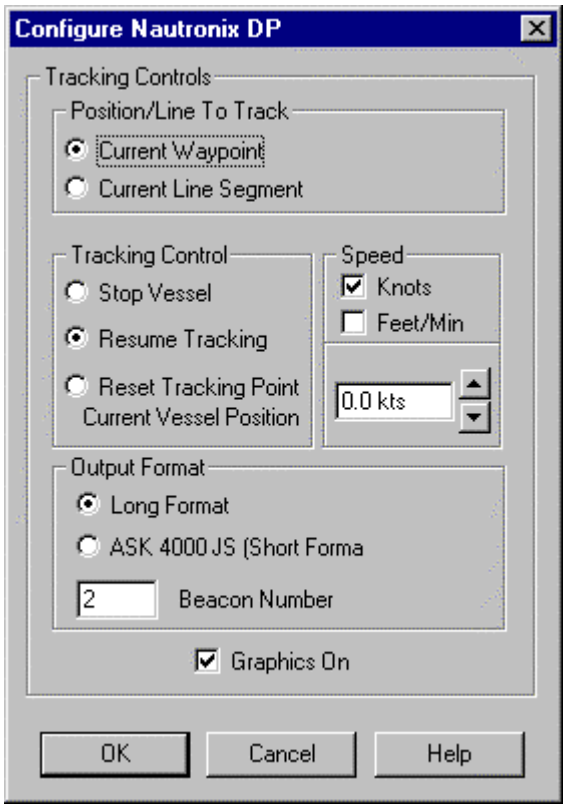
Nautronix DP systems provide integrated control of the vessel's propulsion system and rudders, based on inputs from gyro, wind, motion reference and position sensors, to provide a stable station keeping and tracking capability for applications in the offshore industry. The Nautronix 5000 series are the most current DP systems being manufactured by Nautronix.

The Nautronix DP Device in WinFrog outputs a choice of two position strings for input to Nautronix DP systems. The Short Format position string was designed for input to the Nautronix 4000 Series DP systems, however this string may work with other models. The position string formats output from WinFrog should be checked with the DP system being interfaced to ensure compatibility. The output formats are detailed in the Configuration Details section of this document.

The Nautronix ASK 4001 DP (Short Format) provides manual three-axis joystick control and closed-loop control. Operating modes include automatic heading and position control and active wind compensation.

DEVICE CONFIGURATION INSTRUCTIONS (WinFrog Suggested):
Baud Rate: 4800
Data Bits: 8
Stop Bits: 1
Parity: None

WINFROG I/O DEVICES > CONFIG OPTIONS:
The NAUTRONIX DP device is added to WinFrog from the OUTPUT device types. The DP OUTPUT data item is added along with the NAUTRONIX DP device. The following dialog box appears for configuring output data via the *Configure > I/O Devices > Configuration* command. This dialog box will also appear by right-clicking in the I/O Devices Window with the NAUTRONIX DP device highlighted and choosing *Configure Device*.



The Configure Nautronix DP dialog box mainly consists of commands controlling the vessels' movement, and the format of the data output string. Commands are administered from this dialog box when the Surveyor clicks the 'OK' button. No commands are introduced when the Cancel button is clicked. The following items are configurable:

Position / Line to Track:
Here you can toggle between Waypoint tracking and Survey Line tracking. By choosing the Current Waypoint tracking option, WinFrog will send the DP system dX, and dY values of a point **close** (depending upon the speed selected: elapsed time X speed = distance) to the Tracking Point or 'Rabbit'. The Tracking Point will in turn move towards the Waypoint location, when the vessel is tracking and a speed is input. The waypoint being tracked has to be changed, or moved ahead by the DP operator, as the Nautronix DP Tracking Point (Rabbit) approaches this location.

The Waypoint Tracking function has proven to be the standard mode for the (WinFrog) Simrad SDP600 driver; however the Line Tracking Mode for the Nautronix DP driver has an improved feature making it more applicable when the intention is to move the vessel down a Survey Line.

If the Current Line Segment option is chosen, the Tracking Point or 'Rabbit' will move towards the closest point on the line. However, the dX/dY commands sent to the DP system will instruct the vessel to move to a point angling toward the desired line, but further down line from the Tracking Point.

The difference between the Position Source Location (DP Reference Point), DP Tracking Point (Rabbit), and dX/dY values sent to the DP are shown in the graphics diagram on the following page. This diagram relates to the Line Tracking Mode where the Rabbit advances with respect to the Current Line Segment.

In the WinFrog Graphics sequence (following page), the Tracking Point was initially reset to the Position Source with the Stop Vessel radio button selected.

Resume Tracking was then initiated with a 5 knot speed value input. With the vessel stationary, the Tracking Point moved directly towards the Survey Line, and at the same time the dX/dY values sent to the DP relate to a point ahead of the vessel and towards the Survey Line (Epoch 1).

Keeping the vessel stationary, when the Tracking Point reaches the Survey Line, the dX/dY values relate to a point approximately 50m down line (Epoch2).

As the Tracking Point continues down line, the dX/dY values are such that the vessel would intercept the Tracking Point at approximately twice the distance down line (Epoch 3). Note that the Epochs are simulated and do not mirror actual vessel movements.

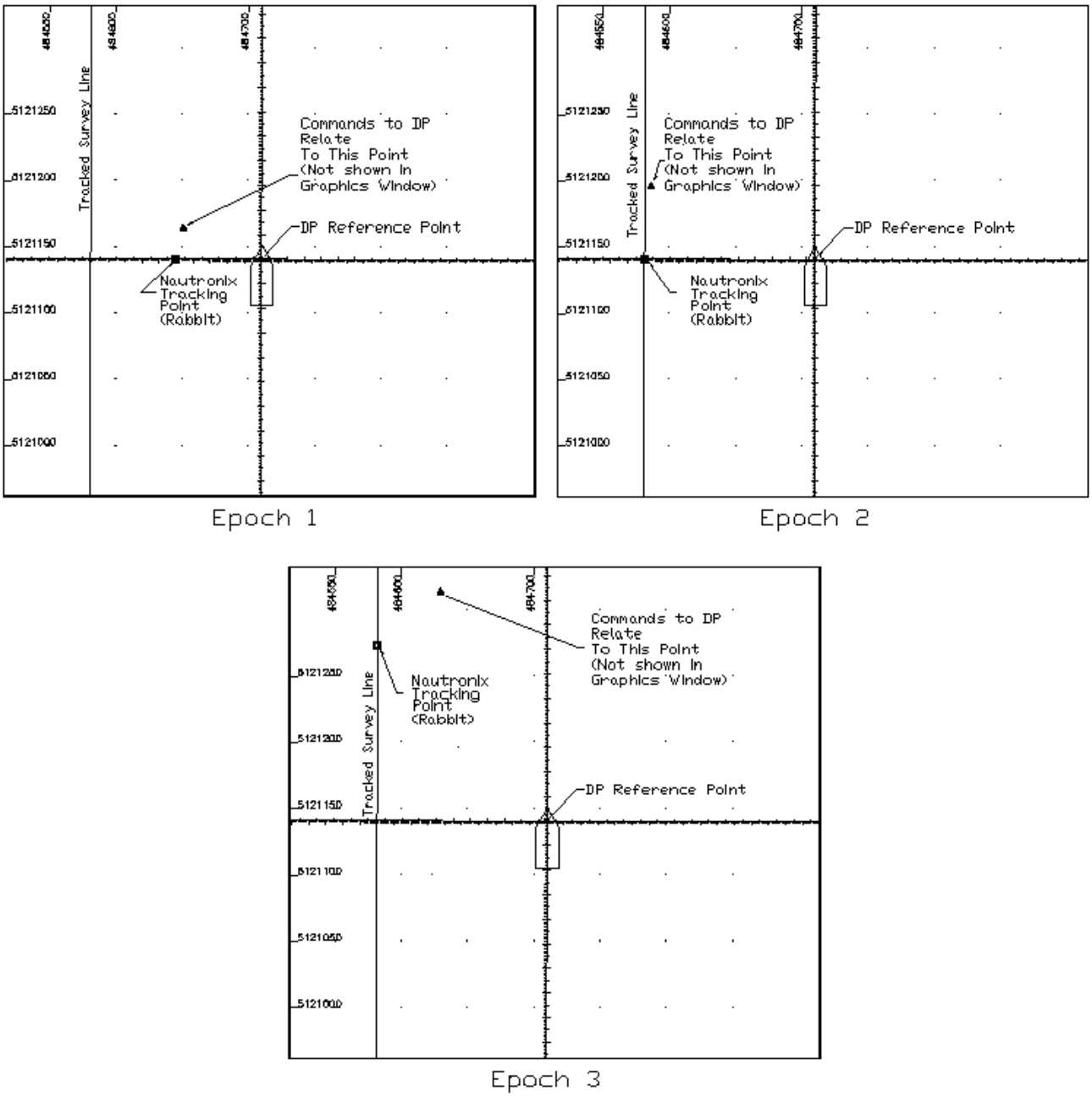


Diagram Showing the Position Source, Tracking Point, and the dX/dY Values Transmitted to the DP System

Tracking Control:
The Stop Vessel radio button issues a zero speed, resets the Tracking Point position to the current vessel position, and captures the current Heading. In this mode the Reference Position for the DP will not change until the operator intervenes with a Resume Tracking or Reset Tracking Point command. The Stop Vessel setting is intended to stop the vessel and remain there. This is the important difference between Stop Vessel as opposed to Resume Tracking when set to a zero speed.

The Resume Tracking is the normal mode for operating the Nautronix DP driver, whether tracking down a line, or to a waypoint.

If a problem should occur, the Stop Vessel command will allow the DP system to utilize its' thrusters to stop the vessel quickly. In normal operations, zeroing the speed while in the Resume Tracking mode is acceptable.

The Reset Tracking Point to Current Vessel Position does exactly this. This option is particularly useful when first applying, or reapplying, DP control, as well as when the Surveyor wants to capture the current position to slow progress of the vessel. This mode will reset the Tracking Point reference to the current position only when the Window is exited. The Tracking Control will then return to either the Stop Vessel or Resume Tracking Mode, depending on the setting prior to exiting the dialog. Note that any changes only take effect when the dialog is exited via the OK button.

If the Surveyor changes from tracking Current Waypoint to tracking Current Line Segment, the Tracking Point is reset.

Speed:
Speed commands can be issued in either Knots (to the hundredth of a knot), or Feet/Min (to the tenth of a foot). This value moves the Tracking Point towards the Waypoint or Line this amount. If the Tracking Point is already on the line, it will move down line at this speed.

Only dX and dY values (and not Speed commands) are issued to the DP system. The DP system therefore must convert these values to issue thrust power on the vessel. The thruster output will increase or decrease accordingly with respect to these values. The thrust when the dX/dY values are at certain distances from the Tracking Point should be checked via DP trials prior to operations.

Refer to the NAUTRONIX I/O documentation for information relating to the operation of a DP system via WinFrog commands. Note that there are differences between the two WinFrog output formats.

Output Format:
Either a long or a short data format can be chosen for output to the Nautronix DP systems. The short format relates to the ASK 4000 JS unit. The DP operator or Surveyor should confirm that the DP System can accept one of these two formats.

The main difference is that the Long Format outputs tempDepth, Pitch, Roll and Heading along with the Date, Beacon Number and dX/dY values. The two formats are listed in the Configuration Details section of this document.

Beacon Number:
If a USBL Beacon is being tracked, the Beacon Number can be stated here, and this value is in turn sent to the DP system.

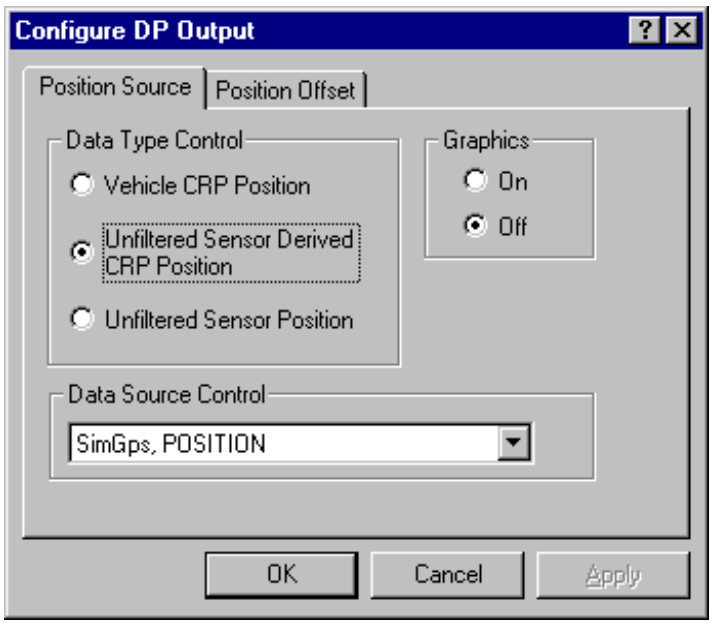
Graphics On:
This box should always be checked, so that the Tracking Point is visible and moving erratically.

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

The OUTPUT, NAUTRONIX DP, DP OUTPUT data item is added to the vehicle with the Nautronix Dynamic Positioning System installed. Most of the real time operation of this device is accessed from the I/O Devices Window. The position source and offsets are configured here.

If the Nautronix is configured to track the Current Waypoint (in the I/O Devices / Configure Device / Configure Nautronix DP dialog box), then the vehicle must be tracking a waypoint. If a waypoint is not being tracked, dX/dY values will be sent to the DP system as if the last waypoint was still being tracked; or a waypoint at 0^o Latitude; 0^o Longitude is being tracked. The same applies for the (tracking) Current Line Segment. No warning window appears if a Line or Waypoint is not enabled.

When the OUTPUT, NAUTRONIX, DP OUTPUT data 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.



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 (Kalman, velocity, etc. as applied to the vehicle) 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 may (or may not) be performed within the DP unit. This is often the preferred option as most DP units have more rigorous filtering routines that require an unfiltered data input.

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.

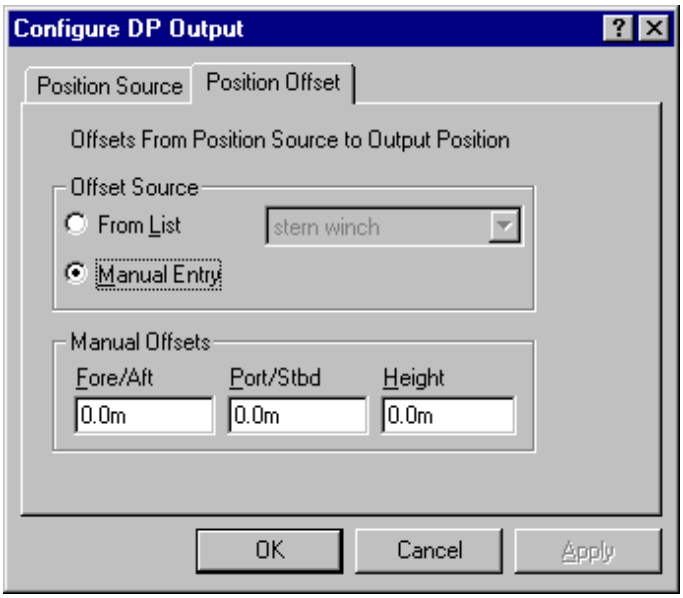
Data Source Control:
The data source depends on the Data Type Control that was previously selected. If the *Vehicle CRP Position* is chosen, the Data Source Control will automatically be set to VEHICLE, CRP POSITION, and data from the primary positioning sensor will be used. If either the *Unfiltered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

selected from the dropdown list under Data Source Control. A primary or secondary positioning sensor can be chosen here. 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 as an example only.

Graphics:
The Graphics item should be turned on in the Configure Nautronix DP dialog box (as described in the section on WINFROG I/O DEVICES > CONFIG OPTIONS). There is no requirement to turn on the Graphics in the Configure DP Output dialog box.

If the Graphics 'square' is enabled here, and not in the previously described dialog box, then the Nautronix position output 'square' will blink between two locations on the screen.

Position Offset:
The Offsets From Position Source to Output Position are configured on the Position Offset tab of the Configure DP Output dialog box. This means that any offset input here will be applied to the position output, as dictated in the Position Source tab 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.

CONFIGURATION DETAILS:

In vessel configurations where WinFrog controls the DP System, extensive sea trials should be performed when new components are introduced to the system. The Surveyor and DP Operator should be knowledgeable about vessel reactions resulting from the interfacing of WinFrog to the Nautronix DP System.

Raw Data (Type 450 record):

When the DP OUTPUT data type is attached to a vehicle the type 450 raw record is logged to file. This record is described in the WinFrog User's Guide (Appendix B) and is as follows for the Nautronix Output Driver:

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);
```

For this record the currentX,currentY position refers to the position of the 'Rabbit'

Raw 450 Record:

```
450,NAUTRONIX DP,984750577.61,46.23869392,-63.19992227,
484914.32451189,5120676.92722770,270.144,5.144,5.567,
484585.76658209,5120587.91492565
```

Where:

`984750577.61,` is the time of the last position.

`46.23869392,-63.19992227,` is the latitude and longitude of the vessel position.

`484914.32451189,5120676.92722770,` is the position (Grid) of the current or last Waypoint Tracked under Waypoint Tracking.

`270.144,` is the True Bearing from the Tracking Point to the Tracked Waypoint (or Current Line Segment).

`5.144,` is the speed in metres/second of the Tracking Point (5.144m/s = 10nm/h).

`5.567,` is the speed of the Tracking Point (units unknown).

`484585.76658209,5120587.91492565,` is the position of the Rabbit.

Output Formats:

Long Format Output:

Following is an example of the Long Format Data String output to the DP System:

```
20 Mar 1 14:29:23 B:1 X:-0.20 Y:-0.09 D:103.7 P:-0.8 R:-0.9 H:345.0
```

i.e. Date, Time, Beacon Number, X-distance to Tracking Point, Y-distance to Tracking Point, Temp Depth, Pitch, Roll, Heading.

Short Format Output:

Following is an example of the Short Format Data String output to the DP System:

```
20 Mar 2001 14:32:25 B:1 X:0.16 Y:0.04
```

i.e. Date, Time, Beacon Number, X-distance to Tracking Point, Y-distance to Tracking Point.