

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 Compliance Statement

EMC compliance:

USA (FCC): Part 15 Class B

Refer also to the system specifications section.

1.4 Disclaimer

As Northstar 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 Northstar 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.

BRUNSWICK NEW TECHNOLOGIES INC. AND ITS SUBSIDIARIES 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. Brunswick New Technologies Inc. and its subsidiaries and affiliates reserve the right to make changes to specifications without notice.

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1.5 Warranty

The Northstar Warranty Statement is supplied as a separate document.

It is shipped with the Product Registration Card.

In case of any queries, refer to www.northstarnav.com.

1.6 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.

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2 Preface

This manual explains how to install the scanner and the radar processor. It also explains how to set up the radar system after installation and gives information on troubleshooting.

This manual is supplementary to the *Northstar 6000i/6100i Installation and Operation Manual* and the *Northstar 8000i System Installation* documentation.

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	WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
 CAUTION	CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
CAUTION	CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

WARNING

Ensure that mains power is OFF before starting installation or servicing work. Electrical shock, fire or injury can result if electrical power remains ON, or is switched ON, during installation or servicing work.

A potentially lethal high voltage is present and can remain for a period of time after the equipment is turned OFF.

Ensure that capacitors are discharged with an Earthed wire before starting servicing work.

Ensure that internal surfaces are no longer charged before you touch them.

To minimize accidents, wear dry cotton gloves and avoid touching equipment with both hands unless absolutely necessary. Always work from a stable position to avoid slipping or falling onto the equipment.

WARNING

The radar is intended ONLY as an aid to navigation.

The skipper must make final decisions based on all of the information sources to hand and must not rely solely on the radar.

⚠ WARNING

Only qualified personnel should install or service this equipment. Installation or servicing work that is done by non-qualified personnel can result in equipment breakdown, poor performance of the equipment, fire, electrical and physical hazards, injury or death.

Wear safety equipment such as a hard hat and a safety belt at all times when installing or working on the scanner.

The scanner is usually installed in an elevated position and serious injury or death can result if a person falls while installing or working on it. It may be necessary to construct a working platform, particularly for the installation.

The scanner is heavy and an open array may start rotating at any time. Install the radar system in a location that will minimize the possibility of anyone being struck or injured by it.

⚠ CAUTION

Install the scanner in an elevated position to minimize the radiation hazard to personnel.

⚠ CAUTION

Never look directly into the scanner at close range while the radar is operating.

Radar scanners emit electromagnetic energy at a frequency that can be harmful at close range. Always keep the recommended safe distance from the scanner as follows:

Scanner Model	Vertical beam angle of scanner (degrees)	Minimum safe distance (100 Watts per m² average power density) Note 1	Minimum safe distance (10 Watts per m² average power density) Note 2
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)	3 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 Northstar radar

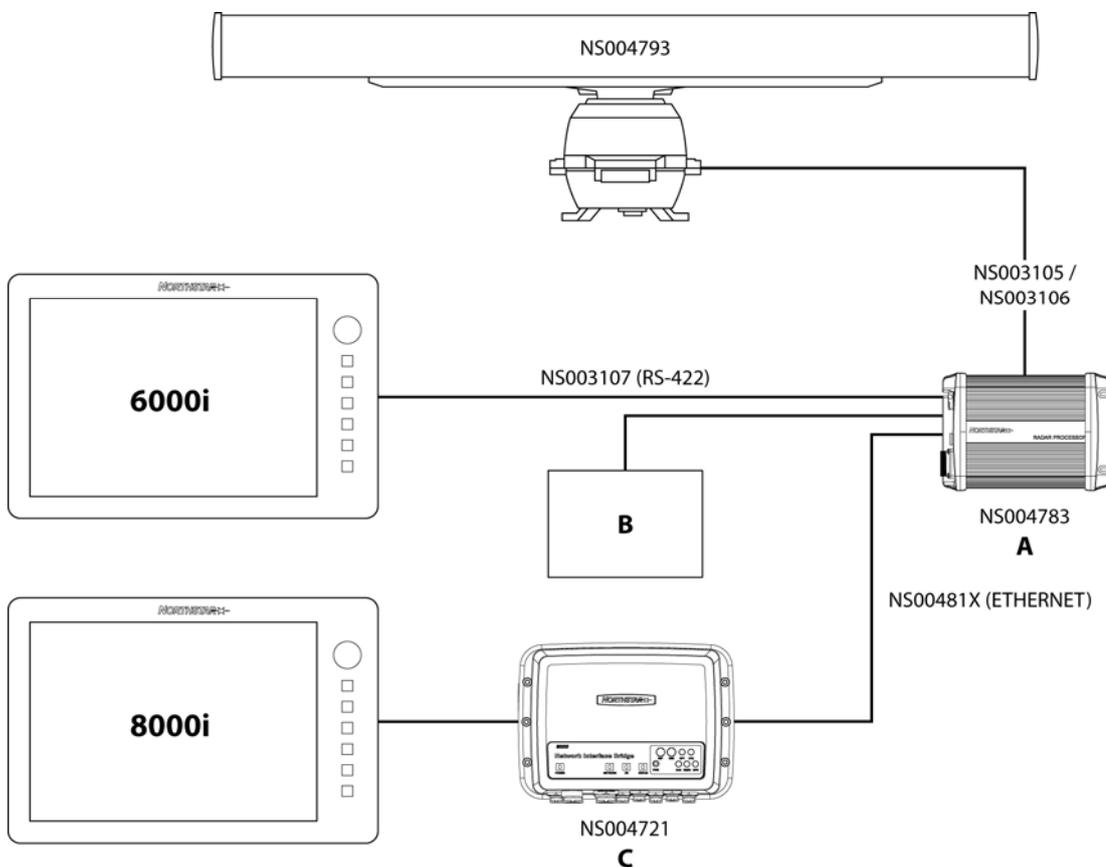
The Northstar radars are designed as an option available to the Northstar 6000i, 6100i, or 8000i systems.

A variety of scanner models are available (2 kW, 4 kW, 6 kW, 10 kW and 25 kW) to suit different customer requirements. Each scanner model has a corresponding radar processor model.

3.1 10 kW radar system overview

The radar system is intended for use in a marine environment.

The 10 kW radar system consists of a scanner and an open array, connected to the 10 kW radar processor by a prefabricated interconnection cable which is available in two lengths (NS003105 or NS003106).



where A is the radar processor, B is the vessel's power supply (24 V DC ONLY), and C is the Network Linker (NS004721).

The 10 kW interconnection cable contains separate motor power wires, and there is a separate motor power fuse in the radar processor.

If the radar processor is connected to a Northstar 6000i or 6100i, it communicates with the display unit through the 6000i and 6100i radar communications cable (NS003107). An optional extension cable (NS003108) is available.

If the radar processor is connected to a Northstar 8000i system, it communicates with the 8000i Network Linker (NS004721) through the 8000i network cable (NS00481X).

DC power for the scanner and radar processor is provided through a power cable that connects the radar processor to the vessel's DC power supply. The power cable is not supplied.

3.2 Check the 10 kW radar parts

The NS-RDR1106MO 10 kW radar system consists of a box containing the scanner, a box containing the open array, and a box containing the 10 kW radar processor.

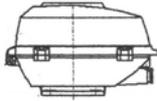
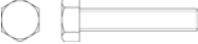
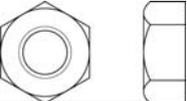
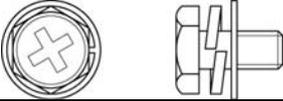
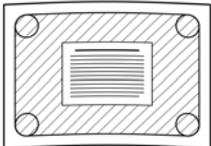
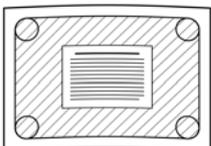
The interconnection cable is not supplied and must be ordered separately. It is available in two lengths; NS003105 is the 65.5 ft (20m) length, NS003106 is the 98.4 ft (30 m) length.

If you want to use an interconnection cable length other than the 65.5 ft (20 m) or 98.4 ft (30 m) options, please consult your Northstar dealer.

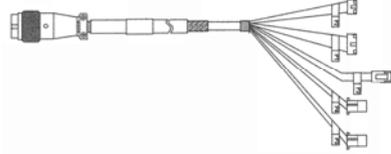
If you're connecting the radar to a Northstar 6000i or 6100i system, a 10 ft (3 m) radar communications cable (NS003107) is supplied with the 6000i or 6100i system. If this is not long enough, an optional 6 ft (1.8 m) extension cable (NS003108) can be added between the radar processor and the 6000i.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

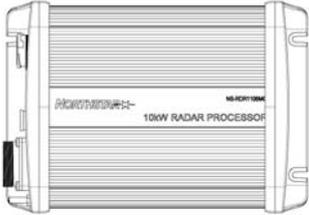
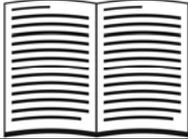
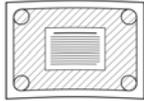
If you're connecting the radar to a Northstar 8000i system, you need the 8000i network cable (NS00481X) which is available in several lengths. This is not supplied as standard and must be ordered separately.

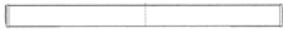
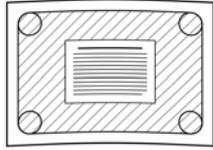
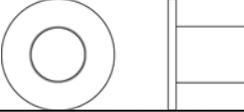
Unpack the boxes carefully and check the contents against the packing lists. If anything is missing, contact your distributor.

NS004793R 10 kW scanner components			
Quantity	Item	Part name	Part number
1		Scanner unit	NS004793
8		M10 Hexagonal bolts	Part of hardware kit HR000069
8		M10 Hexagonal Nuts	Part of hardware kit HR000069
4		M10 Spring washers	Part of hardware kit HR000069
4		M10 Plain washers	Part of hardware kit HR000069
1		Copper Earth plate	Part of hardware kit HR000069
4		Brass washers	Part of hardware kit HR000069
1		Earth bolt	Part of hardware kit HR000069
1		Installation template MTZ303532	LA000413A
1		Mounting template	LA000455A

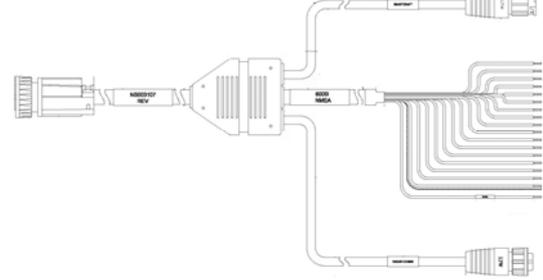
1		Packing list	LA000456A
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NS00310X interconnection cable - order separately			
Quantity	Item	Part name	Part number
1		Interconnection cable	NS003105 length 65.5 ft (20 m) OR NS003106 length 98.4 ft (30 m)

NS004783R 10 kW radar processor standard components			
Quantity	Item	Part name	Part no.
1		10 kW radar processor	NS004783
1		This manual	MN000358A
1		Installation template	LA000276A
1		Product Registration Card	CD000085A
1		Warranty	CD000260A
		Spare 7.5 A fuse (motor)	Part of Hardware kit HR000069
1		Spare 5 A fuse (scanner)	Part of Hardware kit HR000069
4		Mounting screw	HR000061

NS004793R 10 kW open array standard components			
Quantity	Item	Part name	Part number
1		10 kW open array	NS004793
1		Assembly instructions sheet	LA000277A
1		Packing list	LA000279A-G
4		Brass washers	WS000033A
4		Spring washers	WS000032A
4		Hexagonal bolts	SR000196A-G

NS00481X cable for 8000i installation only - order separately			
Quantity	Item	Part name	Part no.
1		Network cable for 8000i installation ONLY.	NS004810 length 1.6 ft (0.5 m) NS004811 length 6.5 ft (2 m) NS004812 length 16.4 ft (5 m) NS004813 length 32.8 ft (10 m)

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 6000i and 6100i installations ONLY.	NS003107

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

3.3 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 6000i or 6100i system or 8000i system to work with the radar
- adjusting the radar for proper performance.

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

NOTE: For the radar overlay to function properly on the chart screen, you must correctly install and calibrate a separate heading sensor. Without the heading sensor, you cannot overlay the chart. A 10 Hz heading output rate is required for best radar/chart overlay performance.

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.

3.3.1 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.

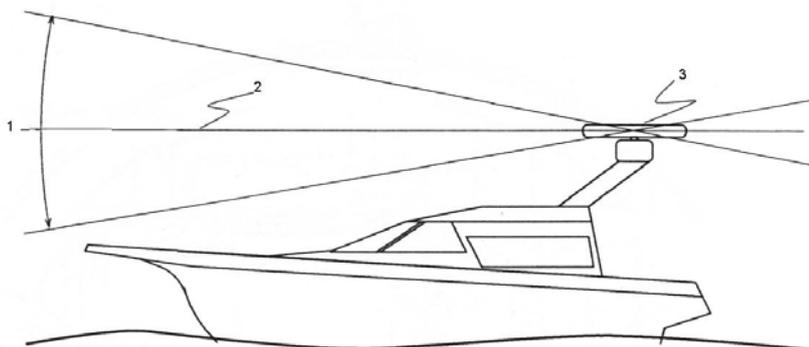
DON'T DO THIS!

- 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.

⚠ CAUTION	
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)

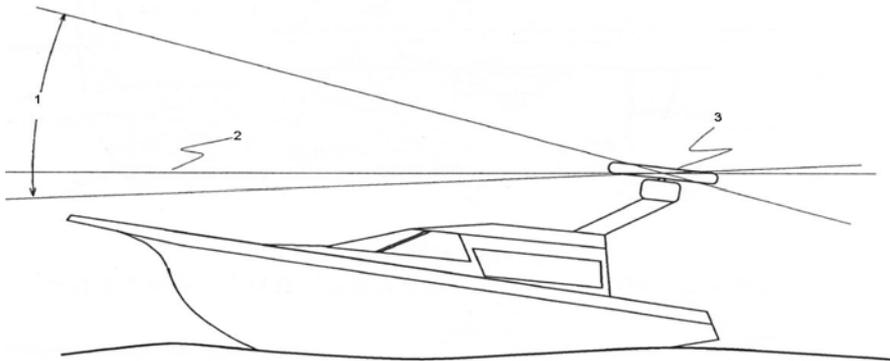
3.1.3.1 Power boat installations

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.

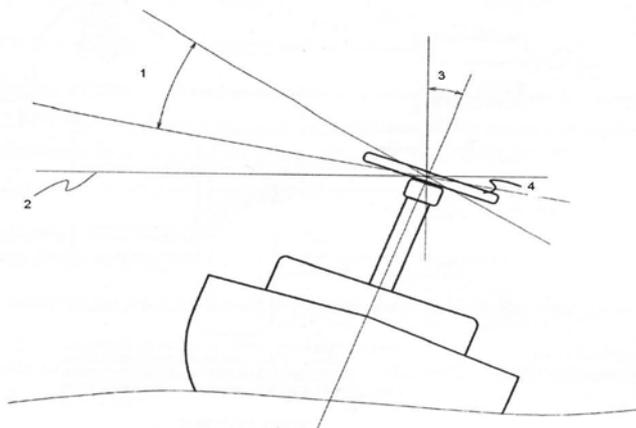


In this case, you're recommended to install the scanner so that is tilted down at the front, at an angle that will produce an almost horizontal sweep when the power boat is running at speed.

3.1.3.2 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.

3.3.2 How to find the optimum height for the scanner

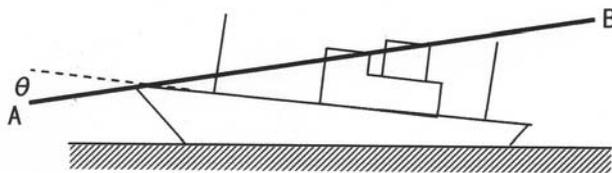
The optimum height for the scanner is as close as possible to the A-B line for best performance.

How to find the A-B Line:

The vertical extent of the radar beam is $2\theta^\circ$, 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	θ° 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:

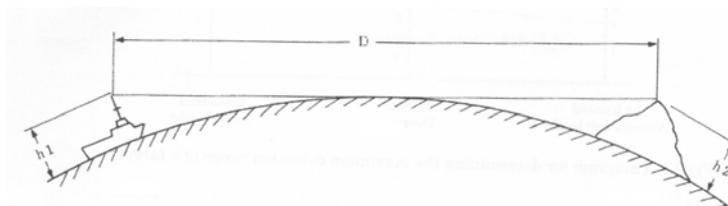
1. Using a drawing of the vessel, lay a rule along the line of the main deck and continue this forwards as a dashed line extending beyond the bow.
2. Using a protractor, measure the θ° value (for your scanner model) below the dashed line at the bow and draw in a new line along this angle.
3. Extend the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

3.3.3 How to find the 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:

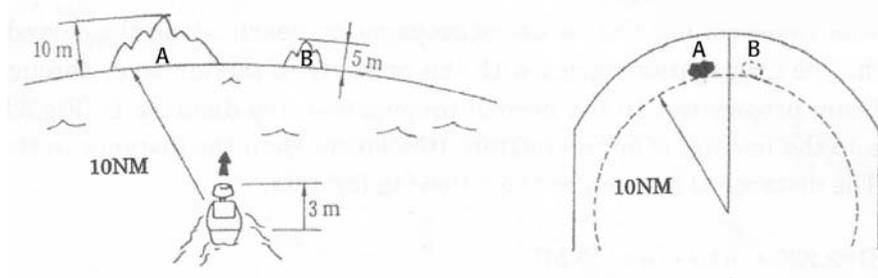
$$D = 2.23 (\sqrt{h_1} + \sqrt{h_2})$$



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 (h1). Island A is 33 ft (10 m) high (h2) and for comparison, Island B is 16.4 ft (5 m) high (h2). 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

3.3.4 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:

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

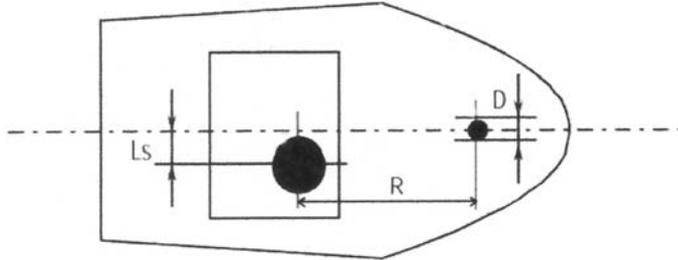
$$L_s = 0.025R + D/2 \text{ (When R is greater than or equal to 49 ft [15 m])}$$

where:

L_s = distance to be moved from the keel line

D = diameter of the obstacle

R = distance between the antenna and the obstacle

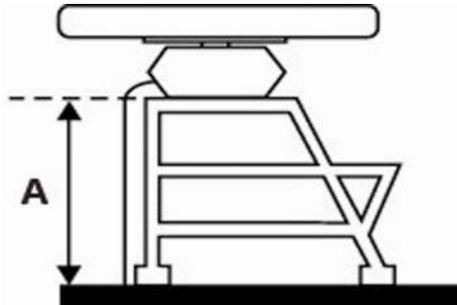


3.3.5 Install an open array scanner on a trestle

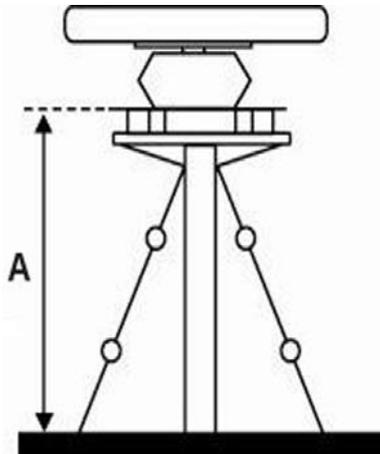
Depending on your chosen location for the scanner, it may be easier to install the scanner if you fabricate a trestle or radar mast on which you can mount the scanner.

In this case, the base of the trestle must be installed parallel to the water surface. Orient the trestle so that the main cabling from the scanner will face the stern. Make sure that the edges of the trestle won't trap water.

If the trestle height (A) is less than 2 m high, use the angle joint method as shown:



If the trestle height (A) is more than 2 m high, install a radar mast secured with guy wires as shown:



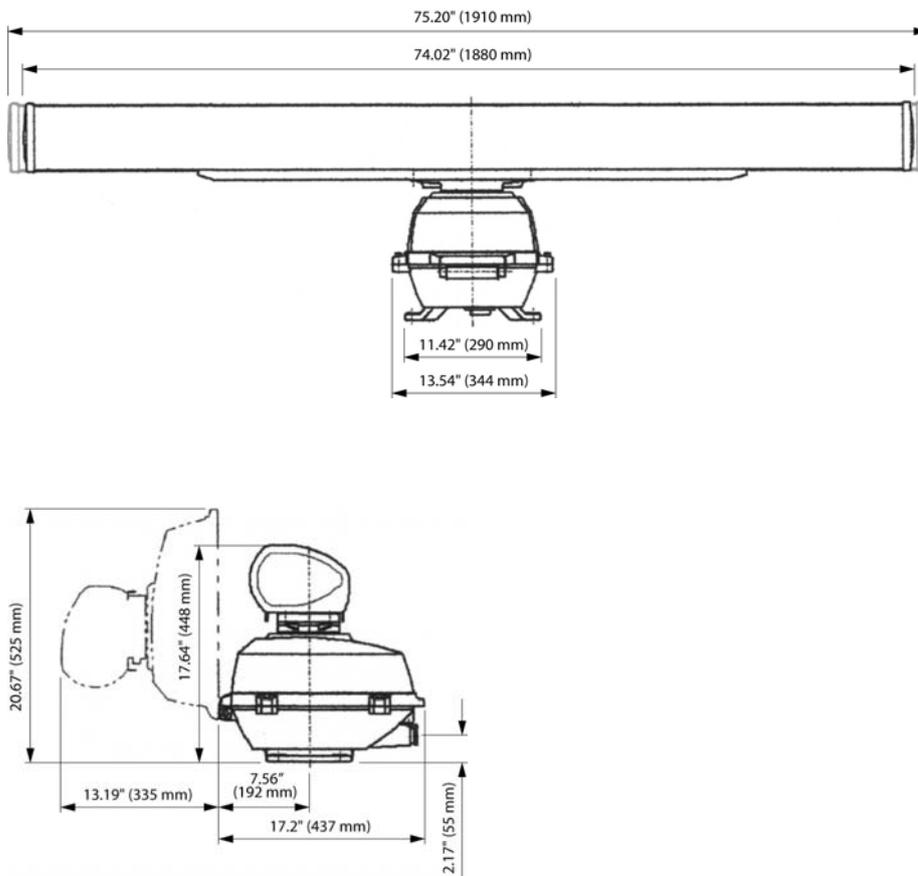
3.3.6 10 kW radar dimensions

The 10 kW scanner is an open array model with a rotation diameter of 75.2" (1910 mm). Ensure that the open array will be able to rotate freely and take this diameter into account when calculating the recommended distances from other equipment.

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

- cable inlet
- safety switch
- Earth bolt
- front and rear of the scanner

The overall radar dimensions are shown:



3.3.7 Install the 10 kW scanner unit

Tape the paper installation template securely to the chosen location site. Before drilling, check that:

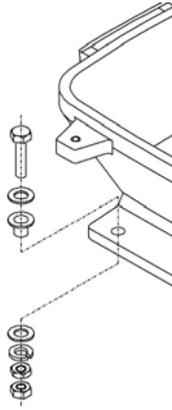
- the location site is not more than 0.6" (15 mm) thick, to ensure that you can use the bolts supplied.
- you've oriented the template correctly so that the front of the scanner unit faces the bow and the cable inlet faces the stern.

Drill the four bolt holes then remove the template and position the scanner over the bolt holes.

Slide a plain washer then a brass washer onto each bolt. Push the bolt down through the scanner bolt hole and the drill hole, working from the top side of the location site.

Slide a plain washer, a spring washer onto the bolt then screw two nuts onto the bolt to secure it.

Repeat this for procedure for each bolt, then tighten all the nuts so that the scanner is secure.



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

3.3.8 *When to install the open array*

IMPORTANT: Install the open array onto the scanner AFTER you have connected the interconnection cable to the scanner otherwise you'll have to remove the open array from the scanner, and then re-install it.

3.3.9 *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 6000i and 6100i radar communications cable or the 8000i 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.

3.3.10 Wire the radar system

CAUTION

Always install a separate circuit breaker or separate fuse for the radar system circuit.

3.10.3.1 Wiring guidelines

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

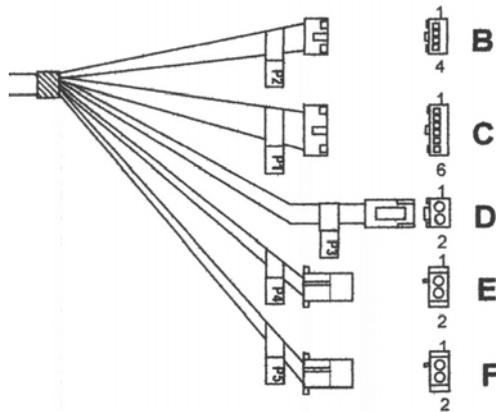
- DON'T make sharp bends in the cables.
- DON'T run cables in a way that allows water to flow down into the connectors.

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.

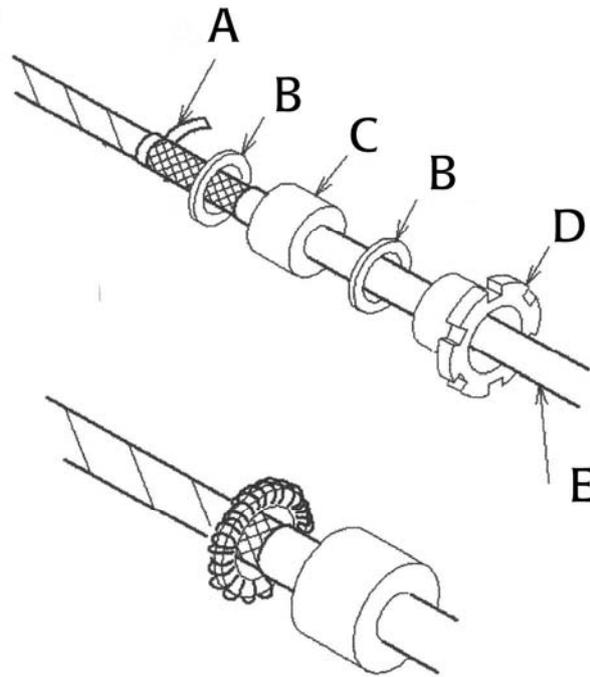
3.10.3.2 Connect the interconnection cable (NS003105/NS003106) to the 10 kW scanner

1. Unscrew and lift up the hinged cover of the scanner.

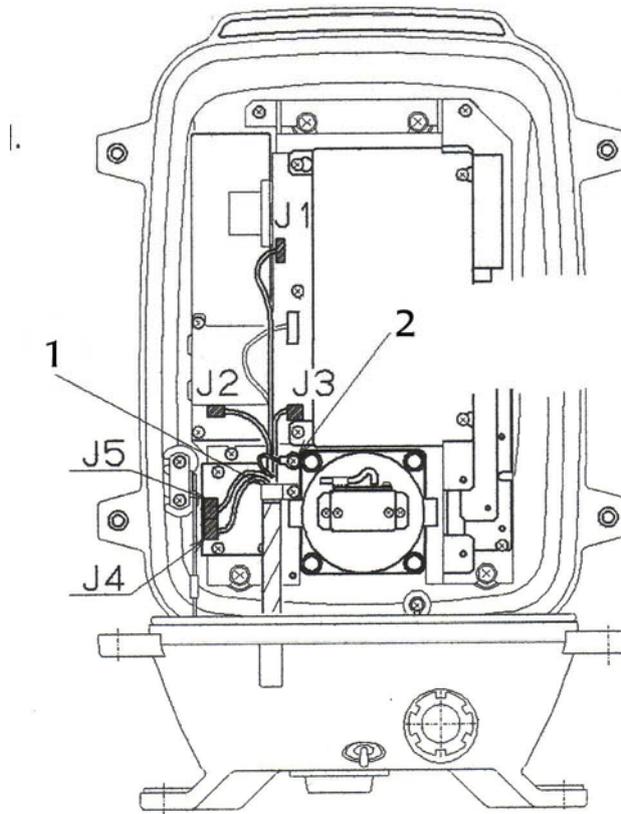


2. Identify the connectors B, C, D, E, and F at the end of the interconnection cable.
3. Push the cable gland (D), a plain washer (B), the gasket (C) and another plain washer (B) over the connector end of the interconnection cable (E) in the order shown. Push the interconnection cable through the cable inlet into the scanner.

4. Tear away the tape (A) then unravel the shield mesh and wrap this around the washer as shown.



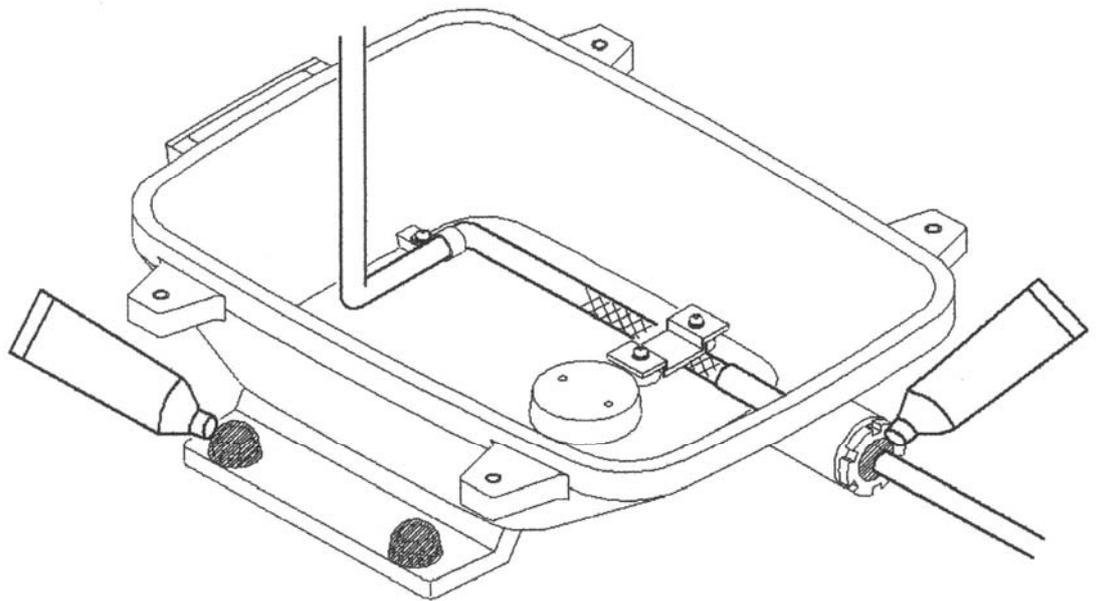
5. Check that the interconnection cable is positioned so that you can easily connect it to the J connectors on the inside of the scanner lid, as shown:



6. The interconnection cable must be clumped at the copper tape at location 1.
7. Connect the five interconnection cable connectors (B, C, D, E, and F) to the J connectors as follows:

Cable connector	J connector
B (P2)	J2
C (P1)	J1
D (P3)	J3
E (P4)	J4
F (P5)	J5

- Screw down the cable holders and clips to keep the interconnection cable in place inside the scanner, then spread silicon sealant around the bolts and the cable entry point.



- Close the lid and secure it with the screws.

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

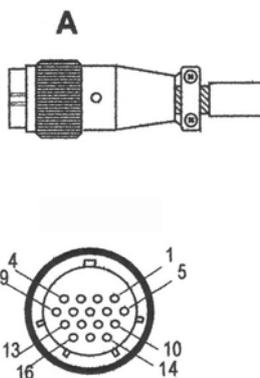
NS003105/NS003106 Interconnection cable - connector ends							
Pin	Color	AWG Size	B	C	D	E	F
1	Blue / Gray (big)	#16				1	
2	Purple / Brown (big)	#16					1
3	White / Orange (big)	#16				2	
4	Red / Green (big)	#16					2
5	Black / Sky (big)	#16			1		
6	Black	#22		6			
7	Drain wire (coax line)	#24	2				
8	No connection						
9	Yellow / Pink (big)	#16			2		
10	Axis line	#24	1				
11	Yellow (thin)	#24	3				
12	Green (thin)	#24		5			
13	White (thin)	#24	4				
14	Drain wire	#24		2			
15	Shield line	#24		1			
16	Orange (medium)	#22		3			
Shell	Braid shield						

3.10.3.3 Run the interconnection cable (NS003105/NS003106) to the radar processor

Run the interconnection cable (NS003105/NS003106) from the scanner unit to the radar processor.

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

The front view of the interconnection cable is shown:

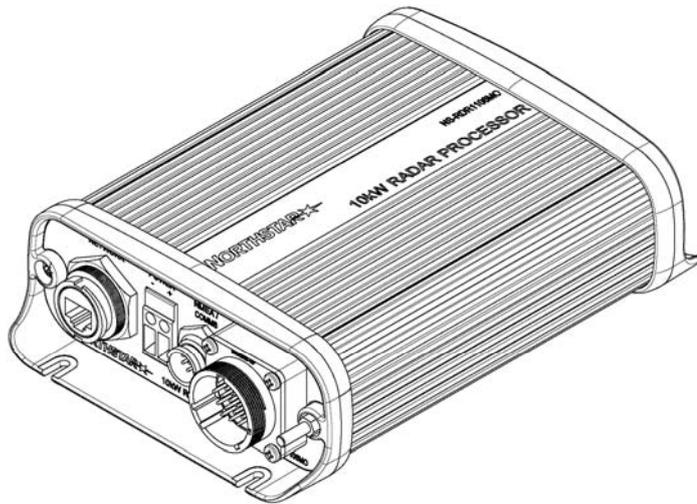


The interconnection cable pin details are provided here for information, in case the connector needs to be removed to feed the cable, or in case the cable needs to be shortened.

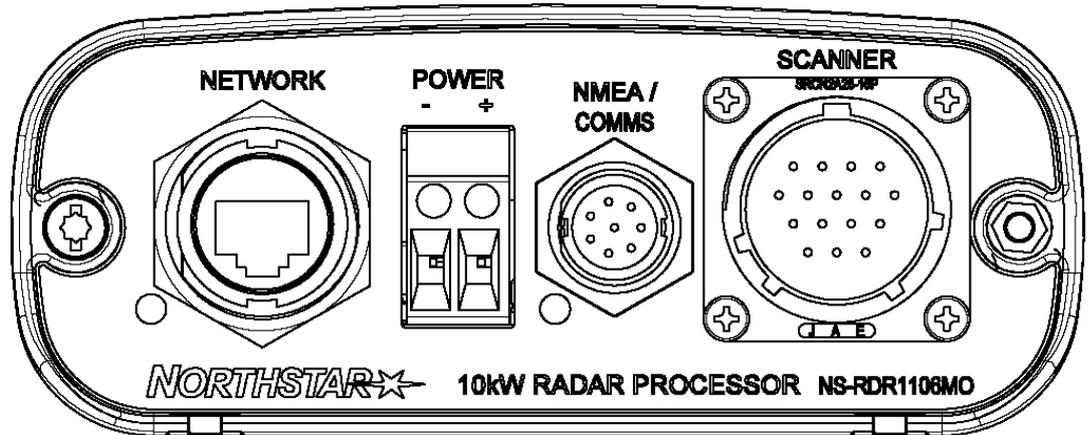
Pin	Color	AWG Size	Signal name
1	Blue / Gray (big)	#16	Motor Ground
2	Purple / Brown (big)	#16	Motor Ground
3	White / Orange (big)	#16	Motor Power
4	Red / Green (big)	#16	Motor Power
5	Black / Sky (big)	#16	Scanner Ground
6	Black	#22	Analog Ground
7	Drain wire (coax line)	#24	Video Ground
8	No connection		Not used
9	Yellow / Pink (big)	#16	Scanner Power
10	Axis line	#24	Video
11	Yellow (thin)	#24	RS-485 Comm+
12	Green (thin)	#24	Bearing Zero
13	White (thin)	#24	RS-485 Comm-
14	Drain wire	#24	Trigger Ground
15	Shield line	#24	Trigger
16	Orange (medium)	#22	Bearing Pulse
Shell	Braid shield		

3.10.3.4 10 kW radar processor connectors

There are four interface connectors on the rear of the 10kW radar processor, plus a Chassis Earth.



You can connect the radar processor to either the Northstar 6100i OR to the Northstar 8000i, but not to both simultaneously.



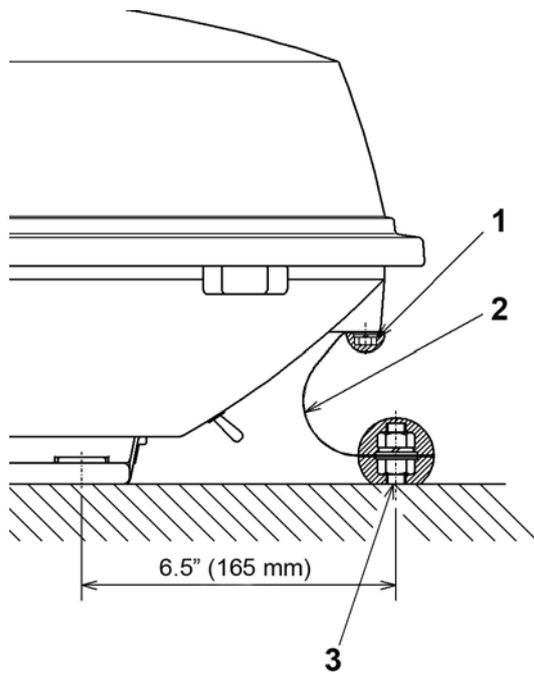
10 kW radar processor interface connectors		
Connector name	Connector function	Connects to...
Network	Ethernet communications for the 8000i	8000i network, using the 8000i network cable (NS00481X)
Power (+Ve and -Ve)	Power input	Ship's power 24 V DC ONLY (using the power cable)
NMEA / Comms	Data communications (for the 6000i and 6100i systems only) Remote power control, relay and ignition (for the 6000i, 6100i, and 8000i) NMEA communications for compass (for the 8000i only).	6000i or 6100i display unit, using radar communications cable (NS003107/NS003108) 6000i, 6100i, or 8000i remote power signals, relay or ignition; cable not supplied 8000i NMEA compliant compass; cable not supplied
Scanner	Scanner communications	Scanner, using the interconnection cable (NS003105 or NS003106)
Chassis Earth	Grounding point	Vessel's Ground using ground wire

3.10.3.5 Earth the 10 kW scanner

The Earth bolt **MUST** be connected to the vessel's ground system.

Connect one end of the copper Earth plate (2) to the bolt (1) on the scanner. Connect the other end of the Earth plate to the mounting location using the Earth bolt (3).

Apply silicon sealant around both of the bolts.



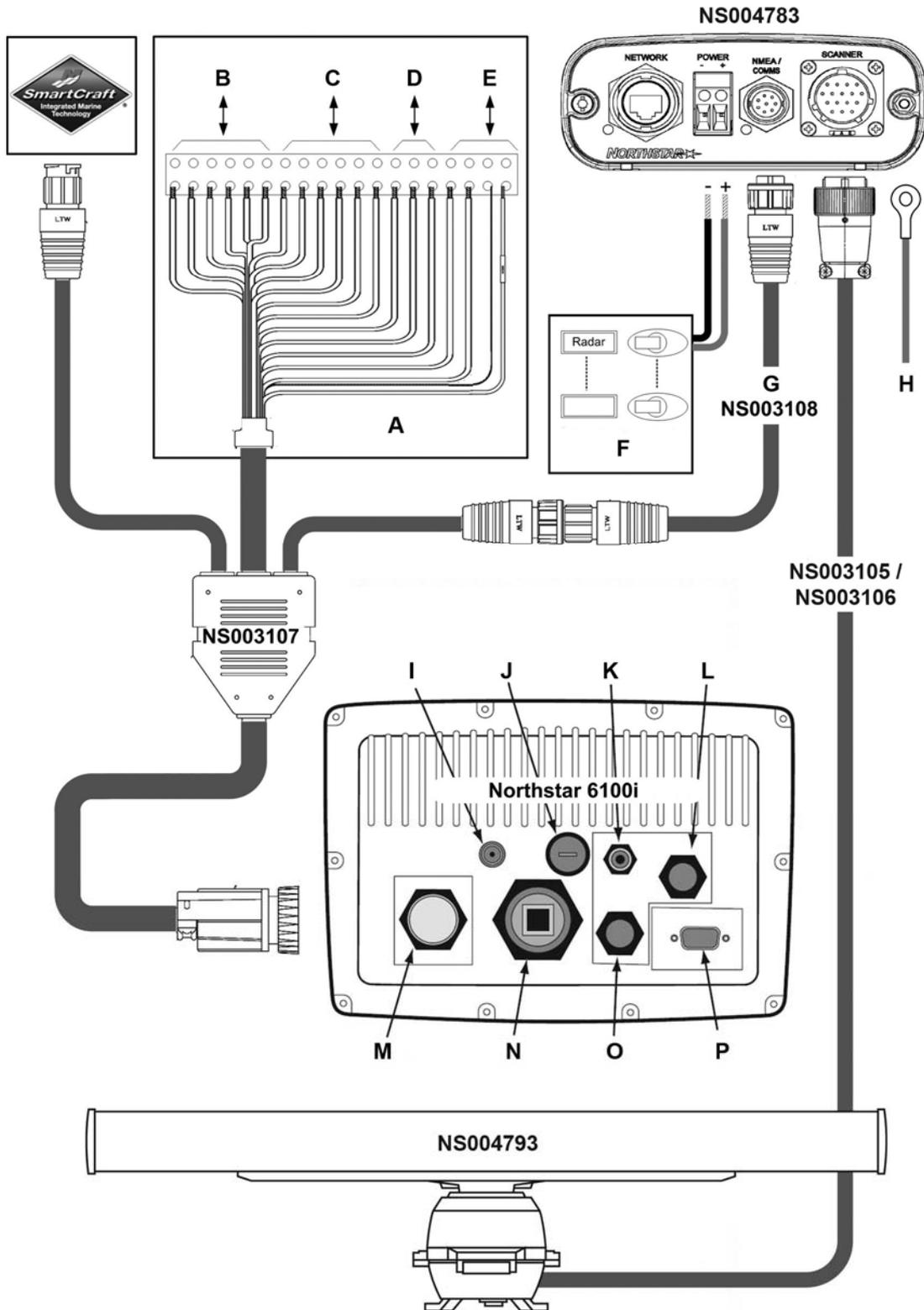
3.10.3.6 Install the 10kW open array

IMPORTANT: Install the open array onto the scanner **ONLY** after you've connected the 10 kW interconnection cable.

Use the assembly sheet provided, and check that you've got all the components shown. Follow the instructions on the assembly sheet to install the open array.

3.10.3.7 Connect the 10 kW radar processor to a 6000i or 6100i display

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



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)

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

The free ends of the radar communications cable (NS003107) must be terminated in a junction box (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/stripe; for example, White/Orange refers to a white colored wire with an orange stripe.

CAUTION

If the radar processor is connected through the 12-pin NMEA/Comms connector on the radar communications cable (NS003107), then all of the NMEA 2 free end signals and grounds must be NO CONNECT in the junction box.

If a SmartCraft device is connected through the 8 pin SmartCraft connector on the radar communications cable (NS003107), then all the RS-232 free end signals and grounds should be NO CONNECT in the junction box.

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

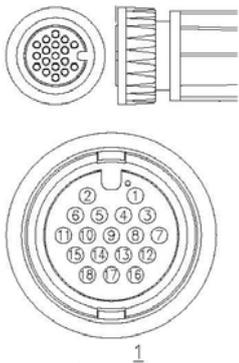
The remote power signal configuration is explained in "Configure the remote power control for a 6000i or 6100i (common power source)" and "Configure the remote power control for a 6000i or 6100i (different power sources)".

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

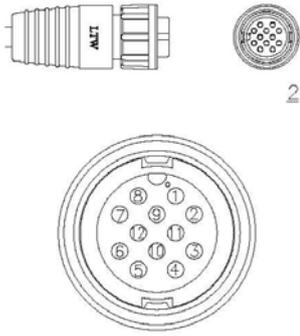
* See cautions on previous page.

The end view of the three connectors is shown:

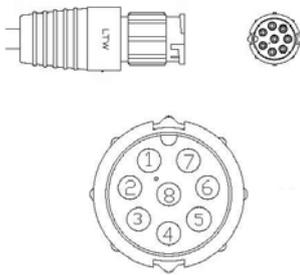
Connector 1 - 6100i NMEA pin assignments



Connector 2 - Radar NMEA/Communications pin assignments



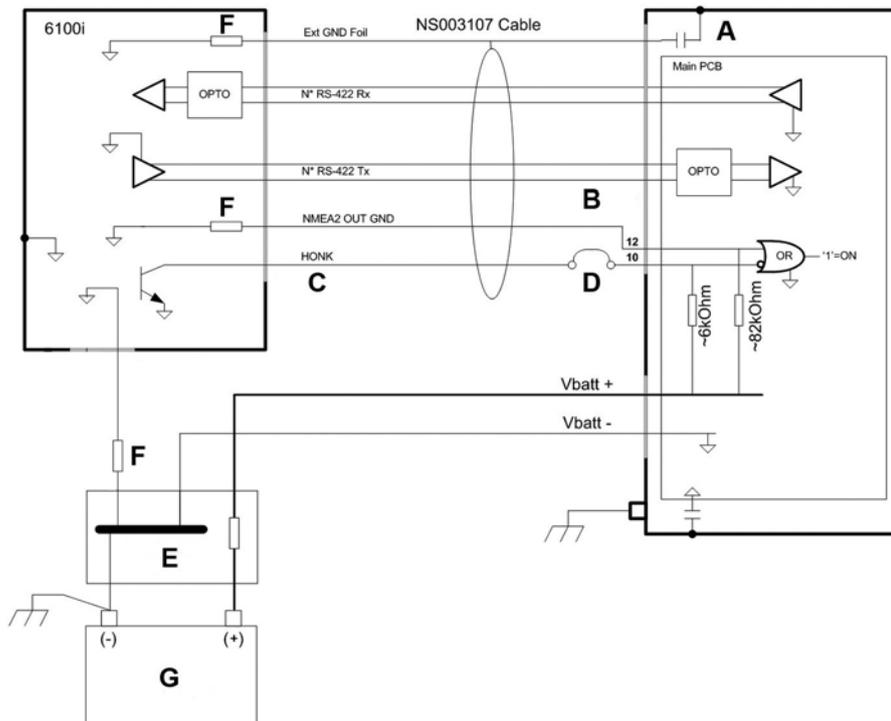
Connector 3 - SmartCraft pin assignments



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

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.

A simplified diagram of the power control circuit for the radar processor and 6000i or 6100i is shown:



where:

Key	Component
A	Radar processor
B	NMEA/Comms port
C	NMEA port
D	Link in the junction box
E	Fuse/Breaker board
F	Fuse
G	Battery

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.

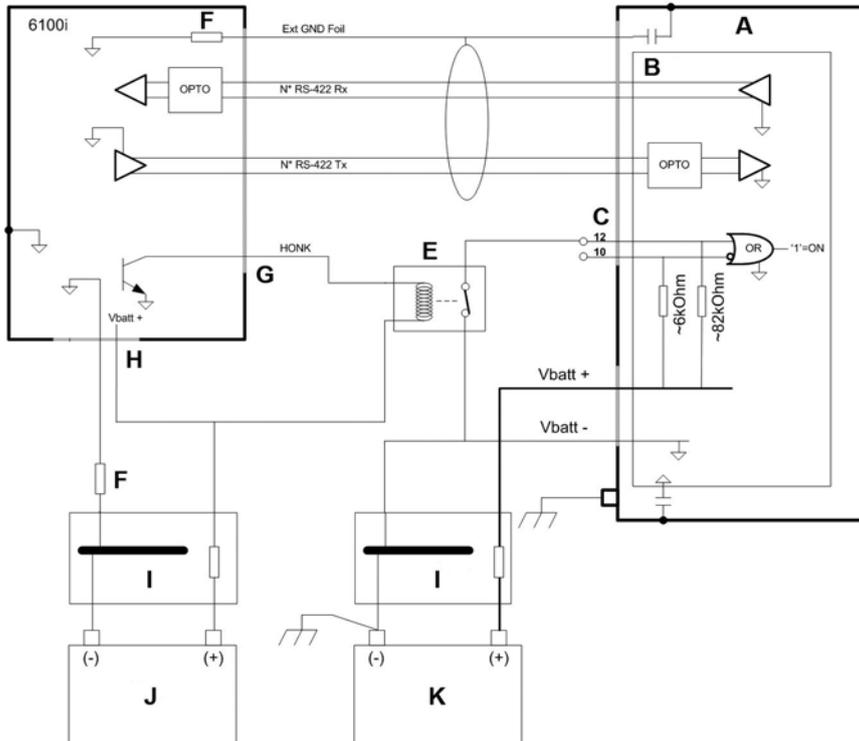
There is a choice of two different modes for powering the radar ON/OFF:

- 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.
- 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.

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:



where:

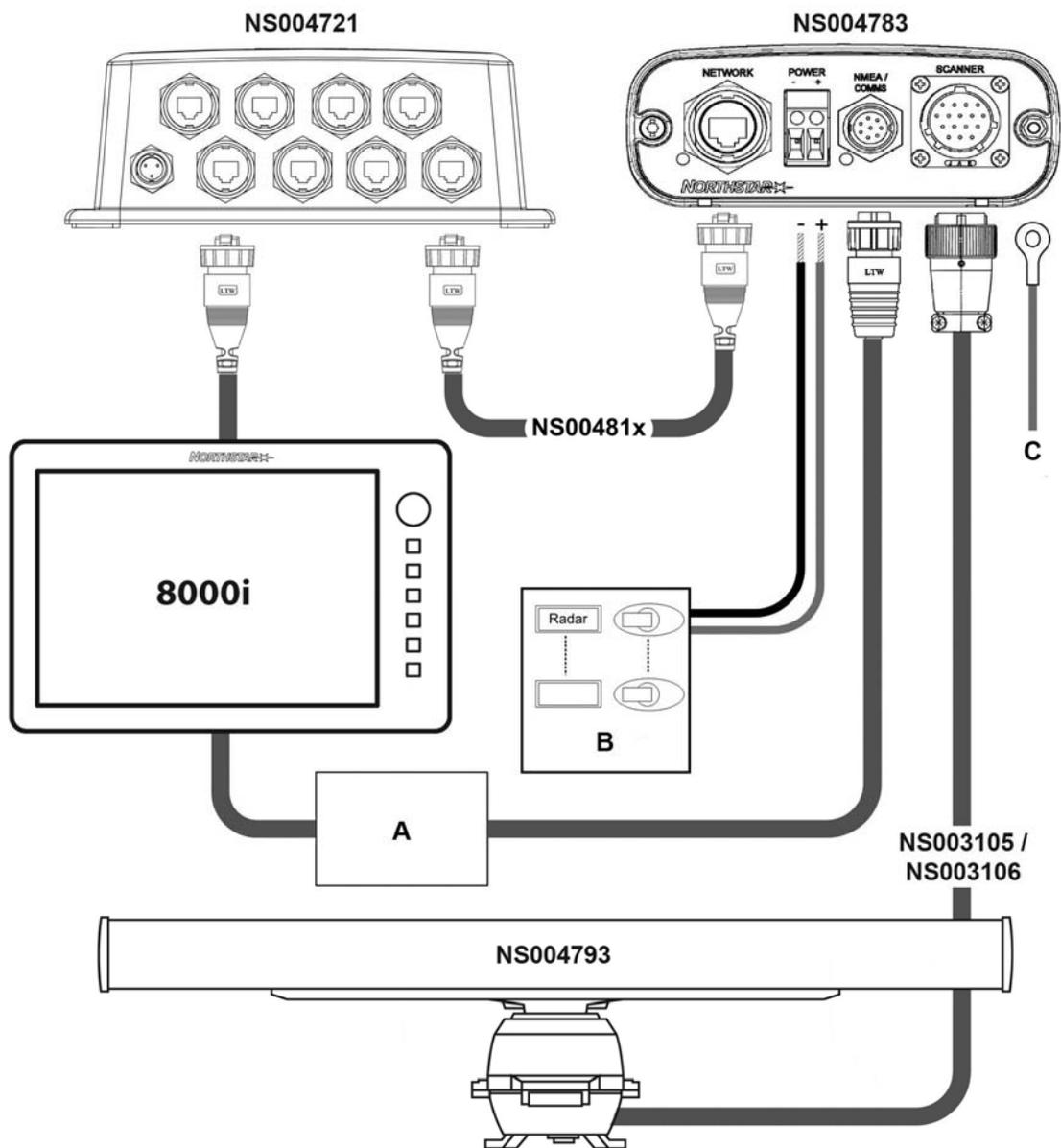
Key	Component
A	Radar processor
B	Main PCB
C	NMEA/Comms port
E	Relay with (normally) closed contact
F	Fuse
G	NMEA port
H	Power port
I	Fuse /Breaker board
J and K	Battery

- 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.

3.10.3.8 Connect the 10 kW radar processor to an 8000i display

You are recommended to use the following configuration when connecting the radar processor to an 8000i display, where A is the (optional) NMEA Compass, B is the Circuit breaker/Fuse box, and C is the vessel's Ground.

Alternative 8000i system configurations are possible. For further information please refer to the Northstar 8000i System Installation documentation.



Configure the remote power control for an 8000i

NOTE: At the time of printing this manual, the 8000i does not support remote power control of network modules. This feature will be added in future release.

The radar processor supports this feature through Pin 12 on the NMEA/Comms port.

If you want the radar processor to power ON automatically whenever power is applied, leave Pin 10 and Pin 12 of the NMEA/Comms connector as No Connect.

Alternatively, if you want the radar to be powered ON only when vessel's engines are running, Pin 12 (active high) must be driven by the vessel's ignition key.

Connect an 8000i network cable (NS00481X)

Connect the 8000i network cable (NS00481X) ONLY if you're connecting the radar system to a Northstar 8000i system.

Push one end of the 8000i network cable into the NETWORK connector on the radar processor. Plug the other end into the network connector on the network linker.

If the NMEA/COMMS connector on the radar processor is not used, leave the sealing cap in place.

Connect the optional NMEA compass for an 8000i

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 display 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.

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 the 8000i network. To achieve this, the NMEA compass data must be fed to other devices on the 8000i network using the spare data channels from the compass (if available) or the NMEA data splitter. See the "Northstar 8000i System Setup Manual" for more information.

3.3.10.8.1.1 Configure the optional NMEA compass

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 HTG 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.)

3.10.3.9 Connect the power cable

The power cable to the radar processor is NOT supplied for either the 6000i or 6100i system or the 8000i system. 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	5 A	33 ft (10 m)	14 AWG
4 kW	10 A	26 ft (8 m)	14 AWG
6 kW	10 A	26 ft (8 m)	14 AWG
10 kW	15 A	26 ft (8 m)	12 AWG
25 kW	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.

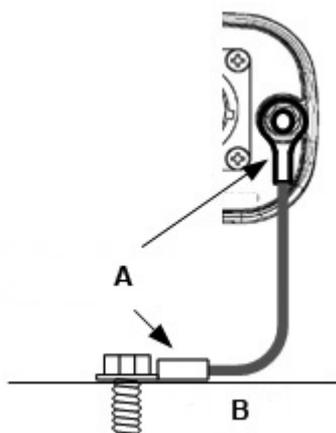
To connect the power cable to the radar processor, you must:

1. 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.
2. Unscrew the small holding screw from the positive power cable input connector (identified by the + sign) on the radar processor.
3. Insert the bare ends of the positive wire into the positive power cable input connector to make a connection.
4. Tighten the small holding screw to hold the positive wire in place. Gently pull on the positive wire to ensure that it is secured.
5. Repeat this process to connect the negative wire to the negative power cable input connector (identified by the – sign).

3.10.3.10 *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.

3.10.3.11 *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 set up the radar with the Northstar system that you're using.

3.3.11 Set up the radar with the Northstar 8000i system

Setting up the radar with the Northstar 8000i is described in the Northstar 8000i System installation documentation for your display processor.

4 Set up the radar with the Northstar 6000i or 6100i

4.1.1.1 Turn the radar on and off

4.1.2 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. The radar countdown timer will appear – typically 90 seconds on lower powered radars – then the radar will automatically start transmitting.

4.1.3 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 "Configuring 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, then turn ON the radar. (The power switch is located on the scanner unit.)

Turn ON the radar processor by installing the fuse or turning ON the circuit breaker to the radar system

Turn ON the navigator (display) unit. The power switch is on the front panel.

4.1.4 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.

4.4.1.1 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 heading 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:

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

4.4.1.2 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 Northstar HS02 or HS03 Heading Sensor) 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" or, for an 8100i system installation, see "Northstar 8000i System Setup Manual").

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:

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

4.4.1.3 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.

Prepare for calibration

Prepare for calibration as follows:

1. Press **RADAR** to display the radar screen on the 6000i or 6100i.
2. 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.
3. Press **Page 2, Page 3, Page 4**, then **Restore...**
4. Press **Restore factory settings**. (A new Northstar 6000i or 6100i is shipped with standard factory settings that are appropriate for basic operation.)
5. Press **Return**.

Tune the radar

The Northstar radar uses a fully automatic tuning procedure that continuously checks for optimum adjustment during operation. Northstar 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 Northstar 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:

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

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:

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

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.

4.4.1.4 Method 1

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

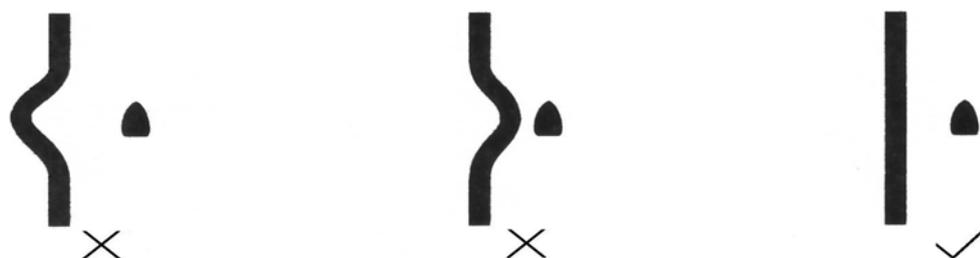
1. Display the main radar screen then press **Page 2**.
2. Press zoom **IN** several items to zoom in to the maximum magnification.
3. If necessary, press **Mode** to make it read **Manual**.

4. Press **Rain Clutter**, then press **0** twice to set the rain clutter value to zero.
5. Press **Sea Clutter**, then press **0** three times to set the sea clutter value to zero.
6. 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.)
7. Press **Page 3, Page 4, and Install... .**
8. Press **Trigger Delay**, then press **000** on the keypad to set the trigger delay to zero.
9. 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.

4.4.1.5 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.

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



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.

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

1. 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.
2. Press **CHART** to display the chart then press **Overlay** to show the radar echoes overlain on the chart.
3. Set the chart rotation to North-Up by pressing **Rotate** several times until **North-Up** is displayed.
4. 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.
5. Zoom in as necessary to place identifiable objects near the outer edge of the screen.
6. Press **Control** so that it displays **Radar**.
7. Press **Page 2, Page 3, Page 4, and Install... .**
8. 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.

9. If possible, check targets in all quadrants to ensure accurate adjustment.

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.

1. Press **RADAR** so that the navigator displays radar only.
2. 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.
3. Zoom in as necessary to place the reference target near the outer edge of the screen.
4. Press **Page 1, Page 2**
5. Check that the chart rotation (**Rotate** button) is set to Hdg Up.
6. Press **Page 2, Page 3, Page 4** and **Install...**
7. 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).

4.4.1.6 *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 Northstar 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.

4.4.1.7 *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:

1. From the main radar page, press **Page 1**.
2. Press **Restore...**
3. 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.

Restore the factory appearance settings

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

1. From the main radar page, press **Page 1**.
2. Press **Restore...**
3. 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.

4.1.5 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.

4.5.1.1 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.

4.5.1.2 Scanner maintenance

CAUTION

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.

4.5.1.3 Other maintenance items

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

4.1.6 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.

4.6.1.1 Technical support, service and repairs

Northstar products are manufactured and serviced by BNT Marine Electronics.

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 Northstar distributor or
- see the inside back cover of the manual or
- visit www.northstarnav.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.

4.6.1.2 Radar is not operating correctly

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

- replace the receiver unit. (see the Service Manual)

If the display shows only noise:

- check that the tuning is adjusted correctly.
- check the magnetron and replace if necessary (see the Service Manual)
- check the modulator circuit and replace if necessary (see the Service Manual)
- check the receiver circuit and replace if necessary (see the Service Manual)
- 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 that the tuning is adjusted correctly
- check the magnetron and replace if necessary (see the Service Manual)
- check the modulator circuit and replace if necessary (see the Service Manual)
- check the receiver circuit and replace if necessary (see the Service Manual)
- 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.

4.6.1.3 *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. If there is no external obstruction, check that the remote power connections or relay in the junction box are sound.
3. Check the motor fuse in the radar processor box.
4. Open the scanner dome or array and perform an internal inspection.
5. Check to make sure that nothing is interfering with the motor and gears, is binding, or preventing the antenna from turning.
6. Check for any disconnected, pinched or broken wires.
7. Check for worn or broken motor brushes.
8. 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.
9. Check the motor and the safety switch and replace any faulty component. (See the Service Manual for information on replacing the motor or safety switch.)
10. Check the wiring of the interconnection cable between the scanner and the radar processor.
11. Checking these connections is especially important if the installer removed the connectors for easy routing when installing the scanner cable.

4.6.1.4 *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.

4.6.1.5 *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.

4.6.1.6 *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.

4.6.1.7 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's a dome, with the power off, remove the dome cover (weather permitting). Apply power to the system. After the warn-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 as shown in the section "Connect the communications cable to the junction box".

5 **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, Northstar 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:

1. From the main radar page, press **Page 1**.
2. Press **Restore... .**
3. 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).
4. 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:

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

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

1. Press zoom **IN** 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").
2. From the main radar page, press **Page 2, Page 3, Page 4, and Install... .**
3. Press **Tune...** to display the tuning screen.
4. Press **Tune Mode** (repeatedly if necessary) to set it to **Manual**.
5. Set the rough tune value to 128 (if necessary) by selecting **Tune Preset** and typing **128** on the keypad.
6. Press **Tune**.
7. 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.
8. 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.

5.1.1 10 kW radar system specifications

	10 kW scanner
Scanner type	Open array

<p>AMERICAS 30 Sudbury Road, Acton, MA 01720, USA Ph: +1 978.897.6600 Ph: +1 800.628.4487 Fax: +1 978.897.7241 sales@bntmarine.com</p>	<p>ASIA / PACIFIC PO Box 68 155, Newton, Auckland Auckland, NEW ZEALAND Ph: +64 9 481 0509 Fax: +64 9 481 0590 northstarnz@northstarnav.com</p>
<p>AUSTRALIA PO Box 479, Gladesville, NSW 2111, AUSTRALIA Ph: +61 2 9879 9060 Fax: +61 2 9879 9009 northstaraus@northstarnav.com</p>	<p>EUROPE Unit 2 Ocean Quay, Belvidere Rd, Southampton, SO14 5QY, ENGLAND Ph: +44 2380 339922 Fax: +44 2380 330345 northstaruk@northstarnav.com</p>

www.northstarnav.com

DC input	10.8 to 36 V (DC 12/24 system)
Scanner dimensions	1.5 ft (448(H) mm) x rotation circle 6.25 ft (1910 mm)
Scanner weight	77.2 lb (35 kg) ± 10%
Vibration	Amplitude 2 x 13.2 Hz, ± 1 mm ± 10% Amplitude 13.2 to 100 Hz, gravity acceleration 0.7m/sec ²
Waterproof	IPX6
Plane of polarization	Horizontal
Preheating time	Minimum 90 seconds

Power consumption	250 W (maximum) at maximum wind velocity
DC input	21.6 V to 41.6 V (24 V DC systems ONLY)
Emission type	P0N. Passed JRC FCC/IC/R&TTE Type Certification: FCC ID: CKENKE2102 IC ID: 768C-NKE2102 R&TTE: QQ-RTTE-17/03-01R
Peak power output	10 kW \pm 50% under any pulse condition
Transmitter frequency	9410 \pm 30 MHz
Transmitter tube	Magnetron NJRC Model MSF1425B
Horizontal beam width	1.2° \pm 10% (-3 dB width)
Vertical beam width	20° \pm 20% (-3 dB width)
Side lobe level	Below -26 dB maximum (within \pm 10°) Below -30 dB maximum (outside \pm 10°)
Rotation rate	27 rpm (minimum 20 rpm at 100 knot wind maximum)
Pulse length/PRF	0.08 μ s \pm 30% 2250 Hz \pm 5% 0.25 μ s \pm 25% 1700 Hz \pm 5% 0.50 μ s \pm 25% 1200 Hz \pm 5% 1.0 μ s \pm 25% 650 Hz \pm 5%
Duplexer	Circulator H-6AJRD00001 FCX-68 and Diode limiter NJS6930
Mixer	MIC front-end - Model NJT1969
IF amplifier	Center frequency 60 MHz \pm 3 MHz
IF bandwidth	20 MHz \pm 3 MHz (0.08 μ s) 6 MHz \pm 2MHz (0.25 μ s, 0.5 μ s) 3 MHz \pm 1MHz (1.0 μ s)
IF characteristic	Log
IF output	-2 V for 100 dB typical Bandwidth controlled by serial port
Com port	RS485 9600 bps Half Duplex Defined in NKE-2102 Digital COM specification
Gain	Minimum 90 dB
Noise figure	NJT1969 @ 6 dB (average) at front-end input
Temperature range	-13°F to + 131°F (-25°C to +55°C)
Relative humidity	93% at + 104°F (40°C)
Relative wind velocity	51.5 m/sec (100 knots)
Sector blank	N/A

	10 kW Radar processor
Radar system	NS-RDR1106MO
Processor model	NS004783
Processor dimensions	Width 5.6" (142 mm) Height 2.2" (56 mm) 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
Power consumption	3 W (when operating) Leakage current <200 μ A (when off, with a remote power input)

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NORTHSTAR 

Northstar 10 kW Radar

Installation Manual

