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Leader in Marine Electronics

Installation Manual

Navico Broadband Radar BR-24

English Preliminary

Navico Radar Broadband Installation manual English, Doc.no. Preliniary

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1 Preface

FCC Statement

Note: This equipment has been tested and complies 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.

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.

CE Compliance

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

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.

Warranty

The Navico warranty card is supplied as a separate document.

It is shipped with the product registration card.

In case of any queries, refer to Navico.com.

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: tech.writing@navico.com

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2 Introduction to the Navico Broadband radar system

What is Broadband radar?

The Navico Broad band radar uses FMCW (Frequency Modulated Continuous Wave) radar technology

What is FMCW?

The current normal leisure radar generates microwave pulses with a thermionic device called a magnetron. This ancient technology sends out bursts of high power microwave energy periodically, and the radar detector listens to the echoes coming back from each pulse. As the radar rotates these echoes are built into a 360 degree image.

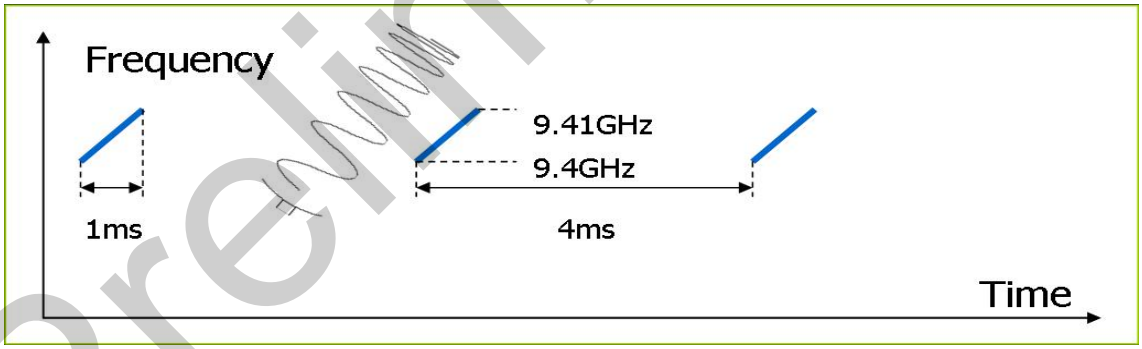
FMCW radar is different:

Firstly it is solid state – i.e. the transmitter is a semiconductor device, not based on thermoinic valve technology.

Secondly it transmits continuously, not in pulses and thirdly it measures the time of the echo not by listening to a received pulse but by varying the frequency of the transmitted signal and detecting the shift in frequency in the received echo. Hence FMCW – Frequency Modulated Continuous Wave.

The building up of the image over 360 degrees and the processing of the radar data is the same as for a magnetron radar.

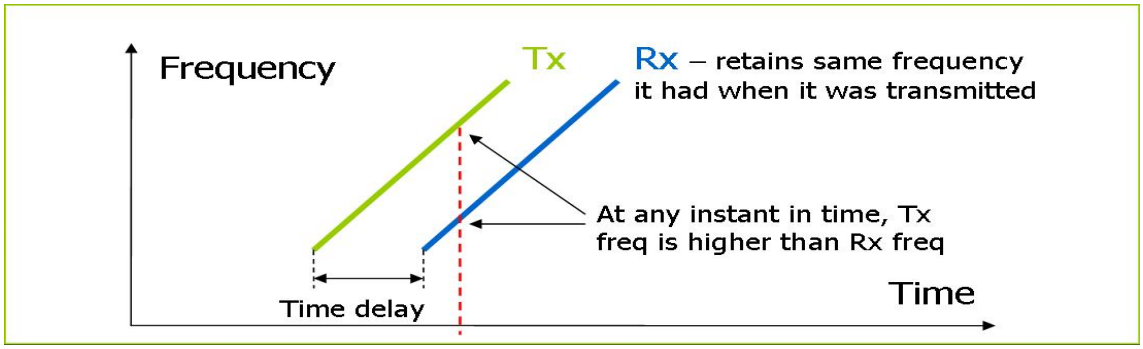
How does FMCW radar work?



FMCW = Frequency Modulated Continuous Wave

The scanner transmits a 'rising tone' (Tx wave) with linear increasing frequency. The wave propagates out from the transmitter retaining the frequency it had when it was transmitted. If it reflects off an object, it will return to the receiver, still at the frequency it had when originally transmitted.

Meanwhile the transmitter continues to output an increasing frequency



The difference in the currently transmitted and currently received frequencies, coupled with the known rate of frequency increase, allows a time of flight to be calculated, from which distance is calculated

Benefits of FMCW radar

Safer

- low energy emissions, similar to a cell phone
- more flexibility in placement on boat
- can run in anchorages and marinas

Short range performance

- Conventional radars can not see anything closer than 30 meters
- FMCW can see within a few meters of the boat
- See the objects that pose the greatest threat to your boat

Low power

- expands market to small boats and yachts
- easier install, lighter cabling
- great for yachts on ocean passage

Instant power-up

- Conventional radars take 2-3 minutes to heat up the filament: Safety – 2 minutes is a long time if you are concerned about collision
- Convenience – switch it on and use it

Radar system overview

The Navico Broadband radar is a state of the art navigation aid providing outstanding radar performance with out the limitations of conventional pulse radars such as dangerous high power microwaves, Standby warm up time, high power consumption and large open arrays which is what would be required to obtain the same image quality at shorter ranges . The Navico Broadband radar as an effective range from 1/16 to 24 nm. and has an operating power consumption of 17 W.

The system consists of radar scanner, an interface box and a interconnection cable. The scanner is housed in a dome on is of similar size to most 2 kW radars on the market.

The interface box is used to connect displays and heading information. There are two models (RI-10 and RI-11) depending on the display system used the main difference being one has a SimNet connector for heading input (RI-10). The other interface box (RI-11) has a connector to interface to RS422 displays and NMEA 0183 heading sensors. both interface boxes have a Network connector to interface to Ethernet displays.

Note Lowrance HDS units sold in the USA do not require an interface box and the scanner connects directly to the display or ethernet switch

Brand	Model	Radar interface box used	Radar connection kit	Data connection protocol	Chart overlay	MARPA
Lowrance	HDS USA	N/A		Ethernet	Yes*	Yes**
Lowrance	HDS R.O.W	RI-11		Ethernet	Yes*	Yes**
Simrad	GB40	RI-10		Ethernet	Yes*	Yes**
Northstar	8000i	RI-11		Ethernet	Yes*	Yes**
Northstar	8000i + N2k	RI-10		Ethernet	Yes*	YES**
Northstar	M series	RI-11		RS422	Yes*	No
Simrad	NX 40/45	RI-11		RS422	Yes*	No

**For best chart overlay performance use a heading sensor. Course over ground can be used but only when moving*

*** For MARPA it is essential to use a heading sensor with an out put speed of 10 hZ or faster*

Warnings

3 Install the radar

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

Check the parts

NEED A BREAK DOWN OF KITS AND UNDER LYING PARTS

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 are no obstacles.

A higher installation position increases the radar ranging distance, but it also increases the minimum range around the vessel where targets cannot be detected.

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 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 the 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!

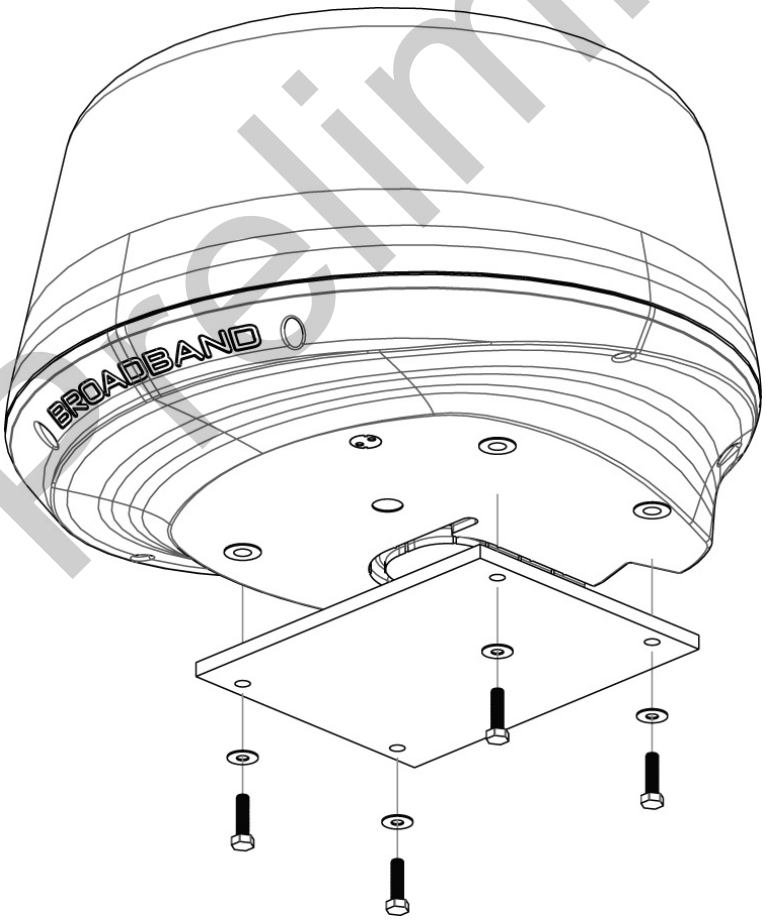
- DON'T install the scanner too high up, where its weight will alter the stability of the vessel and cause degradation of the radar picture over short ranges.
- DON'T install the scanner close to lamps or exhaust outlets. The heat emissions may damage the dome. Soot and smoke will degrade the performance 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.

Mounting the scanner

- Use the supplied mounting template and tape it securely to the chosen location site.
- Before drilling, check that:
  - you have oriented the mounting template correctly so that the front of the scanner unit will face the front of the vessel
  - the location site is not more than 15 mm (0.6") thick. If the location site is thicker use longer bolts

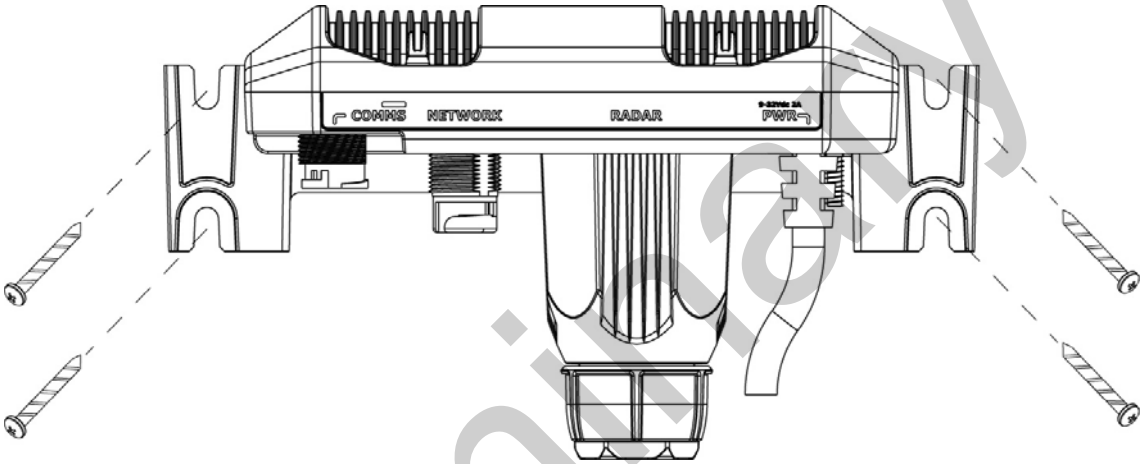
Note: The bolts supplied are M8 x 30 mm x 4. If you need to use longer bolts make sure they are 304 stainless steel and allow for 15 mm (0.6") of thread contact

- the location site allows the drain hole to empty.
- Drill the four holes where shown.
- Remove the mounting template,
- Connect the scanner interconnection cable (see "Connect the Broadband radar to your display" page 16)
- Position the scanner carefully over the bolt holes so that they are aligned
- Place a spring washer then a plain washer onto each bolt, as shown.
- Screw each bolt into each drill hole from the under side of the location site, and tighten securely



Mounting the radar interface box

- Install the radar interface box in a dry location away from spray, rain, drips and condensation.
- The radar processor must be located where it can be easily connected to the ship's ground, the scanner interconnection cable, a power source and the display or display network.
- Allow enough room for cables to form a drip loop.
- Preferably mount the radar interface box on a vertical surface with cables exiting downwards.
- Secure to the surface using the four mounting points



4 Wiring the radar system

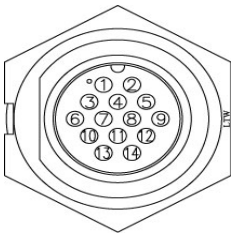
Connect interconection cable to the scanner

The scanner interconnection cable connects the scanner to the RI-10 or RI-11 interface box (or Lowrance HDS U.S only). The cable connects to the scanner using a 14 pin connector.

Insert cable connector on to the male 14 pin plug on the scanner. take care to align the connector correctly to avoid bending the pins. Secure the locking collar by rotating clockwise

Feed and secure the cable into the cable retention channel

Interconnection cable pin out



Scanner connector

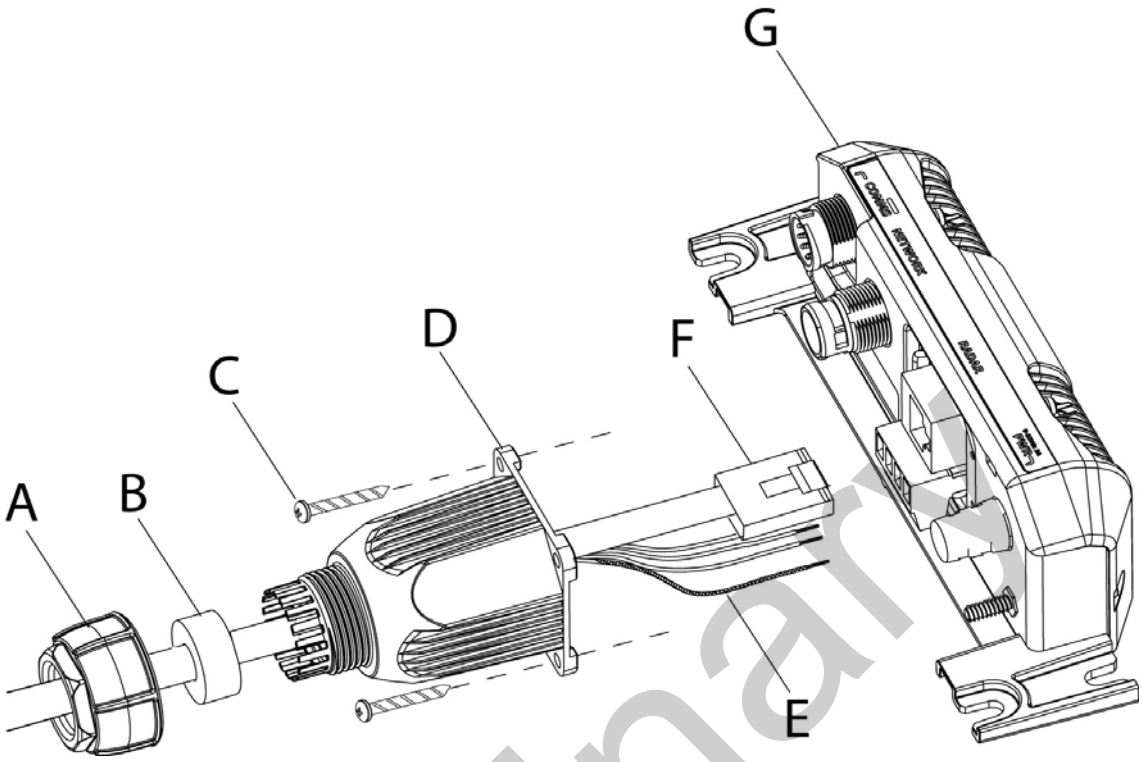
Cable connector

Pinout		
Conn	**Wire color**	**RJ45**
1	Black	Tinned wire
2	Red	Tinned wire
3	Yellow	Tinned wire
4	Drain	Tinned wire
5	N/A	N/A
6	Blue	RJ45 Pin 4
7	White / Blue	RJ45 Pin 5
8	white / Brown	RJ45 Pin 7
9	Brown	RJ45 Pin 8
10	White / Green	RJ45 Pin 3
11	N/A	N/A
12	White / Orange	RJ45 Pin 1
13	Green	RJ45 Pin 6
14	Orange	RJ45 Pin 2

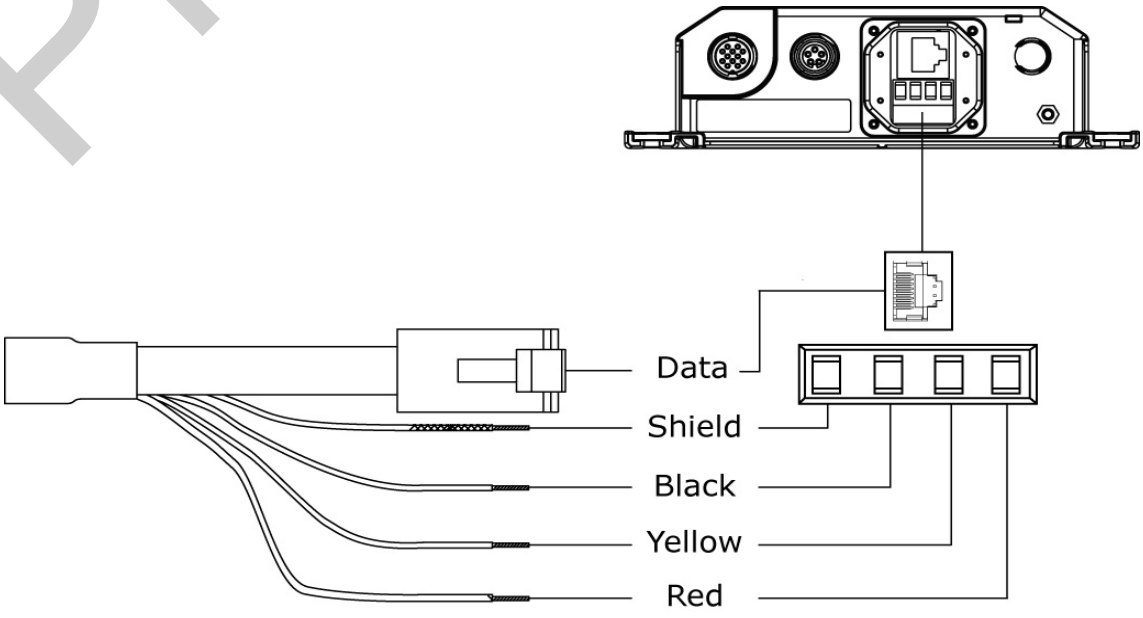
Connect the interconnection cable to radar interface box

- Remove the 4 phillips screws that secure the cable gland housing and disassemble
- slide the lock nut, gland washer, and glad housing on to the scanner cable
- connect power wires to the terminal strip
- connect the RJ45 data connector
- secure the gland housing to the interface box using the 4 screws
- Insert the gland washer into the gland housing

- screw the lock nut on to the gland housing

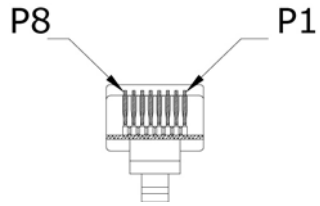
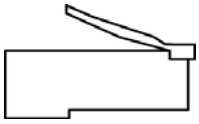


Key	Description	Part Number
A	Lock nut	
B	Gland washer	
C	Screws x 4 M3x12mm phillips pan head	SR000041-G
D	Cable gland housing	
E	Power wires (see "Connect power" page 14)	
F	Radar data connector RJ45	
G	Radar interface box	AA010204 (Serial) AA010189 (Network)



Shortening the cable

It is not recommended to shorten the cable but if it is essential use the pin-out below to re-terminate the RJ45 connector

RJ45 Connector		
	Pin	**Colour**
	1	White/Orange
	2	Orange
	3	White/Green
	4	Blue
	5	White/Blue
	6	Green
	7	White/Brown
	8	Brown
		
RJ45 Connector	15 mm Heat shrink (10 mm dia)	

Connect power

Before connecting power to the system:

- make sure the scanner has been installed and is secured
- make sure the scanner cable is connected to the scanner
- if using the Radar Interface Box make sure all connections have been made to the display

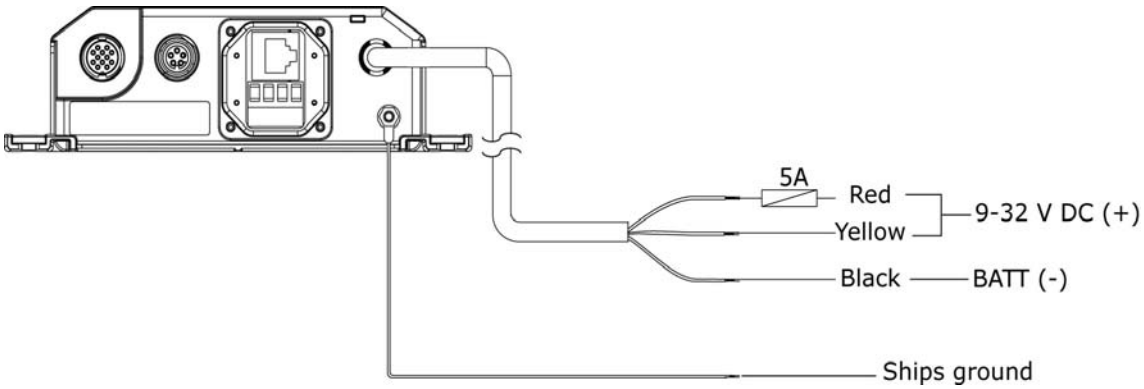
The radar system can operate on voltages of 9-32 V DC. The system requires a (+ V DC) to be applied to the yellow remote power on wire in order to operate. This can be achieved by one of three ways.

- Common the red and yellow wires together. Radar will power on when power is applied
- Install a switch that will provide power to the yellow wire. Radar will turn on when switch is activated
- Connect to the yellow wire to a the external wake up of a suitable display. Radar will turn on when display is turned on

For systems using a radar interface box

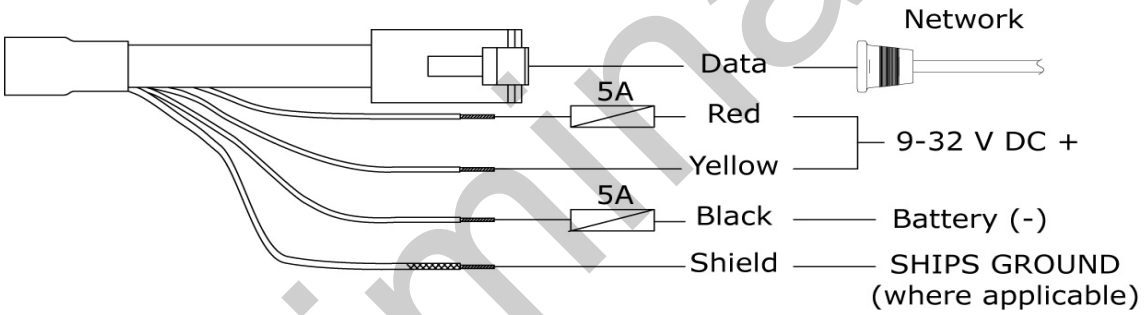
- Connect the red wire to power positive 9-32 V DC. Use a 5 amp fuse or breaker
- Connect the yellow wire to power source that will turn on the system (see above)
- Connect black to power negative

It is recommended where possible to connect the radar interface box to ships ground

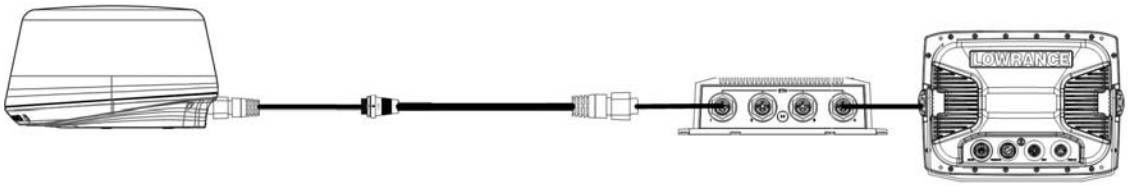


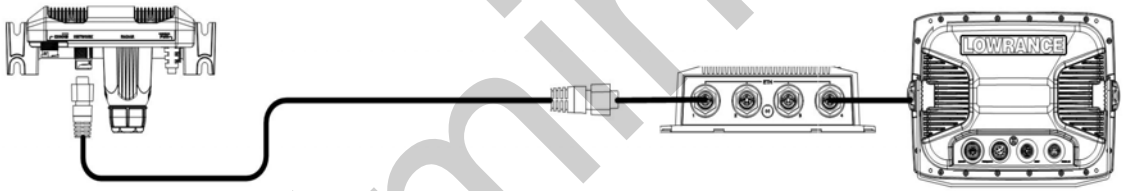
For systems that do not require a Radar Interface Box, connect power directly to the scanner cable.

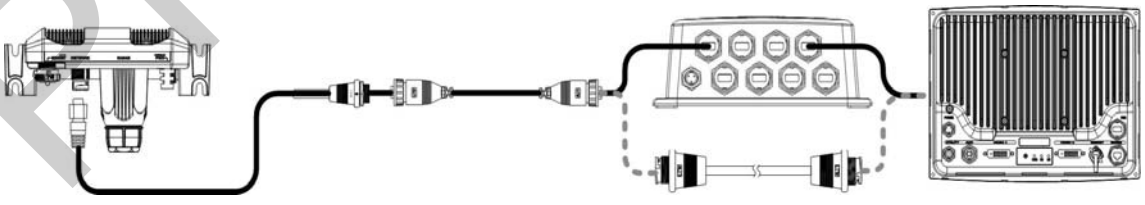
Note: Connect shield to ships ground if applicable or connect to battery negative



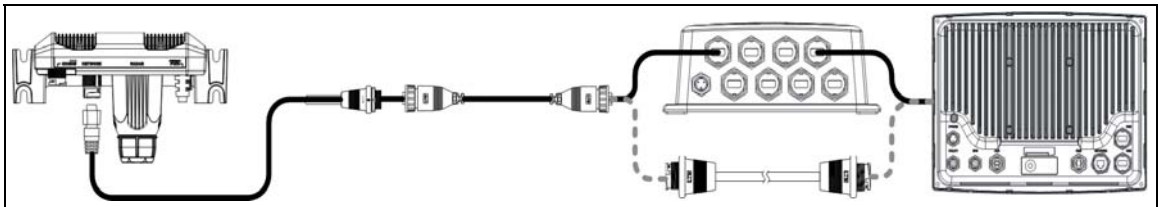
Connect the Broadband radar to your display

LOWRANCE	Lowrance HDS (U.S only)		
			
Broadband scanner	Adapter cable 000-0127-56 0.6 m (2 ft)	Optional 5 port switch	HDS Display ENET Port
Lowrance broadband in the US market does not require a Radar interface box. the scanner connects directly the display or ethernet switch via the adaptor cable			

LOWRANCE	Lowrance HDS (Non U.S market)		
			
RI-11 NETWORK port	Ethernet cable	Lowrance 5 port ethernet switch	HDS Display ENET port

SIMRAD	GB40			
				
RI-10 NETWORK port	Adaptor cable	Ethernet cable	8 port Ethernet linker or cross-over cable	NETWORK port
Connects to GB40 system via ethernet. Connect a GB40 ethernet cable in between 8 port ethernet linker (or crossover cable) and supplied adaptor cable. Use only GB40 8000i ethernet cables				

NORTHSTAR	8000i 12" Display processor or Black box processor



RI-11 NETWORK port	Adaptor cable 000-0127-56	Ethernet cable AA000056	8 port Ethernet linker (or cross-over cable) AA010009 (AA010084	NETWORK port
Connects to 8000i system via ethernet. Connect 8000i ethernet cable in between 8 port linker (or crossover cable) and supplied adaptor cable.				

SIMRAD NORTHSTAR

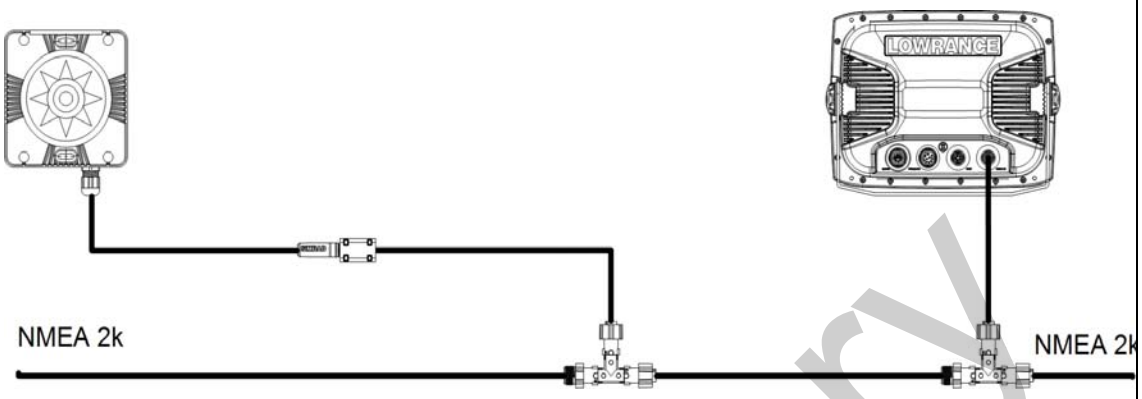
NX40 and NX 45

M84 and M121

RI-11 COMMS port	Data cable AA010114 3m (9.8 ft)	NX or M series RADAR port

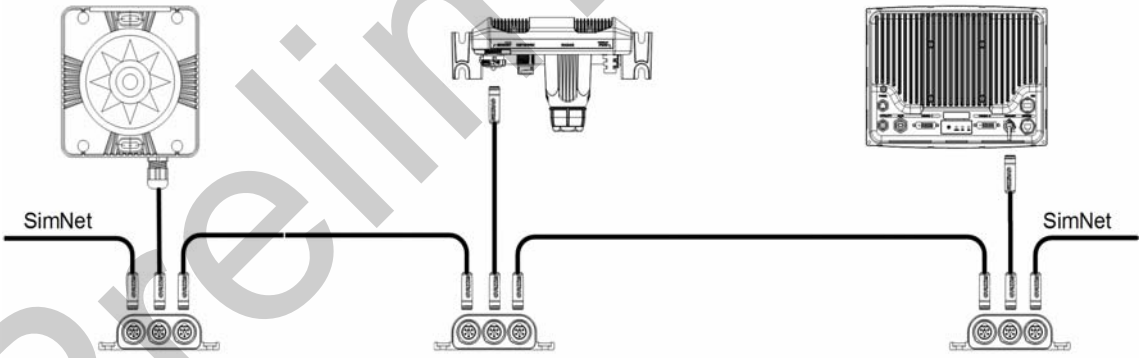
Connecting a heading sensor

LOWRANCE



SimNet heading sensor FC40 or RC42	SimNet to NMEA converter	HDS NMEA 2K port

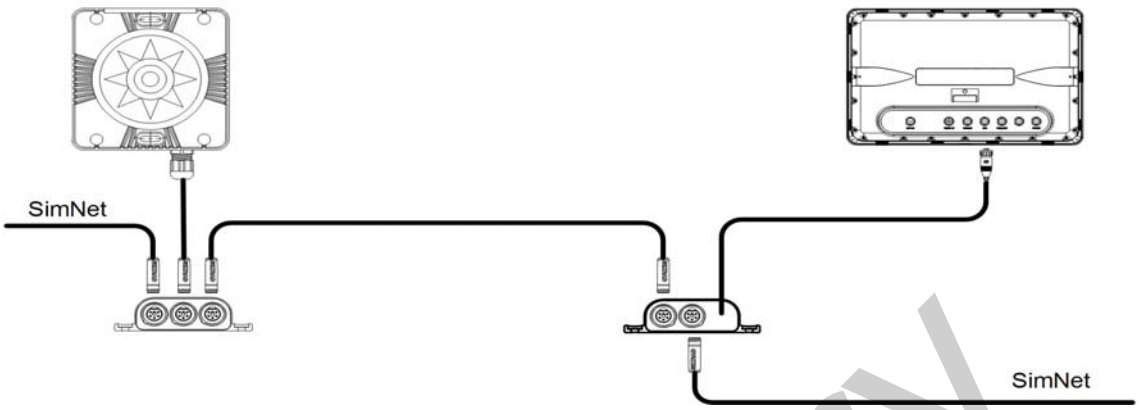
SIMRAD **GB40**



SimNet heading sensor FC40 or RC42	RI-10 SimNet port	GB40 Navcomputer SimNet port

For MARPA functionality on GB40 heading information at 10 Hz needs to be sent to both the RI-11 and the GB40 NavComputer. Connect a SimNet drop cable from the Simnet backbone to the RI-11 and connect to the COMS port (SimNet connector)

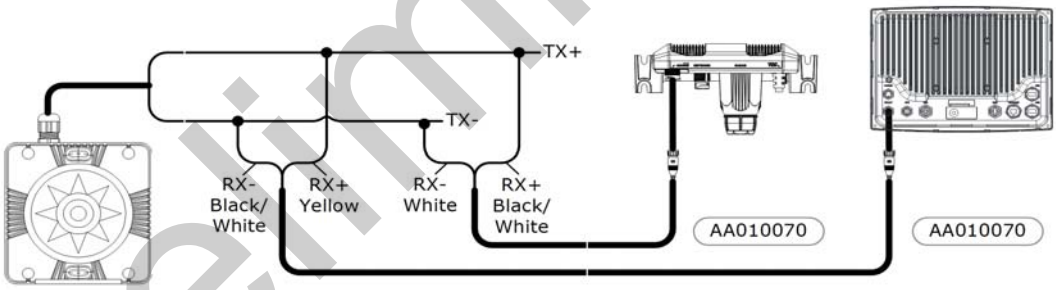
SIMRAD	NX 40, NX45



SimNet heading sensor FC40 or RC42	AT40 or AT45 SimNet to NMEA 0183 converter	NX 40 or NX45 GPS port

For accurate radar chart overlay a heading sensor on the SimNet backbone passes thought the AT40 or AT45 which connects to the GPS port on the NX display

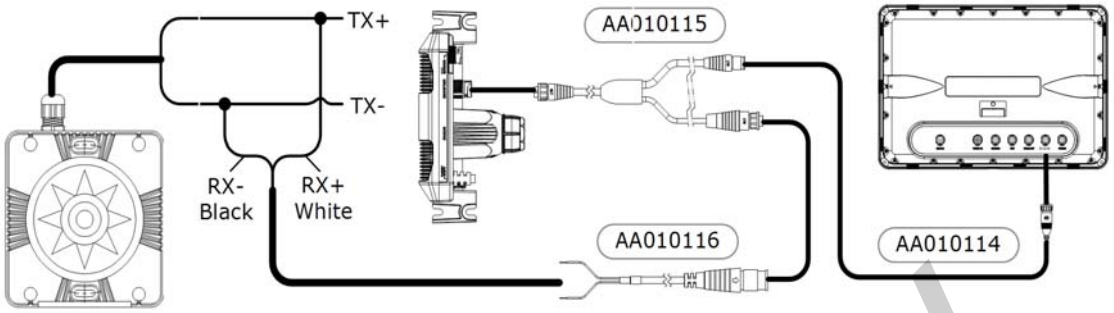
NORTHSTAR	8000i NMEA 0183 12" Display processor, Black box processor, Simrad GB40 not using a SimNet heading sensor



NMEA0183 Heading Sensor	Junction Box	RI-11 COMMS port	8000i navcomputer Utility port

For MARPA functionality, heading information at 10 Hz needs to be sent to both the RI-11 and the 8000i master navcomputer. Use the 12 pin cable AA010070 cable from both units to a junction box to share the same heading source.

NORTHSTAR	M-84 and M-121



NMEA0183 heading sensor	Junction box	RI-11 COMMS port	Connection kit AA010112	M-84 or M121 Display Radar port
For accurate radar overlay use an NMEA0183 heading sensor. Use supplied connection kit				

5 Configure displays to use radar

Setup and configuration of the Broadband radar has been simplified compared to traditional pulse radars. There is no warm up time or burn in required. there is no "main bang" setup. The only adjustment needed is to

- Set the scanner height: This is to help the radar calculate for sea clutter
- Adjust the heading marker. This is to align with the heading marker on the screen with the center line of the vessel, this will compensate for any slight misalignment of the scanner during installation. Any inaccuracy will me evident when using MARPA or chart overlay.

Lowrance HDS radar setup

To commission the radar using Lowrance HDS. Set the bearing alignment and antenna height.

Enter radar installation by pressing Menu > Settings > Radar > Installation.

To set the antenna height

- Use the up / down arrows to select antenna height. Use the Left / Right arrows to select the antenna height. The value will represent the antenna height in the units that have selected such as feet ot meters.

To start the radar

- Press pages > Radar > Radar State. Use Cursor to edit the radar state. Select transmit to activate the radar

To adjust the bearing alignment

Use the up / down arrows to select bearing alignment. Use the Left / Right arrows to adust bring the heading line on the screen to represent the actual heading of the boat. point the boat to the end of a head land or peninsular. adjust the bearing alignment so th heading line touches the end of the same head land or peninsular

Simrad GB40 / Northstar 8000i radar setup

To Set antenna height

- Select Pages (Display 8000i) > Setup > Radar.
- Press edit and key in the height of the scanner in feet or meters depending on system units setting
- Select Return

To Transmit

- From the radar page select Radar Mode
- Select transmit

To change the radar bearing alignment:

- Select Pages (Display 8000i). If you:
  - don't have a page that shows the Radar screen in one pane and the Chart screen in the other pane, edit or create a page that shows these two screens.
  - do have a page that shows the Radar screen in one pane and the Chart screen in the other, select it.
- Check that the Chart screen has the Radar Overlay turned On.
- Select the Radar pane so that it becomes the active pane. If you can't see the Adjust Radar button, select Return.

- Select Adjust Radar, then select Installation.
- The Bearing Alignment button shows the current setting. Select it to change the setting. Use the Up and Down buttons to move the radar image one degree at a time, until the radar overlay is aligned with the chart.
- Select OK.
- Select Return.

Simrad NX40/45 or Northstar M84/M121 radar setup

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 ☑.

Zero bearing

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

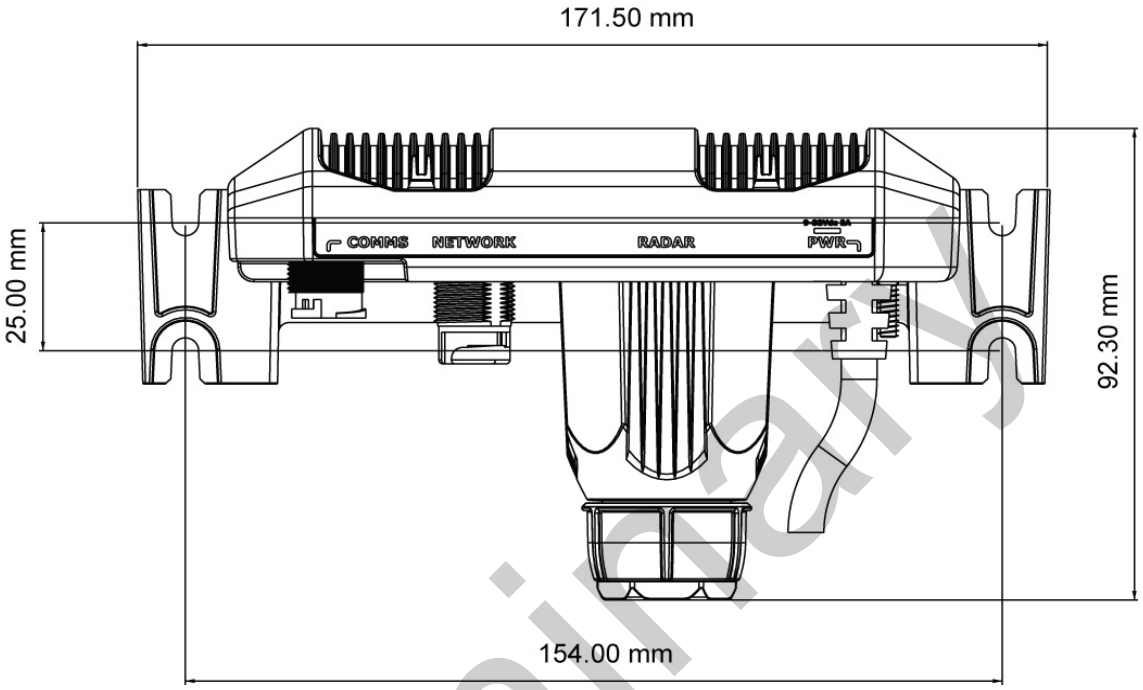
- Press Menu twice > Radar > Installation
- Select Zero bearing then use the arrow keys to enter the new bearing angle.

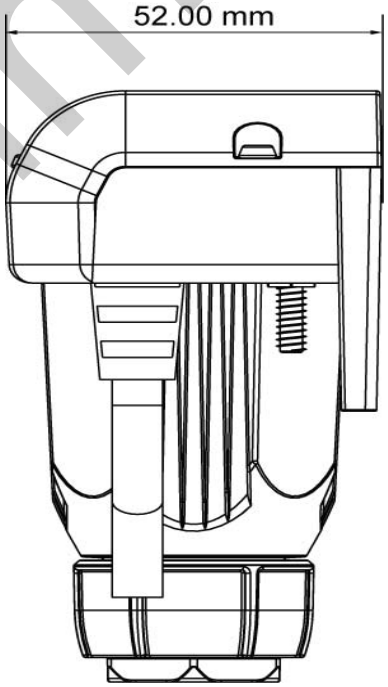
Antenna height

- Press Menu twice > Radar > Installation
- Select Antenna height then enter the height of the antenna above sea level.

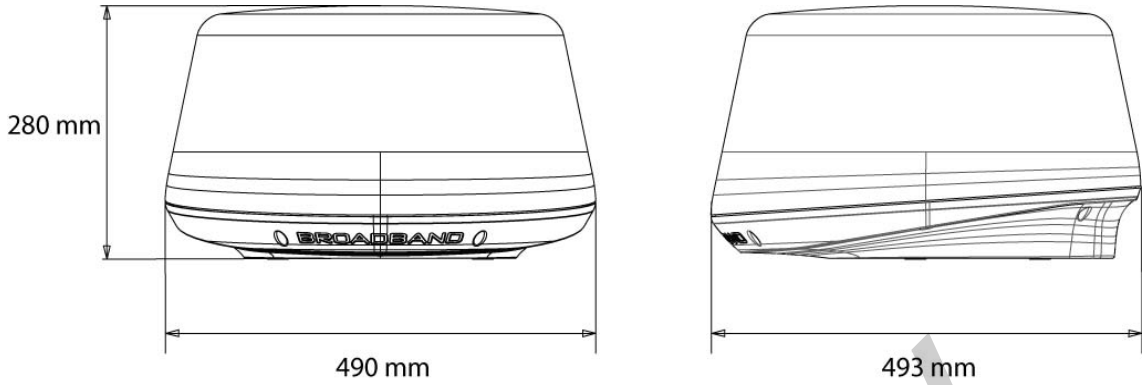
6 Drawings

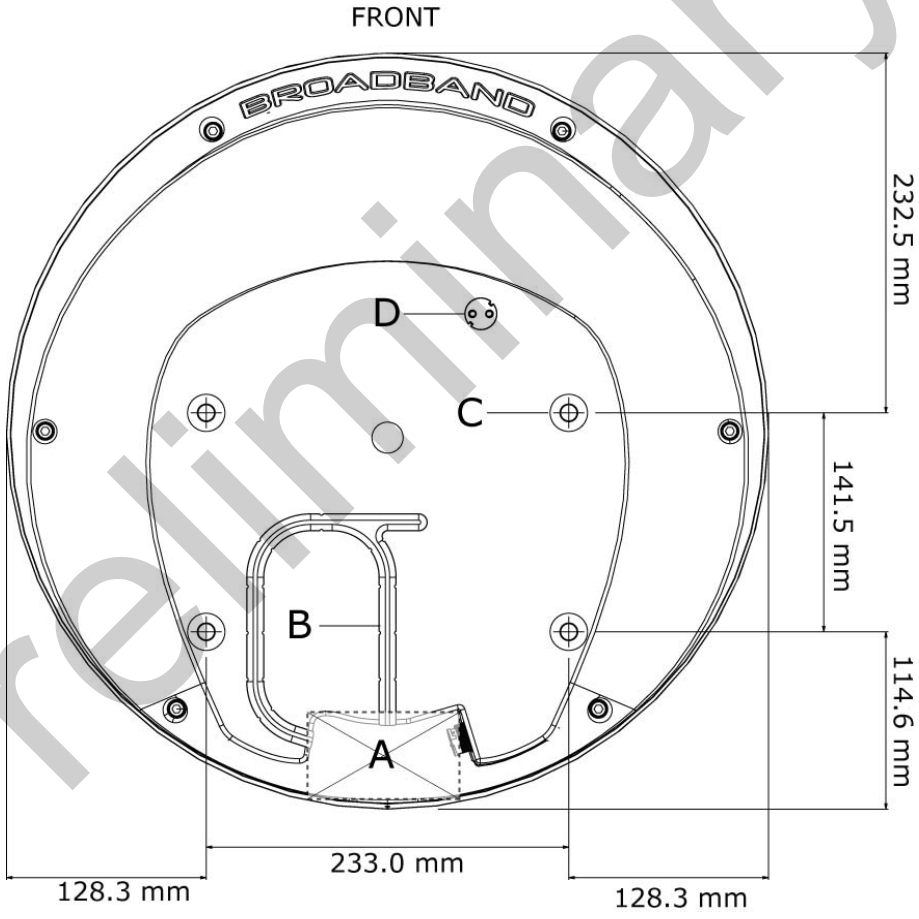
Radar interface box





Scanner dimensions





Key	Description
A	Cable entry area
B	Cable retention channel
C	Bolt holes x 4 M8 x 30 mm
D	Breather

7 Specifications

Characteristic	Technical Data
General	
Compliance	FCC/IC/R&TTE/AUS Type Certification pending FCC ID: RAYBR24 IC ID: 4697A-BR24
Environmental	IEC60945 4th edition 2002-2008 Operating Temperature: -25° to +55°C Relative humidity: +35° C, 95% RH Waterproof: IPX6
Relative wind velocity	36.0 m/sec (Max:70 Knots)
Power consumption	Operating: 17 W (Typ.) @ 13.8 Vdc Standby: 1.6 W (Typ.) @ 13.8 Vdc - only 110 ma
DC input (at end of radar cable)	9 V to 31.2 V DC (12/24 Volt systems). Reverse polarity protection
Transmitter Source (Pre-heating time)	No magnetron - Instant ON
Outside dimensions	Height 280 mm x Diameter 488 mm
Weight (no cable)	7.4 kg
Radar and Antenna Parameters	
Radar Ranges	1/16 to 24 nm with 15 range settings (nm/sm/km)
Rotation	24 rpm +/- 10%
Transmitter frequency	X-band - 9.3 to 9.4 Ghz
Transmitter source (warmup time)	No Magnetron - all solid state. Instant ON
Plane of polarization	Horizontal polarization
Transmitter peak power output	100 mW nominal
Sweep Repetition Frequency	200 Hz
Sweep Time	1 ms
Sweep Bandwidth	65 MHz max
Horizontal Beam width (Tx and Rx antenna)	5.2° +/- 10% (-3dB width)
Vertical Beam width (Tx and Rx antenna)	30°+/-20% (-3dB width)
Side lobe level (Tx and Rx antenna)	Below -18 dB (within ±10°);Below -24dB (outside ±10°)
Noise figure	Less than 6dB
Coms/Cabling/Mounting	
Com Protocol	High Speed Ethernet
Heading	NMEA2000 / Simnet with interface box
Inter Connecting cable length	10 m standard with RJ45 thin custom connector - Display model dependent
Maximum Inter Connecting cable length	30 m
Bolts (4)	30 x M8 - 304 stainless steel
Footprint	W233 mm (port / starboard) x L141.5mm
Compatible Displays	
Lowrance HDS - 5", 7", 8". 10"	
Simrad GB40 - 10", 12", 15"	
Simrad NX40/45 - 8", 12"	
Northstar 8000i - 12", 15"	
Northstar M84/M121 - 8", 12"	

8 Navico Broadband radar part numbers

Broadband radar scanner part numbers			
Model	Part Number	Description	Length
Scanner			
BR24	AA010186	Broad band radar scanner	
Interface boxes			
RI-10	AA010189	Broadband radar SimNet interface box	
RI-11	AA010204	Broadband radar serial interface box	
Scanner cables			
	AA010211	Broadband scanner interconnection cable	10 m (33 ft)
	AA010212	Broadband scanner interconnection cable	20 m (65.6 ft)
	AA010213	Broadband scanner interconnection cable	30 m (98.5 ft)
Ethernet cables			
	000-00127-56	Adapter cable: yellow ethernet male to RJ45 female	2 m (6.5 ft)
	AA010079	Navico Ethernet cable for GB40 and 8000i	0.5 m (1.6 ft)
	AA010080	Navico Ethernet cable for GB40 and 8000i	2 m (6.5 ft)
	AA010081	Navico Ethernet cable for GB40 and 8000i	5 m (16.4 ft)
	AA010082	Navico Ethernet cable for GB40 and 8000i	10 m (33 ft)
	AA010083	Navico Ethernet cable joiner F/F for GB40 and 8000i	0.3 m (1 ft)
	000-00127-28	Navico Ethernet cable E-Yellow-E-Yellow for Lowrance	0.6 m (2 ft)
Data cables			
	AA010070	Utility cable, 12 pin F / tinned wires for GB40/8000i	2 m (6.5 ft)
	AA010114	HD serial comms cable for NX40/45 and M84/121	3 m (9.8 ft)

9 Maintenance

Clean the radome using soapy water and a soft cloth. avoid using abrasive cleaning products. Do not use solvents such as gasoline, acetone, M.E.K etc. as this will damage the dome surface

Upgrading Firmware

Navico Broadband Radar BR-24 Installation manual English, Doc.no. Preliniary

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