

navico

Navico Marine Network Systems

# 2 kW Radar

Installation Guide

MN000802A-G

# 1 2 kW Radar Installation Manual

## 1.1 FCC Statement

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a normal installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an output on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced technician for help.
- A shielded cable must be used when connecting a peripheral to the serial ports.

## 1.2 Industry Canada

Operation is subject to the following two conditions (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Refer also to the system specifications section.

## 1.3 CE Compliance

Hereby, Navico New Zealand, declares that this Radar Processor is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.

## 1.4 Intro: Disclaimer

As Navico is continuously improving this product we retain the right to make changes to the product at any time which may not be reflected in this version of the manual. Please contact your nearest distributor if you require any further assistance.

It is the owner's sole responsibility to install and use the instrument and transducers in a manner that will not cause accidents, personal injury or property damage. The user of this product is solely responsible for observing safe boating practices.

NAVICO HOLDING AS. AND ITS SUBSIDIARIES, BRANCHES AND AFFILIATES DISCLAIM ALL LIABILITY FOR ANY USE OF THIS PRODUCT IN A WAY THAT MAY CAUSE ACCIDENTS, DAMAGE OR THAT MAY VIOLATE THE LAW.

Governing Language: This statement, any instruction manuals, user guides and other information relating to the product (Documentation) may be translated to, or has been translated from, another language (Translation). In the event of any conflict between any Translation of the Documentation, the English language version of the Documentation will be the official version of the Documentation.

This manual represents the product as at the time of printing. Navico Holding AS. and its subsidiaries, branches and affiliates reserve the right to make changes to specifications without notice.

## **1.5 Warranty**

The Navico Warranty Statement is supplied as a separate document.

It is shipped with the Product Registration Card.

In case of any queries, refer to the Manufacturer of Radar/Chart/Multifunction Displays

## **1.6 Feedback from you**

Your feedback is important and helps Navico ensure that this manual is a valuable resource for all marine technicians. E-mail your comments or suggestions about this manual to the following address: [manuals@navico.com](mailto:manuals@navico.com)

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## 2 Preface





This manual explains how to install the Navico Radar scanner and the radar processor System. It Explains how to connect to products produced by Navico and sold under the Navico house of brands.

This Radar system can interface to the following equipment.

### Ethernet Connectivity


-  Simrad GB40
-  Northstar 8000i

### Serial Connectivity

-  Simrad NX40 and NX45
-  Northstar 6100
-  Northstar M Series
-  GlobalMap, LCX, LMS and X ranges of displays. See above list for specific models

This manual should be used in conjunction with the installation manual provided with the display It also explains how to set up the radar system after installation and gives information on troubleshooting.

This manual is written for professional marine technicians, installation technicians, and service technicians, and can be used for information by dealers.

|   |  |
|---|--|
| PLEASE READ CAREFULLY BEFORE USE  |  |
|  | WARNING indicates a potentially hazardous situation which, if not avoided, could result in death, serious injury or damage to property |

## 2.1 Warnings



***Use the radar at your own risk. Your radar was designed for use as a navigation aid. It should not be used for purposes that require precise measurements of direction, distance, topography or location. Always compare the navigation information received from your radar with data from other navigation aids and sources. When a conflict arises between the navigation data from your radar and data from other navigation aids, make sure you resolve the conflict before proceeding with navigation. A CAREFUL NAVIGATOR NEVER RELIES ON ONLY ONE METHOD TO OBTAIN NAVIGATION INFORMATION. Caution:***

***International Regulations for Preventing Collisions at Sea mandate that when radar is on a vessel, the radar must be used at all times, regardless of weather conditions or visibility. Numerous court decisions have not only ruled the radar must be used, but that the radar operator must be knowledgeable in all operational aspects of radar performance or otherwise face a greater risk of liability if an accident occurs.***

***WARNING: High Voltage Hazard***

***Dangerously high voltages are present within the radar scanner unit. Technicians must exercise extreme care when working inside the unit. ALWAYS remove power before removing the cover. Some capacitors may take several minutes to discharge, even after switching off the radar. Before touching the magnetron or any high voltage components, ground them with a clip lead. WARNING: Microwave Radiation Hazard***

**The microwave energy radiated by a radar antenna is harmful to humans, especially to the eyes. NEVER look directly into an open waveguide or into the path of radiation from an enclosed antenna. Radar and other radio frequency radiation can upset cardiac pacemakers. If someone with a cardiac pacemaker suspects abnormal operation, immediately turn off the radar equipment and move the person away from the antenna. Turn off the radar whenever it is necessary to work on the antenna unit or other equipment in the beam of the radar.**

*Note! Most countries accept that RF power density levels below 100 W/m<sup>2</sup> cause no significant RF hazard.*



| <b>Scanner Model</b> | <b>Vertical beam angle of scanner (degrees)</b> | <b>Minimum safe distance (100 Watts per m<sup>2</sup> average power density) Note 1</b> | <b>Minimum safe distance (10 Watts per m<sup>2</sup> average power density) Note 2</b> |
|----------------------|---|---|--|
| 2 kW                 | 30  | 1.6 ft (0.5 m)  | 4.6 ft (1.4 m)   |
| 4 kW                 | 25  | 3 ft (0.9 m)  | 9.3 ft (2.8 m)   |
| 6 kW                 | 20  | 3.6 ft (1.1 m)  | 11.5 ft (3.5 m)  |
| 10 kW                | 20  | 9.5 ft (2.9 m)  | 30 ft (9.0 m)  |
| 25 kW                | 20  | 18 ft (5.5 m)   | 57 ft (17.4 m)   |

*NOTES: Limits apply to exposure within the vertical beam angle.*

*Note 1: Peak occupational exposure limit pursuant to IEC 60936 Clause 3.27 and IEC 62252 Clause 4.32*

*Note 2: General public exposure limit pursuant to IEC 60936 Clause 3.27 and IEC 62252 Clause 4.32*





### 3 Introduction to the Navico radar system


The Navico radar system platform is designed to work with many types and models of display heads that belong to brands under the Navico house of brands

The radar systems consist of a scanner, processor and connection cables. Scanner models are available with power outputs of 2 kW, 4 kW, 6 kW, 10 kW and 25 kW to suit different customer requirements. Each scanner model has a corresponding radar processor module.

Note 10 kW and 25 kW scanners are not compatible with the Simrad NX40 , NX45, Northstar M84 or M121).

#### Branding information

| Brand  | Display heads that support the Navico radar system   |
|--|--|
|   | Simrad GB40 network system<br>Simrad NX 40/NX45<br>To ensure that scanners have the correct brand decal please ensure that scanner part numbers to end in SIM, for Simrad branding<br>e.g AA010024SIM                      |
|  | Northstar 8000i network system<br>Northstar M84<br>Northstar M121<br>To ensure that scanners have the correct brand decal please ensure that scanner part numbers to end in NOR, for Northstar branding<br>e.g AA010024NOR |

|   |   |
|---|---|
|  | <p>GlobalMap 9300c HD<br/> GlobalMap 9200c<br/> GlobalMap 8300c HD<br/> GlobalMap 8200c<br/> GlobalMap Baja 840c<br/> GlobalMap 7300c HD<br/> GlobalMap 7200c<br/> Globalmap 5200c<br/> Globalmap 5300c iGPS<br/> Globalmap Baja 540c<br/> LCX-113c HD<br/> LCX-112c<br/> LCX-38c HD<br/> LCX-37c<br/> LCX-28c HD<br/> LCX-27c<br/> LMS-520c<br/> LMS-522c iGPS<br/> LMS-525c DF<br/> LMS-527c DF iGPS<br/> X510c<br/> X515c DF</p> <p>To ensure that scanners have the correct brand decal please ensure that scanner part number ends in LOW, for Lowrance branding e.g AA010024LOW</p> |
|---|---|

### 3.1 2 kw Radar overview

The 2 kW radar system is intended for use in a marine environment. It consists of a Scanner protected by a 450mm diameter dome connected to the 2 kW radar processor module by a prefabricated 15m (49ft) interconnection cable (AA010088), The cable is attached to the dome at the factory. A longer 20m (65.5 ft) cable is also available which has to be ordered separately and will need to be exchanged by a qualified radar technician.



***Note Changing the scanner cable should only be done by a qualified radar technician.***


The radar processor module connects to the various display heads using three different protocols. These are: -

**Ethernet.** For more information on connecting via Ethernet (see "Connect Simrad GB40 or Northstar 8000i" page 30)



-  GB40
-  8000i

### Serial Connectivity

**RS485** For more information how to connect to RS485 displays (see "Connect Simrad NX40 / NX45, Northstar M84 / M121" page 38)

-  NX40 / NX45
-  M Series

**RS422.** For more information how to connect to RS422 displays (see "Connect Northstar 6000i / 6100i" page 42)

-  6000i / 6100i
-  GlobalMap, LCX, LMS and X ranges of displays. See above list for specific models

## 4 Install the radar

A radar unit should only be installed by a qualified marine technician, as potentially lethal high voltage is present along with heavy rotating parts. There is a transmit interlock that prevents radar transmissions if the scanner is not rotating. However, a high voltage remains for a period of time after the system is turned off. If you are not familiar with this type of electronics, consult with a trained service or installation technician before attempting to service any part of the equipment.

Installation includes

- mechanical mounting
- electrical wiring
- configuring the display or network system to work with the radar
- adjusting the radar for proper performance.

Don't take any shortcuts, and follow these instructions carefully.

This section explains how to:

- choose the correct location for the scanner
- install the scanner on a power boat or a yacht
- choose the correct location for the radar processor
- install the radar processor

Read the important warning and safety information in the Preface before you install the radar.

Note: Form MARPA functionality be more accurate you must send heading data at greater than 10Hz into the radar processor module. This is different for different display products. Please see the section relating to the display you are connecting to for more information

## 4.1 Choose the scanner location

The radar's ability to detect targets depends greatly on the position of its scanner. The ideal location for the scanner is high above the vessel's keel line where there aren't any obstacles.

The higher the installation position, the longer the radar ranging distance, but the minimum range that the radar can detect targets increases the higher that the radar is mounted.

Also see the sections on installing the scanner on a power boat or yacht.

When you're deciding on the location, consider the following:

- the length of the interconnection cable supplied with your radar is usually sufficient. If you think you'll need a longer cable, consult your Northstar dealer before installation, because a longer cable may reduce the performance of the radar.
- if the roof of the wheelhouse is the highest existing location, consider installing a radar mast or a pedestal on which you can mount the scanner. You may also need to construct a working platform for your own safety during installation and servicing work.
- if you mount the scanner on a pedestal or base, ensure that rain and sea spray can drain away from it rapidly.
- if you locate the scanner on the mast, position it on the forward side so that there is a clear view to the front of the vessel.
- the scanner is usually installed parallel to line of the keel
- ensure that the location site provides the scanner with a clear view of the front of the vessel.

### DON'T DO THIS!

- DON'T install the scanner too high up, where its weight will alter the stability of the vessel and cause degradation of the radar picture over short ranges (see "How to find the optimum height for the scanner").
- DON'T install the scanner close to lamps or exhaust outlets. The heat emissions may cause the equipment to breakdown and soot and smoke will degrade the performance of the radar.
- DON'T install the scanner close to the antennas of other equipment such as direction finders, VHF antennas, GPS equipment and so on, because it may cause interference.
- DON'T install the scanner where a large obstruction (such as an exhaust stack) is at the same level as the beam, because the obstruction is likely to generate false echoes and/or shadow zones.
- DON'T install the scanner where it will be subjected to strong vibrations (such as a derrick post) because these vibrations will degrade the performance of the radar.
- DON'T install an open array close to halyards or flags because the wind could wrap these around the scanner and jam it.

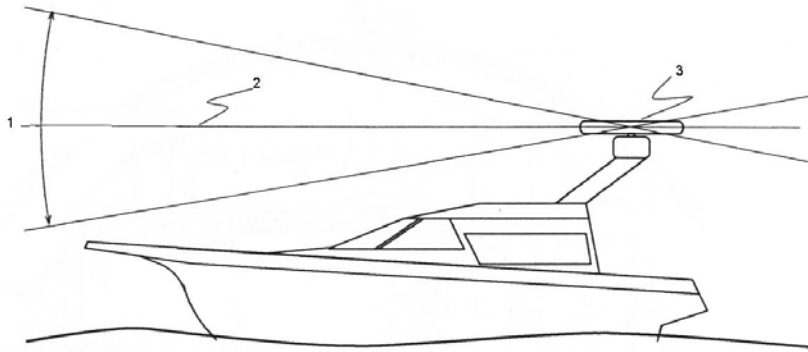


***DON'T install the scanner inside of the recommended compass safe distances of any navigation instruments such as the magnetic compass and the chronometer. The compass safe distances are as follows:***

|             |  |
|-------------|--|
| 2 kW radar  | STD 2.3 ft (0.7 m) / STEER 1.6 ft (0.5 m)  |
| 4 kW radar  | STD 6.5 ft (2.0 m) / STEER 5 ft (1.5 m)    |
| 6 kW radar  | STD 7.5 ft (2.3 m) / STEER 5.7 ft (1.75 m) |
| 10 kW radar | STD 7.9 ft (2.4 m) / STEER 6 ft (1.8 m)    |
| 25 kW radar | STD 7.9 ft (2.4 m) / STEER 6 ft (1.8 m)    |

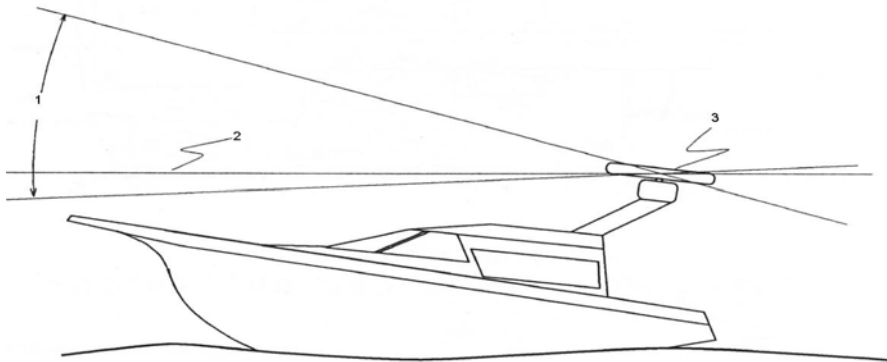
## 4.2 Power boat installations

Normally, you should install the scanner horizontally, to produce an equal sweep around the power boat:



However, when the power boat is traveling at high speed, the bow rises up out of the water and if the elevation angle (trim) of the bow is raised up so that it equals, or exceeds, 50% of the vertical beam width of the radar, this can cause two problems:

- ahead of the power boat, the beam is projected too high to sweep the water surface effectively. Targets can be missed completely or appear at a very poor resolution on the display screen.
- astern of the power boat, the beam is projected too low and is concentrated over a small area of water so that sea clutter becomes a problem on the display screen.

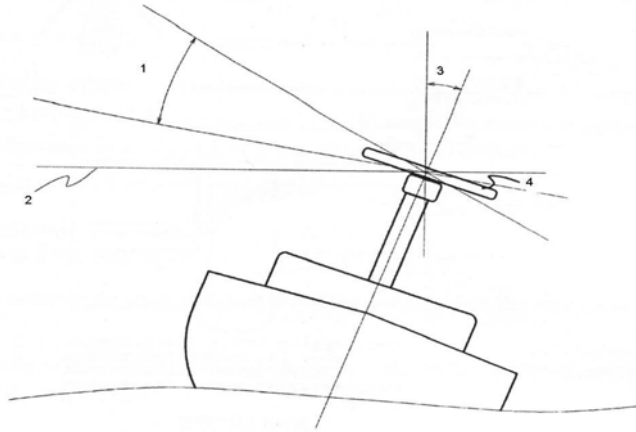


In this case, you're recommended to install the scanner so that is tilted down at the front, at an angle that will produce an almost horizontal sweep when the power boat is running at speed.

### 4.3 Yacht installations

Normally you should install the scanner horizontally, to produce an equal sweep around the yacht. However, a yacht heels over to the lee side, and when the heel angle exceeds 50% of the vertical beam width of the radar, this can cause two problems:

- on the windward side of the yacht, the beam is projected too high to sweep the water surface effectively. Targets can be missed completely or appear at very poor resolution on the display unit.
- on the lee side of the yacht, the beam is projected too low and is concentrated over a small area of water so that sea clutter becomes a problem on the display unit.



In this case, you're recommended to install the scanner on a gimbal mounting so that it can operate effectively in a heavy swell or when the yacht is heeled over.

### 4.4 How to find the optimum height for the scanner

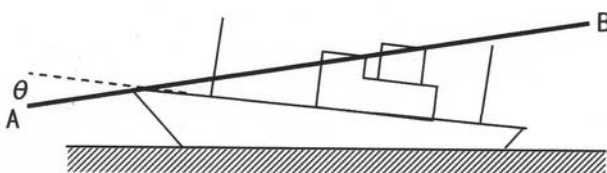
The optimum height for the scanner is as close as possible to the A-B line for best performance.

How to find the A-B Line:

The vertical extent of the radar beam is  $20^\circ$ , so most of the radar beam is concentrated within this angle, meaning that outside of this angle the radar beam will be very weak.

| Scanner model | $\theta^\circ$ value (half the -3 dB beam width) |
|---------------|--|
| 2 kW          | 15   |
| 4 kW          | 12.5   |
| 6 kW          | 10   |
| 10 kW         | 10   |
| 25 kW         | 10   |

An example of an A-B Line is shown in the picture. If you install the scanner below the A-B line, the scanner will be too low. It will be difficult to acquire distant targets and the superstructure will be more likely to impede the passage of the beam and generate false echoes. If the scanner is installed too high above the A-B line, the beam will miss close targets and increase sea clutter return.



You can find the A-B line for any vessel as follows:

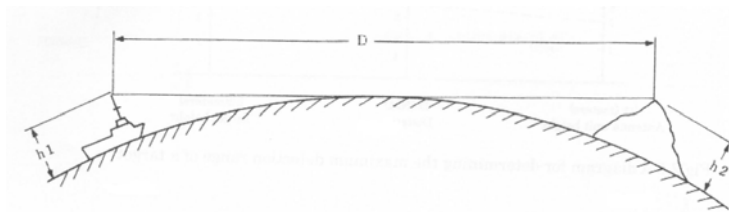
- Using a drawing of the vessel, lay a rule along the line of the main deck and continue this forwards as a dashed line extending beyond the bow.
- Using a protractor, measure the  $\theta^\circ$  value (for your scanner model) below the dashed line at the bow and draw in a new line along this angle.
- Extend the new line back beyond the bow of the vessel. This is the A-B line.

#### 4.5 How to find the theoretical maximum detection range

Propagation of the radar beam can vary, depending on the properties of the air through which it's traveling. Under normal conditions, the distance that the radar beam travels is approximately 10% further than the distance to the optical horizon.

You can calculate the theoretical distance traveled by the radar beam using the following formula:

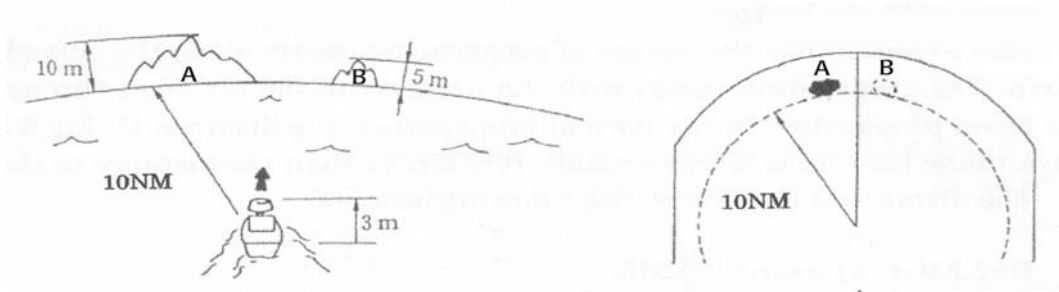
$$D = 2.23 (\sqrt{h_1} + \sqrt{h_2})$$



where:

- D is distance traveled by the radar beam
- h1 is the height above sea level of the scanner
- h2 is the height above sea level of a target

An example is shown below:



In this example, the scanner is installed on the vessel at a height of 10 ft (3 m) above sea level ( $h_1$ ). Island A is 33 ft (10 m) high ( $h_2$ ) and for comparison, Island B is 16.4 ft (5 m) high ( $h_2$ ). Both islands are at a distance (D) of 10 nautical miles from the vessel.

Calculations using the formula show that, at this distance, the radar can only detect objects that are more than 25 ft (7.6 m) high, which means that Island A is shown on the radar but Island B is not shown.

Remember that:

- the maximum detection range of the radar is limited by the curvature of the Earth's surface under normal conditions of wave propagation.
- bad weather conditions can reduce the maximum detection range



## 4.6 How to reduce false echoes and shadow zones

False echoes can be produced on the radar display if the scanner is installed too close to an object on the vessel's superstructure. This object can block the radar beam and reflect it back, generating the false echoes and shadow zones.

If you're having problems with false echoes and/or shadow zones, check if it's possible to re-install the scanner at a higher location where the radar beam will be clear of any obstructions.

If not, try relocating the scanner away from the central keel line of the vessel to the starboard side. This will move any shadows to the port side, maximize the radar view of your give way sector, and ensure a clear view of the area around the vessel at the bow.

Use the following formula to calculate the distance that you'll need to move the scanner:

$$L_s = 0.4R + D/2 \quad (\text{when } R \text{ is less than } 49 \text{ ft [15 m]})$$

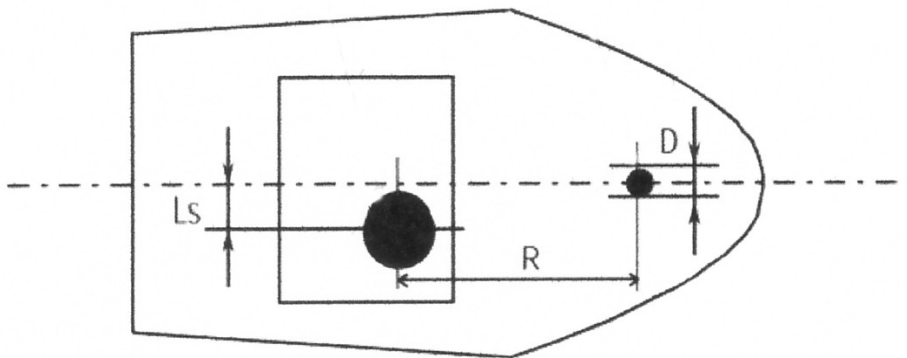
$$L_s = 0.025R + D/2 \quad (\text{When } R \text{ is greater than or equal to } 49 \text{ ft [15 m]})$$

where:

$L_s$  = distance to be moved from the keel line

$D$  = diameter of the obstacle

$R$  = distance between the antenna and the obstacle

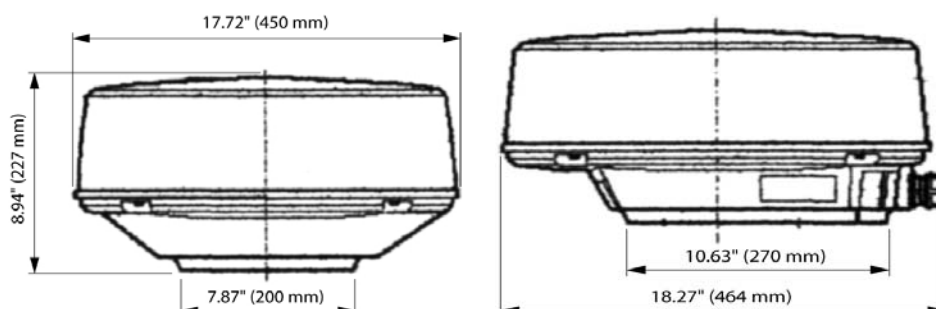


## 4.7 2 kW scanner dimensions

Before starting the installation, use the drilling template to identify the:

- cable inlet
- drill holes
- front and rear of the radome
- location of the drain hole (ensure that your chosen location allows the drain hole to empty).

The 2 kW scanner dimensions are shown:



## 4.8 Install a scanner on a trestle

Depending on your chosen location for the scanner, it may be easier to install the scanner if you fabricate a trestle (or radar mast) on which you can mount the scanner.

The trestle must be sturdy and secure, and capable of supporting the scanner in all weather conditions.

You are recommended to install the base of the trestle parallel to the water surface.

Orient the trestle so that the cable inlet on the scanner will face the stern, and so that the scanner can be mounted at the correct angle (as discussed in the "Power boat installation" section).

Make sure that the edges of the trestle won't trap water.

## 4.9 Install the 2 kW scanner unit



*IMPORTANT: Remember that you must screw the bolts into place from the underside of the location site, because the shape of the dome prevents you from installing the bolts from the topside. Ensure that you can access the underside of the location site before drilling.*

Find the paper installation template and tape it securely to the chosen location site. Before drilling, check that

- the location site is not more than 0.6" (15 mm) thick.
- you have oriented the template correctly so that the front of the scanner unit will face the front of the vessel.
- the location site allows the drain hole to empty.

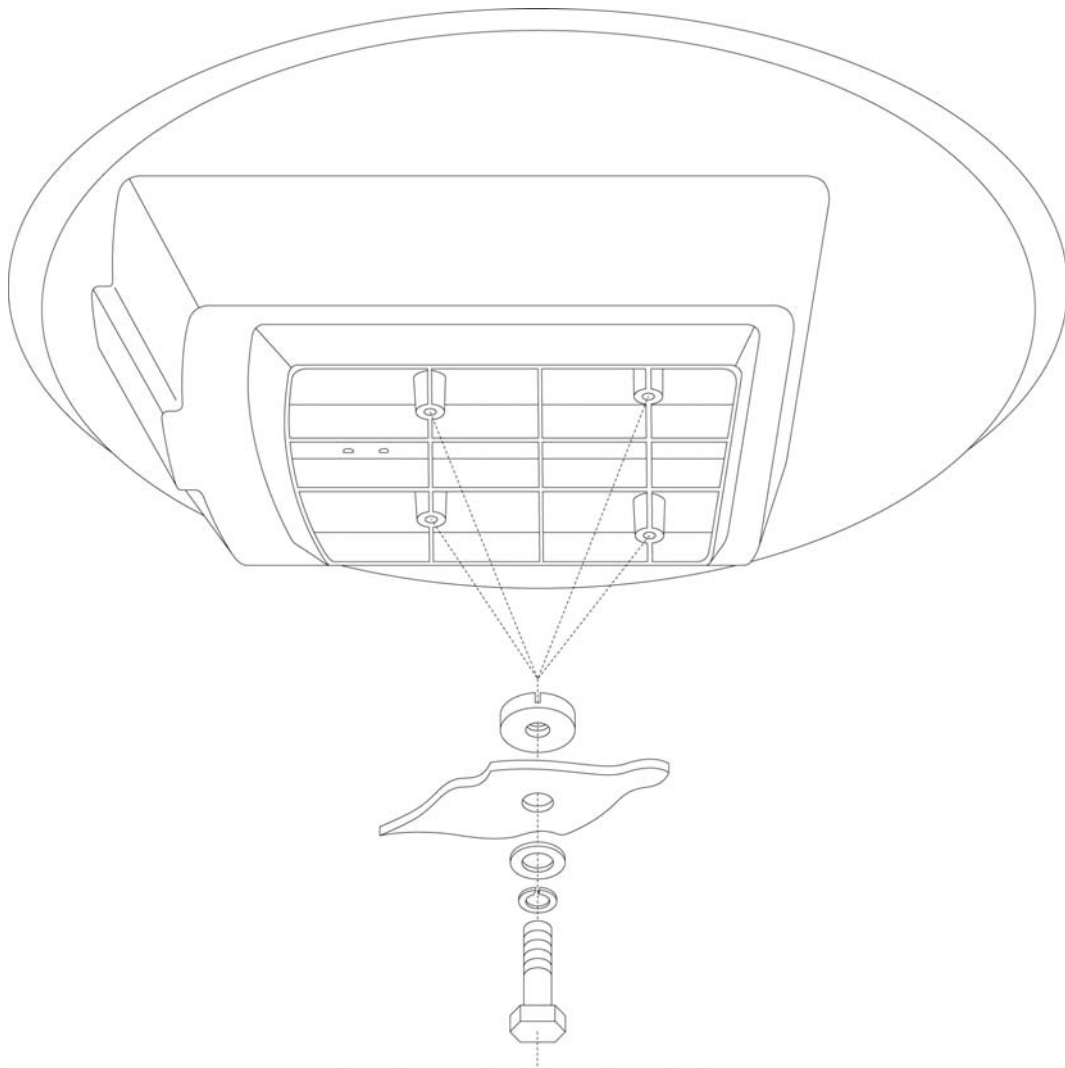
Drill the four holes where shown to a maximum depth of 0.6" (15 mm) plus the drain hole. Remove the template then position a rubber washer over each hole on the scanner. Ensure that the slot in the rubber washer is aligned with the rib on the scanner.

Position the scanner carefully over the bolt holes so that they are aligned with the holes of the rubber washers and the drill holes.

Place a spring washer then a plain washer onto each bolt, as shown. Screw each bolt into each drill hole from the underside of the location site, and tighten securely with a 5.31" (135 mm) torque wrench.



*NOTE: Use the bolts supplied as these are hardened stainless steel and the correct length.*



#### **4.10 Install the radar processor**

Install the radar processor in a dry location away from spray, rain, drips, and condensation.

The location site must allow you to easily connect the radar processor to the ship's ground, the interconnection cable, the power cable, and the radar communications cable or the network cable. Check that these cables and the ship's ground can easily reach the radar processor **BEFORE** you drill.

The radar processor dimensions are shown on the drilling template. Follow the instructions on the drilling template to install the radar processor.

## 5 Check the 2 kW radar parts

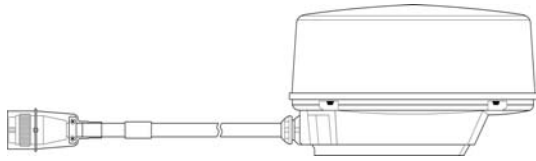

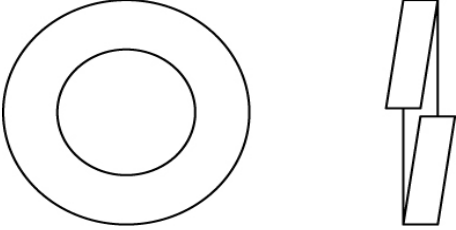
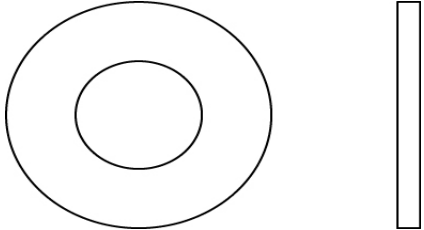

The Navico 2 kW radar system consists of a scanner, a radar processor, and associated cables, some of which need to be ordered separately

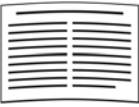
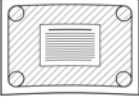
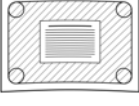
There are two main for the 2 kW radar system:

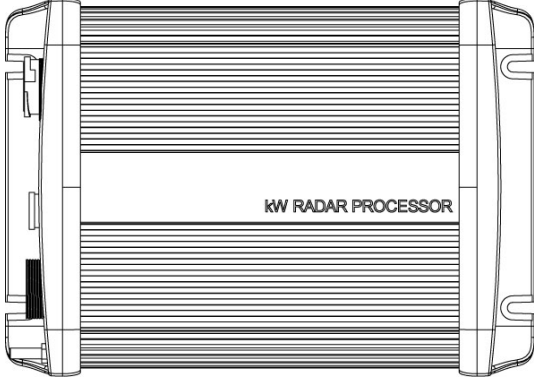

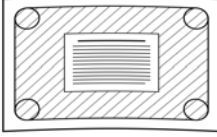
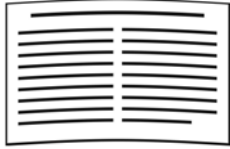


- AA010024SIM (Simrad branded), AA010024NOR (Northstar branded), AA010024LOW (Lowrance branded) is the standard 2 kW radar system, consisting of a box containing the scanner and the 49 ft (15 m) interconnection cable (AA010088). This is pre-installed into the scanner. An optional 20 m (65.5 ft) AA01089 cable is available and will need installed by an experienced radar technician
- AA010012 is the radar processor. No inter connection cables are shipped with this item and have to be ordered separately See interconnection cables in the section relating to the display head unit

If you want to use an interconnection cable length other than the 15 m (49 ft) or 20 m (65.5 ft) options, please consult your Navico brand dealer.

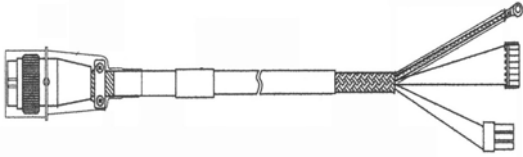
Unpack the boxes carefully and check the contents against the packing lists. If anything is missing, contact your distributor.

| AA010024SIM Simrad branded 2 kW scanner standard components    |   |                                       |  |
|--|---|---------------------------------------|--|
| AA010024NOR Northstar branded 2 kW scanner standard components |   |                                       |  |
| AA010024LOW Lowrance branded 2 kW scanner standard components  |   |                                       |  |
| Quantity   | Item  | Part name                             | Part no.   |
| 1  |  | Scanner unit                          | AA010024xxx with interconnection cable (AA010088) 15 m (49 ft) pre-installed |
| 4  |  | Hexagonal bolt 5/16-18 UNC x 31.75 mm | Part of Hardware kit HR000066  |
| 4  |  | M8 Spring washer                      | Part of Hardware kit HR000066  |
| 4  |  | M8 Plain washer                       | Part of Hardware kit HR000066  |
| 4  |  | Rubber washer                         | Part of Hardware kit HR000066  |

|   |   |                                 |          |
|---|---|---------------------------------|----------|
| 1 |  | Packing list                    | LA000450 |
| 1 |  | Installation sheet<br>MTZ303386 | LA000410 |
| 1 |  | Mounting template               | LA000451 |

| <b>AA010012 2 kW Radar processor standard components</b> |   |                           |                |
|--|---|---------------------------|----------------|
| <b>Qty</b>   | <b>Item</b>   | <b>Description</b>        | <b>Part No</b> |
| 1  |   | 2 kW Radar processor      | AA010012       |
| 1  |  | This Manual               |                |
| 1  |  | Installation Template     | LA000276       |
| 1  |  | Product Registration Card | CD000085       |
| 1  |  | Warranty Card             | CD000260       |
| 4  |  | Mounting Screws           | HR000061       |

**AA010089 Optional longer length interconnection cable for radar scanner  
- order separately**

| <b>Quantity</b> | <b>Item</b>   | <b>Part name</b>                            | <b>Part No</b>                      |
|-----------------|---|---|-------------------------------------|
| 1               |  | Interconnection cable for the radar scanner | AA01089<br>length 65.5 ft<br>(20 m) |

## 6 Wiring guidelines

Most installation problems are caused by shortcuts taken with system cables. When wiring the radar:

- DON'T make sharp bends in the cables.
- DON'T run cables in a way that allows water to flow down into the connectors.
- DON'T allow the scanner cable to place pressure on the radar processor connector

but

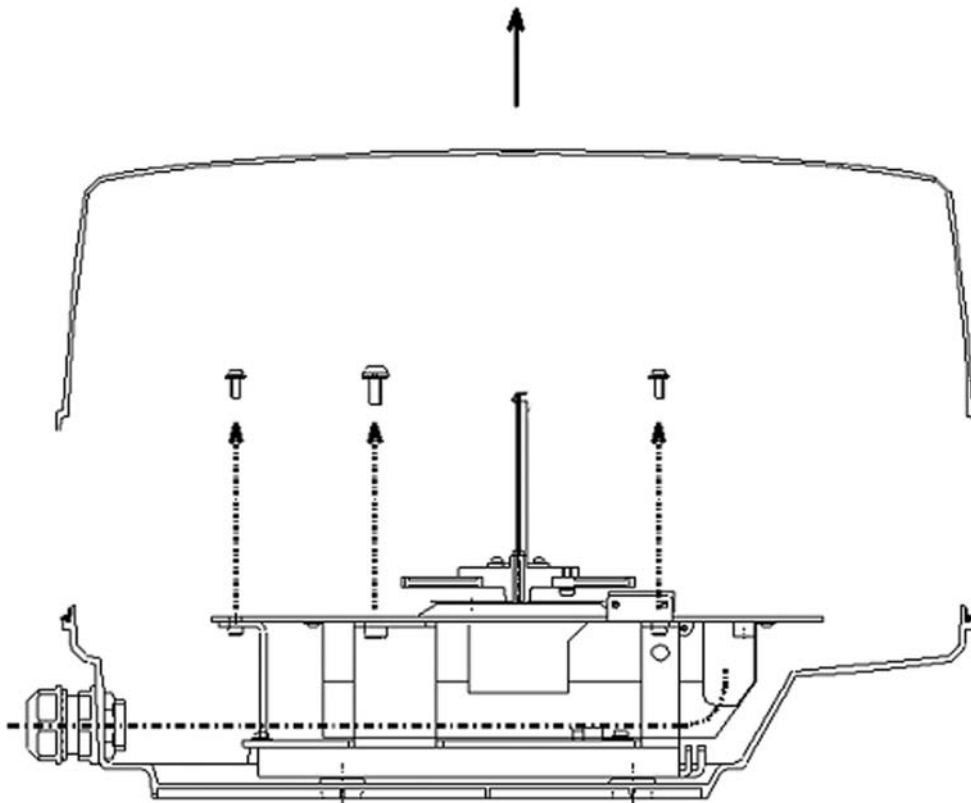
- DO make drip and service loops.
- DO use cable ties to keep the cables tidy and secure.
- DO seal and protect all wiring connections if cables are shortened, lengthened, or re-terminated.
- DO leave room to easily access, install and remove cables.
- DO make sure cables connecting to the radar processor are not under stress from bending or twisting that could place pressure on the processors connectors.

### 6.1 Connect the 2 kW interconnection cable (NS003101) to the scanner

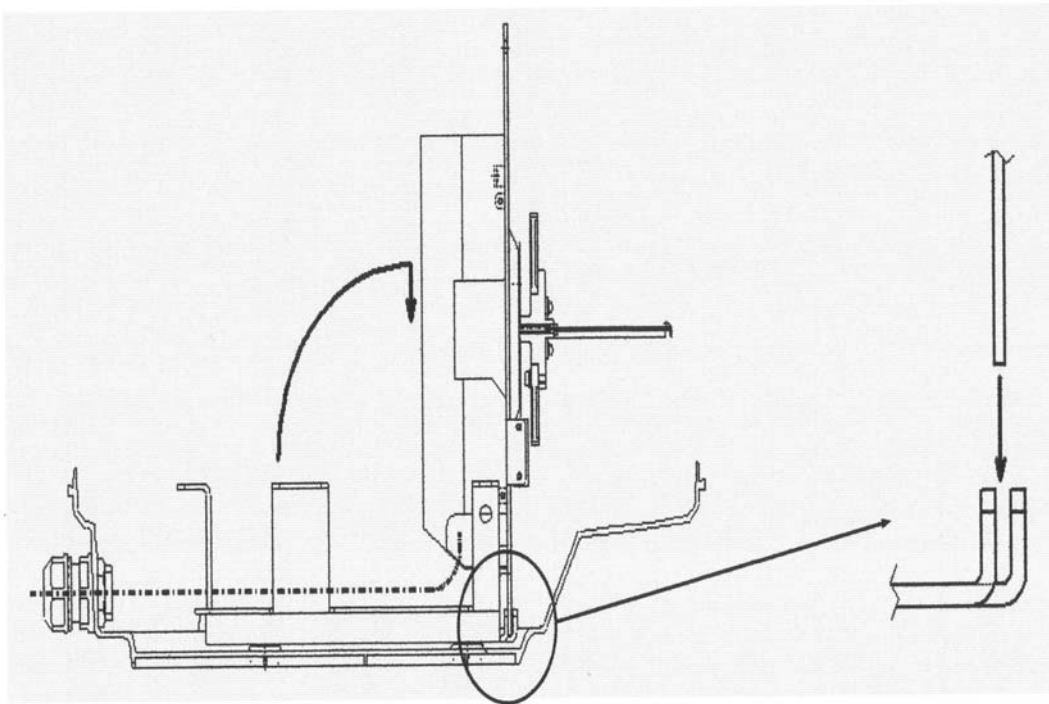
If you have the NS004790R standard 2 kW radar system, the scanner is supplied with the 49 ft (15 m) interconnection cable (NS003100) already connected and you can ignore this section.

If you have the NS004790M alternative radar system and have ordered the longer 65.5 ft (20 m) interconnection cable (NS003101), follow the guidelines in this section to connect the two items.

Unscrew and remove the cover of the scanner, lifting it vertically to avoid bumping it against the antenna.



Carefully lift the main unit and stand it upright in the slot on the scanner casing:

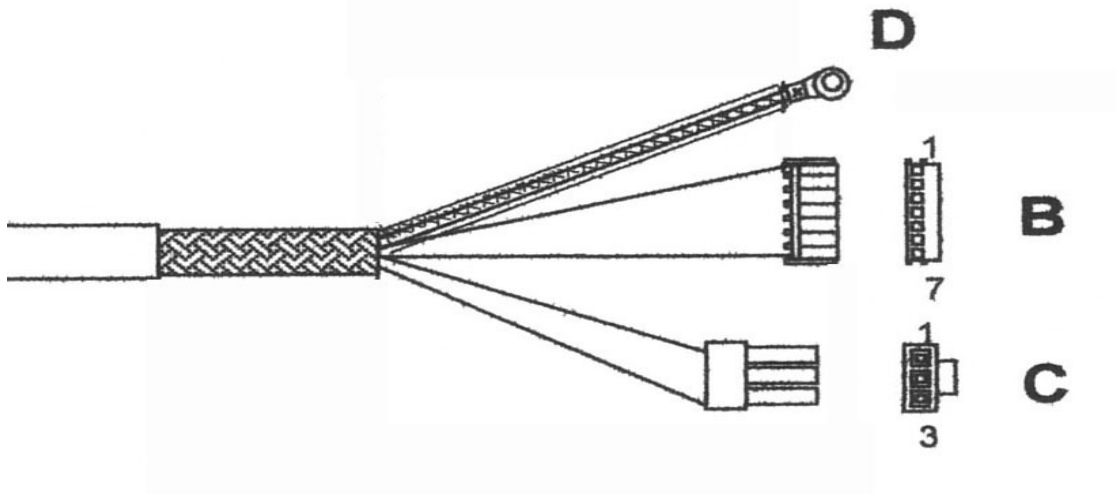




Remove the shield cover from the underside of the main unit to expose the connector locations and ground terminal location.

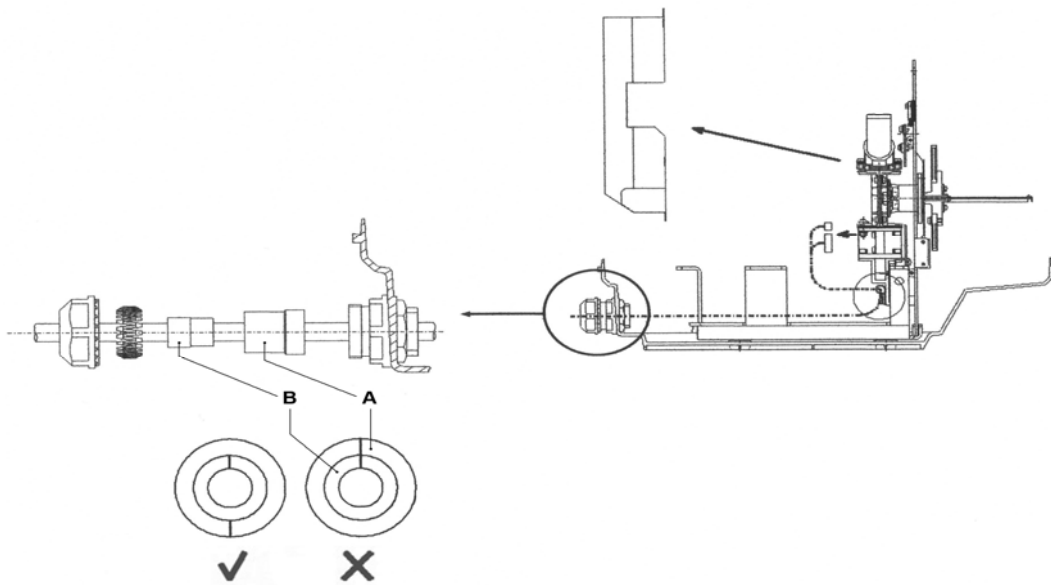
The broken line shows the route for the interconnection cable.

Identify the connector ends B, C, and D on the 2 kW interconnection cable (NS003101). Connector D is an Earthing strap.



Place the locking nut, gasket A and gasket B over the end of the interconnection cable in the order shown, then push the interconnection cable through the cable entry point into the radome. (Ensure that you push through sufficient cable to easily connect the connectors.)

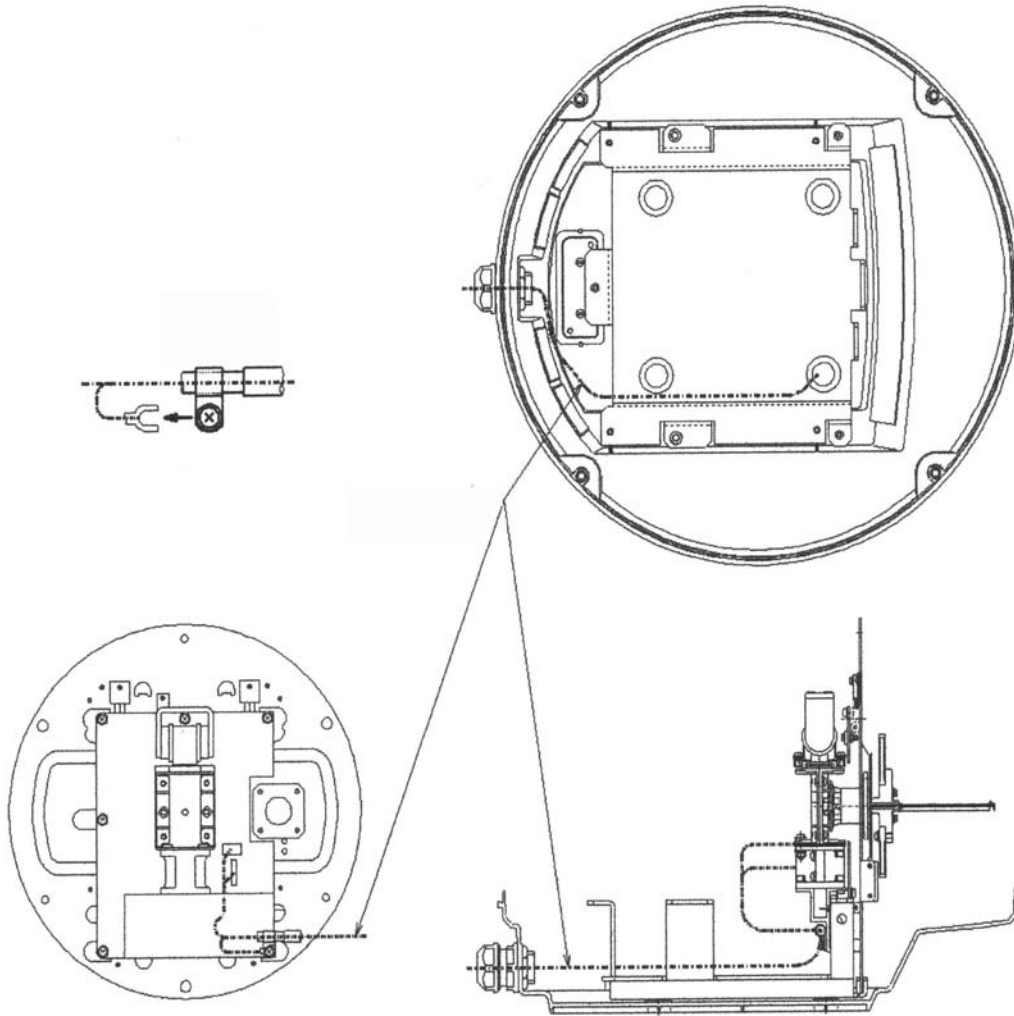
At the cable entry point, take care that the grooves in gaskets A and B are opposite each other (see the figure). Tighten the locking nuts to hold the interconnection cable firmly in place and to provide a waterproof seal.



Place the internal locking nut over the end of the interconnection cable, then attach connectors B and C to the connectors (as shown in the figure).

The broken line shows the route for the interconnection cable.

Attach connector D to one of the screws close by to provide an Earth (as shown in the figure).



The wiring details for the connector ends (B, C, and D) are as follows:

| <b>2 kW interconnection cable (NS003101) connector ends</b> |                   |                 |          |          |          |
|---|-------------------|-----------------|----------|----------|----------|
| <b>Pin</b>  | <b>Color/Name</b> | <b>AWG size</b> | <b>B</b> | <b>C</b> | <b>D</b> |
| 1   | Green (big)       | #12             |          | 1        |          |
| 2   | Yellow (big)      | #12             |          | 2        |          |
| 3   | Green (thin)      | #24             | 7        |          |          |
| 4   | Clear Coax signal | #24             | 4        |          |          |
| 5   | Drain wire for 4  | #24             | 5        |          |          |
| 6   | Drain wire for 7  | #24             | 3        |          |          |
| 7   | Black Coax signal | #24             | 2        |          |          |
| 8   | White             | #24             | 6        |          |          |

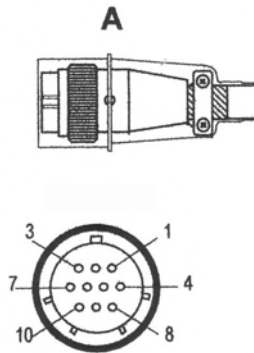
|       |              |     |   |   |   |
|-------|--------------|-----|---|---|---|
| 9     | Yellow       | #24 | 1 |   |   |
| 10    | White (big)  | #12 |   | 3 |   |
| Shell | Braid shield |     |   |   | X |

## 6.2 Run the 2 kW interconnection cable (NS003100/NS003101) to the radar processor

Run the 2 kW interconnection cable (NS003100/NS003101) from the scanner to the radar processor.

Push the round connector (A) of the 2 kW interconnection cable into the scanner connection on the radar processor and tighten the locking nut.

The interconnection cable pin details are provided here for information, in case the connector needs to be removed to feed the cable, or in case the cable needs to be shortened.



The front view of the 2 kW interconnection cable is shown above.

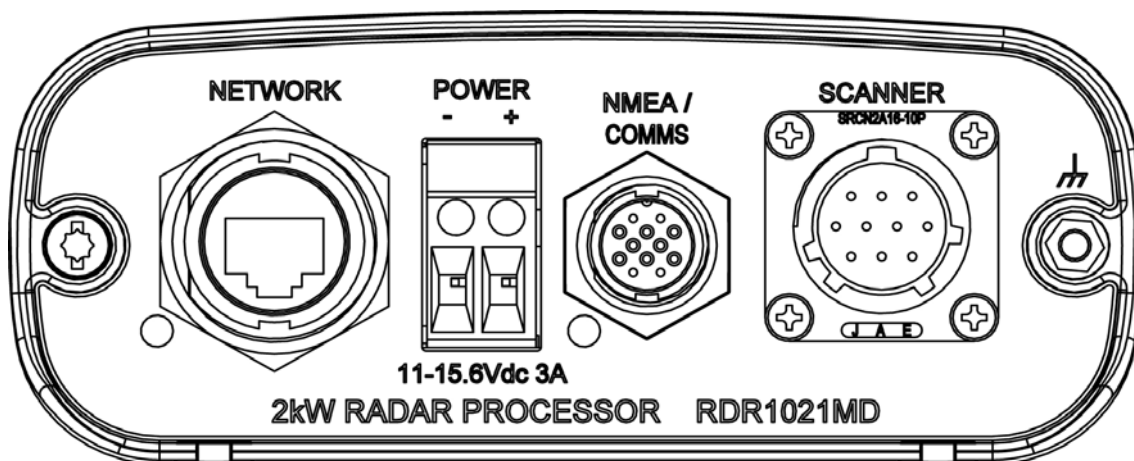
| <b>2 kW interconnection cable pin details</b> |                   |                    |                 |
|---|-------------------|--------------------|-----------------|
| <b>Pin</b>                                    | <b>Color/Name</b> | <b>Signal name</b> | <b>AWG size</b> |
| 1   | Green (big)       | Power              | #12             |
| 2   | Yellow (big)      | Power GND          | #12             |
| 3   | Green (thin)      | Pulse width        | #24             |
| 4   | Clear Coax signal | Video              | #24             |
| 5   | Drain wire for 4  | Video GND          | #24             |
| 6   | Drain wire for 7  | Trig GND           | #24             |
| 7   | Black Coax signal | Trig/STC           | #24             |
| 8   | White             | BZ Tune to scanner | #24             |
| 9   | Yellow            | Tune from scanner  | #24             |
| 10  | White (big)       | No connection      | #12             |
| Shell   | Braid shield      |                    |                 |

## 6.3 2 kW radar processor connections

There are four interface connectors on the rear of the 2 kW radar processor, plus a Chassis Earth.

You can connect the Navico radar processor to either of the following but not to any simultaneously.

- Simrad NX40 NX45, GB40
- Northstar 8000i, 6100, 6000i, M84, M121
- Lowrance GlobalMap 9300c HD, 9200c, 8300c, 8200c, Baja 440c, 7300c, 7200c, 5200c, 5300c, Baja 540c, LCX-113c HD, LCX-112c, LCX-38c HD, LCX-37c, LCX-28c HD, LCX-27c, LMS-520c, LMS-522c iGPS, LMS-525c DF, LMS-527c DF iGPS, X510c, X515c DF



| 2 kW radar processor interface connectors |   |  |
|---|---|--|
| Connector name                            | Connector function  | Connects to...   |
| Network                                   | Ethernet communications for Simrad GB40 and Northstar 8000i   | GB40 / 8000i network, using Navico network cables (NS00481X). 0.5 m, 2 m, 5 m and 10 m available   |
| Power (+ve and -ve)                       | Power input   | Ship's power 12 V DC ONLY (using the power cable)  |
| NMEA / Comms                              | Data communications for:<br>Simrad NX40/45<br>Northstar 6000i, 6100i, M84 and M121 systems)<br>Lowrance systems as above<br>Remote power control, relay and ignition<br>NMEA communications for compass input | Simrad NX40/45, Northstar 84/121 use the communication cable in the radar connection kit (AA002461)<br>6000i or 6100i display unit, using radar communications cable (NS003107)<br>Lowrance systems as above using the RIM300 Cable<br>6000i, 6100i, M84, M121 or 8000i remote power signals, relay or ignition; cable not supplied<br>NMEA / SimNet compliant compass; cable not supplied |
| Scanner                                   | Scanner communications  | Scanner, using the interconnection cable (NS003100 or NS003101)  |
| Chassis earth                             | Grounding point   | Vessel's Ground using ground wire  |

## 6.4 Connect the power cable

The power cable to the radar processor is NOT supplied. Power must be supplied through a fuse/breaker element located at the power source end of the power cable.

**Check the system specifications section for the recommended DC input voltage.**

The power cable and fuse requirements are shown in the table.

| Scanner           | Fuse/Circuit breaker rating | Maximum length of power cable | Power cable size |
|-------------------|-----------------------------|-------------------------------|------------------|
| 2 kW 12 v DC ONLY | 5 A                         | 33 ft (10 m)                  | 14 AWG           |
| 4 kW 12-24 v DC   | 10 A                        | 26 ft (8 m)                   | 14 AWG           |
| 6 kW 12-24 v DC   | 10 A                        | 26 ft (8 m)                   | 14 AWG           |
| 10 kW 24v DC only | 15 A                        | 26 ft (8 m)                   | 12 AWG           |
| 25 kW 24v DC only | 15 A                        | 26 ft (8 m)                   | 12 AWG           |

Typically the fuse /breaker would be located in a fuse/breaker box with the fuses/breakers for other devices.

The radar processor must have it's own exclusive fuse/circuit breaker. The fuse/circuit breaker should be labeled appropriately.

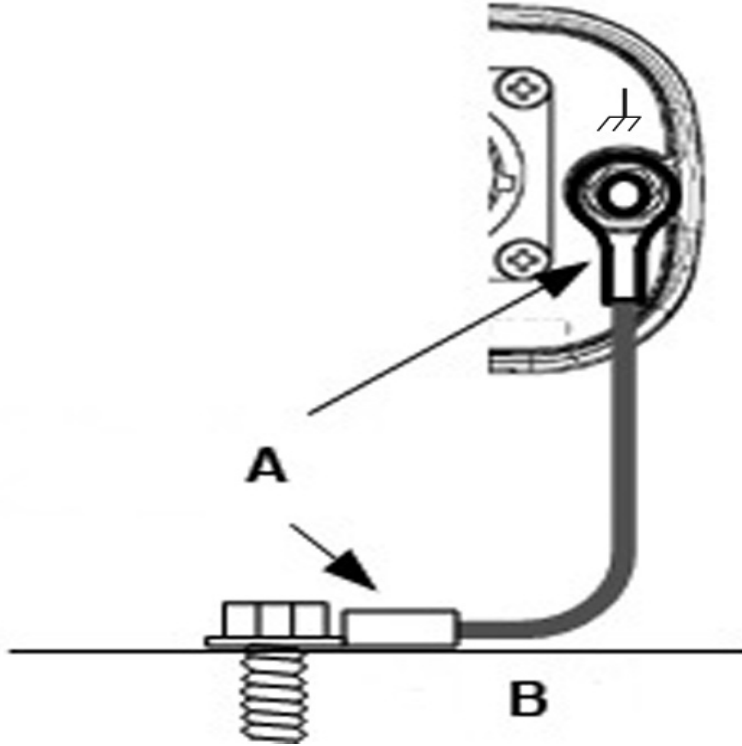
➤ *To connect the power cable to the radar processor, you must:*

- Strip away approximately 0.4" (10 mm) of the shielding at the end of the power cable, and then identify the positive wire and the negative wire.
- Unscrew the small holding screw from the positive power cable input connector (identified by the + sign) on the radar processor.
- Insert the bare ends of the positive wire into the positive power cable input connector to make a connection.
- Tighten the small holding screw to hold the positive wire in place. Gently pull on the positive wire to ensure that it is secured.
- Repeat this process to connect the negative wire to the negative power cable input connector (identified by the – sign).

## 6.5 Connect the ground wire

The radar processor has a Chassis Earth connection stud located on the far right hand side of the unit. The Chassis Earth is DC isolated from power (-ve) to eliminate the risk of galvanic corrosion.

If you are installing the radar processor on a vessel with a metal hull, connect the radar processor Chassis Earth to the hull at the closest possible location, using 12 AWG wire (or thicker):



The eyelets must be crimped or soldered at both locations (A) and the method of connection to the vessel's hull is shown at (B).

If you are installing the radar processor on a vessel with a non-metallic hull, connect the radar processor Chassis Earth to the vessel's ground network. If a vessel's ground network is not available, leave the radar processor Chassis Earth unconnected.

## 6.6 Radar system checklist

When you've finished the wiring, visually check that:

- each component is securely mounted and able to withstand rough sea conditions.
- all the cables are correctly installed.
- any cable shield mesh is correctly configured.
- all cable entry points are watertight.
- water can't leak into the scanner.

Now you're ready to interface to your choice of display head.

## 7 Connect Simrad GB40 or Northstar 8000i

Both the Simrad GB40 and the Northstar 8000i systems interface to the Navico radar via a ethernet network. The Ethernet network connectivity is the same for the two types of display system. The two systems are different in the way they accept heading information for MARPA and accurate chart overlay. The Northstar 8000i requires NMEA 0183 heading to be sent both the Master NavComputer and also the radar processor module. The Simrad GB40 NavComputer gets heading over SimNet. The radar processor module requires the use of a AT10HD (SimNet to NMEA 0183 converter) to feed simnet heading at 10 Hz

*Note. Do not use a standard AT10 as this only passes heading at 4 Hz*




The Navico Radar module connects to the GB40 / 8000i systems using an ethernet cable. An Ethernet cable will connect between the radar modules network port and a free port on the Navico 8 Port Ethernet Linker (AA010009). These are available in the following lengths. and need to be ordered separately. They do not ship with any products

|          |   |
|----------|---|
| NS004810 | Network Cable 1.6 ft (0.5 m)                |
| NS004811 | Network Cable 6.5 ft (2 m)                  |
| NS004812 | Network Cable 16.5 ft (5 m)                 |
| NS004813 | Network Cable 33 ft (10 m)                  |
| NS004816 | Use network Connector Field Terminating kit |
| NS004817 | Unterminated Cable 328 ft (100 m)           |
| NS004818 | Unterminated Cable (300 m)                  |

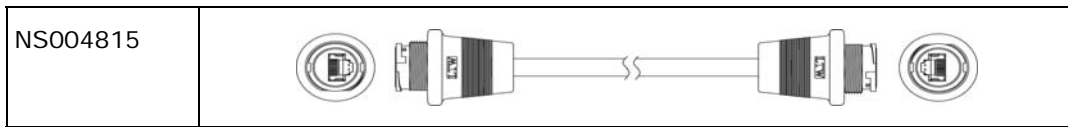
If there are only 2 ethernet network devices that make up the network i.e the NavComputer and the radar processor it is possible to use an ethernet crossover cable (NS004815)

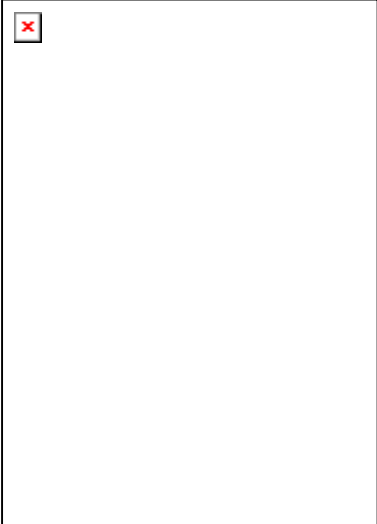
### 7.1 Parts needed to connect radar to a GB40 or 8000i system

| <b>Ethernet Cables: (Simrad GB40 and Northstar 8000i)</b>  |  |
|--|--|
| The connection between the radar processor and the GB40/8000i system is via a ethernet network. 1 ethernet cable is used to connect the radar to a Navico 8 port network linker linker. Select the desired length. |  |
| If there is only one NavComputer with Radar, a crossover cable can be used   |  |
|    |  |
| Part No  | Description  |
| NS004810   | Ethernet cable 0.5 m (1.6 ft) male / male connectors                             |
| NS004811   | Ethernet cable 2 m (6.5 ft) male / male connectors                               |
| NS004812   | Ethernet cable 5 m (16.5 ft) male / male connectors                              |
| NS004813   | Ethernet cable 10 m (33 ft) male / male connectors                               |
| NS004814   | Ethernet cable joiner 0.5 m (1.6ft) female / female                              |
| NS004817   | Ethernet cable bulk roll 100m (328 ft) un-terminated                             |
| NS004818   | Ethernet cable bulk roll 300m (985 ft) un-terminated                             |
| NS004816   | Ethernet Connector. Field terminating ethernet connector for bulk ethernet cable |

#### **Ethernet Crossover cable**

Used to connect the radar processor directly to a NavComputer. Cable has Female connectors on both ends and joins two of the above standard ethernet cables together (see "Simrad GB40 connection using SimNet heading" page 32)



| <b>Optional parts to connect (GB40 only)</b> |   |  |
|--|---|--|
| AA010151                                     |  | <p data-bbox="1094 394 1209 416">AT10-HD</p> <p data-bbox="1094 439 1319 779">This is used to supply the radar processor with heading information at 10 hz from a SimNet heading source. This connects to the 12 pin NMEA /COMS connector on the radar processor</p> |

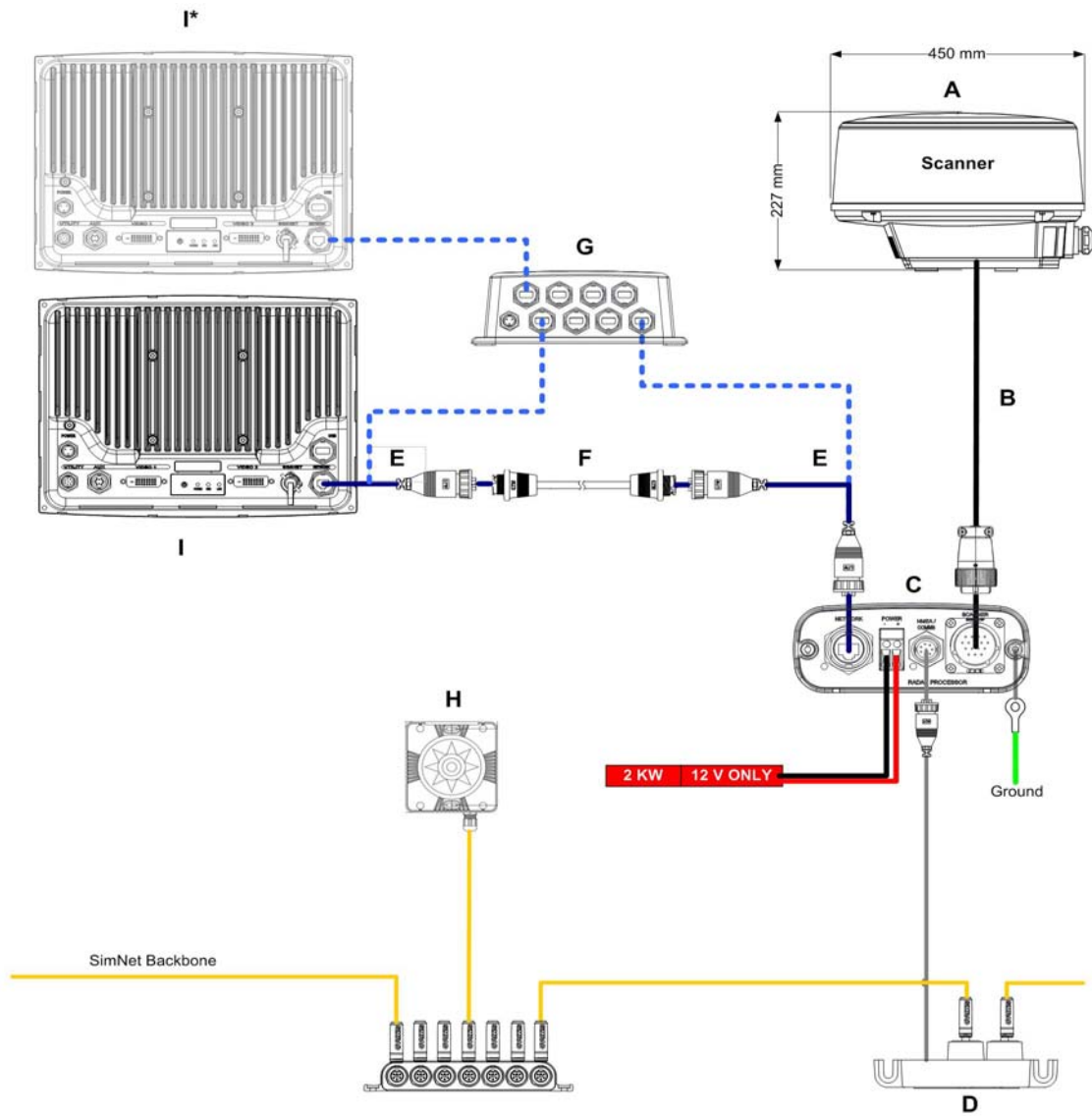
| <b>Optional parts to connect (GB40 and 8000i)</b> |  |   |
|---|--|---|
| NS004801  |  | <p data-bbox="1094 1059 1241 1081">Utility cable</p> <p data-bbox="1094 1104 1319 1469">This is used to supply the radar processor with heading information at 10 hz from a NMEA 0183 heading source. This connects to the 12 pin NMEA /COMS connector on the radar processor</p> |



## 7.2 Simrad GB40 connection using SimNet heading

The diagram below details how to connect the Navico radar to a GB40 system using a crossover cable (or using the 8 port ethernet linker). Heading is via SimNet

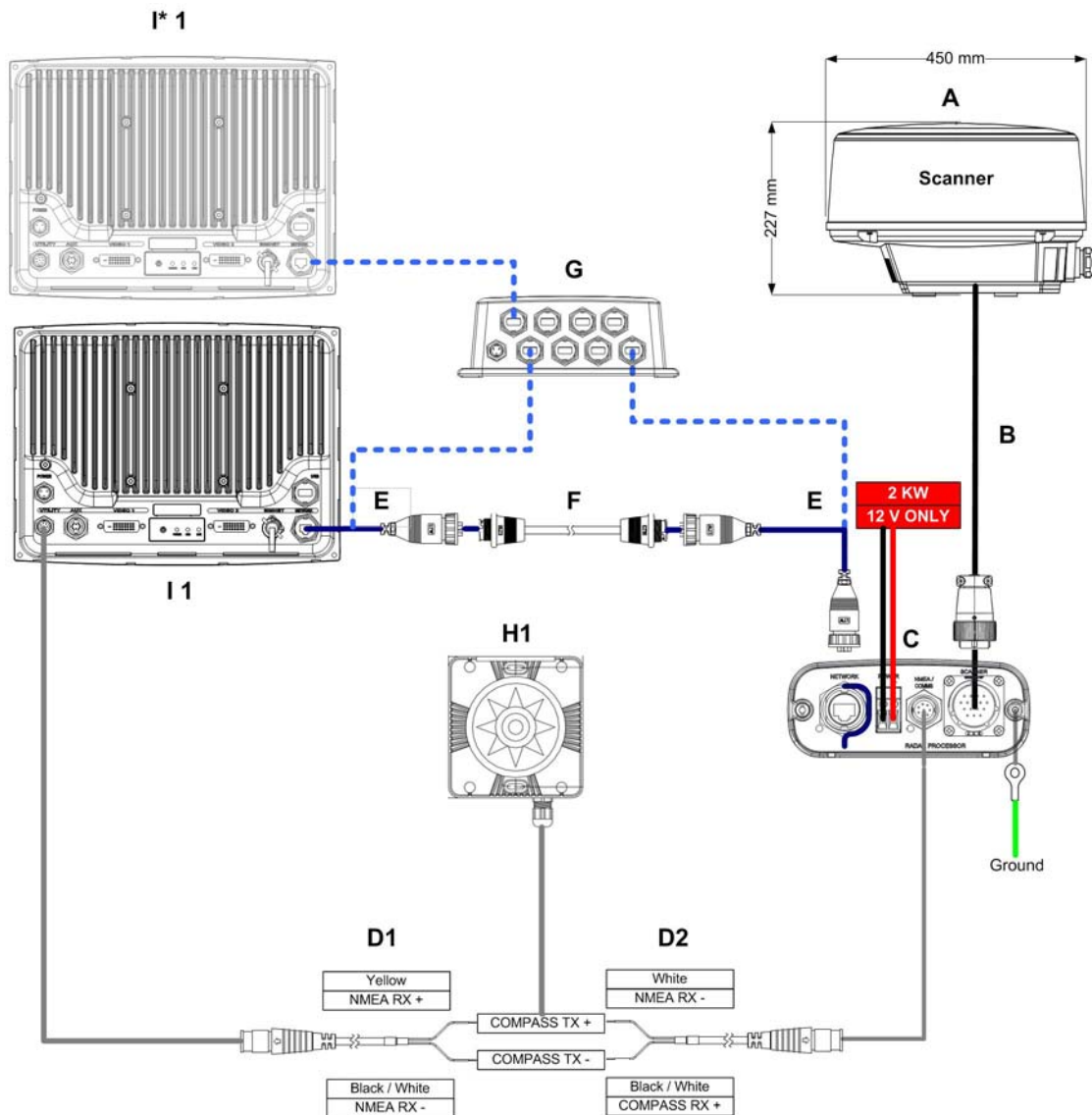
For Key information (page 33)




## 7.3 Northstar 8000i / Simrad GB 40 using NMEA 0183 heading

The diagram below shows how to connect the radar to a Northstar 8000i or Simrad GB40 system for vessels that use a NEMA 0183 heading sensor

For key information (page 33)



| Key | Part Number | Description  |
|-----|-------------|--|
| A   | AA010024SIM | 2 Kw Scanner comes with 15 m (49 ft) (NS003100) Cable attached. Cable from Scanner connects to Radar Processor box. An Optional longer cable is available but only upto 20 m (65.5 ft)   |
| B   | NS003100    | Optional 20 m (65.5 ft) Scanner cable. Will require disassembly of dome to connect this replacement cable. Cable has radar processor connector on one end and 3 small terminated flat connector on the other<br><br><div style="text-align: center;">  </div> CAUTION: Installation of this cable should only be done by experienced radar service technicians: Installation is difficult |

|     |          |   |
|-----|----------|---|
| C   | AA010012 | <p>2 Kw Radar processor box. No cables supplied. Connects to GB40 system via Ethernet.</p> <p>The Radar box requires heading @10hz. For Vessels using NMEA 0183 order cable NS004801 to connect to a suitable heading sensor.</p> <p>2kW System is 12 V DC ONLY 25 W max Power connects to the two screw terminals</p>  |
| D   | AA010151 | <p>AT10HE SimNet to NMEA0183 converter Converts SimNet heading to 0183 @10hz To allow for accurate MARPA and overlay.</p> <p>Has two simnet ports to sit on simNet Bus and a 2 m (6ft) cable terminating with 12 Pin Female connector. This plugs into socket labeled NMEA COMS on the radar processor box</p>  |
| D1  | NS004801 | <p>Utility Cable 2 m (6ft) This cable has 12 Pin Female connector on one end and 12 bare wires on the other. This plugs into socket labeled Utility on the 8000i or GB40 Master Navcomputer this cable is shipped with each NavComputer</p>   |
| D2  | NS004801 | <p>Same cable as D1 but needs to be ordered separately. Connects to the radar processor labeled NMEA /COMS</p>  |
| E   |          | <p>Ethernet Cables: All ethernet cables need to be ordered. They are not supplied with any product. They are available in four lengths as well as self terminating bulk rolls</p> <p>NS004810 Ethernet cable 0.5 m (1.6 ft) male / male connectors</p> <p>NS004811 Ethernet cable 2 m (6.5 ft) male / male connectors</p> <p>NS004812 Ethernet cable 5 m (16.5 ft) male / male connectors</p> <p>NS004813 Ethernet cable 0.5 m (1.6 ft) male / male connectors</p> <p>NS004814 Ethernet cable joiner 0.5 m (1.6ft) female / female</p> <p>NS004817 Ethernet cable bulk roll 100m (328 ft) un-terminated</p> <p>NS004818 Ethernet cable bulk roll 300m (985 ft) un-terminated</p> <p>NS004816 Ethernet Connector. Field terminating ethernet connector for bull ethernet cable</p> |
| F   | NS004815 | <p>Ethernet cross-over joiner cable 0.5m (1.6 ft) Female / Female.</p> <p>This can be used to connect no more than 2 network devices together e.g a radar processor and a GB40 NavComputer.</p> <p>The cable has Female connectors at each end. Two standard ethernet cables are required to link to network devices.</p> <p>Connector ends are red in colour</p> <p>Tip:</p> <p>When deciding which standard ethernet cables to order locate the crossover joiner where logically a network linker could be placed in the future if the system was upgraded</p> <p>If more than 2 ethernet devices are going to be used please use the Navico 8 Port Linker (see G)</p>  |
| G   | AA010009 | <p>Navico 8 Port Ethernet Linker: Used to connect more then two ethernet devices together. Ships with power cable only. Order ethernet cables additionally. 12 / 24 V DC</p>  |
| H   | 2209195  | <p>RC42 Heading sensor (or use SimNet heading output from and autopilot)</p>  |
| H 1 | 2209195  | <p>RC37 Race Compass or heading sensor with 10 Hz output.</p> <p>Note: Make sure the heading sensor shares the same ground as the NavComputer</p>   |
| I   |          | <p>Simrad GB40 NavComputer</p>  |
| I*  |          | <p>Simrad GB40 NavComputer second station</p>   |

|      |  |   |
|------|--|---|
| I 1  |  | Northstar 8000i or Simrad GB40 NavComputer Master |
| I* 1 |  | Northstar 8000i or Simrad GB40 second station     |

The compass must be NMEA compliant and configured as follows:

- 10 Hz update rate
- 4800 baud

The compass must be able to supply the NMEA 0183 HDT, HDM, and HDG heading sentences (all other sentence types will be ignored).

Ideally, the compass should draw less than 100 mA. (If this is not possible, power the compass using a separate 12 V source.)

The NMEA compass may be directly connected to the radar processor through the NMEA/COMMS port.

Compass data is appended to the radar data by the radar processor and then broadcast over the network to the 8000i or GB40 displays and other devices. This enables more precise radar chart overlay and target tracking (MARPA) than is possible by compass connection to other points in the network or just using GPS

The NMEA compass cable is not supplied but the pinout of the NMEA/COMMS port is shown for information:

|  | Pin | Function                        |
|--|-----|---------------------------------|
|  | 3   | NMEA TX+ data                   |
|  | 4   | NMEA Ground                     |
|  | 5   | NMEA Rx-data                    |
|  | 6   | NMEA RX+ data                   |
|  | 9   | Shield                          |
|  | 11  | 12 V Compass Power (100 mA max) |

It is recommended that a single compass data source is used for a 8000i or GB40 network.

## 7.4 Commission the radar using a GB40 or 8000i

### ➤ *tarting up Radar*



***When commissioning the Navico radar leave the unit on Standby for 20 minutes before transmitting. This makes sure the magnetron reaches optimum operating temperature aiding the auto tune function. Normal use afterwards only requires the standard standby count down.***

Select **Radar** on your OP30 controller or touch screen (8000i),

**Radar Mode** shows the current radar mode. Select **Radar Mode** to display an option list:

### ➤ **Transmit**

If the radar was in **Standby** mode, it will start transmitting immediately.

If the radar was **Off** there will be a pause of 90 - 180 seconds while the radar warms up before it starts transmitting.

### ➤ **Standby**

This stops transmission, but keeps the radar ready to transmit again.

### ➤ **Off**

This saves on power consumption (but you must turn it on and wait for the radar to warm up before you can use it again).

The radar transmits until you change the radar mode to **Standby** or **Off**.

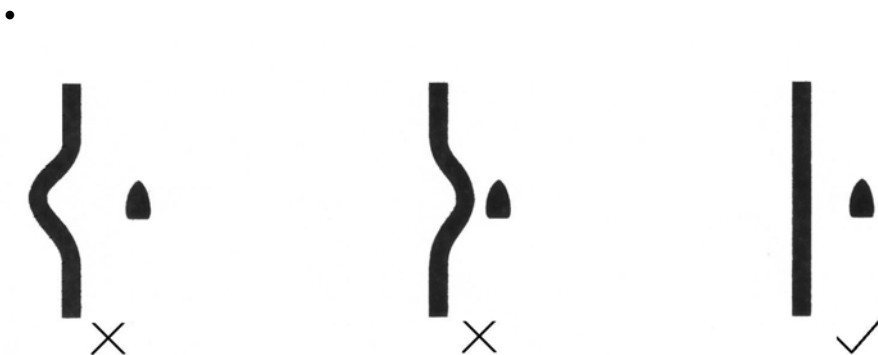
➤ *Set Radar Range offset (trigger Delay)*

The radar sweep should commence at your vessel (a radar range of zero). You may need to adjust the radar range offset to achieve this. (The radar range offset is also known as the trigger delay.)

If this is set incorrectly a large dark circle in the center of the sweep might occur. You might notice straight objects such as straight sea walls or piers having curves or an indentation. Objects close to your vessel may appear "pulled in" or "pushed out". To rectify this adjust the radar range offset.

➤ *To correct:*

- position the vessel about 50 yards to 100 yards (45 m to 90 m) from a straight-walled jetty or similar feature that produces a straight line echo on the display.
- Select the 1/8 mile range
- Adjust the gain setting until a reasonably good image of the jetty echo is displayed.
- Adjust the radar range offset to make the jetty echo appear as a straight line on the display, as shown:



If it's not possible to position the vessel near a suitable target, perform a rough set up of the range offset by using the circle at the center of the radar screen as a guide.

If your **Radar** screen has:

- a wide black circle around the center, decrease the radar range offset until it almost disappears.
- no black circle at the center, increase the radar range offset until a black circle just starts to appear at the center.

➤ *To change the radar range offset:*

- Display the **Radar** screen and main menu. If you can't see the **Adjust Radar** button, select **Return**.
- Select **Adjust Radar**, then select **Installation**.
- Select **Radar Range Offset** then use **Up** and **Down** to adjust the current setting.

➤ *Select **OK** to confirm the new setting.*

Other radar settings

➤ *To enter Radar setup options*

- Select **Pages**, then **Setup** from the main menu.
- Select **+ Radar** to display a list of options.

| -Radar | Default | Installer Defined | Description |
|--------|---------|-------------------|-------------|
|--------|---------|-------------------|-------------|

**Radar Antenna Height**

|                        |             |  |  |
|------------------------|-------------|--|--|
| (Small Distance Units) | 4m/13.12 ft |  | <i>Sets the antenna height above the water-line so that the sea clutter control works properly</i> |
|------------------------|-------------|--|--|

**Radar Open Array Parking Angle**

|       |   |  |  |
|-------|---|--|--|
| (Deg) | 0 |  | <i>Sets the angle that the radar scanner will come to rest</i> |
|-------|---|--|--|

**Radar Power on Action**

|            |   |  |  |
|------------|---|--|--|
| Standby    | X |  | <i>When powered, the radar will warm up, then go into standby mode</i> |
| Remain Off |   |  | <i>When powered, the radar will remain off</i>                         |

**Radar information**

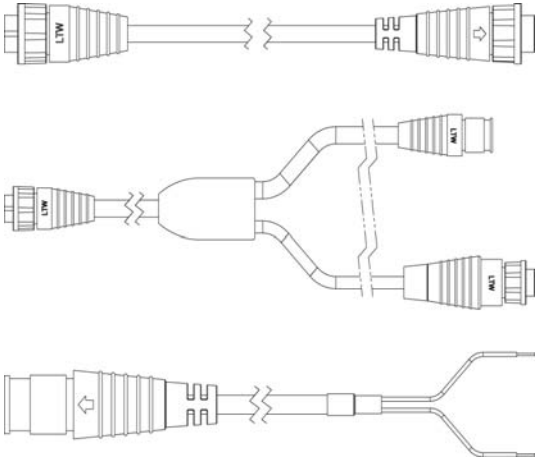
|        |  |  |  |
|--------|--|--|--|
| switch |  |  | <i>Displays magnetron hours information for the 10 kW and 25 kW Scanners</i> |
|--------|--|--|--|

Select **Return**.

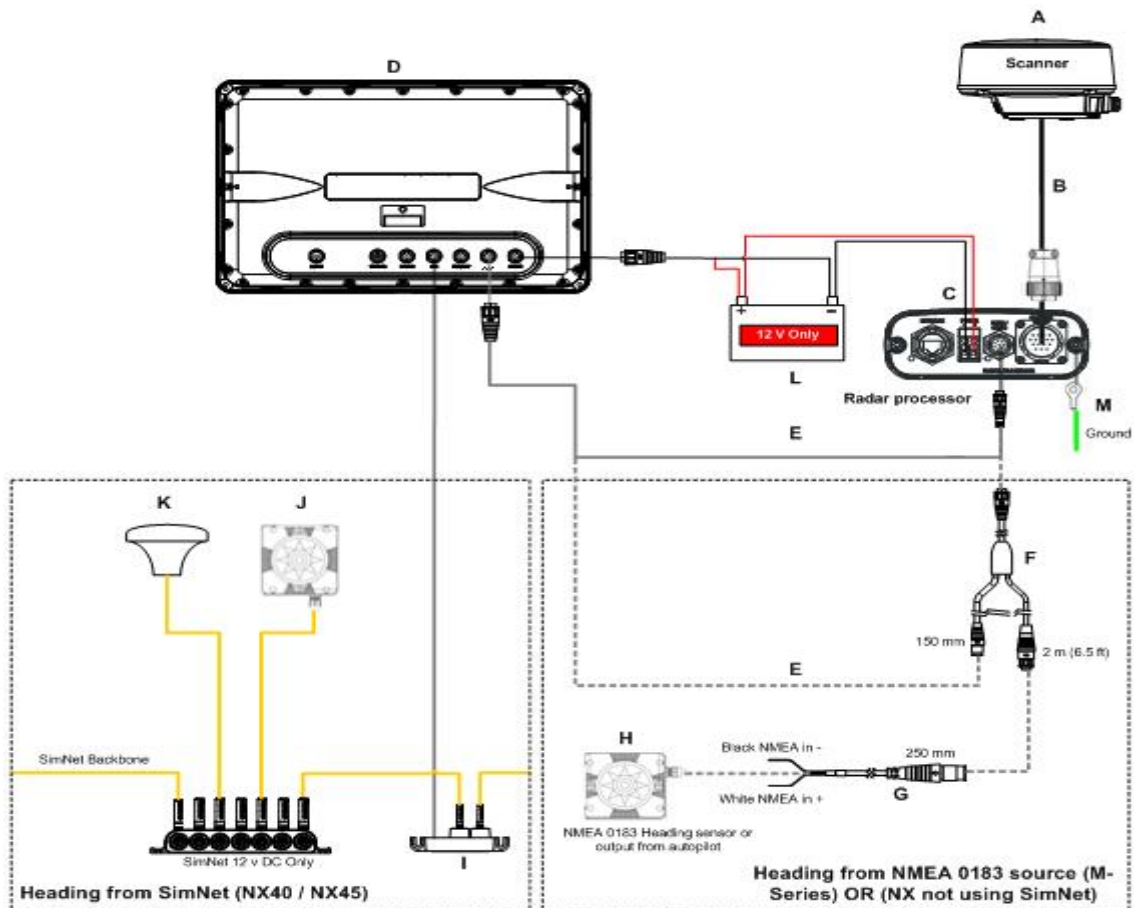
## 8 Connect Simrad NX40 / NX45, Northstar M84 / M121

### 8.1 Parts needed

If you're connecting the radar to an Simrad NX40/NX45 or a Northstar M841 or M121 you need the AA002461 connection kit. This is not supplied as standard, and must be ordered separately.

| Radar connection kit AA002461 |  |   |  |
|-------------------------------|--|---|--|
| Quantity                      | Item   | Part name   | Part no.   |
|                               | Radar connection kit   |   | AA01011<br>2   |
| 1                             |  | Radar serial comms cable 3 m (9.75 ft)<br><br>Radar processor heading sensor/display Y cable<br><br>Radar processor NMEA in cable 250mm (9.75 in) | CB00060<br>7<br><br>CB00061<br>2<br><br>CB00061<br>7 |

## 8.2 Connect the 2 kW radar processor to an M84 or M121 Display



|       |                      |  |
|-------|----------------------|--|
| A     | AA010024(SIM or NOR) | 2 kW Scanner comes with 15 m (49 ft) cable (B) Attached NS003100   |
| B     | NS003101             | Optional Scanner cable 20 m (65.5 ft). Will require disassembly of scanner to connect. The cable has a radar processor connector on one end, and three small terminated flat connectors on the other<br><br>CAUTION: Installation of this cable should only be done by an experienced radar service technician |
| C     | AA010012             | 2 Kw radar processor. No cables supplied. Connects to displays via RS485 protocol, using optional radar connection cable kit. The 2 kW System is 12 V DC ONLY 25 W max.  |
| D     |                      | Display Head NX40/45 or M84/121  |
| E,F,G | AA010112             | Radar connection Kit (see "Parts needed" page 38)  |
| H     |                      | Heading Sensor NMEA 0183   |
| I     | AA010150             | AT40   |
| J     |                      | Heading Sensor SimNet RC 40 or RC 42 (NX Only)   |
| K     |                      | GPS Antenna Simnet (NX Only)   |
| L     |                      | Ships Power 12v DC Only. Radar and Display need to share the same ground   |
| M     |                      | Ships Ground   |



## 8.3 Set up the radar with the Northstar M84 or M121

When the radar is enabled, it will turn on, warm up, and enter standby mode.

### ➤ *To enable the radar functionality:*

- Press Setup(NX) or menu twice to display the Setup menu, then select system
- Set Radar to .
- The radar immediately turns on and enters warm-up mode. A message shows how long this will take.

When the warm-up period is complete, the radar enters standby mode and is ready to transmit.

- Select Installation:



### ➤ *Park position*

If your radar has an open array and you take it out of enabled mode, the open array continues to rotate for a short distance before it finally stops. The stop position is known as the park position. You can adjust the angle of the parking position so that the open array will always stop at your preferred position; for example, facing the bow.

- Select Park position then enter the angle of the new park position.

**Note:** You may need to try a few different park positions to find the correct one. The strength of the wind will also affect the park position.

### ➤ *Zero bearing*

Use the zero bearing alignment to rotate the radar image, one degree at a time, so that a known object dead ahead is directly under the boat's heading marker.

This means that the radar image is aligned with the displayed chart and the compass. An accurate bearing alignment is particularly important when the radar image is overlaid onto the chart.

Adjust this on a chart window with the radar overlay on.

- Select Zero bearing then use the arrow keys to enter the new bearing angle.

### ➤ *Zero range*

The zero range is also known as the radar range offset and as the trigger delay.

If your radar window shows a blank, black circle around the centre or a solid circle of color at the centre, you need to adjust the zero range setting until this circle disappears or almost disappears. Ideally, the radar sweep should start at your boat (a radar range of zero).

To adjust the zero range setting:

- Position your boat about 45 to 90 m (50 to 100 yards) away from and parallel to a straight-walled jetty or similar feature.

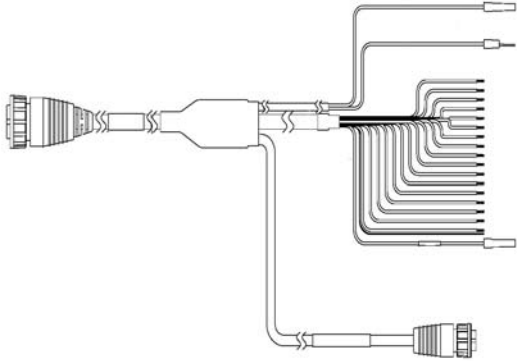
- Adjust the gain setting if necessary, so that a reasonably good image of the jetty echo is displayed on the radar window. At this stage, the jetty echo may appear to be bent.
- Select Zero range then use the arrow keys to adjust the zero range setting until the jetty echo appears as a straight line on the radar window.


➤ *Antenna height*

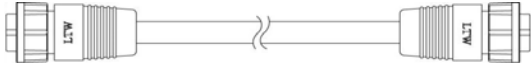
Select Antenna height then enter the height of the antenna above sea level.

## 9 Connect Northstar 6000i / 6100i

### 9.1 Parts needed to connect to a Northstar 6000i / 6100i

| NS003107 cable for 6000i and 6100i installations only - supplied with 6000i and 6100i system |   |                                |          |
|--|---|--------------------------------|----------|
| Quantity   | Item  | Part name                      | Part No  |
| 1  |  | Radar communications cable for | NS003107 |

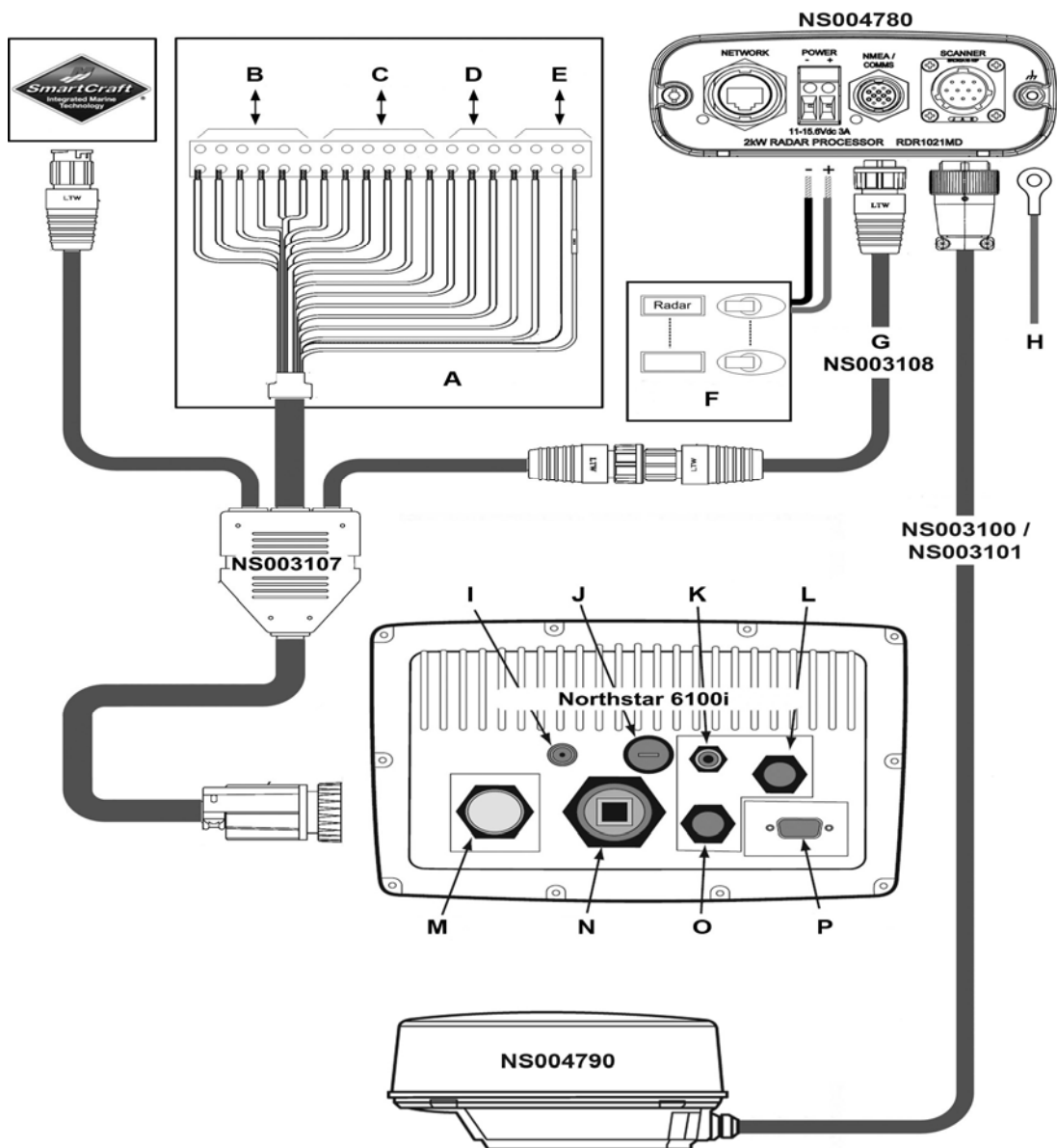
| NS003108 Optional extension cable for 6000i and 6100i installations only - order separately |   |                                      |          |
|---|---|--------------------------------------|----------|
| Quantity  | Item  | Part name                            | Part no. |
| 1   |  | Radar communications extension cable | NS003108 |

| Serial comms extension cables + adaptor |   |                                       |          |
|---|---|---------------------------------------|----------|
| Quantity                                | Item  | Part name                             | Part no. |
| 1                                       |  | 16.4 ft (5 m) extension and adapter   | AA002430 |
|   |   | 32.8 ft (10 m) extension and adapter  | AA002431 |
|   |   | 49.25 ft (15 m) extension and adapter | AA002432 |
|   |   | 65.5 ft (20 m) extension and adapter  | AA002433 |

## 9.2 Connect the 2 kW radar processor to a 6000i or 6100i display

The following diagram shows the recommended method for connecting a radar processor to a 6000i or 6100i display unit:

If you're connecting the 2 kW radar to a Northstar 6000i or 6100i system, a 10 ft (3 m) radar communications cable (NS003107) is supplied with the 6000i or 6100i system. If this is not long enough, an optional 6 ft (1.8 m) extension cable (NS003108) can be added. between the radar processor and the 6000i. This extension cable is not supplied as standard, and must be ordered separately.



| Item | Function         |
|------|------------------|
| A    | Junction box     |
| B    | To NMEA Device 1 |
| C    | To NMEA Device 2 |
| D    | To Smartcraft    |
| E    | Remote power     |

|   |  |
|---|--|
| F | Circuit breaker/fuse box                                 |
| G | Optional radar communications extension cable (NS003108) |
| H | Vessel's Ground  |
| I | NTSC Video Input   |
| J | Fuse (7A)  |
| K | GPS antenna  |
| L | Power  |
| M | NMEA   |
| N | Ethernet   |
| O | AUX  |
| P | VGA (out)  |

### 9.3 Connect the radar communications cable (NS003107) to the junction box

The radar communications cable (NS003107) splits the 14 pin connector of the 6000i/6100i into (three) 3 different connectors, Bare Wires, Radar Comms and SmartCraft. This cable allows the 6000i/6100i to connect to NMEA devices (Bare Ends) or to Navico digital radar (Connector 1) or to a SmartCraft junction box (connector 2).

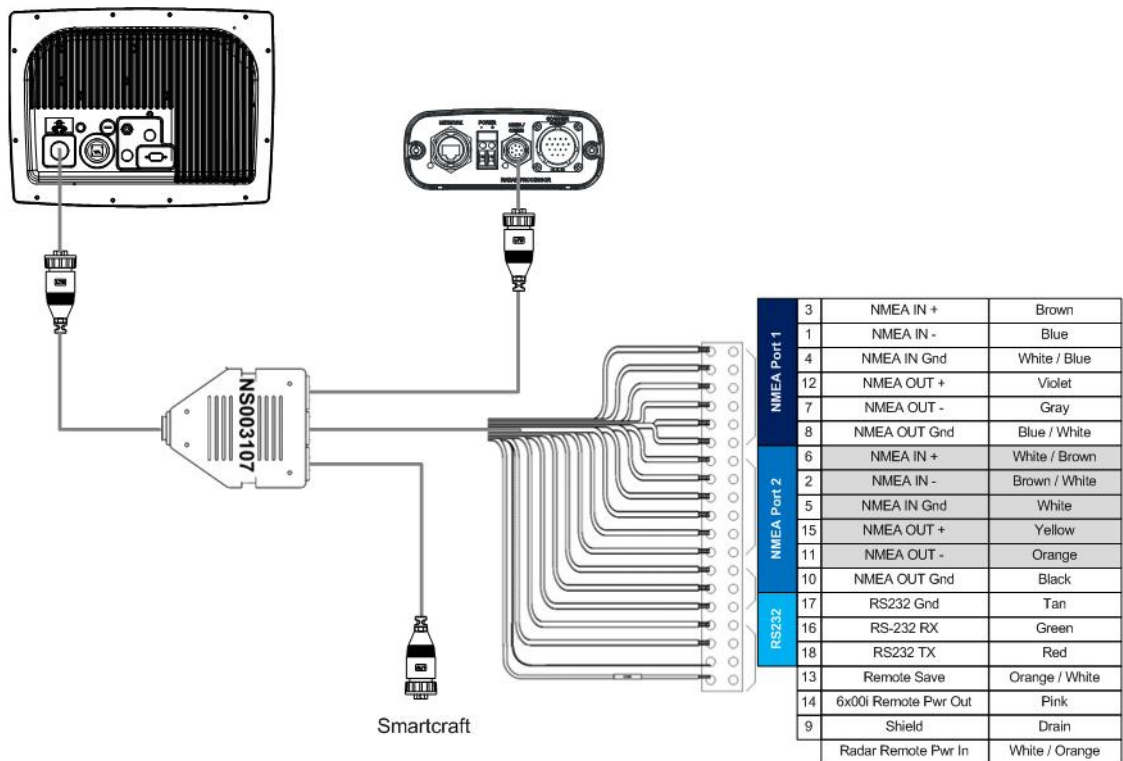
The output of the internal wires of the cable are in some cases duplicated, for example, pin 6 on the connector ends the white/brown bare end and the pin 1 of the radar comms connector. It is critical that the connector pins sharing multiple outputs such as pin 6 not be connected at the same time to different devices. i.e. If you are connecting a 6000i/6100i to the Navico radar processor box you must not connect any other device to the bare ends White/Brown, Brown/White, Yellow, Orange, Black, Orange/White and Drain.

The free ends of the radar communications cable (NS003107) must be terminated in a junction box or isolated from each other(see the figure in the previous section). The junction box is not supplied.

The communications cable has a 0.41" (10.5 mm) diameter. The junction box must be waterproof and large enough to contain a 20 way strip connector.

All cable entry points should use suitable grommets or glands to ensure that waterproofing is maintained.

The table shows the wiring and pin details of the radar communications cable. The naming convention for the bi-colored wires is primary color/striped; for example, White/Orange refers to a white colored wire with an orange stripe.



**\* DO NOT connect the bare wires if the radar comms (connector 1) is connected to the radar processor box**

**\*\*DO NOT connect these bare wires if the SmartCraft (connector 2) is connected to the SmartCraft gateway**



NMEA devices must be connected to an unused NMEA port on the connector strip.

The remote power signal configuration is explained in "Configure the remote power control for a 6000i or 6100i (common power source)" and "Configure the remote power control for a 6000i or 6100i (different power sources)".

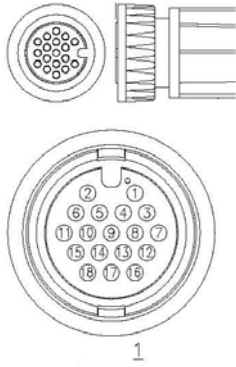
| Wire function                   | 6000i/6100i Connector PIN |              | Bare Wires Color | Radar Comms (Connector 1) |        | SmartCraft (Connector 2) |       |
|---------------------------------|---------------------------|--------------|------------------|---------------------------|--------|--------------------------|-------|
|                                 | PI N                      | Color        |                  | Pin                       | Color  | Pin                      | Color |
| NMEA 1 IN A                     | 3                         | Brown        | Brown            |                           |        |                          |       |
| NMEA 1 IN B                     | 1                         | Blue         | Blue             |                           |        |                          |       |
| NMEA 1 IN GROUND                | 4                         | White/Blue   | White/Blue       |                           |        |                          |       |
| NMEA 1 OUT A                    | 12                        | Violet       | Violet           |                           |        |                          |       |
| NMEA 1 OUT B                    | 7                         | Gray         | Gray             |                           |        |                          |       |
| NMEA 1 OUT GROUND               | 8                         | Blue/White   | Blue/White       |                           |        |                          |       |
| NMEA 2 IN A                     | 6                         | White/Brown  | White/Brown *    | 1                         | Green  |                          |       |
| NMEA 2 IN B                     | 2                         | Brown/White  | Brown/White *    | 2                         | Red    |                          |       |
| NMEA 2 IN GROUND                | 5                         | White        | White *          |                           |        |                          |       |
| NMEA 2 OUT A                    | 15                        | Yellow       | Yellow *         | 7                         | Orange |                          |       |
| NMEA 2 OUT B                    | 11                        | Orange       | Orange *         | 8                         | Blue   |                          |       |
| NMEA 2 OUT GROUND               | 10                        | Black        | Black            | 12                        | Yellow |                          |       |
| RS-232 GROUND                   | 17                        | Tan          | Tan              |                           |        | 1                        | White |
| RS-232 RX                       | 16                        | Green        | Green **         |                           |        | 3                        | Green |
| RS-232 TX                       | 18                        | Red          | Red **           |                           |        | 8                        | Red   |
| REMOTE SAVE                     | 13                        | Orange/White | Orange/White     |                           |        |                          |       |
| 6000i or 6100i REMOTE POWER OUT | 14                        | Pink         | Pink             |                           |        |                          |       |
| SHIELD                          | 9                         | Drain        | Drain            | 9                         | Drain  |                          |       |
| RADAR REMOTE POWER IN           |                           | White/Orange |                  | 10                        | Brown  |                          |       |

\* See cautions above.

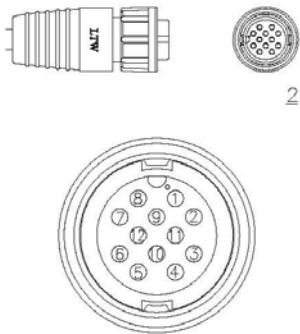
\*\* See cautions above.

The end view of the (three) 3 connectors are shown:

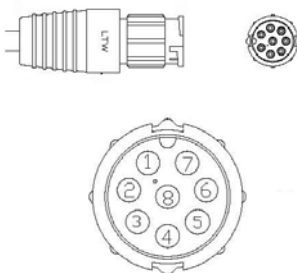
6000i/6100 connector NMEA pin assignments



Connector 1 - Radar NMEA/Communications pin assignments



Connector 2 - SmartCraft pin assignments





## 9.4 Configure the remote power control for a 6000i or 6100i (common power source)

There is a choice of two different modes for powering the radar ON/OFF:

### ➤ *Power on Option 1*

- If you want the radar to power ON automatically whenever the 6000i or 6100i is ON, program the Honk Output as REMOTE PWR in the 6000i or 6100i. This option is contained in the Alarms menu. (To access the Alarms menu, repeatedly press the \* key until the Alarms menu is visible.) You must also connect the Pink wire to the White/Orange wire in the junction box.

### ➤ *Power on Option 2*

- If you want the radar to power ON automatically when the radar processor is powered ON, connect the White/Orange wire to a NMEA ground in the junction box.

*IMPORTANT: This remote power control option works correctly only when the 6000i or 6100i and the radar processor share the same power earth and are located 16.5 ft (5 m) or less apart.*

The radar processor has two remote power inputs with opposite active states which are OR'ed together.

Pin 10 input (active low) is used by the 6000i or 6100i systems and Pin 12 input (active high) is used by the 8000i system.

Pin 12 is tied to ground through the NS003107 cable, to allow control through Pin 10.

The radar processor has an active low input with a pullup resistor to Vbatt, to complement the open collector output configuration of the 6000i or 6100i systems.

## 9.5 Configure the remote power control for a 6000i or 6100i (different power sources)

When the 6000i or 6100i and the radar processor have isolated power supplies, or are located more than 16.5 ft (5 meters) apart, there is a choice of two different modes for powering the radar ON/OFF:

- If you want the radar to power ON automatically whenever the 6000i or 6100i is ON, use the following power ON/OFF configuration:
- If you want the radar to power ON automatically when the radar processor is powered ON, omit the relay and leave Pin 10 and 12 on Connector 1 (the NMEA/Comms connector) as No Connect.

## 9.6 Set up the radar with the Northstar 6000i or 6100i

### 9.7 Turn the radar on and off

#### 1.1.1 Before you turn on the radar for the first time

To extend magnetron lifetime, you're recommended to leave the radar in Standby mode for 30 minutes when activating the radar for the VERY FIRST time. (When the radar is in Standby mode, it's NOT transmitting but it is powered up – this allows the magnetron heater to stabilize). Then, after 30 minutes, press the RADAR ON key to test and align.

If you're using the radar with the 6000i or 6100i, press CLR (NOT ENT) the VERY FIRST time when the radar transmit activation message appears. After this first time, you can press ENT anytime this screen appears. If the radar has not already warmed up, the radar countdown timer will appear – typically 90 seconds on lower powered radars – then the radar will automatically start transmitting.

#### 1.1.1 Turn the radar on

*IMPORTANT: Do not use the navigator's Demo Mode when the radar is switched on.*

Several menu buttons on the radar display must be activated before the adjustment they control can be changed. Here's how they work:

- any button displayed in red is already active. Press it, or use the keypad or cursor controls to adjust the value.
- any button displayed in blue is inactive. Press it once to activate it.

The radar normally provides a good picture when used in its automatic modes described in "Configure the navigator". In many cases, the picture can be improved by using the Range Rider mode.

Before turning ON the radar for the first time to set it up, check that the vessel's DC primary power supply is within the recommended range of 10.8 V to 16 V for a 12 V system, or 21.6 V to 32 V for a 24 V system.

Check that everyone is outside the radiation hazard area and any rotation hazard area.

#### ➤ Turn ON the radar as follows:

- Turn ON the radar processor by installing the fuse or by turning ON the circuit breaker to the radar system
- Turn ON the navigator (display) unit. The power switch is on the front panel.

#### ➤ Turn the radar off

***Be sure to turn the scanner OFF before servicing the scanner or working in the vicinity of a rotating open array.***

***Turn the radar OFF by removing the fuse or by switching OFF the radar's dedicated circuit breaker.***

***Depending on the power switch configuration, the radar may automatically turn OFF when the navigator (display) unit is turned OFF.***



## 9.8 Configure the navigator communications

*IMPORTANT: If you are going to operate the radar without a heading sensor, ignore this section and set up the radar as described in "Disable the header sensor input".*

➤ *To enable the radar to communicate with the navigator, set up the radar option on the navigator's PORT 2 SETUP screen as follows:*

- Press **STAR** several times to display the OPTIONS/SERVICE INFO screen.
- Press **Port Setup Options**.
- Press **Port 2 Setup** and use the **Cursor Pad** to select the **Output Format** line.
- Press **Edit**, then use the **Cursor Pad** to select **Radar**.
- Press **Enter**. The change is made immediately and you do not need to restart the navigator.

## 9.9 Adjust the appearance settings

The Mode, Rain Clutter, Sea Clutter and Gain are usually set to automatic mode to obtain an excellent image under most conditions and, by default, allow you to see any approaching weather rain cells for maximum safety. However, these settings may need minor adjustments depending on the location of the radar.

➤ *To access these controls, press **Page 2** from the main radar screen.*

- The **Mode** key determines how the gain and clutter keys work. It has the following settings:
  - **Auto 1** and **Auto 2** are for normal, open-water conditions. The two automatic modes can be optimized for two different conditions.
  - **Harbor** automatically optimizes the radar settings for use in a harbor. This is the default setting.
  - **Range Rider** is a Navico exclusive feature recommended for use when manual settings are required. You can make changes to the clutter and gain settings for different ranges, and the Range Rider will store these settings for each range. Then, when you select a particular range again, the settings are already optimized.
  - **Manual** is a fully manual function in which you will usually need to adjust the settings manually each time you change the range.

Gain and Sea Clutter appearance settings are available in Auto1, Auto 2 and Harbor modes.

These can be accessed by pressing the Gain or Sea Clutter buttons while in Auto1, Auto 2 or Harbor mode with Gain or Sea Clutter set to Auto.

The default appearance setting is 25 for both Gain and Sea Clutter for all ranges.

The appearance settings can be adjusted between 0 and 50. This represents a +/- 25 step offset away from the nominal Auto mode setting. The value set will be applied only to the current range.

## 9.10 Heading sensor requirements

The heading sensor can be a stand-alone unit or may be integrated into an auto-pilot system, provided that it supplies the NMEA 0183 HDG, HDT, OSD, HCC, HCD or HDM heading sentences to the navigator. It must output data at a 10Hz update rate.

If the heading sensor requires sea trial calibration, perform the manufacturer's recommended calibration procedure before you calibrate the radar heading.

Heading calibration should be performed during initial setup, annually, and after any major structural changes to the vessel.

The Northstar 6000i and 6100i accepts the following standard NMEA 0183 sentences from a heading sensor (such as the Simrad RC37 Rate compass) to obtain the following heading information: HDG, HDT, OSD, HCC, HCD, and HDM.

For sensor installation and calibration instructions, see the sensor manufacturer's Installation Manual. In addition, the navigator must be calibrated to the heading sensor (see the section "Set the heading calibration" in this manual and, for a 6000i or 6100i system installation also see "GM6KIM Rev D (6000i Installation Manual)" or the new "MN000320A Northstar 6000i & 6100i Installation Manual")

## 9.11 Disable the heading sensor input

The heading sensor is configured by default when the navigator is configured for radar.

If a heading sensor is NOT installed and connected, you must remove its configuration as follows:

- Turn on the navigator and wait for it to complete its power-up sequence.
- Press **RADAR** to display the radar screen on the 6000i or 6100i.
- The system asks if you want to turn on the scanner. Press **Enter** to turn it on.
- Press **Page 2, Page 3, Page 4,** and **Install...** to show the installation screen.
- Press **Hdg Sensor Installed** to change its displayed status to **No**.
- Press **STAR** to display the alarm screen, then press **Clear Alarm**. This clears the heading sensor alarm.

## 9.12 Calibrating the radar

You must calibrate the newly installed radar by adjusting the trigger delay and the heading calibration.

To evaluate medium and short range returns, you are recommended to perform the calibration at sea in a normal operating environment and under fair weather conditions. There should be an area of at least 3 nautical miles forward of the vessel, containing known targets including the coastline. A wave height of about one to two feet (half a meter) to create some sea clutter, is ideal. Do not perform the calibration in an enclosed or busy area such as a boatyard.

Attempts to tune and calibrate under less than recommended conditions may lead to substandard performance. A sea trial that allows the selection and use of all the ranges is highly desirable.

## 9.13 Prepare for calibration

➤ *Prepare for calibration as follows:*

- Press **RADAR** to display the radar screen on the 6000i or 6100i.
- The unit may ask if you want to turn on the scanner. If it does, turn it on. You should see range rings displayed on the screen or the scanner warm-up countdown followed by a message saying "Radar is OFF". If nothing appears, the radar control box is not powered up or not properly interfaced to the navigator. Check the power wiring, interface wiring, and navigator communications configuration.
- Press **Page 2, Page 3, Page 4,** then **Restore...**
- Press **Restore factory settings**. (A new Northstar 6000i or 6100i is shipped with standard factory settings that are appropriate for basic operation.)

- Press **Return**.

## 9.14 Tune the radar

The Navico radar uses a fully automatic tuning procedure that continuously checks for optimum adjustment during operation. Navico recommends using auto tuning mode for normal operation. For special situations requiring manual tuning, see the section on "Manual Tuning Mode".

Tune the radar so that the radar receiver frequency matches the transmitter frequency.

For normal operation of a Navico radar, you're recommended to set the tuning mode to Auto.

➤ *To tune the unit manually see the section "Manual tuning procedure for the 6000i or 6100i system". To check the tuning mode or change it to Auto:*

- Press **RADAR** to display the radar screen on the 6000i or 6100i.
- Press **Page 2, Page 3, Page 4**, then **Install...** and then **Tune...** .
- If necessary, press **Tune mode** repeatedly until it displays **Auto**.

## 9.15 Set the STC Curve

The STC (Sensitivity Time Control) attempts to compensate for the high strength of nearby echoes compared with the very much weaker echoes from distant objects. It lowers the receiver gain when the pulse is transmitted, and raises the gain as echoes return from longer distances. Ideally, the result is that all echoes are displayed with strengths proportional to the reflectivity of the objects. A graph showing the receiver gain plotted against time is called the STC curve. You can select different curve shapes, if required for special applications.

The height of the scanner affects the STC curve shape needed for the sea control to effectively reduce sea clutter. The STC curve shape corresponds to the scanner's height (in meters) above the waterline; for example, if the scanner is 20 ft (6 m) above the waterline, select STC curve 6.

Curve 4 is the default, and represents a scanner 13 ft (4 m) above the waterline.

➤ *To select a different curve:*

- Press **RADAR** to display the radar screen on the 6000i or 6100i.
- Press **Page 2, Page 3, Page 4** then **Install...** and then **Tune...** .
- Press **STC Curve** then use the keypad to enter a curve number from 0 to 8.

## 9.16 Set the trigger delay

There are two methods that you can use to set the trigger delay. The two methods should produce very similar settings. Method 1 is easier to perform but Method 2 may produce more accurate results. You can use either, or both, methods.

Set the trigger delay after you have restored the factory settings (see "Prepare for calibration") OR manually turn off the Interference Rejection, Trails and Expand functions.

### Method 1

➤ *Use this method when the vessel is in open water with few or no nearby echoes.*

- Display the main radar screen then press **Page 2**.
- Press zoom **Range** - several items to zoom in to the maximum magnification.
- If necessary, press **Mode** to make it read **Manual**.
- Press **Rain Clutter**, then press **0** twice to set the rain clutter value to zero.
- Press **Sea Clutter**, then press **0** three times to set the sea clutter value to zero.

- Press **Gain**, then press **1, 5, 0** to set the gain to 150. If you're using standard screen colors, the display will show a green ring with a black center or solid green circle. If it doesn't, try changing the gain value until you can see the green ring and black center clearly. (If the gain is set too high, the display may be saturated.)
- Press **Page 3, Page 4, and Install...**
- Press **Trigger Delay**, then press **000** on the keypad to set the trigger delay to zero.
- Increase the trigger delay by pressing the Cursor Pad to the right (or enter a larger number on the keypad). The black circle will shrink as you increase the trigger delay. Set the trigger delay so that the black center just disappears, with only one or two dots remaining in the center of the display.

## Method 2

➤ *Use this method when the vessel is about 50 to 100 yards (45 to 90 m) from a straight-walled jetty or similar feature that produces a straight line echo on the display.*

- Adjust the gain setting until a reasonably good image of the jetty echo is displayed.
- Adjust the **Trigger Delay** to make the jetty echo appear as a straight line on the display, as shown:



## 9.17 Set the heading calibration (heading sensor installed)

The heading calibration rotates the radar image on the screen to line it up with the displayed chart and the compass. Accurate heading calibration is particularly important when the radar image is overlain onto the chart.

*Note: Make sure the heading sensor is calibrated according to the manufacturer's recommendations.*



- When performing a sea trial of the vessel, set a straight course for a solid object such as a lighthouse, jetty or radar navigation marker that is at least 1 nautical mile distant as referenced on the chart.
- Press **CHART** to display the chart then press **Overlay** to show the radar echoes overlain on the chart.
- Set the chart rotation to North-Up by pressing **Rotate** several times until **North-Up** is displayed.
- Find a target at least 1 nautical mile distant that appears on both the chart and the radar overlay. Do not choose a beach or a buoy as a target; instead, choose an obvious land pattern or solid object with a fixed reference point such as a jetty, lighthouse, or pier.
- Zoom in as necessary to place identifiable objects near the outer edge of the screen.
- Press **Control** so that it displays **Radar**.
- Press **Page 2, Page 3, Page 4, and Install...**
- Press **Heading Calibrate** then press the **Cursor Pad** left and right to rotate the radar image so that the radar target matches its compass heading on the chart and lines up on top of the position shown on the chart.
- If possible, check targets in all quadrants to ensure accurate adjustment.

## 9.18 Set the heading calibration (heading sensor not installed)

The heading calibration rotates the radar image on the screen so that a target dead ahead corresponds to a bearing of 0° on the screen.

- Press **RADAR** so that the navigator displays radar only.
- Find a target at least 1 nautical mile distant. Choose an obvious land target or solid object with a fixed reference such as a jetty, light house or pier. Steer the vessel until the reference target is directly head up then maintain this heading.
- Zoom in as necessary to place the reference target near the outer edge of the screen.
- Press **Page 1, Page 2**
- Check that the chart rotation (**Rotate** button) is set to Hdg Up.
- Press **Page 2, Page 3, Page 4** and **Install... .**
- Press **Heading Calibrate** then press the cursor pad left and right to rotate the radar image so that the reference target is at 0° (vertical from the centre of the radar sweep).

## 9.19 Restore all the factory settings

If you need to restore ALL of the radar settings (except trigger delay, heading calibration and whether or not a heading sensor is installed) to their factory settings, do the following:

- From the main radar page, press **Page 1**.
- Press **Restore... .**
- Press **Restore factory settings** to return the unit to its state when it was shipped with the exception of the following:
  - trigger delay
  - heading calibration
  - whether or not a heading sensor is installed
  - parking calibration

This function is used before performing manual tuning (see Appendix B) or at any time it's necessary to restore the unit to a known state.

## 9.20 Restore the factory appearance settings

➤ *Appearance settings and manual settings can be restored to values that normally produce a useful picture as follows:*

- From the main radar page, press **Page 1**.
- Press **Restore... .**
- Press any or all of **Restore Auto, Restore Harbor, Restore Range Rider, and Restore Manual** to return to the factory appearance settings.

This completes the installation calibration.

*Note that the heading correction may need to be adjusted slightly after the gain is optimized to provide a better picture.*

## 9.21 Manual tuning procedure for the 6000i or 6100i system

*Note: The following manual tuning procedure is provided only for possible situations where the unit's automatic tuning does not perform well with a Northstar 6000i or 6100i system. At present, Navico is not aware of any such situation and recommends that automatic tuning be used, unless a reason is found to use this manual procedure.*

➤ *Begin by restoring all radar settings to their factory settings (except trigger delay, heading calibration and whether or not a heading sensor is installed), as follows:*

- From the main radar page, press **Page 1**.
- Press **Restore...**
- Press **Restore factory settings** to return the unit to its state when it was shipped (with the exception of trigger delay, heading calibration and whether or not a heading sensor is installed).
- Press **Return** and **Done** to return to the main radar screen.

➤ *Next, set the rain clutter and sea clutter to 0 and the gain to 150 as follows:*

- From the main radar page, press **Page 2**.
- If necessary, press **Mode** to make it read **Manual**.
- Press **Rain Clutter** to activate the control.
- If necessary, press **Rain Clutter** again to make it read **Manual**.
- Press **0** twice on the keypad to set the rain clutter value to zero.
- Press **Sea Clutter**.
- Press **0** twice on the keypad to set the sea clutter value to zero.
- Press **Gain** to activate the control.
- If necessary, press **Gain** again to make it read **Manual**.
- Press **1**, **5**, and **0** on the keypad to set the gain to 150.
- Press **Return** and **Done** to return to the main radar screen.

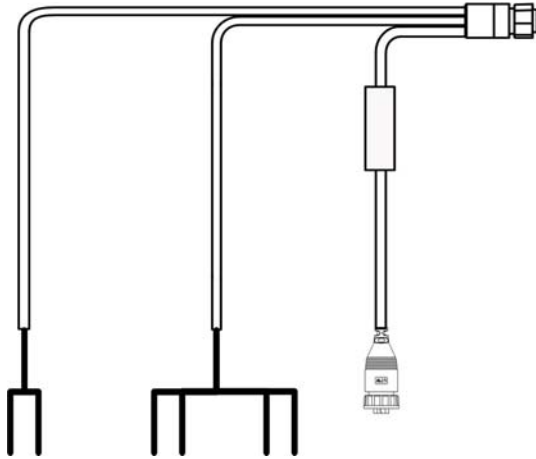
➤ *Next, set the scale to 1/8 nautical miles as follows:*

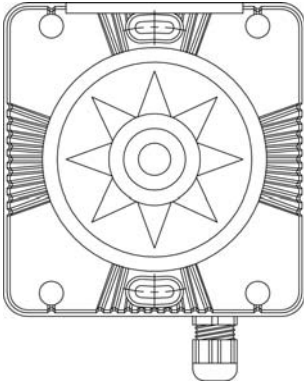
- Press zoom **Range** - several times to access the 1/8 nautical miles scale. (The current scale is shown in the upper left corner of the screen, identified as "RNG").
- From the main radar page, press **Page 2**, **Page 3**, **Page 4**, and **Install...**
- Press **Tune...** to display the tuning screen.
- Press **Tune Mode** (repeatedly if necessary) to set it to **Manual**.
- Set the rough tune value to 128 (if necessary) by selecting **Tune Preset** and typing **128** on the keypad.
- Press **Tune**.
- Adjust the tune preset value upwards by pressing the up arrow key on the cursor pad until the quantity and strength of visible targets is maximized.
- If the quantity and strength of targets does not increase, return to 128 by typing **128**. Then adjust the tune preset value upwards by pressing the down arrow key on the cursor pad until the quantity and strength of visible targets is maximized.

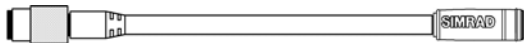


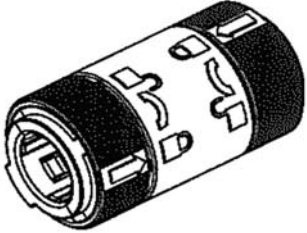
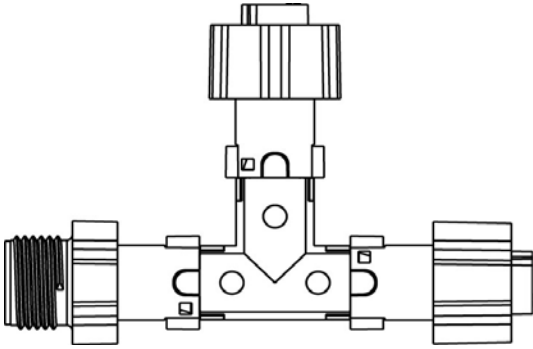
## 10 Connect to Lowrance Displays

### 10.1 Parts needed to connect to Lowrance displays

| RIM300 Radar Interface Module |  |               |         |
|-------------------------------|--|---------------|---------|
| Quantity                      | Item   | Part name     | Part No |
| 1                             |  | Rim 300 Cable |         |

| Heading Sensor (Optional) |   |   |                          |
|---------------------------|---|---|--------------------------|
| Quantity                  | Item  | Part Name   | Part No                  |
| 1                         |  | FC40 Fluxgate Compass<br>OR<br>RC42 Rate Compass. This has a 5.5 m (18 ft) SimNet cable attached<br>Connect using the below radar accessories kit | 22090245<br><br>22090237 |

| Radar Accessories kit (000-0127-45) Optional. Used to interface the above heading sensors |   |                   |          |
|---|---|-------------------|----------|
| Quantity  | Item  | Part Name         | Part No  |
|   |  | Simnet to Micro C | 24005729 |

|  |   |                                 |             |
|--|---|---------------------------------|-------------|
|  |  | Simnet cable joiner             | 44172260    |
|  |  | Lorance NMEA 2000 "T" Connector | 037-0491-01 |

## 10.2 RIM300

### RIM 300 Installation

The RIM 300 will replace the power cable that came with your display unit. Your RIM 300 has three cables branching out from the cable plug, which include: radar data cable, display unit power cable and NMEA 2000 power cable.

#### NOTE:

You will need to purchase a SIMRAD heading sensor for the Radar Overlay feature to work properly.

**You MUST remove the power cable that came with your unit and replace it with the RIM 300 to complete this installation.**

#### WARNING:

**Even though the RIM 300 is replacing your original power/data cable, you must follow the same rules, cautions and warnings for powering the display unit and a NMEA 2000 network or LGC-3000 antenna module. These details are described in the display unit manual and the LGC-3000 instruction sheet. Failure to follow all power connection instructions and fusing requirements could result in damage to your equipment and injury to you. The RIM 300 radar data cable is connected to the radar processor. Radar processor installation is covered in the Radar Installation manual.**

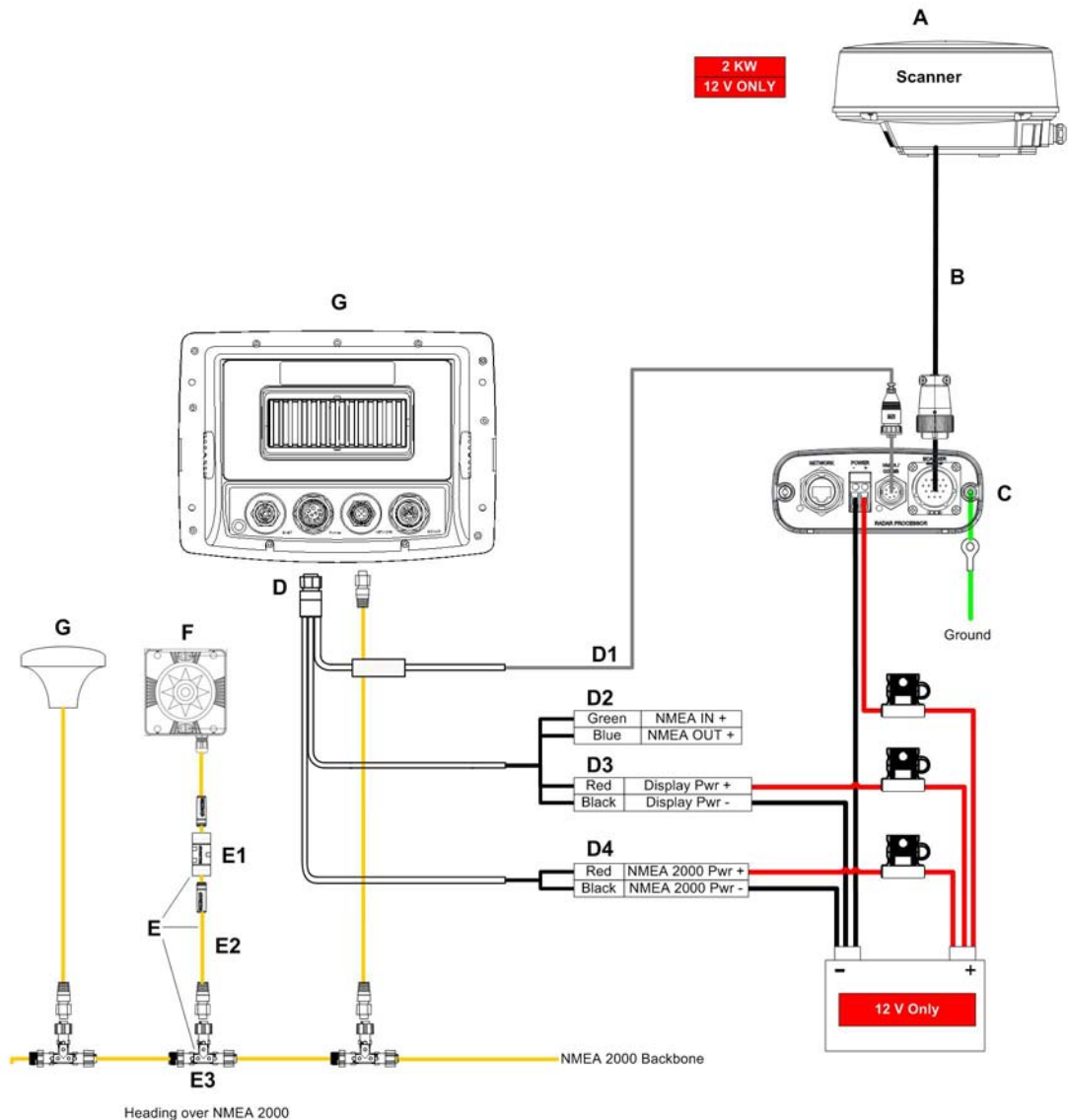
- The RIM 300 works from a 12-volt DC battery system. The display unit power cable has four wires: red, black, blue and green. You will use the red and black wires to power your display unit. Attach the red wire (+) to an accessory switch or power bus connected to a 12-volt battery. Connect the black ground wire (-) to the battery negative post.

**If possible, keep the power cable away from other boat wiring, especially the engine's wires. This will provide the best isolation from electrical noise. If the cable is not long enough, splice #16 gauge wire onto it. Make sure to attach the in-line fuse holder to the red lead as close to the power source as possible. Make sure it is**



- The blue and green wires (Com port 2) can be used to exchange GPS position data with any NMEA 0183-compatible device. Connect the blue (TX) transmit wire to the receive (RX) wire from the NMEA 0183 device. Now connect the green (RX) receive wire to the transmit (TX) wire from the NMEA 0183 device. There is no ground wire, so the NMEA 0183 device MUST be grounded to the same source as the display unit. fused with a 3-amp fuse.

- If you are powering a NMEA 2000 network or an LGC-3000 GPS antenna, you must connect the NMEA 2000 power cable. Attach the NMEA 2000 red wire (+) to an accessory switch that is connected to the same 12-volt power source as the display unit power cable red wire (+). Be sure to use the 3-amp fuse. Connect the black wire (-) to the negative battery post.
- Plug the RIM 300 radar data cable into the NMEA/COMMS port on the radar processor box.
- After all wires and cables have been connected and all unused wires insulated, insert the RIM 300 cable plug in the power/data receptacle on the back of your display unit.



### 10.3 Setup the radar with Lowrance displays

The Radar Setup menu allows you to setup and adjust radar settings, like Transmit Off Zone and Antenna Park. Most of the settings in the

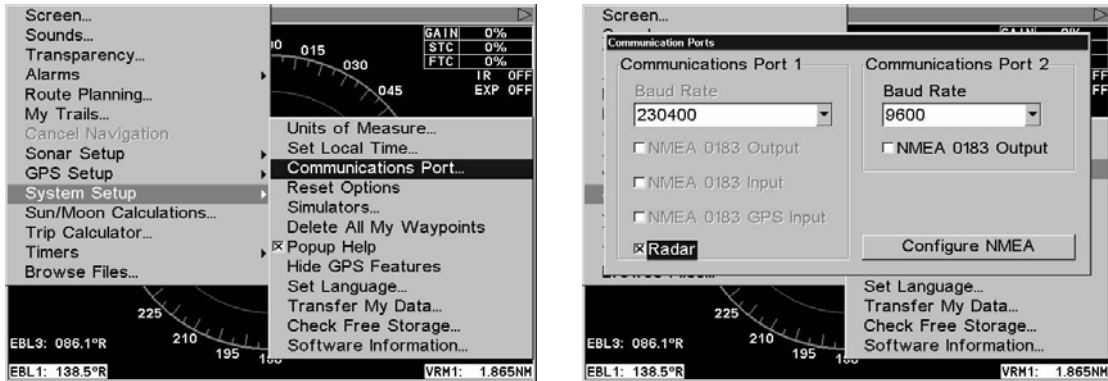
Radar Setup menu will only have to be set once, but we recommend you check the settings periodically for general maintenance.

***Before starting radar setup, take your vessel out on open water with fairly calm seas, like an open bay.***



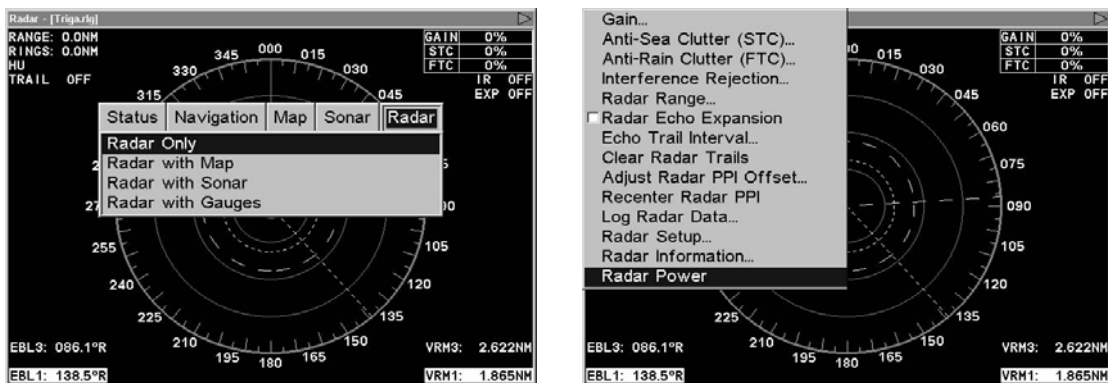
## 10.4 Setup the basics

- After turning on the unit, press **MENU|MENU**, then use  $\uparrow \downarrow$  to **SYSTEM SETUP** and press **ENT**.



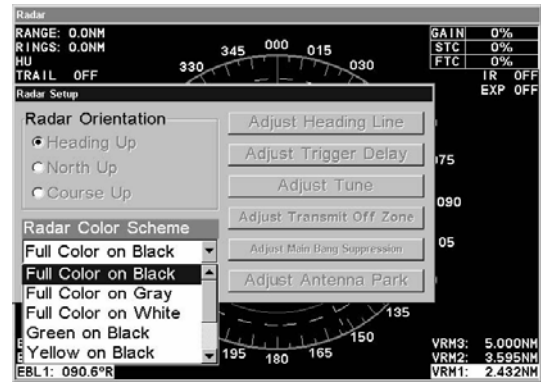
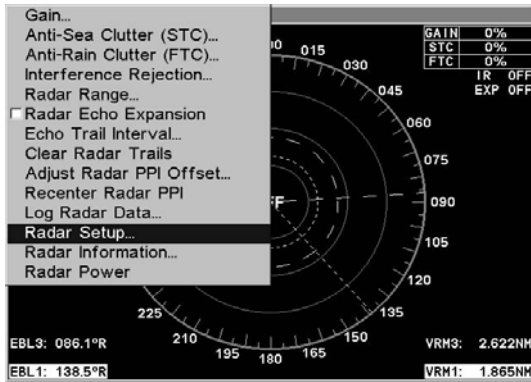
Communications Port selected from System Setup menu (left). Communications Port menu (right).

- From the System Setup menu, highlight COMMUNICATIONS PORT and press **ENT**.
- Press  $\downarrow$  to RADAR and press **ENT**, which will place an X in the radar checkbox. The Baud Rate automatically will switch to 230400. Press **EXIT** repeatedly to return to the main page display.
- Press **PAGES**, then use  $\leftarrow \rightarrow$  to select the radar tab.
- Press  $\downarrow$  to select RADAR ONLY, then press EXIT.



Radar only highlighted on Radar Pages menu (left). Radar menu with Radar Power selected (right).

- Press **MENU**, then use  $\uparrow \downarrow$  to select RADAR POWER from the radar menu and press **ENT**. A confirmation message will appear. Press  $\leftarrow$  to select **YES** and press **ENT**. A warm-up countdown will commence that will vary depending on the model of radar you have.
- After the countdown is finished, the unit will enter **STANDBY** mode.
- Access the Radar Setup menu to make sure your radar display is set to **Heading Up** and is set to a Full Color scheme. Press **MENU**, select RADAR SETUP and press **ENT**.



Radar Setup selected from Radar menu (left). Radar Setup menu with Full Color on Black highlighted (right).

- Highlight **HEADING UP** and press **ENT**, which will set the radar to Heading Up.
- To display the radar images in full color, press **↓** to select **RADAR COLOR SCHEME** and press **ENT**.
- Use **↑ ↓** to highlight one of the three full color options and press **ENT**. Press **EXIT** to return to the main page display.

## 10.5 Radar Setup

The three setup features we want to modify are Adjust Trigger Delay, Adjust Main Bang Suppression and Adjust Heading Line.

We will set them up in that order, but before making any adjustments, make sure the display is set to a range of 1/8 nautical miles and that Gain, Anti-Sea Clutter (STC), Anti-Rain Clutter (FTC), Main Bang Suppression and Trigger Delay all have been set to zero percent.

### ➤ *Trigger Delay Preparation*

#### Range

- To reset range to 1/8 nm, make sure you are on the Radar Only page and press **MENU**.
- Use **↑ ↓** to select **RADAR RANGE** and press **ENT**, which will call up the Radar Range list. Press **↑** to select 1/8 nm and press **ENT**. You also can set the range to 1/8 nm from the radar screen by using the **ZIN** and **ZOUT** keys.

#### Gain

- To set Gain to zero, press **MENU**, select **GAIN** and press **ENT**.
- That will launch the Gain vertical scrollbar. Press **↓** until the Gain is set to zero percent. Press **EXIT**. (Notice the corresponding value in the upper right-hand corner of the screen.)

NOTE:

When adjusting Gain back to a useable level, increase the level until you see a light peppering on the display. Also remember, you will have to adjust gain every time you change ranges.

#### Anti-Sea Clutter

- To set Anti-Sea Clutter to zero, press **MENU**, select **ANTI-SEA CLUTTER (STC)** and press **ENT**.
- That will launch the Anti-Sea Clutter vertical scrollbar. Press **↓** until the Anti-Sea Clutter is set to zero percent. Press **EXIT**. (Notice the corresponding value in the upper right-hand corner of the screen.)

#### Anti-Rain Clutter

- To set Anti-Rain Clutter to zero, press **MENU**, select **ANTI-RAIN CLUTTER (FTC)** and press **ENT**.

- That will launch the Anti-Rain Clutter vertical scrollbar. Press ↓ until the Anti-Rain Clutter is set to zero percent. Press **EXIT**. (Notice the corresponding value in the upper right-hand corner of the screen.)

### Main Bang Suppression

- To set Main Bang Suppression to zero, press **MENU**, select RADAR SETUP and press **ENT**.
- Press →|↓ to ADJUST MAIN BANG SUPPRESSION and press **ENT**. That will call up the Main Bang Suppression vertical scrollbar.
- Press ↓ until Main Bang Suppression is set to zero percent. Press **EXIT**.

### Trigger Delay

- To set Trigger Delay to zero, press **MENU**, select RADAR SETUP and press **ENT**.
- Press →|↓ to ADJUST TRIGGER DELAY and press **ENT**. That will call up the Adjust Trigger Delay vertical scrollbar.
- Press ↓ until Trigger Delay is set to zero percent. Press **EXIT**. Adjust Trigger Delay

This feature eliminates the time lag between real radar returns and the time it takes data to be processed by the radar software, a common issue with all radars.

***If you have any doubt about your understanding of the Trigger Delay feature, you should have it set up by a qualified radar technician.***



- The radar should already be in STANDBY mode, so press **PWR** for 2 seconds to switch the radar into transmission mode. A confirmation message will appear, press ← to select **YES**.
- Press **MENU**, then select **GAIN** and press **ENT**, which will call up the Gain vertical control bar. Press ↑ to increase the Gain level to around 15%. One or two red rings with blue borders should be visible on the screen, depending on the wattage of your radar antenna.
- Now from the Radar Setup menu, press →|↓ to ADJUST TRIGGER DELAY, then press **ENT**. The Adjust Trigger Delay vertical scrollbar will appear.

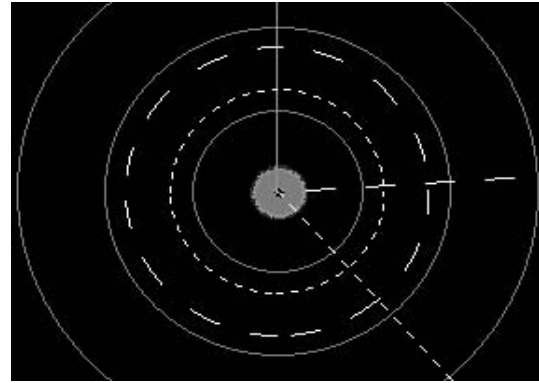
The 2 kW models, the LRA-1000 and LRA-1500, will have only one ring on the display. The 4 kW radars — LRA-2000, LRA-4000 and LRA-5000 — will have two rings on the display. See the following figures.



Before adjusting the Trigger Delay for 4 kW radars, two rings will be shown on the screen (left). As Trigger Delay is increased, the larger ring will start to get smaller. The small ring will disappear (right).

You may have to increase gain in the previous step if the rings are not visible. Increase gain until you have solid red rings shown on the screen, like in the preceding example. Increasing Gain too much can cause distortion of the rings.

- Press ↑ to increase the level of Trigger Delay, which will decrease the size of the ring. If you have a 4 kW radar, as the large ring decreases in size, the smaller ring in the center of the screen will disappear, leaving only one ring.



Increase Trigger Delay to diminish the size of the red ring (left). To set Trigger Delay correctly, reduce the ring to as small a size as possible, while keeping a black circle in the middle (enlarged view, right).

In either case, continue to increase the Trigger Delay level until the ring is as small as possible, while keeping a black circle in the middle. Every radar is different, but typically, a setting between 35 and 42 percent will get the job done.

If you over apply the Trigger Delay, the black circle will disappear. Decrease the Trigger Delay level and it will reappear.

- Press **EXIT** to return to the main page display.

#### Adjust Main Bang Suppression

Main Bang Suppression is only for 4kW units — LRA 2000, LRA 4000 and LRA 5000. This feature filters out electronic noise close to your vessel. It gives you control of radar sensitivity in the area surrounding your vessel, approximately 180 feet in all directions.

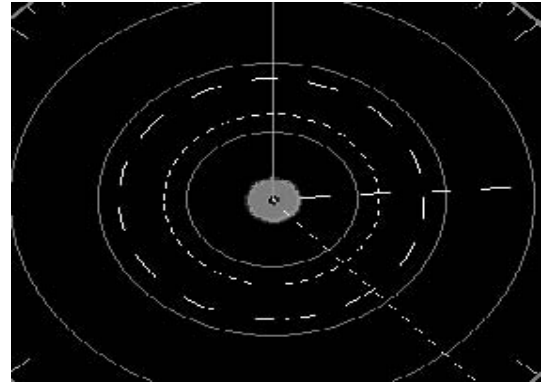
Before making any adjustments to Main Bang Suppression, take your vessel out on open water with fairly calm seas, like an open bay.

***If you have any doubt about your understanding of the Main Bang Suppression feature, you should have it set up by a qualified Radar technician.***



- From the Radar Setup menu, press →|↓ to ADJUST MAIN BANG SUPPRESSION and press **ENT**. That will launch the Main Bang Suppression vertical scrollbar.
- The small red ring we adjusted during Trigger Delay setup will still be on the display.
- Press ↑ slowly — Main Bang Suppression can be sensitive — to increase the Main Bang Suppression level so the red ring becomes as thin as possible.
- Press ↓ to slowly decrease the level until you have returned the red ring back to its thinnest point. Every radar is different, but typically, a setting between 2 and 8 percent will be satisfactory.

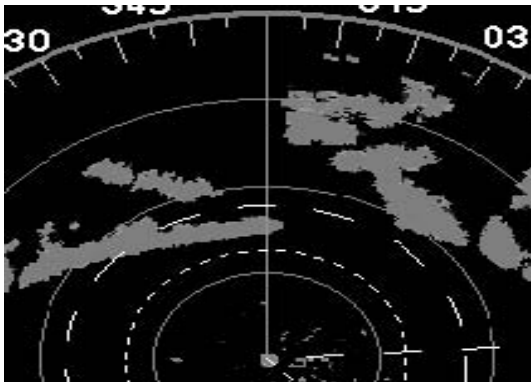
***In many cases, depending on the radar unit you have, over applying Main Bang Suppression can make the ring disappear, start to make it wider or the ring can get to a point where it is as small as it will get. At this point, increasing the main bang level will not change the red ring. If the red ring does not decrease in size when increasing the suppression level, reduce the level until you see a slight increase in the size of the ring, then leave it at that setting.***



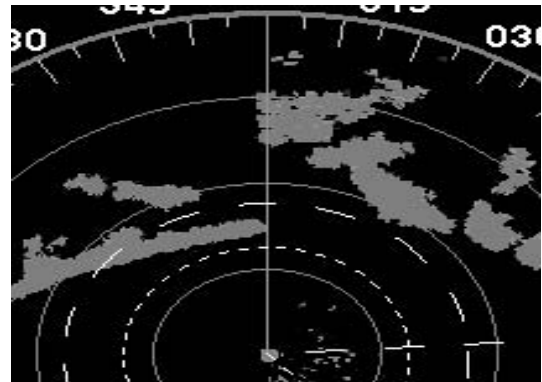
Main Bang Suppression begins with the same red ring we resized during Trigger Delay setup (left). Slowly increase Main Bang Suppression to make the ring as thin as possible (enlarged view, right). Adjust Heading Line

- Press EXIT to clear the scrollbar from the screen. Now reset Gain, Anti-Sea Clutter and Anti-Rain Clutter back to a desired level. The Heading Line command is used to make sure the green heading line (zero point) on your display is lined up with the bow of your vessel

**(Before heading line adjustment)**



**After heading line adjustment**





## 11 Maintenance

***Before doing any maintenance work, always ensure that the radar system is turned OFF at the main power source.***

***If a rectifier unit is used, turn OFF the power supply to this too. Remember that high voltages from the rectifier unit are always present, even if the radar is not operating, and these can cause severe injury or death.***



### 11.1 General maintenance

***Proper maintenance of the radar system will keep it in good condition and minimize breakdowns. Periodically:***

- remove any dust, dirt, or sea salt from the external surfaces with a dry, lint-free cloth.
- check that the radar components are held securely in place and that the screws, nuts and bolts have not worked loose. Tighten and re-apply marine paint where necessary to prevent corrosion.
- check that all the radar cabling is not frayed, bent, or cut and that the radar system cable connections are secure, tight and waterproof.

### 11.2 Scanner maintenance

***Before working on the scanner, remove your watch and any magnetic cards, because the modulator circuit in the magnetron emits a strong magnetic field that can badly affect such items***

- Remove any dust, dirt, or sea salt from the external surfaces, particularly the front side of the scanner, with a lint-free cloth dampened with alcohol or water. Do NOT use petrol, gasoline, benzene, thinner, or similar solvent to dampen the cloth as these cause deterioration of the external surfaces.
- At least once every six months, apply grease (Mobilux 2 or equivalent) evenly to the lubricating gears, with a brush or knife. More frequent application is desirable to maximize the life of the lubricating gears.
- The drive motor brush has an expected life of 2,000 hours. Replace it when half of the overall length has worn away. The drive motor carbon brush can be removed easily by unclipping the two caps located on both sides of the bottom part of the drive motor.
- Clean any carbon powder off the drive motor commutator with a dry brush or, if this will not remove it, use sand paper #250 to #400.

### 11.3 Scanner maintenance

***Before working on the scanner, remove your watch and any magnetic cards, because the modulator circuit in the magnetron emits a strong magnetic field that can badly affect such items***

- Remove any dust, dirt, or sea salt from the external surfaces, particularly the front side of the scanner, with a lint-free cloth dampened with alcohol or water. Do NOT use petrol, gasoline, benzene, thinner, or similar solvent to dampen the cloth as these cause deterioration of the external surfaces.
- At least once every six months, apply grease (Mobilux 2 or equivalent) evenly to the lubricating gears, with a brush or knife. More frequent application is desirable to maximize the life of the lubricating gears.
- The drive motor brush has an expected life of 2,000 hours. Replace it when half of the overall length has worn away. The drive motor carbon brush can be removed easily by unclipping the two caps located on both sides of the bottom part of the drive motor.
- Clean any carbon powder off the drive motor commutator with a dry brush or, if this will not remove it, use sand paper #250 to #400.

#### **11.4 Other maintenance items**

Re-set the heading calibration annually and after any major structural changes to the vessel.

#### **11.5 Feedback from you**

Your feedback is important and helps Northstar ensure that this manual is a valuable resource for all marine technicians. E-mail your comments or suggestions about this manual to the following address: [manuals@northstarnav.com](mailto:manuals@northstarnav.com).

#### **11.6 Feedback from you**

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## 12 Troubleshoot the radar

This appendix gives information on fixing possible problems with the radar. Many problems are caused by:

- faulty or loose contacts at switches and relay points
- poor adjustment of the radar (particularly inadequate tuning adjustment)
- poor maintenance (particularly of the cables)

You'll save yourself a considerable amount of time if you check these items before placing a call to Northstar; plus, you may find the problem right away.

### 12.1 Technical support, service and repairs

The product is covered by a warranty which is supplied as a separate document.

If you need technical support, or answers to other questions after you've followed the instructions in this manual, you can:

- contact your Navico distributor or
- see the inside back cover of the manual or
- visit [www.navico.com](http://www.navico.com)

Before you make contact, be sure to have:

- the serial number of the hardware (usually shown on the faceplate of the unit).

When you describe the problem, be as complete and as accurate as possible.

### 12.2 Radar is not operating correctly

If the scanner is working but no image appears on the display:

- adjust gain and threshold

If the display shows only noise:

- check that the scanner and open array (if applicable) are fitted correctly

If radar reception is poor:

- check for physical damage to the cables (such as fraying) and for any loose connections
- check for water damage to the radiator or to the cables between the radar components
- check for interruptions in the pulse switching signal

If an image appears on the display but the direction of the radar image is not stable:

- the direction standard signal (BZ) is being interrupted (see the Service Manual)
- check for water damage to the radiator or cables between the radar components.

### 12.3 If the scanner fails to turn

If the scanner fails to turn, it is possible that there has been a breakdown of either the motor unit inside the scanner or the safety switch of the scanner unit.

Turn the power OFF and investigate as follows:

- 1 Visually check for, and remove, any external obstruction.
- 2 Open the scanner dome or array and perform an internal inspection.
- 3 Check to make sure that nothing is interfering with the motor and gears, is binding, or preventing the antenna from turning.
- 4 Check for any disconnected, pinched or broken wires.
- 5 Check for worn or broken motor brushes.
- 6 Verify that the scanner cable is correctly pinned, all wires are in the correct locations and the connectors are correctly locked to the mating connectors on the modulator board.

- 7 Check the motor and replace any faulty component. (See the Service Manual for information on replacing the motor)
- 8 Check the wiring of the interconnection cable between the scanner and the radar processor.
- 9 Checking these connections is especially important if the installer removed the connectors for easy routing when installing the scanner cable.

## 12.4 How to reduce noise and interference

If other electronic equipment on the vessel is being affected by noise interference from the radar, check that the radar is actually the source of the problem by switching it off, running the other electronic equipment for a while to see if the noise interference has disappeared, and then switching the radar on again.

If the radar is causing the noise interference, check that:

- the affected piece of equipment and/or the antenna is not located within the radar beam. (See the section "Install the radar" for information about the optimum installation height and the radar beam width)
- the cables supplied with the equipment have been installed correctly. In particular, check for loose connections and loose or missing shield meshwork at the cable ends
- the covers of the scanner and radar processor box are securely screwed and/or fastened in place, so that the internal shielding is effective
- each piece of radio equipment is grounded to the closest ground location, and that other devices are grounded to the closest ground location on the hull
- the radar cabling has not been bundled with the VHF radio cabling and/or with the direction finder cabling. The radar cabling must always be separate.

## 12.5 Make sure the power is present and correctly wired

Check the in-line fuse.

Re-verify that the correct system voltage is being used for the radar processor box model and that the power is properly wired. If the radar processor has incorrect power, the system may not initialize properly or the radar processor may be damaged.

## 12.6 Confirm the equipment installed

1. Confirm the type of navigator used with the radar (6000i, etc).
  - Serial number: \_\_\_\_\_
  - Software version: \_\_\_\_\_
2. Confirm that the NMEA Port 2 interface option is set to RADAR.
3. Confirm the type of radar installed:
  - 2 kW dome
  - 4 kW dome
  - 6 kW open array
  - 10 kW open array
  - 25 kW open array
4. Make sure the voltage input and radar processor are correct for the system being installed, as follows:
  - 2 kW - 12 V DC - Radar Processor NS004780
  - 4 kW - 12 V DC or 24 V DC - Radar Processor NS004781
  - 6 kW - 12 V DC or 24 V DC - Radar Processor NS004782
  - 10 kW - 24 V DC - Radar Processor NS004783
  - 25 kW - 24 V DC - Radar Processor NS004784.

## 12.7 Confirm the equipment installed

1. Confirm the type of navigator used with the radar (6000i, etc).

MAKE \_\_\_\_\_

MODEL \_\_\_\_\_

SERIAL NUMBER \_\_\_\_\_

SOFTWARE VERSION \_\_\_\_\_

2. Confirm that the NMEA Port 2 interface option is set to RADAR.
3. Confirm the type of radar installed:
  - 2 kW dome
  - 4 kW dome
  - 6 kW open array
  - 10 kW open array
  - 25 kW open array
4. Make sure the voltage input and radar processor are correct for the system being installed, as follows:
  - 2 kW - 12 V DC - Radar Processor NS004780
  - 4 kW - 12 V DC or 24 V DC - Radar Processor NS004781
  - 6 kW - 12 V DC or 24 V DC - Radar Processor NS004782
  - 10 kW - 24 V DC - Radar Processor NS004783
  - 25 kW - 24 V DC - Radar Processor NS004784.

## 12.8 Are range rings displayed?

*Yes, range rings are displayed.*

- 1 Confirm that the installation set up had been performed.
- 2 Verify that the array is turning. If it is a dome, with the power off, remove the dome cover (weather permitting). Apply power to the system. After the warm-up countdown has completed, and the transmit option is set to ON, verify that the array is turning.
- 3 If the antenna does not turn, skip to the section "If the scanner fails to turn".

*No, range rings or range scale information are not displayed.*

- 1 Verify that the serial data cable wiring is correct for the communications cable.

## 13 2 kW radar system specifications

|                        | <b>2 kW scanner</b>  |
|------------------------|--|
| <b>DC input</b>        | <b>10.8 V to 15.6 V DC (DC 12 V system ONLY)</b>   |
| Scanner type           | Radome   |
| Scanner model          | NS004790   |
| Scanner dimensions     | Depth: 17.7" (450 mm)<br>Height: 8.93 (227 mm)   |
| Scanner weight         | 9.26 lbs (4.2 kg) $\pm$ 5%   |
| Vibration Amplitude    | 0.1" (3 mm) (0 to 500 cpm)<br>0.29" (0.75 mm) (550 to 1500 cpm)<br>0.007" (0.2 mm) (1500 to 3000 cpm)  |
| Waterproof             | IPX6   |
| Plane of polarization  | Horizontal   |
| Preheating time        | Minimum 90 seconds   |
| Power consumption      | 25 W (maximum) at 12 V DC  |
| Emission type          | PON<br>FCC ID: CKEJMA1020<br>IC ID: 768381105A<br>R&TTE: DERA-RTTE-34/01-01  |
| Peak power output      | 2 kW $\pm$ 50% under any pulse conditions  |
| Transmitter frequency  | 9445 $\pm$ 30 MHz  |
| Transmitter tube       | Magnetron NJRC M1537   |
| Horizontal beam width  | 5.2° $\pm$ 10% (3 dB width)  |
| Vertical beam width    | 30° $\pm$ 20% (3 dB width)   |
| Side lobe level        | < -21 dB maximum (within $\pm$ 10°)  |
| Rotation rate          | 27 rpm $\pm$ 10%   |
| Pulse length/PRF       | 0.08 $\mu$ s +50/-25% (2250 Hz)<br>0.3 $\mu$ s +50/-30% (1200 Hz)<br>0.8 $\mu$ s $\pm$ 25% (600 Hz)<br>See Pulse Width and Bandwidth Selector table (below). |
| Duplexer               | Microwave T-junction with diode limiter<br>Model NJRC NJS6947  |
| Mixer                  | MIC front-end  |
| IF amplifier           | Center frequency 60 MHz $\pm$ 3 MHz  |
| IF amplifier output    | 14 dB for -3.2 V into 50 ohms (typical)  |
| IF band width          | 10 MHz $\pm$ 3 MHz (0.08 $\mu$ s)<br>3 MHz $\pm$ 1 MHz (0.3 $\mu$ s, 0.8 $\mu$ s)  |
| IF characteristic      | Linear   |
| Gain                   | Minimum 90 dB  |
| Noise figure           | NJT1027 @ 7 dB (average) at front-end input  |
| Temperature range      | +5°F to +131°F (-15°C to +55°C)  |
| Relative humidity      | 95% at 95°F (35°C)   |
| Relative wind velocity | 118.11 ft (36.0 m)/sec (maximum 70 knots)  |

|                      | <b>2 kW Radar processor specifications</b>  |
|----------------------|---|
| Radar system         | NS-RDR-1021MD   |
| Processor model      | NS004780  |
| Processor dimensions | Width 5.6" (142 mm)<br>Height 2.2" (56 mm)<br>Length 7.9" (200 mm)                    |
| Processor weight     | 1.9 lbs (870 g)   |
| Vibration            | EN60945   |
| Waterproof           | No rating   |
| Temperature range    | +5°F to +131°F (-15°C to +55°C)   |
| Relative humidity    | 95% at 104°F (+40°C)  |
| Power up time        | Approximately 35 seconds  |
| DC input             | 10.8 V to 36 V (DC 12/24/32 V system) *   |
| Power consumption    | 3 W (when operating)<br>Leakage current <200 µA (when off, with a remote power input) |

\* Operation is limited to 12 V DC systems due to processor box supply limits