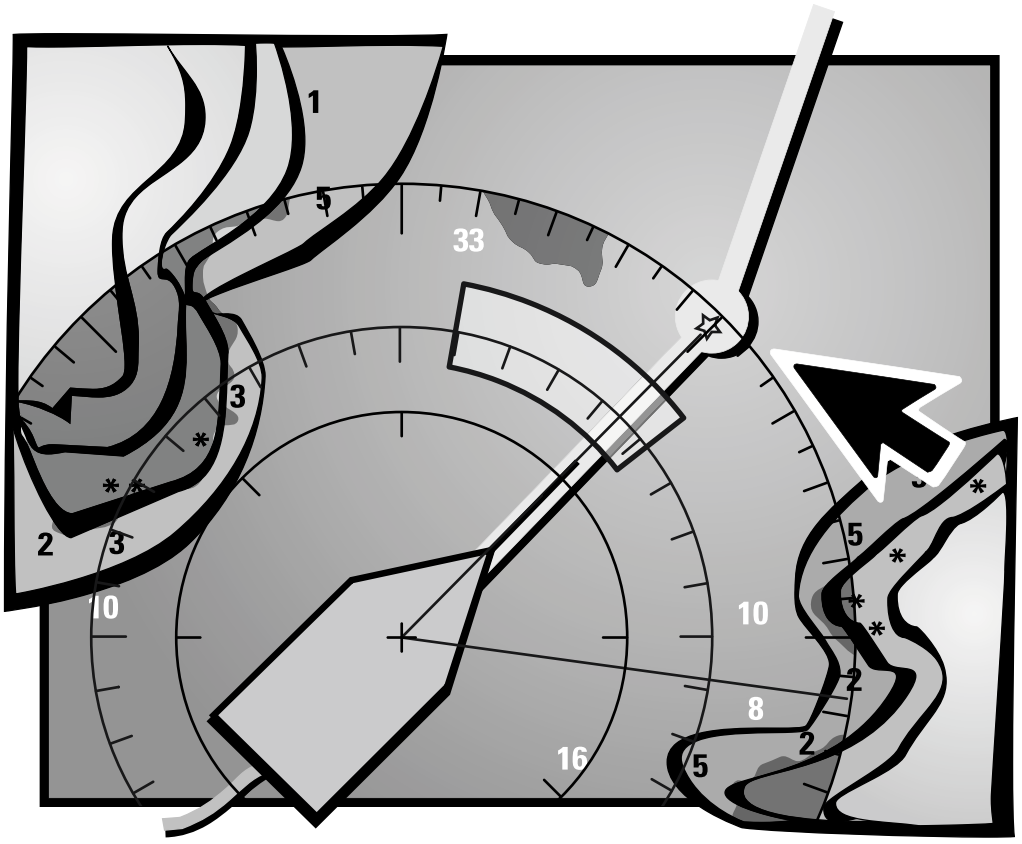
NOBELTEC®



Radar Operations Manual

Covers the Nobeltec Line of Radar Products

Nobeltec® InSight™ Radar 2 (IR2)

NTMRG002 4/04

Table of Contents

chapter 1

InSight Radar Introduction

Welcome to Nobeltec

Congratulations. You have purchased the world's most advanced marine radar.

How to use this manual

This manual assumes that you are already familiar with Nobeltec's charting software. The Nobeltec software is easy-to-use and powerful. If you need a brush-up, please refer to the Users Guide that came with your Nobeltec charting software. You can also access the On-line Software Help File by clicking on the Help drop down menu and then on the Help Topics option.

Also included in your Nobeltec software is a Training CD. This CD is full of light overviews of the product's functionality. For a refresher course on this powerful software, take some time to review the training clips on this CD.

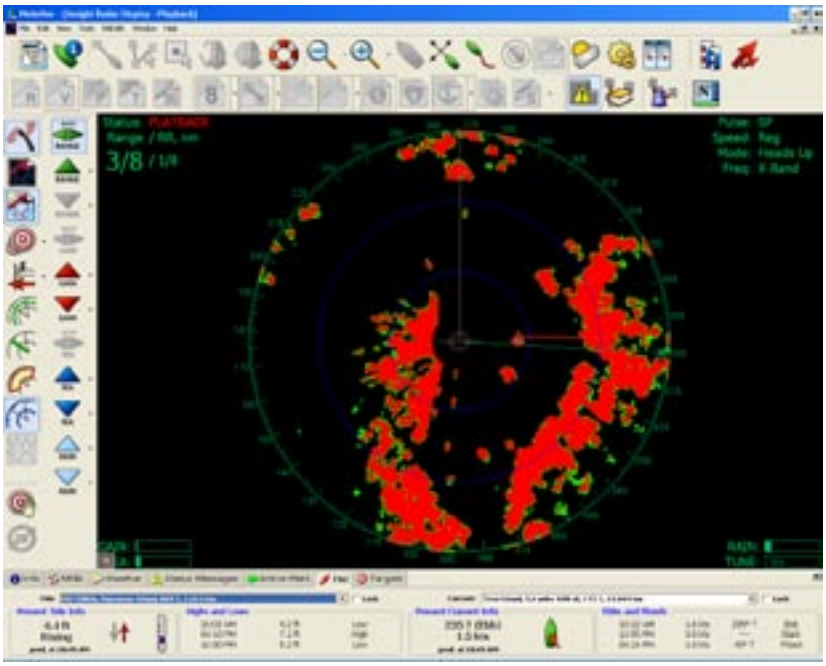
What is Nobeltec's IR2?

InSight Radar (or IR2) is Nobeltec's comprehensive radar solution. It includes either a special radar that transmits digital data or a converter box to convert the standard analog radar into the required digital format. It also includes a special version of Nobeltec's navigation software designed to work with this digital radar data stream. This radar software includes a host of powerful tools designed to make navigating more safe and fun.

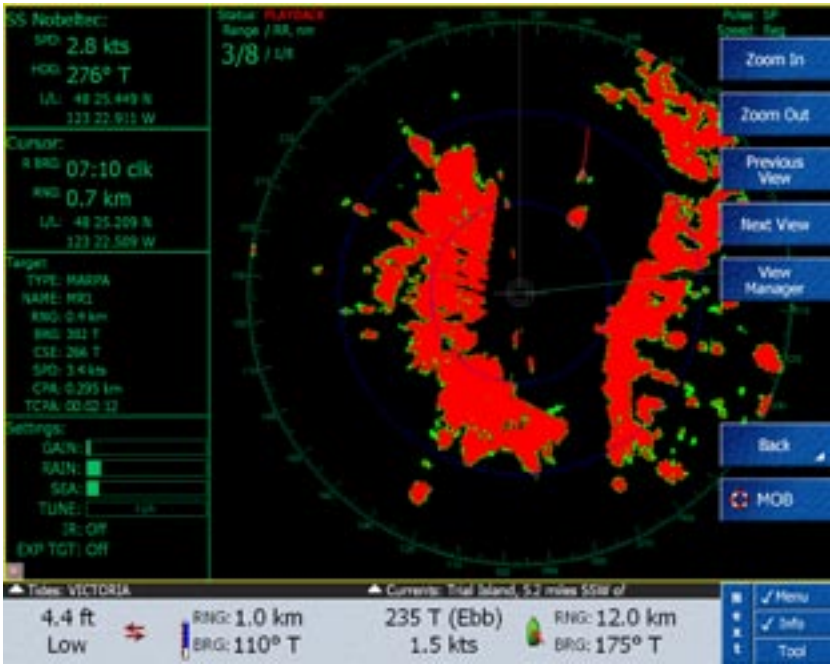
If the InSight Radar option is installed on top of the Nobeltec Visual Navigation Suite or Admiral programs, the version of the program is followed by an "R" (e.g. Version 7.0.793R) and will say InSight Radar on the Help | About screens. You will also see a Radar drop down menu near the other menu options.

The InSight Radar Window

The InSight Radar window is the window inside the Nobeltec software for viewing radar images. It can be resized and moved like any other standard window. It also has a host of features specific to the radar functionality. The window is viewed in either the standard PlanView mode or Admiral's exclusive NavView.



InSight Radar Window in PlanView



InSight Radar in Admiral's NavView

We'll talk more about these two window options and the way of using them later in this Operations Manual.

The InSight Radar combines all the power of electronic charting with all the functionality of a radar. These two technologies are considered by many to be essential for safe navigation. Combining the two technologies provides a level of functionality not attainable separately.

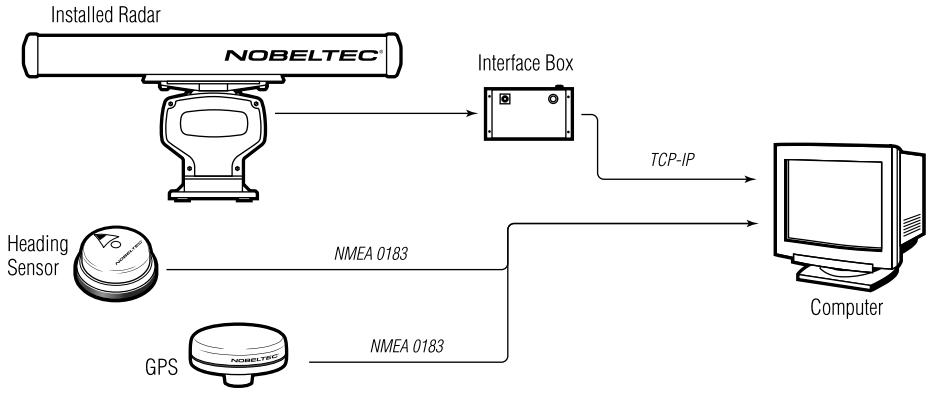
The IR2 product line has two ways to interface Nobeltec software with a radar:

- **A Full Nobeltec InSight Radar.** A special radar designed to send digital imagery directly to a personal computer through your computer's ethernet port. IR2 is Nobeltec's digital radar.
- **InSight Radar Box.** This converter box works with most legacy radars to convert the analog radar information into digital imagery. The benefit of this option is that it does not require a complete retrofit of your radar system and yet takes advantage of the advancements in radar display. Connecting this device to your computer is accomplished through a standard TCP/IP port.

What is a Nobeltec digital radar?

Nobeltec IR2 is complete radar solution that sends the radar information directly to a personal computer in a format that it can understand. Most radars transmit information between the transceiver and a display unit in analog form. However, a digital radar sends the information digitally, making extra displays unnecessary.

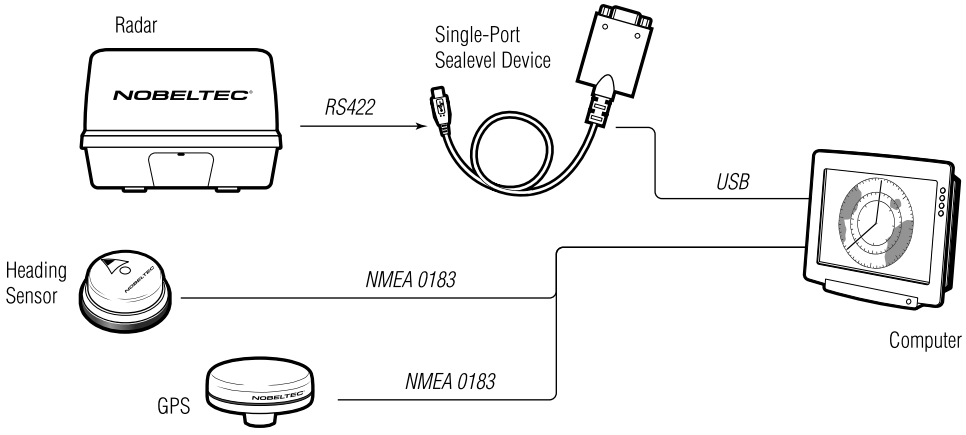
How Does the Nobeltec Digital Radar Work?



The Digital Radar connects to a personal computer through a standard ethernet or network port. In most cases, it can also be connected to a network hub or router. For Network connections consult the Installers Guide.

Important Notice Regarding 2kW Dome Models

The Nobeltec IR2-2D (2kW Dome) varies slightly from other IR2 models. Although it is still a digital radar, it connects to the computer differently than the other IR2 models (see diagram below). In addition, the IR2-2D does not have some of the same features as the other IR2 models. If the feature being described is not available for the IR2-2D, the term “4kW and Higher” will be listed next to the feature.



What is the InSight Radar Box?

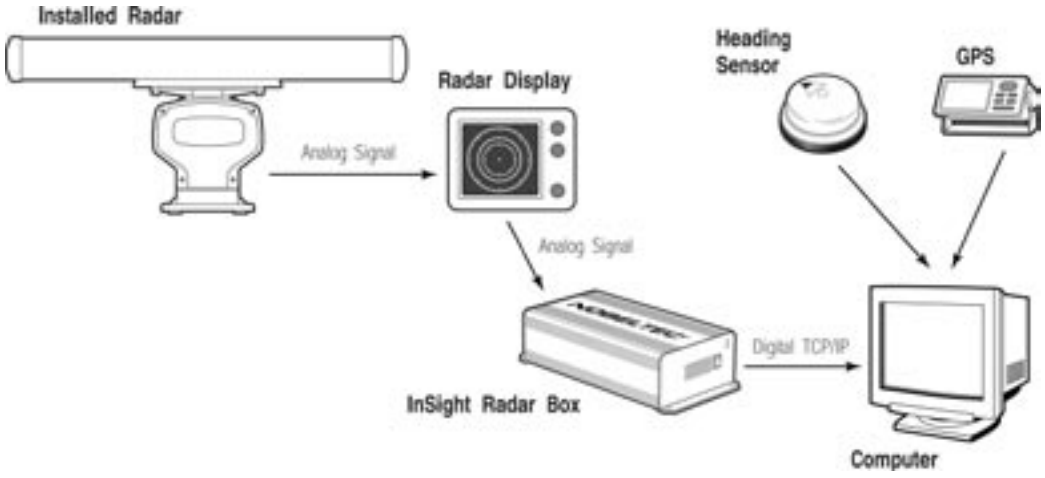
The InSight Radar Box is a specially designed box that converts the analog signal from many existing radars into a digital format usable by a personal computer.

Over the past decades, little has changed with the way a radar antenna sends and receives radar microwaves. However, there have been significant advancements in the display and utility of the resulting image. Until now, boaters wanting to take advantage of these technological advancements had to replace the entire radar system even though the antenna was virtually unchanged.

The InSight Radar Box is another market breakthrough. With the InSight Radar Box and Nobeltec software, you can avoid the cost of a complete retro-fit and still get the significant advantages of combining the information of radar and electronic charts.

How Does the InSight Radar Box Work?

The InSight Radar Box essentially “repeats” the radar data from your traditional radar display to the personal computer. Depending on your radar make and model, tuning or other adjustments may occur on the already processed radar image. An advantage to this radar system is that you can keep your existing radar display for redundancy, comparison and safety. A disadvantage, aside from taking up more helm space, is that the radar image may look slightly different between the computer and radar display.



Minimum System Requirements

In order to properly run Nobeltec InSight Radar software, you need the following:

- Windows 2000/XP
- Pentium III 1 GHz with 256 MB RAM and 50 MB hard disk space (Additional space required for navigation data)
- CD-ROM drive
- The following available data ports
  - 2 Serial or USB ports (GPS, Heading sensor or other device)
  - USB port for Nobeltec InSight Radar Box input (if applicable)
  - Ethernet Network port for the Digital Radar input (if applicable)
- Heading Sensor capable of outputting NMEA heading information If not using the preferred combo GPS/Heading sensor, we recommend the Nobeltec heading sensor. Its fast 10Hz output makes for better radar overlay.
- GPS capable of outputting NMEA heading information.

Recommended System Requirements

In order to get the best results using Nobeltec InSight Radar software, we recommend you use a PC with the following specifications:

- Windows 2000/XP Pro
- Pentium IV 2.4 GHz with 512 MB RAM (or more) and 50 MB hard disk space (Additional space required for navigation data)
- CD and DVD-ROM drive
- The following available data ports
  - 2 Serial or USB ports (GPS, Heading sensor or other device)
  - USB port for Nobeltec InSight Radar Box input (if applicable)
  - Ethernet Network port for the Digital Radar input (if applicable)
- High-end 3D video graphics card with OpenGL capabilities
- Heading Sensor capable of outputting NMEA heading information If not using the preferred combo GPS/Heading sensor, we recommend the Nobeltec heading sensor. Its fast 10Hz output makes for better radar overlay.
- GPS capable of outputting NMEA heading information.

For Technical Support on your InSight Radar

If your technical question revolves around the InSight Radar Box or the Nobeltec software and how it functions with the incoming radar signal, call Nobeltec technical support at: (800) 732-2800.

chapter 2

Setting up InSight Radar

This chapter is a review of what should have already been done through the Installers Guide.

Installing InSight Radar (IR2)

Getting your radar up and running can be separated into two areas:

1. Installing the hardware
2. Setting up the Nobeltec software

Installing the Hardware

Included with your Nobeltec radar solution are installation and wiring instructions. The majority of technical support issues revolve around incorrect installation. Nobeltec strongly recommends using a qualified marine technician to install your radar hardware. If you install the hardware components yourself, be sure to double check your wiring and connections.

Depending on which radar solution you own, the radar may integrate to the computer using the USB (Universal Serial Bus) port, or the Ethernet Network port. Instructions for each of these connections is documented in the Installers Guide.

Refer to the Installer's Guide for detailed installation instructions

Installing Nobeltec Software

It is necessary to install this software even if you have Nobeltec software already loaded on your system. In addition to installing the Nobeltec software on a new computer, it can also upgrade existing Nobeltec software to recognize and operate the InSight Radar 2.

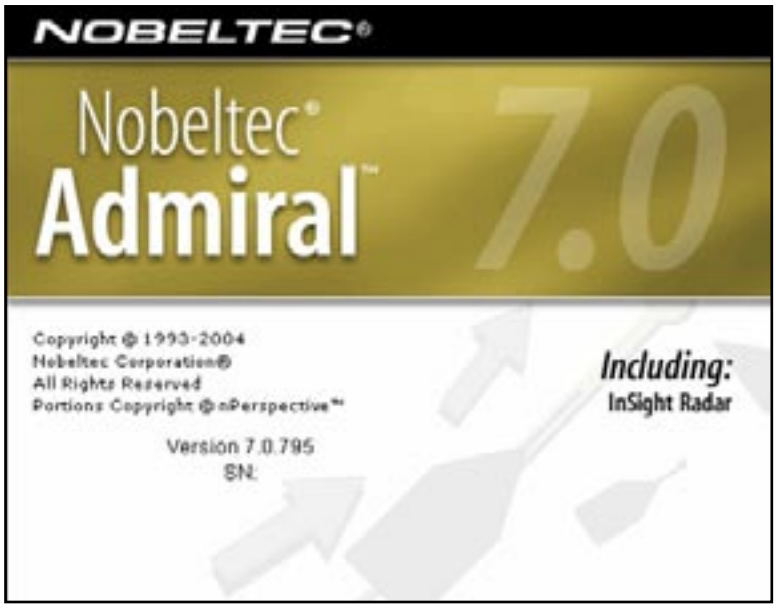
To install the Nobeltec software, Insert the program CD into your CD-ROM drive. The program will autorun an installation program.

Follow the on screen instructions to install or update the Nobeltec software.

If the CD does not autorun, follow the next set of instructions.

1) Select **Start** | **Run** from the taskbar and type E:\setup.exe (substitute the drive letter of your CD-ROM drive for “E” if it is different).
2) Follow the on screen instructions to install or update the Nobeltec Software.

Once installed, you should see a splash screen similar to the one shown below.



Nobeltec Admiral’s Splash Screen showing the InSight Radar components are installed.

Tip: Notice that in the lower right corner, under the banner: “Including”, the InSight Radar components are installed. If you do not see this, chances are good that you have installed the wrong CD. Locate the correct CD and re-install.

Using the Radar Setup Wizard

This section assumes that you have correctly installed the IR2 and that it is functioning properly.

The Insight Radar option to the Nobeltec software includes a Radar Setup Wizard that simplifies the integration process. You must run the Radar Setup Wizard the first time you install the software on a new computer on which you want to see the InSight Radar.

The Wizard also sets up the communication ports for other NMEA devices such as a GPS, heading sensor and more.

IMPORTANT NOTE FOR NETWORKS

When running the Radar Wizard, it is important that you turn off all IR2 radars and copies of Nobeltec software connected to the network except the IR2 radar that you want to connect with.

To launch the Radar Setup Wizard

1) Click on the **Start** button on your Windows task bar. Then **Programs** | **Nobeltec** | **Radar Wizard**

If the Radar Setup Wizard is not in the Nobeltec program group, you have not installed the Nobeltec software with the Insight Radar module. Check to make sure that you installed the correct CD.

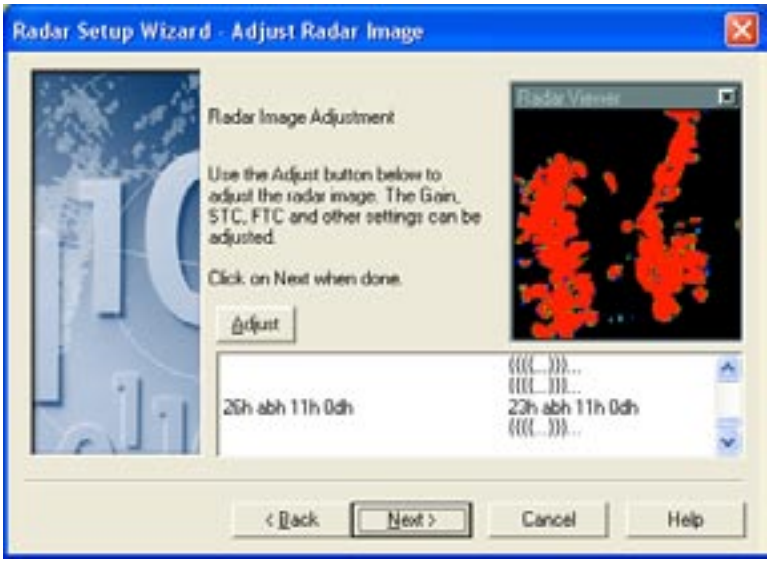
2) After the opening screen appears, click on the **Next** button.

3) Verify that you have accomplished all of the requirements as outlined and then click on the **Next** button.

The Radar Setup Wizard will search your available serial ports for incoming information, including your GPS and heading sensor. Continue stepping through the Radar Setup Wizard making sure to closely follow the instructions.

Tip: When you run the Radar Setup Wizard, make sure that your GPS, heading sensor and the radar are all properly installed, turned on and connected to your computer.

Once the Radar Setup Wizard detects your radar and other NMEA devices, you can advance the Radar Wizard to the Adjust Radar Image page.



The primary objective on this page is to see the data in the white box towards the bottom of this screen flowing on both sides. The data on the left side is data going to the radar from the PC. The data on the right side is the radar responding to the PC. As long as you see data on both sides of this window, you can finish the radar wizard.

This page shows, after the appropriate radar warm-up period, a mini-version of the current radar image.

Tip: You may need to cycle the power on your radar for the Radar Viewer image to appear.

If desired you can adjust the radar image inside the Radar Wizard. To do so, click on the Adjust button to control various functions of the radar. None of the settings that you enter here will be saved in the Nobeltec program.

Initial Radar Setup

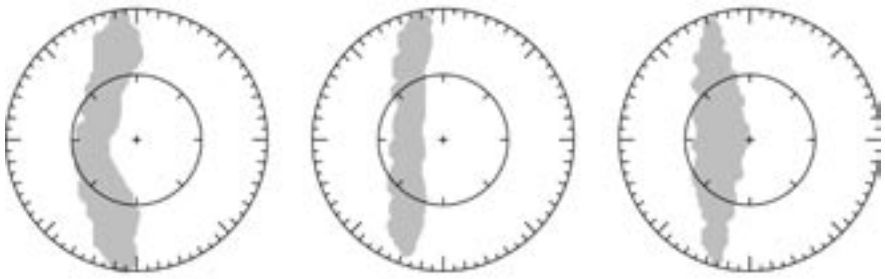
Setting the Trigger Delay

After successfully installing the radar, transmit trigger delay should be reviewed and adjusted in order to compensate for cable transmission delays. Longer cable runs generally require a higher trigger delay setting.

To do this, start the Nobeltec software and launch the Insight Radar window. Once it is open and displaying a radar image, adjust the Transmit Trigger Delay. Next, click on the **Radar** drop down menu then on the **Initial Radar Setup** option.

Setting the Transmit Trigger Delay: The transmit trigger delay (TxTrig) is a setting that when set incorrectly can cause a donut like ring to appear in the center of the radar image. The trigger delay should be initially set to reduce the size of the ring. In most cases, Transmit Trigger should be between 125 and 160. Refinement of the Transmit Trigger is best done using Nobeltec's radar overlay on a chart.

Transmit Trigger Delay can also affect the radar image of a straight object such as a breakwater or riverfront. These can appear deformed due to excessive or inadequate trigger delay. Properly setting this may require on-the-water tuning when looking at a straight object. The trigger delay adjustment removes deformations in the radar return as shown in the images below.



Aligning the Radar Image

Getting the radar to properly align with the electronic chart requires a few key devices and software settings. As a summary, these three are:

Compass Master Heading Correction: In certain cases, it is not possible to install the digital compass exactly parallel with the vessel center line. This software setting allows an offset to be entered into the program to compensate for this occurrence.

Radar Heading Line: For similar reasons to the compass, it is not always possible to install the radar with the front of the radar exactly parallel with the vessel's keel line or center line. The Radar Heading Line adjustment can compensate for this occurrence.

Compass Deviation: Magnetic compasses can give incorrect readings for many reasons. The most typical is magnetic interference on the boat. The engine block, a large anchor or chain, and even electronics can create magnetic interference. The Nobeltec software allows you to make entries in a deviation table that tells the software how to adjust the incoming heading data to compensate for these local deviations.

Tip: Using a Combination GPS/Heading sensor that determines heading based on dual GPS antennas (instead of magnetic influence) significantly improves the accuracy of incoming heading data and simplifies the radar alignment process.

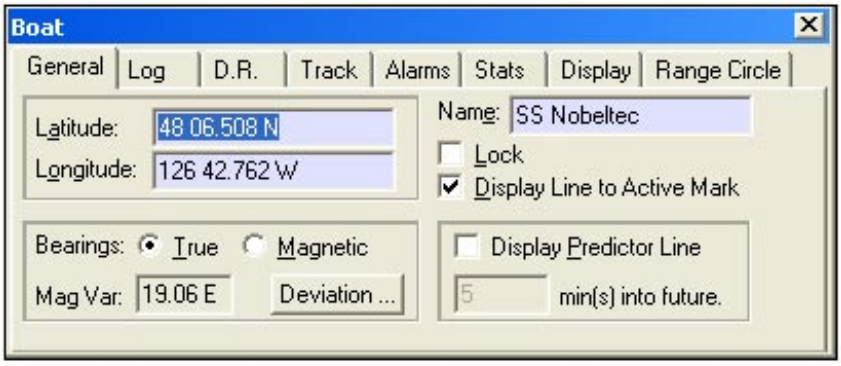
Remember: Aligning the radar with a chart is not a perfect science. Remember that a chart is a hydrographers artistic view of the coastline and surrounding navigable information. A radar on the other hand is a real depiction of what is being returned and interpreted by the radar. You should expect that there will be some level of disparity between the chart and the radar.

Adjusting the Compass Master Heading Correction

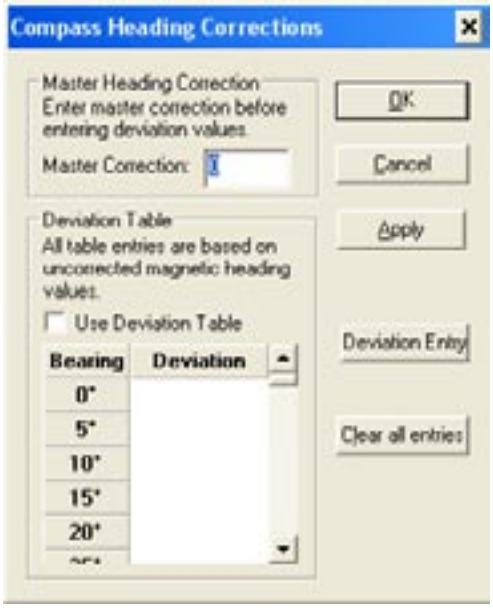
This process allows you to align the digital compass with the vessel center line. This is normally a one-time process that corrects the entire 360° equally.

To align the compass determine the amount of offset and enter it into the Compass Heading Correction screen.

To do this, Open the Nobeltec software and click on the Boat Properties tool which can be found on the toolbar (shown below). You can also right click on the boat and choose the option titled: Properties.



Once the Boat properties window is open, the General tab shows how the compass bearings are displayed (True or Magnetic) along with the magnetic variation at the boat location. Click on the Deviation button to open the Compass Heading Corrections dialog.



Enter the compass master correction value in the field provided.

Because the master value affects all degrees equally, make sure that you enter it before you proceed to creating a compass deviation table.

Click the **OK** button to close out of this dialog.

Adjusting the Radar Heading Line Rotation

This process allows you to align the radar transceiver with the center line of the vessel and only needs to be set once. This is a different function than aligning your heading sensor so make sure you are adjusting the radar's physical heading line to match the center line of your vessel.

One way to do this is to simply eyeball the difference. However, it is easiest to do this using the radar overlay feature. If the charted land does not appear to line up correctly with the radar return for the same land mass, use the rotate scroll bar to adjust the rotation angle until the overlaid image aligns correctly.

Remember: Make sure you have a heading sensor connected to the PC. Without a heading sensor, the Nobeltec software cannot align the image correctly onto the chart. To check if you have heading connected and that data is being sent to your Nobeltec software, add the Heading console item to the console and verify that it does not read N/A. (Tools | Options | Console | Heading check box).

To adjust this setting, Start the Nobeltec charting software and launch the InSight Radar window. Once it is open and displaying a radar image, click on the **Radar** drop down menu then on the **Initial Radar Setup** option.

Once in this window, use the spinner buttons or the slider to line up the image.

Remember: The Radar Heading Line is a one-time setup. Once you have it corrected, there should not be a regular need to adjust this setting. Alignment issues while underway are typically a function of compass deviation challenges.

Creating a Compass Deviation Table

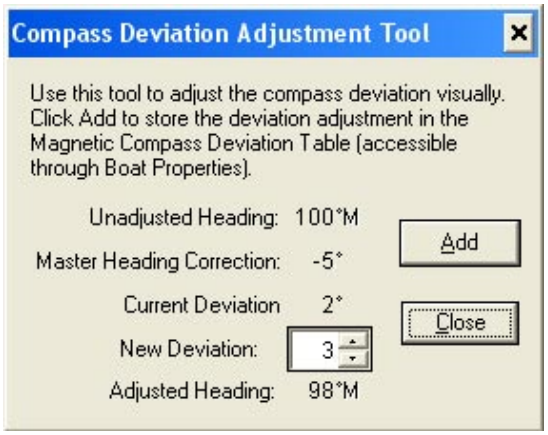
Due to magnetic interferences and other considerations, magnetic compasses can provide inaccurate information. To complicate this matter, the level of heading innacuracy can change at each compass heading. To resolve this, inside the Nobeltec software is a table that allows you to enter correction values at each 5° increment.

Tip: Using a Combination GPS/Heading sensor that determines heading based on dual GPS antennas (instead of magnetic) significantly improves the accuracy of incoming heading data and simplifies the radar alignment process.

Once you have resolved the radar heading line and compass master rotations, you now need to test the radar alignment at various headings to discover the onboard deviations. The easiest way to do this is to be on the water in a clear open area and drive at each heading for a short while correcting the deviation as you go.

An example of a way to do this follows:

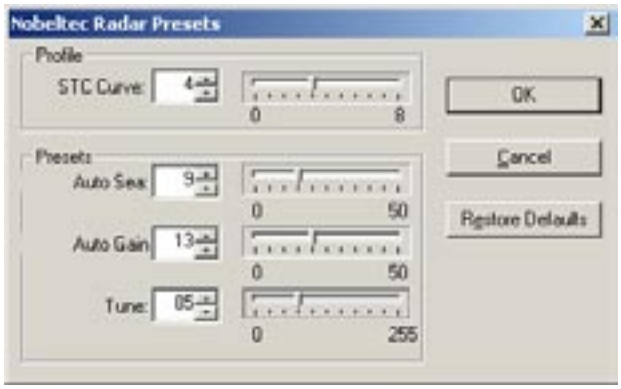
1) Once on the water with the Nobeltec software running with radar and the heading sensor, open the Compass Deviation Adjustment tool (click on the **Deviation entry** button in the Compass Heading Corrections window - shown above).



2) Steer to magnetic North.
3) With a chart window open with radar overlay turned on, observe how the radar lines up with the chart. If the radar does not line up correctly, use the screen above to rotate the radar image to the chart. Once lined up, hit the **Add** button to add this value to the deviation table.
4) Now, change the vessel heading to another heading and repeat the process until you feel confident that the radar image lines up with the chart at each heading.

Setting the Radar Presets (4kW Models and Above Only)

The auto gain and auto sea functions allow for hands free operation of the radar. As with any other setting on the radar, these modes must be properly set up in order to operate correctly. The following sections describe the presets that must be set for proper operation.



There are several presets that affect the quality of the image. This section only reviews those that affect the performance of the radar while using the “auto” functions.

The dialog above is used for all preset controls (your actual values may vary from those in the image). Pressing **OK** applies and saves the changes you have made. Pressing **Cancel** eliminates any changes you have made, and restores the settings prior to modification. **Restore Defaults** sets the values to factory defaults.

Follow the instructions below to adjust specific preset values on the radar.

Auto Tune Preset Controls

The Nobeltec radar is always in auto tune mode. In order to optimize the image, it is necessary to set the auto tune preset to make sure you are receiving the best quality image possible. Once set, you should not need to adjust the auto tune preset unless the image quality deteriorates out of the control of the auto control. Generally, you should adjust the auto tune preset once a year to make sure you have the best image.

Follow these steps:

1) Select Adjust Radar Presets by right clicking on the radar image window or from the Radar menu.
2) Adjust the auto tune control down until you see the image start to deteriorate. Note the value of the setting.
3) Adjust the auto tune control up past the point where the image looks good until the image starts to deteriorate.
4) Select the point between the two where the quality of the image is at its best.

Setting the Auto Gain Preset

The auto gain function automatically preserves the look of the image based on the auto gain preset. You must first adjust the auto gain preset before adjusting the auto sea settings. Once the auto gain is set, it will be set for all ranges.

Follow these steps to adjust the Auto Gain preset:

1) Click and depress the Auto Gain toolbar button 

.
2) To adjust the image quality, right click in the InSight Radar window and select **Adjust Radar Presets**
3) Adjust the auto gain control down if the image looks too strong. Adjust the auto gain control up if the image looks too faint.
4) Click **OK** once the image looks good.

Setting the Auto Sea Clutter Preset

The Auto Sea function adjusts the image to dynamically compensate for changing sea state due to wind or swells. The radar evaluates the type of echoes returned and more Sea Clutter control is applied from the center going out on the image. One benefit of the Auto Sea setting is that if the sea state increases due to wind, more Sea Clutter control is applied on the leeward side of the image to counteract the wave chop on that side of the vessel.

Auto Sea is a combination of two modes: Harbor Sea Clutter and Auto Sea Clutter control. When the range of the radar is 1 mile or less, the program places the radar in the Harbor Sea Clutter mode; over 1 mile and the program switches the radar to Auto Sea Clutter mode.

Harbor Sea Clutter is applied in situation where Auto Sea Clutter control does not work well; in environments where strong echoes are returned from land or nearby buildings. Unlike the Auto Sea Clutter mode, this mode does not attempt to dynamically adjust the Sea Clutter application, but rather applies a static Sea Clutter control value based on the Harbor Sea Clutter preset.

As with the Auto Gain setting, the Auto Sea Clutter applies to all ranges. But due to the nature of Sea Clutter application, it is applied based on the STC Curve profile set below and generally has greater application closer to the vessel.

Follow these steps to adjust the Auto Sea Clutter Preset:

1) Set the radar range to 12nm.
2) Click and depress the Auto Sea toolbar button 

.
3) Select the **Adjust Radar Presets** option by right clicking on the radar image window or from the radar menu.
4) Set the auto sea preset to 10. Set the STC Curve preset to 4. Click OK.
5) Manually adjust the gain until you get secondary echoes through out the image (make sure your radar color selection allows you discern between strong and weak echoes).
6) Go into the **Adjust Radar Presets** option again.
7) Adjust the Auto Sea preset value up until most of the weak echoes for an 8nm radius are eliminated. Click OK.
8) Adjust the radar range to 1.5nm and verify that strong echoes from nearby vessels or land are not eliminated. If land or vessel echoes are small or have been eliminated, follow the steps above to decrease the Sea Clutter preset.

Follow these steps to adjust the Harbor Sea Clutter Preset:

1) Set the radar range to 1nm.
2) Click and depress the Auto Sea toolbar button.
3) Select the **Adjust Radar Presets** option by right clicking on the radar image window or from the Radar menu.
4) Set the harbor sea preset to 10. Set the STC Curve preset to 4. Click **OK**.
5) Manually adjust the gain until you get secondary echoes through out the image (make sure your radar color selection allows you discern between strong and weak echoes).
6) Go into the **Adjust Radar Presets** option again.
7) Adjust the Harbor Sea preset value up until most of the weak echoes are eliminated. Click **OK**.
8) Adjust the radar range to 1/8nm and verify that strong echoes from nearby vessels or land are not eliminated. If land or vessel echoes are small or have been eliminated, follow the steps above to decrease the Harbor Sea Clutter preset.

STC Curve

The STC Curve function allows you to control the Sea Clutter profile of the radar. By default, the STC Curve profile is set to a value of 4. For most applications, there should be no need to change this setting. However, you may want to adjust this value to get a better application of Sea Clutter if the radar is either mounted very high on the vessel, or extremely low. This setting affects all modes of Sea Clutter application (auto, harbor and manual).

Follow these steps to adjust the STC Curve profile:

1) Set the radar range to 12nm.
2) Set the gain and sea clutter to manual settings.
3) Setting the STC curve profile to a lower number causes the application of sea clutter to be focused around the vessel. Setting it to a higher number causes STC to be applied through out more of the image. Adjust the STC curve profile value up or down and observe its impact on the radar image.
4) Select the desired application of the STC curve profile and click **OK**.

NOTE: If the STC curve profile is not set correctly, adjusting the sea clutter (manual or automatic) may not have the desired impact. If you notice that increasing the sea clutter control has no impact on the image, your STC curve profile is too low. On the other hand if you notice that echoes disappear too quickly when applying sea clutter, the STC profile may be too high.

chapter 3

Working with InSight Radar

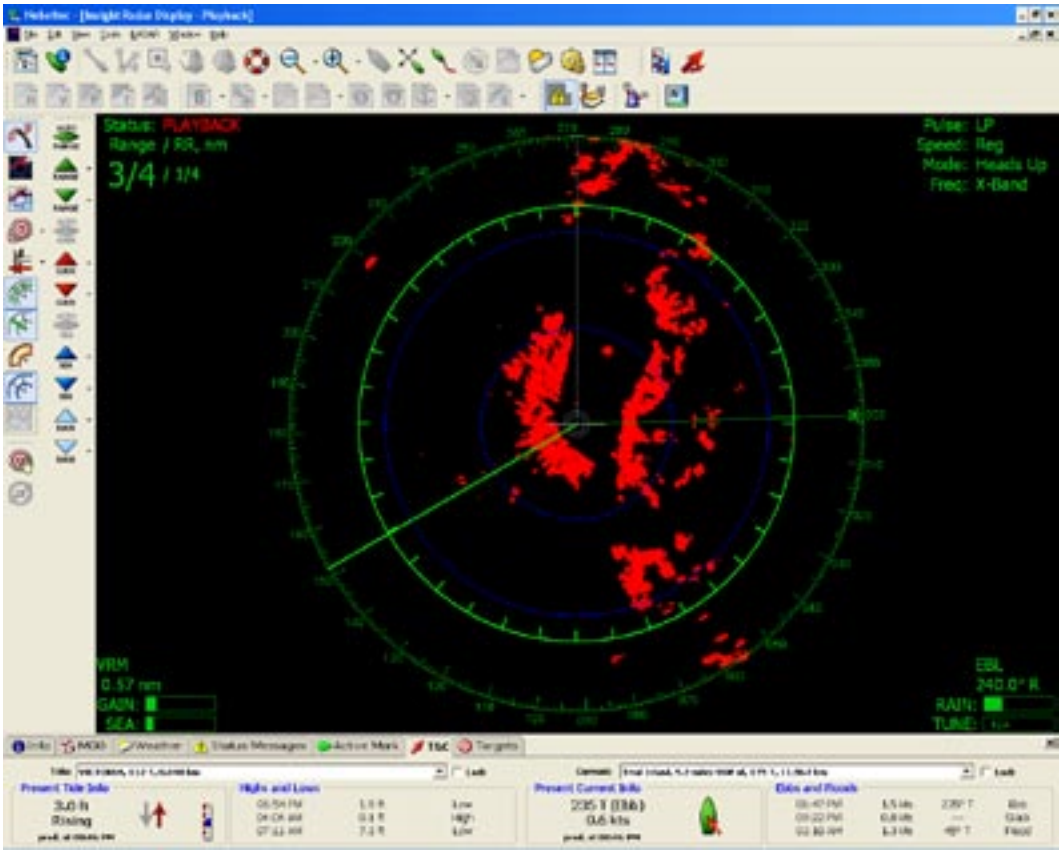
Opening the InSight Radar Window

1 Launch the Nobeltec Navigation software by double clicking on its desktop icon.

2 Click on the Radar drop down menu and then InSight Radar Window...

or Click on the **InSight Radar Window** toolbar button  .

The InSight window will open. If the radar unit is turned on and is properly connected to the computer, the InSight window automatically displays the radar image similar to that shown below.



Turning on your Radar

Once the hardware portion of your digital radar is properly installed, viewing a radar image is as simple as powering the antenna, and opening an InSight Radar window within the Nobeltec software.

With the radar powered on, click on the **Radar Transmit/Standby**  button to begin or stop radar transmission.

Depending on the antenna, the power-up process takes between 90 and 120 seconds. Once powered, Nobeltec automatically displays incoming radar data. If the radar is in standby mode, use the Radar Transmit/Standy toolbar button to begin transmitting.

Once the InSight window is open and active, a range of tuning and control options and other features are available. InSight Radar features are listed on the following pages.

Radar right click and Radar menu

The InSight window can be managed as any other window. It can be minimized, maximized and can even share the screen with another chart window. The InSight Radar window can also be closed while the radar is still in operation. If you are overlaying the radar image on an electronic chart, the dedicated radar window is not required to be visible.

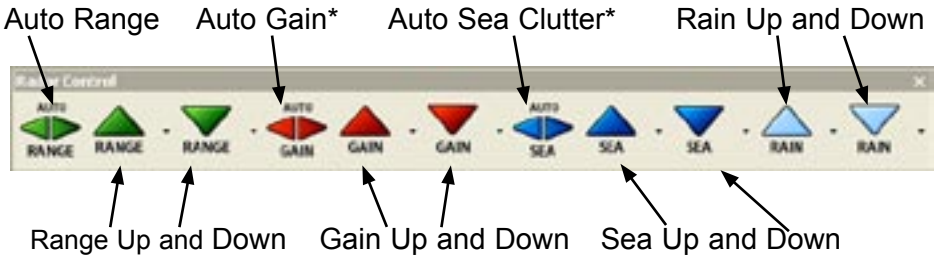
Similar to other Windows applications, common features can often be found by clicking on the right mouse button or the Radar menu. The following pages describe the radar features found in these menus in greater detail.

Radar Toolbars

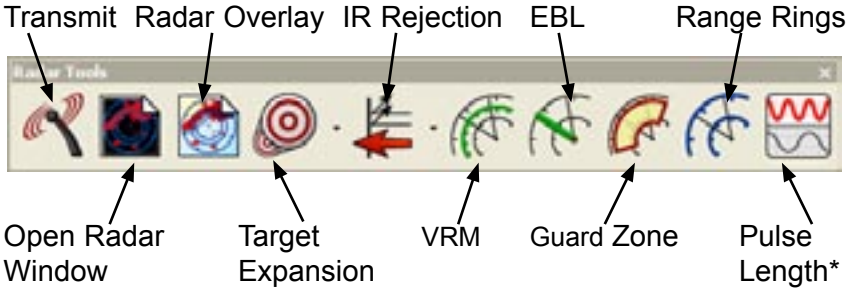
There are a number of radar toolbars that give you complete control over the InSight Radar features. The three primary toolbars are displayed below. The remaining available toolbars contain the same toolbar buttons as those displayed below but are re-organized in smaller subsets.

To turn on new toolbars, click on the Tools drop down menu, then on the Toolbars option. Check the toolbars that you want to see and click on the **Apply** button.

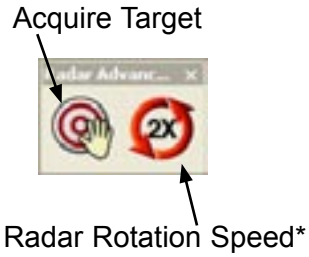
Radar Control Toolbar



Radar Tools Toolbar



Radar Advanced Toolbar (Nobeltec Admiral Only)



**Please Note: If you are using the IR2-2D (2kW Dome), these tools are not available and will be "greyed" out on the toolbar.*

Range Scale

Range Scales: The range buttons determine the size of the area that appears in your InSight Radar window. In addition, the range setting also determines the number and distance of the range rings. Click on the Range Up or Range Down button to increase or decrease the range of the radar respectively.

Range Scales in nautical miles

Range (nm)	1/8	1/4	1/2	3/4	1	1 1/2	2	3	4	6
Ring Interval	1/16	1/8	1/8	1/4	1/4	1/2	1/2	1	1	2
No. of Rings	2	2	4	3	4	3	4	3	4	3

Range (nm)	8	12	16	24	36	48	64	72	96
Ring Interval	2	3	4	6	9	12	16	18	24
No. of Rings	4	4	4	4	4	4	4	4	4

Tip: The maximum range depends what radar model you own. The ranges for the InSight Radar Box when integrated with a third party radar may vary depending on the range options of that radar.

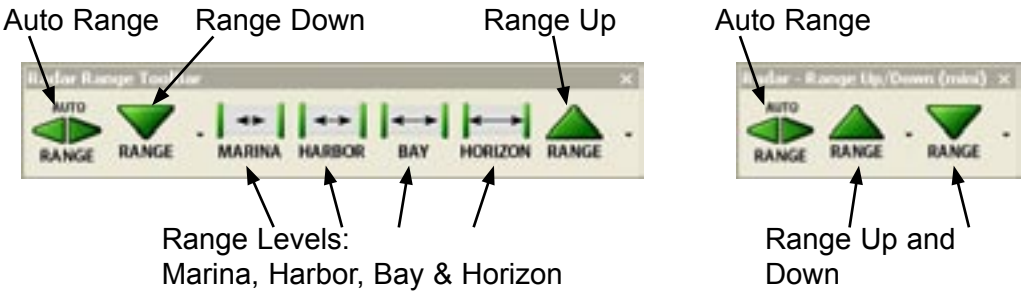
The Range setting is shown in the upper left hand corner of the InSight window. Once you have requested a range change command, it may take a second or two to update the radar window.

Tip: When the InSight Radar Window is the active window, you can also change the radar range by hitting the Zoom buttons  or  or the keyboard +/- keys.

Autorange: This useful feature automatically adjusts the radar range to match the chart window. This keeps the overlaid radar image consistently scaled and sized with the chart window and helps maintain a cleaner image. When enabled, a change in radar range or chart zoom level changes the other window accordingly.

Radar Range Toolbar

In addition to the Radar Control toolbar displayed above, there are two additional Range toolbars designed to give you greater flexibility and control.



The special Range Levels buttons are designed to give you the ability to range out or in to a given level with a single click. Depending on your radar type, these ranges may vary slightly.

Range Level	Approximate Range Level
	1/4 nm
	1 nm
	4 nm
	16 nm

Adjusting the Gain

Use the Gain Up  and Gain Down  keys to adjust the sensitivity of the radar.

A higher gain value makes the radar more sensitive to radar returns, allowing it to display weaker targets. However, if the gain is set too high, the image might get overly cluttered with background noise and even strong returns could be hidden or masked. Conversely, a lower gain could cause weak echoes to be missed.

Auto Gain (4kW and Higher)

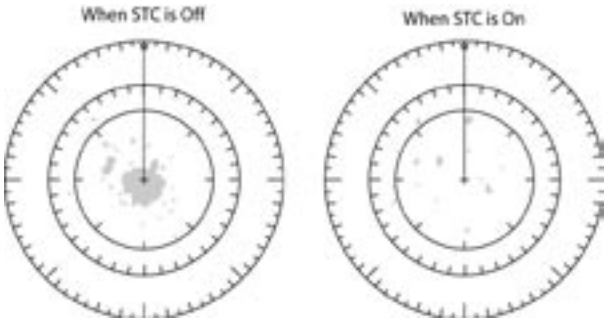
Based on the Radar Presets, the Auto Gain function is designed for hands free operation of the radar. By setting the gain preset (as described in the chapter titled **Setting up the InSight Radar**) the software preserves the relative gain settings for every range level.

Reducing Sea Clutter (SEA)

Use the Sea Up  and Sea Down  keys to reduce the effect of random echo returns from waves or rough water near the vessel. Sea Clutter is sometimes referred to as STC (Slow Time Constant) or just SEA.

Reducing the on-screen clutter caused by the echoes of waves is accomplished by increasing the SEA value.

Sea Clutter is primarily focused near the vessel and shows on your radar screen as a thick cluster of radar returns. Increasing the Sea Clutter (or STC; Slow Time Constant) can help filter out the echoes between rough seas and real targets.



Auto SEA (4kW and Higher)

Based on the Radar Presets, the Auto SEA function is designed for hands free operation of the radar. By setting the SEA preset (as described in the chapter titled **Setting up the InSight Radar**) the software adjusts to the changing weather conditions to maintain the radar quality. The effect of Auto SEA varies based upon range and conditions.

Reducing Precipitation Clutter (Rain)

The vertical beam width of the radar antenna allows you to see targets on the surface even when a ship is rolling. This feature, however, can have the side effect of confusing rain, snow or other conditions with real targets. Increasing the Rain value helps to discriminate between weather and solid returns.

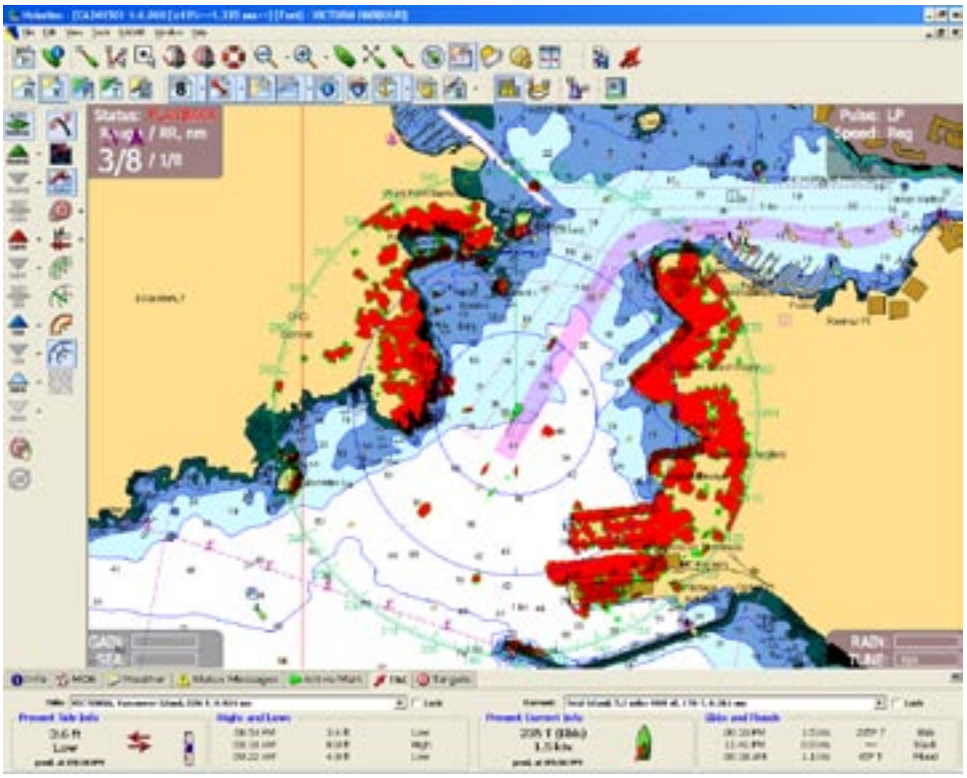
Use the Rain Up  and Rain Down  keys to reduce the effect of weather or other meteorological phenomenon on your radar image. Be careful not to increase the rain value too much as it can filter out real targets with the weather. Rain Clutter control is still effective when the Gain is lowered.

If you are using the 2kW Dome model, the Rain Up and Rain Down actually turn Rain Clutter on and off. The Rain Up button turns Rain Clutter on and the Rain Down button turns it off.

Radar / Chart Overlay

Overlay Radar Image on Chart: Overlaying the radar on the chart is the ideal way to merge the power of electronic charting and the security of radar. The chart brings context to what can often be a confusing display of radar blobs. Clicking on the radar overlay button toggles the radar overlay on and off.

When radar overlay is on, the important radar information is also displayed in the corners of the chart screen as shown below.



Warning: Radar Overlay on your electronic charts requires a high speed and well-adjusted compass. Slight deviation errors are significantly magnified with radar overlay. Make sure that you have setup your radar and digital compass correctly.

Tip: You can also turn Radar Overlay on by right clicking on the chart and choosing the Radar Overlay button or from the Radar drop down menu.

Remember: The Auto Range feature  keeps the chart scale and the radar range in sync, making it easy to understand the radar in context with the chart. To change the radar range, simply zoom out using any of the charting zoom tools, including the plus and minus keys on your keyboard.

Cursor Ghosting

When in SplitScreen mode, one way to compare the electronic chart and the radar is to use a function called Cursor Ghosting. If Cursor Ghosting is enabled in the Radar tab of the program Options, then moving your cursor over the radar or chart creates another cursor in the other window in the same relative position. Cursor Ghosting is particularly useful when trying to understand more about certain radar targets. By hovering your mouse cursor over the radar target in question, you can see its exact location on the chart.

Rejecting Radar Interference

Radar Interference Rejection: Interference Rejection (IR) is a setting that reduces the interference caused by radar signals from other radar units operating in the same frequency band as your radar. There are four IR options. Off, 1 (weak), 2 (middle) and 3 (strong). The higher you set IR, the less interference you will receive. In order to not miss weak targets, make sure to turn interference rejection off when no interference exists.

Measuring the Range and Bearing to a Target

The range and bearing to a target can be measured inside the Nobeltec application a number of ways, including using the range and bearing to the cursor as displayed in the Info tab of the NavBar at the bottom of the screen or by using the appropriate console panes as shown here.

Bearing of Boat to Cursor (BBC)

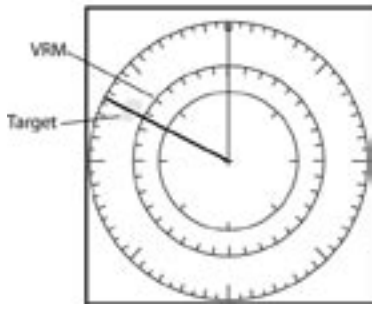
Range of Boat to Cursor (RBC)

You can also measure range and bearing to a target using the three radar tools below:

Range Rings. This button toggles the radar range rings on and off. As described above in the Range section, these rings are at preset distances from the vessel based on the radar range. The distance between rings is shown in nautical miles and is found in the upper left hand corner of the radar window directly next to the Range setting.

To measure the range of a radar echo from the vessel, count the number of rings between the center of the display (where the vessel is) and the target. Check the range ring interval and guesstimate the distance of the target to the nearest ring.

Variable Range Marker (VRM): This tool is a user-controlled range ring that surrounds the vessel. The VRM is normally used to measure distances to targets and is adjusted by grabbing it with the mouse cursor and dragging it to the desired distance. The range for the VRM is displayed in the lower left hand corner of the InSight window as shown below.



Electronic Bearing Line (EBL): This is a bearing line from the center of the vessel that remains constant as the vessel moves. Use the EBL to measure the bearing from the vessel's position to a target. To adjust the EBL, click on it and drag it to the desired angle. The angle can be displayed in three ways as shown below and is found in the lower right corner of the radar window.

EBL in Clock degrees

EBL in Relative degrees

EBL in Absolute degrees

Setting up a Guard Zone

Guard Zone: One of the powerful InSight features is the ability to create fully customizable guard zones. This zone acts as a shield to the vessel. If the InSight Radar receives radar returns inside the guard zone, you will be notified with an alarm. Once a guard zone is created, you can click on any of the outer edges to change the size and shape of the guard zone in that direction. Click in the center to move the whole guard zone around the vessel. When radar echoes enter the guard zone, you are notified in the Status tab of the NavBar as seen here.

Warning: Neither guard zones nor any other part of the InSight Radar should be relied upon as the sole means for detecting collision possibilities. To improve the function of the guard zone, make sure your radar is properly adjusted to see targets inside the guard zone.

Pulse Length (4kW and Higher)

Pulse Length: Refers to the length of time of each transmit of the radar waves by the transceiver. Typically a longer pulse length produces better long range target detection and a shorter pulse length is for better target range discrimination. The pulse length is shown in the upper right corner of the InSight Radar window.The pulse lengths are pre-set for each range so you are not typically required to change this setting. However, if you are not satisfied with the current pulse length setting, it is possible to toggle between the pulse lengths with this toolbar button.

Radar Orientation (rotation) (4kW and Higher)

You can rotate the InSight Radar window by using the Radar drop down menu or the right click. In both cases, click on the option Radar Orientation and then on one of its sub-menu options. The current orientation is displayed in the upper right corner (as seen on previous page). Orientation options are:

Heads Up: Rotates the radar image such that the line connecting the center of the radar image to the top of the display is the vessel's current heading. The radar is painted relative to own ship's heading. This rotation option works only if you have an attached heading sensor.

North Up: Rotates the radar image so that North is always directly up on the radar window. In this case the line connecting the center of the radar image to the top of the display is the North indicator.

Course Up: This option rotates the radar image to the current Course Over Ground (COG). As your course changes, so does the radar window. COG is necessarily different than Heading in that your boat can be pitching and rolling creating sudden heading changes while COG remains consistent. Heading is typically delivered via a heading sensor while COG is a function of your GPS and track history.

Leg Up: This option rotates the radar image to the intended course between your start point (or last waypoint) and the next waypoint in your route. Leg Up is useful when your ship is yawing excessively and the radar image is changing too much. This option only works when you have a activated route in a chart window.

Please Note: When using the 2kW Dome, the only Radar Orientation available is Heads Up. If the radar image is overlaid on an electronic chart, you can select any of the orientation modes listed above.

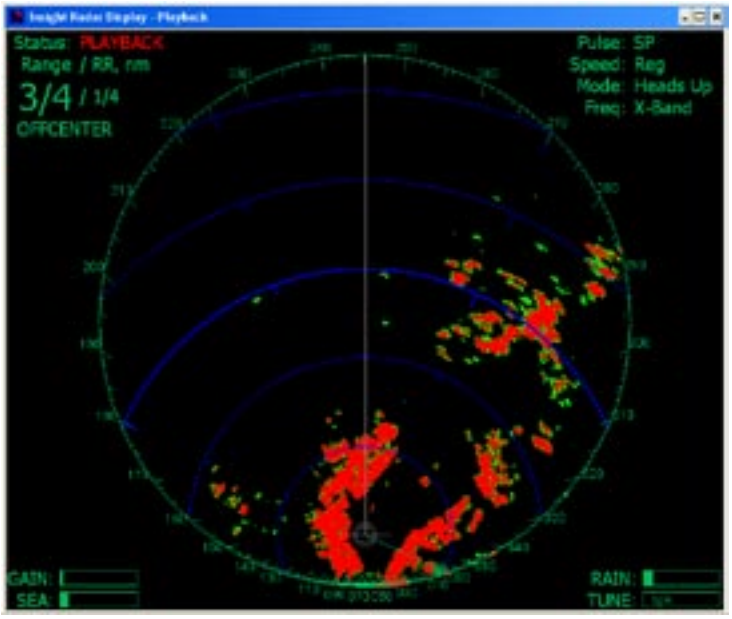
Off Centering the radar (shifting) (4kW and Higher)

Own ship position can be off centered to provide greater radar range. You can control the positioning of the radar image inside the radar window in one of three ways:

Click and Drag: With your mouse, click and drag on the vessel icon to recenter the image wherever desired.

 **AutoScroll: Look Ahead:** Clicking on this button does two things. First, it orients the radar image to Heads Up and then centers the radar image at the bottom of the radar window. This gives you the maximum view ahead.

 **Center on Boat:** This button re-centers the radar image. This button performs the same command in a chart window.



Radar image is off centered to the Look Ahead position. Notice that the heading line extends up on the image and the North indicator extends to the lower right side.

Recording the Radar

Record/Playback Control: Another powerful feature of the Nobeltec software is the ability to record the radar images on your voyage and play them back at a later time. Clicking on this button launches a dialog that looks like a VCR control:

Play: This button launches a dialog where you can find pre-recorded radar files. Radar files are saved with a ".rad" or ".ras" extension. Once found, the radar window plays the recordings back at real-time speeds. Note: Not all radars support the Record/Playback functions.

Rewind: This rewinds the radar file that you are currently viewing.

Pause: Pause the radar file that you are currently viewing.

Record: This button begins recording the radar data in real-time. By clicking on this button you will be prompted to designate the file name and location on the hard drive.

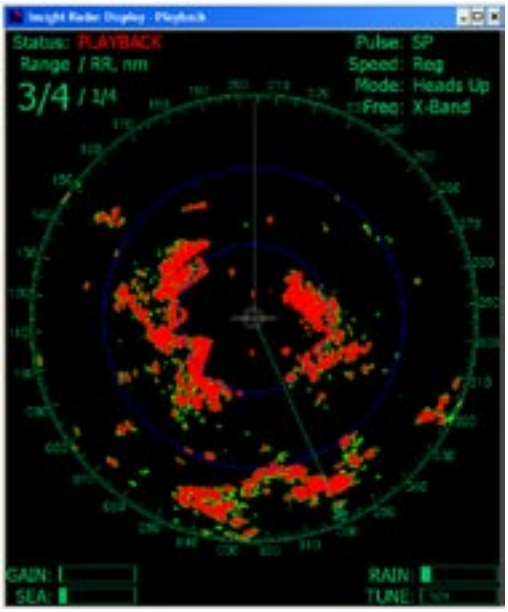
Stop: This stops playing the file that you are currently viewing.

Loop: When depressed, the loop button constantly replays the radar playback file that you have chosen.

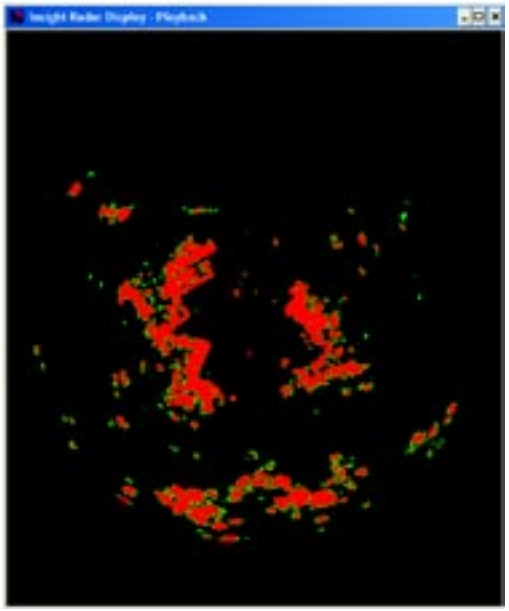
Warning: Recording radar files consumes large amounts of hard drive space in short periods. You may want to delete radar files or back them up once they are no longer needed.

Decluttering the Radar

Declutter Hot Key: In the InSight Radar Window or a chart window with Radar Overlay, press and hold down the space bar to clear the windows of any radar objects other than the radar return itself. This gives you a radar image free of all objects, including the range rings, the Variable Range Marker, etc. When finished, let up on the space bar and your radar image will return to normal.



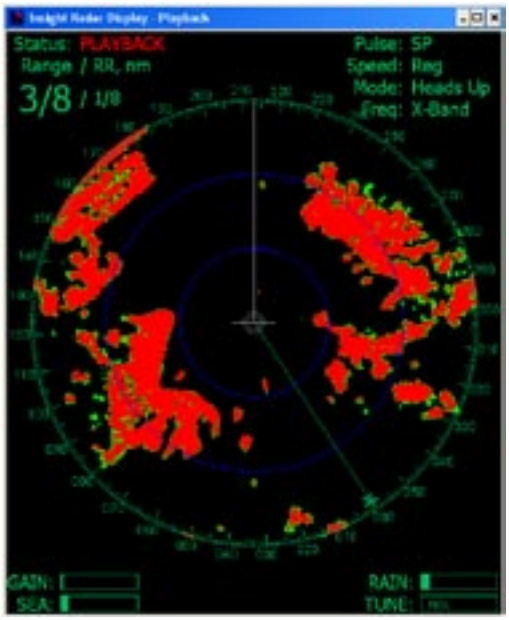
Standard InSight Radar



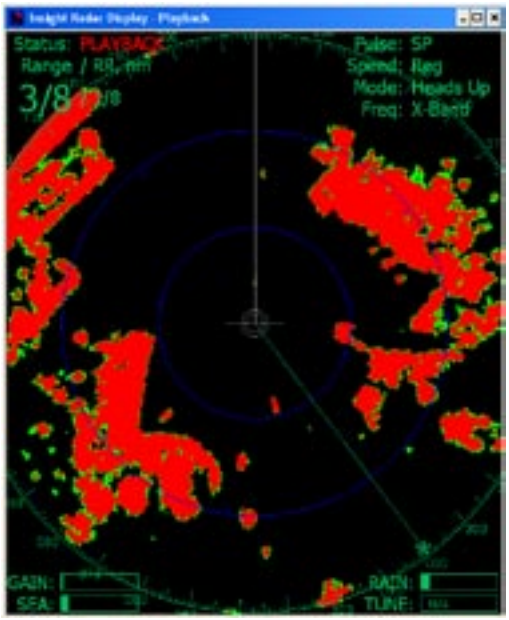
Standard InSight Radar with Decluttering

Resizing the Radar Image

The InSight Radar window can be resized like any standard Window. In addition, the radar image inside the window can be made to fit the window or can be maximized so that the radar takes up more of the window space. To do this right click in the InSight Radar window and choose either the **Fit** or **Clip** option.



Fit Mode



Clip Mode

Using Radar in Admiral - Advanced Features

A powerful benefit of Nobeltec's Admiral product is the special, non-Windows look and feel called NavView. NavView has been designed specifically for touchscreen monitors and on the water navigation where operating a mouse on a moving bridge can be troublesome. Buttons and menu entries are oversized and easy to read. While Admiral's NavView has all of the commonly used features for navigation, it does not have some of the planning features. The idea behind NavView is that it is for navigating and light planning. Serious planning is most effective in the standard PlanView mode.

NavView is easy to understand and operate, however if you need a refresher course, review the Users Guide that came with your Admiral product.

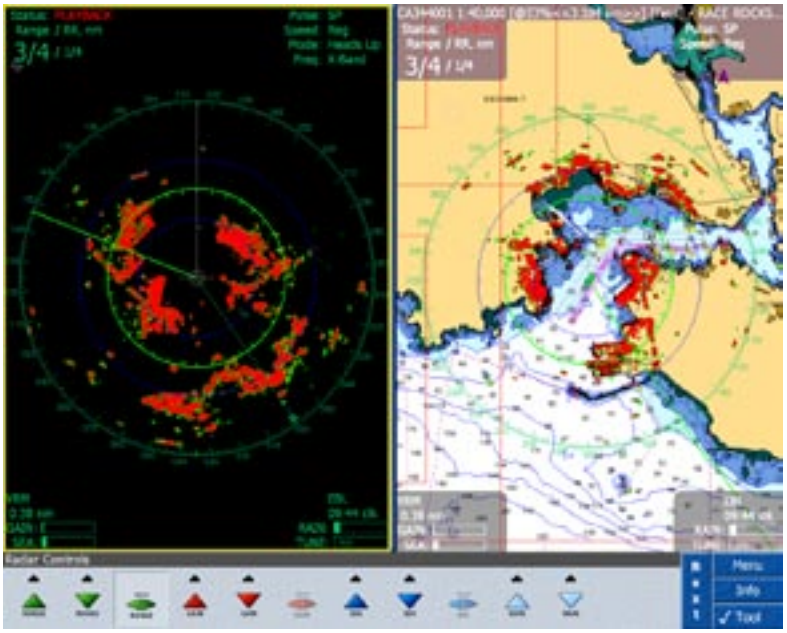
NavView's Multiple Monitor Support

One of the powerful features of Admiral's NavView is the ability to have a single computer drive more than one monitor. This is particularly useful when using integrated devices such as the InSight Radar. Hooking up multiple monitors allows you to show the InSight Radar on one screen as a dedicated radar while the other monitor(s) show other navigation data.

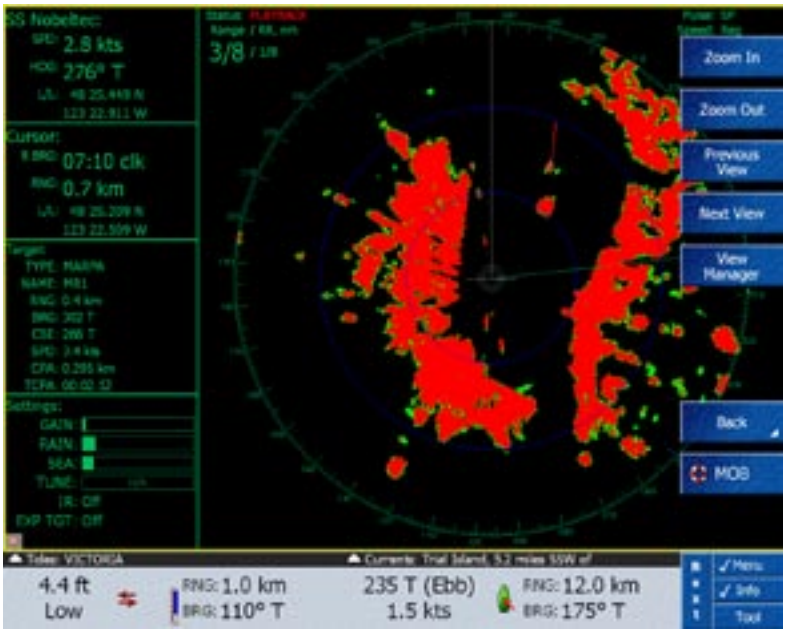
A primary benefit of NavView is the use of screen real-estate. By eliminating the Windows toolbars and other functions, your PC looks and operates more like a function specific device than a PC. The InSight Radar window can be maximized to full screen or split as shown here.

Full Screen Radar Console

When the InSight Radar is being displayed as a full screen in NavView, a special Radar Console provides detailed navigation and radar information on either the right or left side of the screen. Although the InSight Radar window can be displayed full screen with a single monitor, it was developed with multiple monitors in mind.



Split Screen InSight Radar Window and Chart Overlay in NavView.



Full Screen InSight Radar in NavView with the Radar Console on the Left side.

The Vessel
- Vessel name
- Speed
- Heading
- Position

The Cursor
- Bearing
- Range
- Position

Selected Target
- Type
- Name
- Range and Bearing
- Course
- Speed
- CPA and TCPA

Radar Settings
- Gain
- Rain
- Sea Clutter
- Tune
- IR rejection
- Expand Targets

The reported values in the Radar Console are effected by the settings in the Radar tab of the program Options. Changing the side of the Radar Console from left to right or turning it off altogether is also accomplished through the program Options.

NavView Toolbars

The radar toolbars in NavView are similar to the toolbars in the PlanView. However, Admiral has some additional radar features. Each button on the NavView toolbars, shown below, operate the same way as the same button in PlanView.

If you are using the 2kW Dome model, please note that the Auto Sea, Auto Gain, Double Speed and Pulse Length tools are not available. These tools will be “greyed” out if you are using that specific model. For more information, please revisit these sections which are listed in greater detail earlier in this Chapter.

The Radar Controls toolbar in NavView controls the radar in the same way as the toolbar of the same name in PlanView.

The Radar Tools toolbar in NavView has a few extra radar tools that are Admiral features only.

In addition to the main NavView toolbars, Admiral has two additional toolbar buttons:

Double Speed (4kW and Higher): When connected to a 24 volt power source, the IR2 can operate at twice its normal antenna rotation speed. Double speed is useful for high-speed vessels or when operating in tight navigation waterways. By operating at double speed the radar is refreshed at twice the speed as normal.

Acquire Targets Mode: This button puts your cursor into the acquire targets mode for manually identifying radar targets. This is discussed in greater detail below.

Target Tracking

The Admiral product has a built in comprehensive target tracking system. Targets can be acquired one of three ways:

AIS: Automatic Identification System is a system where vessels can broadcast position, course, speed, rate of turn and other useful information. It can be used to educate local traffic about the traffic conditions. Vessels of a certain size are required to broadcast the AIS signals, but anyone can listen. If your vessel is equipped with an AIS receiver or transceiver, Nobeltec Admiral picks up the incoming information and paints the targets on the chart.

External Radar: Many external radars can acquire targets using either ARPA or MARPA. Most of these radars can also broadcast this data to Nobeltec using the NMEA standard sentences. When properly connected, Admiral paints these targets from external radars.

Point and Click (MARPA): Nobeltec Admiral can be used to easily acquire and track radar targets. Using the power of the PC and the mouse cursor, identifying and tracking targets is easier than ever.

Point and Click Radar (MARPA)

MARPA is an acronym for Mini Automated Radar Plotting Aid. Its primary purpose is for collision avoidance and target tracking.

WARNING

No single navigational aid should be relied upon for the safety of vessel and crew. The captain has the responsibility to use all navigation aids to verify position. Electronic navigation aids are not a substitute for basic navigational principles and common sense.

Properly tuning and adjusting your radar in changing conditions is critical for target tracking.

MARPA target tracking requires accurate heading data. A poorly performing heading sensor makes target tracking impossible. For best performance, use a high speed GPS gyro compass and GPS.

Remember: MARPA requires a well adjusted and properly setup digital compass. If using a magnetic compass, you will have to setup a deviation table to adjust the compass input for magnetic interferences on your boat. For more information on setting up your compass deviation table see the chapter titled: **Setting up the InSight Radar**

Acquiring MARPA targets

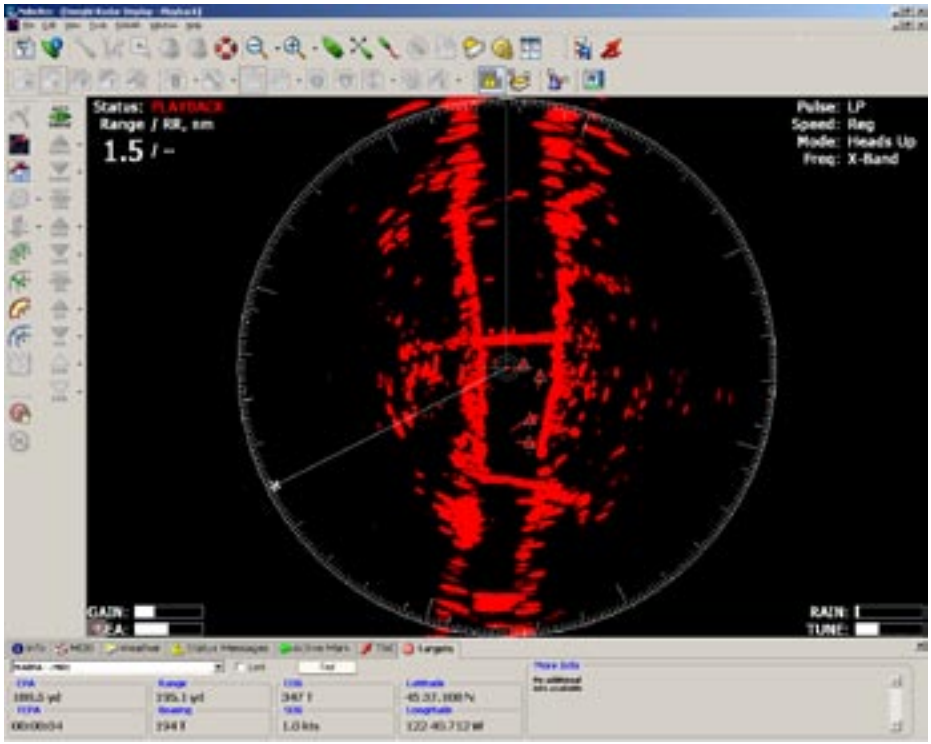
Acquiring MARPA targets in Nobeltec is simple. The first step is to identify the target that you wish to track.

There are three ways to acquire MARPA targets using Nobeltec's exclusive Point and Click Radar.

Double Click: In the InSight Radar window, simply move your mouse on top of the radar target that you wish to track and double click.

Right Click In the InSight Radar window, move your mouse on top of a radar target, right-click and select the option: **Acquire this target**.

Acquire Mode  The Acquire mode changes the cursor to a dashed box. When in this mode, every left click, in the InSight window and a chart window that has Radar Overlay, tells Nobeltec to track the radar object at the location you clicked.



MARPA targets using Nobeltec's Point and Click radar. Targets are shown in InSight Radar window and Targets Navbar.

Once you've identified a target, it takes a few full radar swings for Nobeltec to properly acquire and track the target.

MARPA Symbology

Nobeltec uses the IMO approved MARPA symbology.

Symbol	Description	Meaning
	Dashed box	Attempting to acquire target. Typically takes up to 7 full rotations.
	Blue Circle with Vector	Tracking target. Vector shows course and speed.
	Red Triangle with Vector	Target is a threat because it is inside the alarm setting. Showing course and speed through the vector.
	Yellow Diamond	Lost target. Attempting to re-acquire.

The predictor line extending from the targets symbol gives an estimate of target course and speed. The end of the predictor line shows the position where, barring changes, the target will be in a designated amount of time. The predictor line timing is set to 5 minutes by default.

Tip: If the MARPA target is lost, another feature of the Point and Click Radar is to use your mouse to drag the symbol back over the radar echo to help it re-acquire. You can also delete targets with the right click.

Once a target has been acquired you can see it in the Radar Console as we saw earlier in the chapter, or on the Targets tab of the NavBar as shown here.

The Targets tab of the NavBar shows all the targets that are being tracked, including AIS targets. Use the drop down box in its upper left corner to choose the target that you wish to view. The More Info section is used to display the extra information from AIS targets.

Target Tracking Terms and Acronyms

Acronym	Full Name	Meaning
CPA	Closest Point of Approach	CPA is the closest distance that can be achieved between your vessel and the tracked target based on your collective speed and direction.
TCPA	Time to Closest Point of Approach	The time it takes to achieve the CPA. Time is expressed in minutes.
Rng	Target Range	The targets range from your vessel.
Brg	Target Bearing	The bearing of the target in True or Magnetic.
CSE	Target Course	The tracked targets course.
SPD	Target Speed	The tracked targets speed.

Setting a Target Alarm

The alarm settings are set based on the targets CPA and/or TCPA. By default the alarm settings are set to:

CPA: 1/2 nm

TCPA: 300 seconds.

When a predicted CPA of any target becomes smaller than the CPA alarm or its predicted TCPA less than the TCPA alarm limit, an audio alarm sounds and the target displays as a red triangle with a red vector.

To change the alarm settings go to the program options by clicking on the Options toolbar button  or through the menu system by clicking on the **Tools** drop down menu and then on **Options**. Now click on the Targets tab and change the Target Threat Criteria as desired. For more information on the Options, see the section later in this chapter.

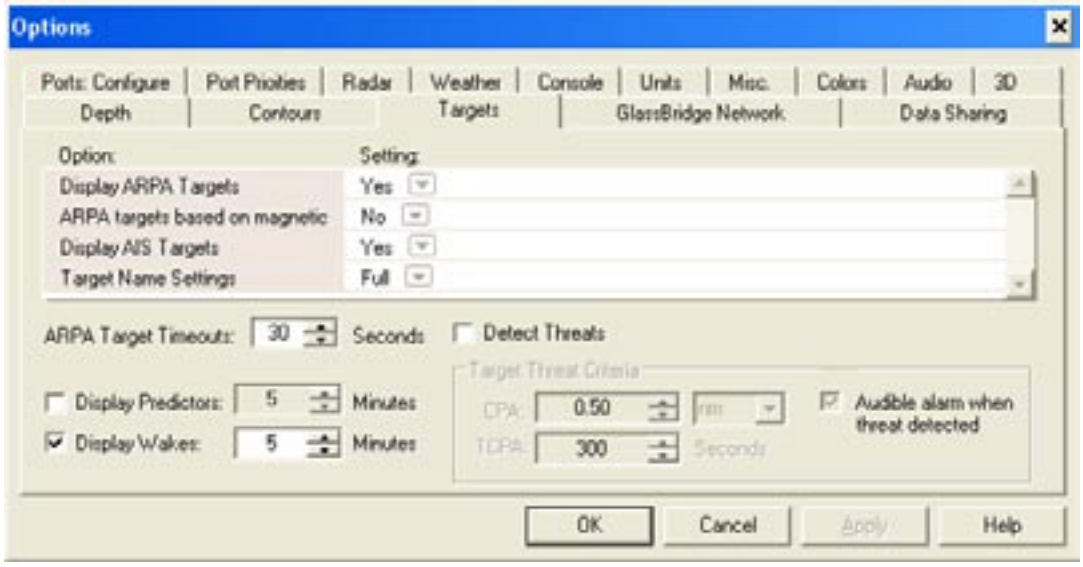
Warning: The CPA/TCPA alarm should never be relied upon as the sole means for detecting the risk of collision. The navigator is responsible for using all means of threat detection, including visual observations.

Radar Configuration Options

In the Nobeltec Options, are two pages specific to Radar or Targets.

To view the Targets tab of the Options dialog

1. Launch the Nobeltec software by double clicking on its desktop icon.
2. Click on the **Tools** drop down menu, and select **Options...**
3. Now click on the **Targets** tab.



Display ARPA Targets: A yes choice tells the Nobeltec software to display ARPA targets coming from an external radar in the standard NMEA format.

ARPA Targets based on magnetic: A yes choice tells the Nobeltec software to recognize an external ARPA source as magnetic bearing data rather than true bearing data.

Display AIS Targets: A yes choice tells the Nobeltec software to display AIS targets coming from an external AIS receiver or transceiver.

Target Name Settings: Tells the Nobeltec software how to display the AIS target names when overlaid on the chart. The options are None, Short or Full.

ARPA Target Timeouts: The time displayed is the time that Nobeltec will keep the ARPA target from the external radar painted on-screen before deleting the target.

Display Predictors and Wakes: When checked these objects display for all target types. Set the number of minutes ahead or behind respectively for each object type to display.

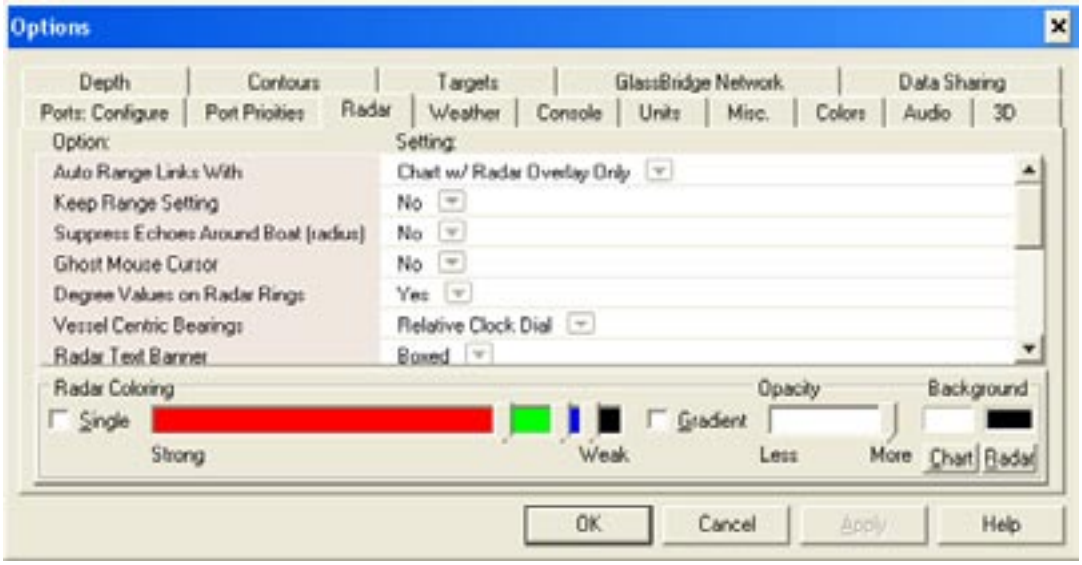
Target Threat Criteria: Check the **Detect Threats** box to enable the threat criteria. Once checked, set the CPA and TCPA limits. You can also turn the audible alarm on/off.

To view the Radar tab of the Options dialog

1 Launch the Nobeltec software by double clicking on its desktop icon.

2 Click on the **Tools** drop down menu, and select **Options...**

3 Now click on the **Radar** tab.



Auto Range Links With: When Auto Range is turned on, this setting controls what windows are effected. Auto Range is the feature that keeps the InSight Radar window and chart window in sync. As you zoom in or out on either of the displays the other matches the range change.

All Chart Windows: This option keeps all chart windows at the same zoom or range level.

Chart w/ Radar Overlay Only: Changes the zoom or scale of chart windows that have the radar overlay turned on to match the radar range.

Keep range setting: When checked, this feature remembers the tuning settings for Gain, Sea Clutter, etc for each range. As you adjust the range, the InSight radar will revert to your last used tuning settings.

Suppress echoes around Boat: Resolves what is commonly referred to as Main Bang Suppression. This feature turns off all radar echoes around the boat within a certain radius of pixels.

Warning: Use caution when using this feature as it could remove real radar echoes that could be collision threats.

Ghost Mouse Cursor: Shows a ghosted image of the mouse cursor in every chart window. Most typically this would be used when the radar window and a chart window are not in the same rotation angle so identifying targets is made simpler.

Degree Marks on Radar Rings: Turns on or off the degree values from the radar range rings.

Vessel Centric Bearings: This option lets you change how the angle of the Electronic Bearing Line is measured and displayed. The value set here is used in the InSight window.

Radar Text Banner: This option changes how the radar information is displayed when overlaid on an electronic chart. There are three options, Boxed, Full and None. This option does not affect the display of the text itself only the background box.

Radar Resolution (not on all radars): This option is only available if you have certain versions of the Nobeltec digital radar. Further, the options included are based upon the particular Nobeltec digital radar you own. Click on the down arrow to see what options are available. While, higher resolution gives an improved radar image it generally consumes more memory.

Image Clipping: Some radars return the radar image in a square. This setting allows you to keep the radar image as a square or clip the corners to see a more standard circular radar image.

Always Open Radar Window: This option tells the Nobeltec software whether or not to open a radar window by default each time the program launches.

Full Screen NavView Radar Console (Admiral only): In NavView, Nobeltec Admiral's non-windows look and feel, when the InSight radar is full screen the Radar Console appears. There are three options from which to choose: Left, Right and None.

Colors: The InSight radar allows you to change the colors of each overlayable item. Use this to make objects more visible in different lighting situations or simply for viewing preference. To adjust your color settings, use the slider tabs to adjust the size of the color section. Once the slider tabs are in place, you can then right click in any color section to open the Color Selection dialog box and select your desired color settings.

chapter 4

Understanding Radar

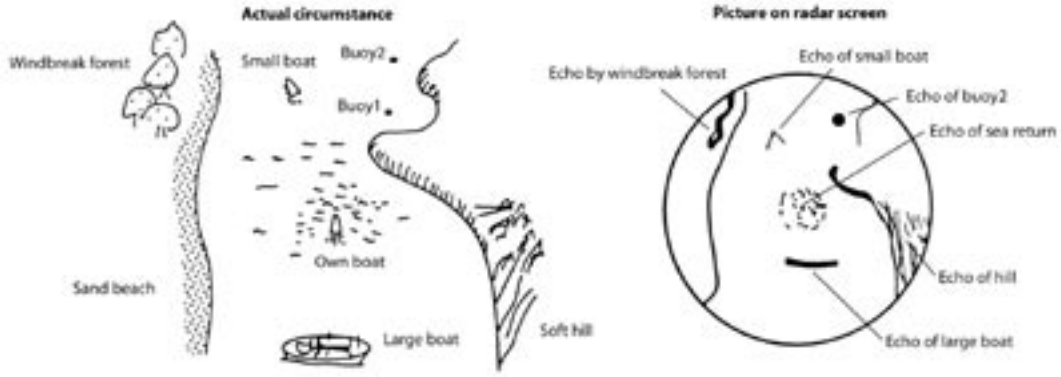
The capability of a radar varies depending on where the radar is mounted, the radars performance, weather conditions, and the skill of the operator. This chapter describes the conditions that affect the capability of the radar, and the correct interpretation of the radar picture.

How to Interpret the Radar Picture

To interpret the radar picture, an operator should be familiar with the radar video presentation caused by the wanted and unwanted effects. For instance, the produced by bridges, sand beaches, waves and even a boat's wake may all be represented differently than expected based on their visual appearance.

For correct interpretation of the radar picture, it is highly recommended that the operator practice using the radar in good weather conditions.

Normal Echoes



The figure above shows an example of typical radar picture compared against a sample real-world scenario. There are a number of things to learn from this image regarding how a radar works. Here is a list of some important ones:

1. The bouy #1 is being blocked by the cape or hill and is not visible in the radar window.
2. Due to its proximity and size, the large boat returns a strong radar return that is similar to its actual profile. On the other hand, the small boat is painted as a small dot, because its reflection area is smaller. Also notice that the smaller boats wake returns a large reflection.
3. The hill on the starboard side of the vessel, because of its dense forest and hilly nature, returns large echoes, while the sandy beach to the port returns a weak radar image. The exception to the port side return is the windbreak forest which returns strong echoes because of its profile differences.

False Echoes

False echoes may appear according to surrounding circumstances. Examples of false echoes and causes of these echoes are described below.

False echoes caused by reflection

A close target may appear in two different directions. One is a real echo, while the other is a false one produced by reflected waves from structures near the radar antenna, such as a funnel, a mast, etc. If a large structure, like an iron bridge exists nearby, it can also create false echoes.

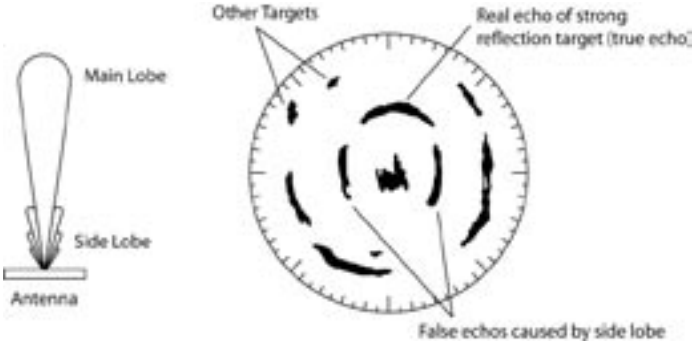
False echoes caused by multiple reflection

When your boat passes near a large boat, radio waves are repeatedly reflected between the two, causing several echoes at regular distances to appear in the same bearing. These false echoes produced by multiple reflection are called multiple echoes. In this case, the real target is the closest. Because multiple echoes soon disappear when your boat moves from the reflection target or the boat direction has changed, even if these multiple echoes are produced, the true image is easily detected.

Shadow and dead angle

If the funnel, mast, post and other structure are located near a transceiver or if a tall obstacle is present, a shadow is produced from the rear of these structures. In extreme cases, no targets will appear in the shadow for a good distance. This range is called the dead range, and the shadow can be produced entirely or partially. Since the dead angle due to the funnel, mast, etc. is detectable during the installation of the transceiver, it can be eliminated by changing the radar mounting position.

False echoes caused by side lobes



The radiation beams emitted from the transceiver comprise side lobes in addition to the main lobe. Since the side lobe energy is very low, it does not affect distant targets. A false echo due to the sidelobes is produced from a close-in target with strong reflections. A false echo caused by the side lobes appears as an arc. It is eliminated by slightly reducing the gain or by changing the FTC level.

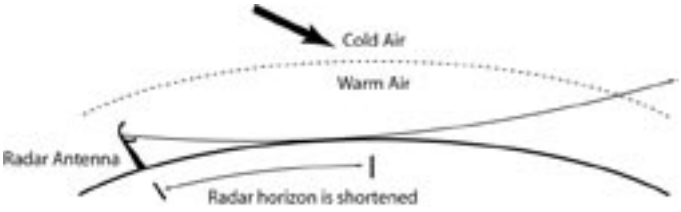
Radar Horizon

The radio waves used for radar are called microwaves, and like light, they travel in straight lines. Because light is generally refracted toward the ground surface, we are able to see farther than the physical horizon. This is called the optical horizon as compared to the physical horizon. Otherwise, microwaves have similar characteristics to light, and this is called a radar horizon. Since microwaves are longer than light in terms of wavelength, the radar horizon is farther than the optical horizon by about 6% and the physical horizon by about 15%. The radar horizon changes according to the radar transceiver height and target height.

Radar Horizon and Mother Nature

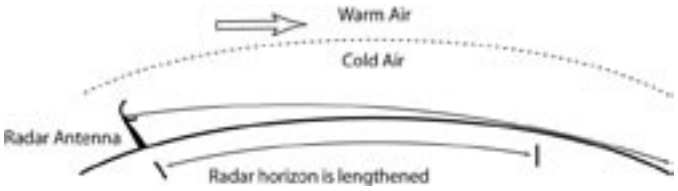
As temperature and humidity change in the air, the refractive index of radar radio waves change, consequently causing the detectable range of the radar to vary. This gives us a variation of detectable range due to a change in ambient conditions

Sub-refraction



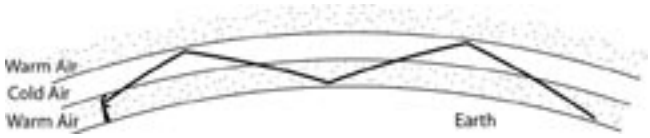
When cold air flows over the warm surface, the radar waves are curved upwards. This phenomenon is called sub-refraction. As a result, the detectable range of the radar is reduced. This is likely to occur in polar regions, or in warm currents where cold air from the polar regions flow into the sea.

Super-refraction



When the air being warmed up inland flows in the cold sea, radio waves are curved downward. This is called super-refraction. In this case, the range of the radar increases. This phenomenon is apt to be produced in the warm coastal regions, and becomes noticeable as the temperature difference becomes larger.

Ducting

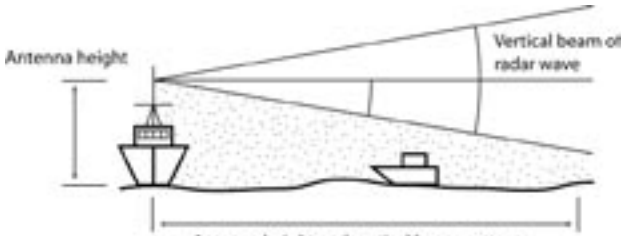


If air layers having a different temperature or different atmospheric pressures are produced alternately in the altitudes, a distant target exceeding the visible range of the radar is detectable. This phenomenon is caused when air layers having a different temperature contact each other. The radio waves are not refracted, but reflected on the boundary where the two layers differ. As a result, radio waves can be propagated farther that the curvature of the earth. The passage where the radio waves travel is called a Duct. The abnormal propagation of radio waves through this duct is called ducting.

Minimum Detectable Range

The minimum distance that the radar can detect a target is called the **Minimum Detectable Range**. This minimum range varies depending on radar factors such as transmission pulse width, RF leakage time and height of transceiver. The following section describes the factors that affect the Minimum Detectable Range.

Height of Transceiver



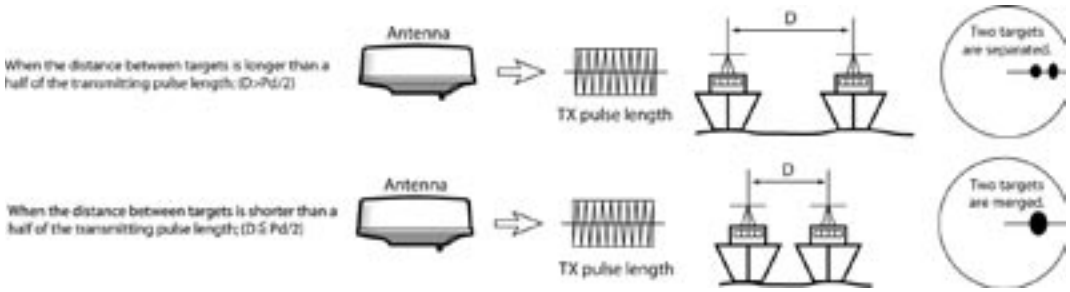
Antenna height and vertical beam pattern affecting detection of short range target.

Height of the transceiver affects the short range target detection. If the transceiver is mounted at a relatively high level from the sea surface, the radar wave may skip closer targets causing the radar to fail in detection of these closer targets. The radar's Vertical Beam Width is also involved, as shown in the figure above. Wider beam results in better short range detection, however it also shortens the detectable range.

Transmission Pulse Width

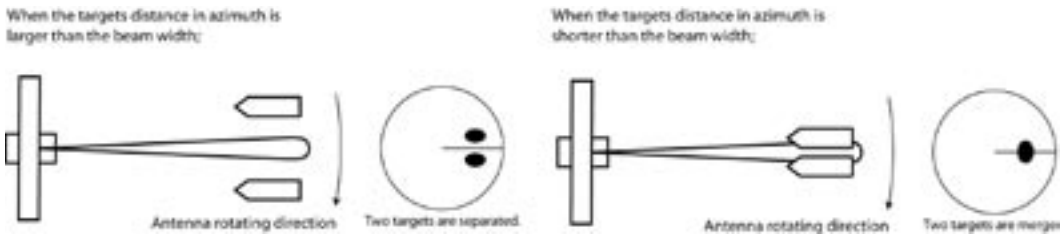
In most radar systems, including the Nobeltec Digital Radar, the radar transmission pulse width is automatically selected to short or long depending on the range scale. At a short range, a short pulse width is used to improve the close target detection as well as picture definition. At long ranges, a longer pulse width is used to achieve good long range performance.

Range Resolution



The range resolution is defined as the minimum distance between two targets in the same bearing which are discriminated as two images in the radar picture.

Bearing Resolution



The bearing resolution is defined as the minimum bearing where the two targets of the same distance are displayed separately as two independent images on the screen, and is determined by the transceiver **Horizontal Beam Width**.

chapter 5

Troubleshooting

Troubleshooting Direct Connections

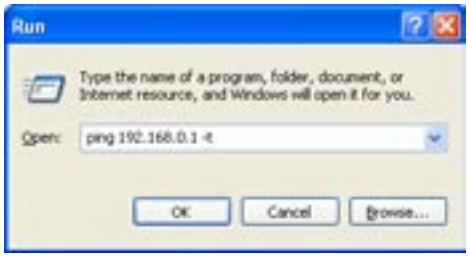
Test the Connection without the Radar Wizard

If the Radar wizard is unable to see the IR2, a good next step is to try and find the radar another way.

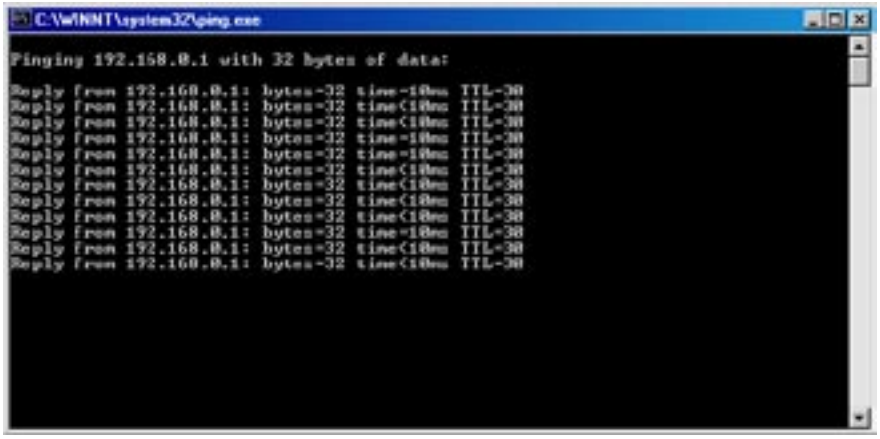
Power the radar and wait for one to two full minutes for the radar to decide to use its default IP address. Reboot your computer. Once everything is up and running, click on the **Start** button and then on the **Run** option. In the field provided, type the following:

Ping 192.168.0.1 –t

As shown below.



This sends a "Hello – are you there" type message to the radar. You should see the following screen:



Once satisfied that the radar is responding, you can terminate the Ping command by clicking on the **X** button in the upper right corner (like any other window) or by hitting the **Ctrl** and **C** key together.

If the list does not scroll as above, or gives the message "Hardware error", "Request timed out" or anything other than "Reply from 192.168.0.1:…." as shown above, something is wrong with the connection. Check the following:

1) The PC and the IR2 Control box are connected with a crossover cable and not a straight through cable.
2) The Network Interface Card software is installed correctly.
3) The power is turned on to the radar and has been for at least one full minute.
4) The LED's on the RJ-45 connector on both the PC and the MDS box are illuminated and/or blinking. The left most LED should remain solid, while the other LED may blink.
5) Verify the IP address and Subnet mask are correct.
6) If you are uncertain about the PC's network configuration, please contact the network administrator or the NIC card provider technical support.

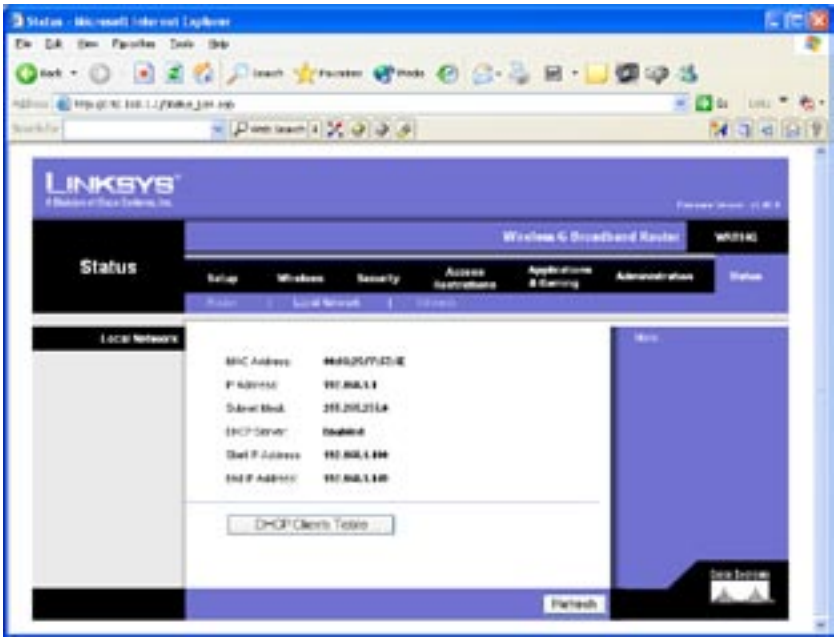
Troubleshooting Network Connections

Test the Connection without the Radar Wizard

If the Radar wizard is unable to see the IR2, a good next step is to try and find the radar another way.

Power the radar and wait for one to two full minutes for the radar to obtain an IP address from the Router/hub. The IP address assigned to the radar is dynamic and may change if the radar is powered off for a period of time, or if the router/hub is re-powered.

The Router/hubs that Nobeltec recommends you use, allow you to view the DHCP table to obtain all the devices on the network. Using this tool for your Router/hub, locate the IP address of the IR2 Radar. It will be in the list as: RadarSensor, as shown in the images below.



With this particular Linksys router, type in the IP address of the router into the Internet Explorer address field to get to its diagnostic pages. Clicking on the Status tab displays the image. The DHCP Clients table button shows the entire list of devices on the network as shown below:

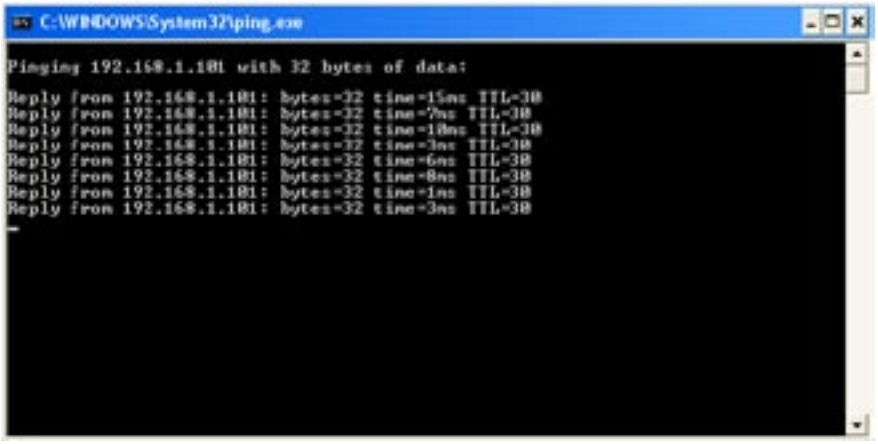
The RadarSensor is clearly identified with its accompanying IP address.

Click on the **Start** button and then on the **Run** option. In the field provided, type the IP address displayed in the DHCP table as shown:

Ping 192.168.1.101 –t

As shown below

This sends a "Hello – are you there" message to the radar. You should see the following screen:



Once satisfied that the radar is responding, you can terminate the Ping command by clicking on the X button in the upper right corner (like any other window) or by hitting the Ctrl and C key together.

If the list does not scroll as above, or gives the message "Hardware error", "Request timed out" or anything other than "Reply from 192.168.0.1:….", something is wrong with the connection. Check the following:

1) Verify that the IR2 works with the direct connect mode. This significantly reduces the possibility of failure in the IR2 Control box and focuses our attention on the network.
2) The PC and the radar are connected to a router/hub using straight through cables (hold connectors upside down side-by-side and verify that the color order is the same on both sides.)
3) The Network Interface Card software is installed correctly.
4) The power is turned on to the radar and has been for at least one full minute.
5) The LED's on the RJ-45 connector on both the PC and the MDS box are illuminated and/or blinking. The left most LED should remain solid, while the other LED may blink.
6) Verify the IP address and Subnet mask are obtained automatically.
7) If you are uncertain about the PC's network configuration, please contact the network administrator or the NIC card provider technical support.

Frequently Asked Questions

Q: I was tracking a target on my radar screen and it suddenly disappeared. What happened to it?

A: One of the most critical pieces of data for target acquisition is a stable and correct heading value. MARPA or AIS targets are generally lost when the target is too small, returning too weak of an echo, or the heading fluctuates too much. If you experience lost targets on a consistent basis, you can create a recording of your radar and send it to us for further troubleshooting. To start recording, right click on the Radar window and select Record/Playback. Select Record, and the software will ask you for a file name. The extension for the existing IR2 radar is .RAD. Please zip your playback file and e-mail to support@nobeltec.com with a description of your problem.

Q: My radar image occasionally looks “smeared”. What is causing this?

A: **“**Smearing” of the radar image generally occurs due to one of two reasons which include:

1) The PC is trying to do too many computations at one time (Nobeltec recommends using at least a 1GHz system to prevent this).
2) As the radar changes ranges, there is a transition between the previous pulse length the radar was using and the pulse length of the new range setting. The transition between these two causes the “smearing” to occur.