

Raystar 120 & Raystar 112LP GPS Receivers

Owner's Handbook

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Handbook information

To the best of our knowledge, the information in this handbook was correct when it went to press. However, Raymarine cannot accept liability for any inaccuracies or omissions it may contain. In addition, our policy of continuous product improvement may change specifications without notice. As a result, Raymarine cannot accept liability for any differences between the product and the handbook.

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About this Handbook

Welcome

Welcome to the handbook for the Raystar 112LP GPS receiver and Raystar 120 SD-GPS receiver. This handbook provides installation details for the following products:

- Raystar 120 SD-GPS receiver with SeaTalk output (Part no: E32025)
- Raystar 120 SD-GPS receiver with NMEA output (Part no: E32026)
- Raystar 112LP GPS receiver with SeaTalk output (Part no: E32001)
- Raystar 112LP GPS receiver with NMEA output (Part no: E32002)

These products are designed to receive GPS (Global Positioning System) signals and convert this information to either SeaTalk or NMEA:

- the Raystar 112LP receives standard GPS signals, providing a typical position accuracy of 15 m (without Selective Availability)
- the Raystar 120 uses Satellite Differential GPS (SD-GPS) signals to provide enhanced typical accuracy of less than 3 m

Note: See Chapter 1: About SD-GPS (RS120 only) for more information about satellite differential GPS.

This handbook contains four chapters:

Chapter	Contents	Page
Chapter 1: About SD-GPS (RS120 only)	Explains how Satellite Differential GPS enables the Raystar 120 to provide enhanced accuracy.	1
Chapter 2: Installation	Explains how to mount the Raystar 112LP and Raystar 120 receivers.	5
Chapter 3: NMEA/SeaTalk Connections	Explains how to connect the Raystar output cable to your GPS display unit or chartplotter.	11
Chapter 4: Product Support & Servicing	Provides product support information for the Raystar 112LP and Raystar 120.	15

At the end of this handbook we have included product specifications and compatibility information, a mounting template & warranty information.

Note: This handbook contains important information about installing, using and maintaining your new Raymarine product. To get the best from the product, please read this handbook thoroughly.

Important Information

Before using this product, please read the following information about:

- Warranty
- Safety notices
- EMC conformance

Warranty

To register your new Raymarine product, please take a few minutes to fill out the warranty card. It is important that you complete the owner information and return the card to us to receive full warranty benefits.

Safety notices

WARNING: Navigation aid

Although we have designed this product to be accurate and reliable, many factors can affect its performance. As a result, it should only be used as an aid to navigation and should never replace common sense and navigational judgement. Always maintain a permanent watch so you can respond to situations as they develop.

WARNING: Product installation

This equipment must be installed and operated in accordance with the instructions contained in this handbook. Failure to do so could result in poor product performance, personal injury and/or damage to your boat.

WARNING: Electrical safety

Make sure the power supply is switched off before you make any electrical connections.

WARNING: Servicing

There are no user-serviceable parts in this unit. Do NOT attempt to open the unit or service the equipment. If the unit develops a fault, return it to your nearest distributor for service.

EMC conformance

All Raymarine equipment and accessories are designed to the best industry standards for use in the recreational marine environment. The design and manufacture of Raymarine equipment and accessories conform to the appropriate Electromagnetic Compatibility (EMC) standards, but correct installation is required to ensure that performance is not compromised.

Chapter 1: About SD-GPS (RS120 only)

1.1 Satellite Differential GPS on the Raystar 120

The Raystar 120 Satellite Differential GPS (SD-GPS) Receiver uses the new satellite differential system to improve the accuracy, integrity and availability of the basic GPS signals. This provides greater positional accuracy compared with standard GPS receivers (e.g. Raystar 112LP).

Three separate and compatible SD-GPS systems currently exist or are being developed:

1. Wide Area Augmentation System (WAAS), developed by the Federal Aviation Administration (FAA).
2. European Geostationary Navigation Overlay System (EGNOS), being developed by a European consortium.
3. MTSAT Satellite-Based Augmentation System (MSAS), being developed by the Japan Civil Aviation Bureau (JCAB).

1.2 SD-GPS in North America (WAAS)

How SD-GPS works

The following description is based on WAAS, but the same principles apply to the EGNOS and MSAS networks.

As shown in *Figure 1-1*, the WAAS network consists of:

- ground reference stations across the USA
- master stations located at East Coast and West Coast
- two geostationary satellites located above the equator

This network operates in conjunction with the existing GPS satellites.

The ground reference stations are located at known positions and receive data continuously from the GPS satellites. The ground reference stations transmit their data to the master stations, which calculate the error of the GPS-received positions and generate correctional data.

The master stations send their corrected 'differential' signals to the two geostationary satellites which broadcast the corrected data on the standard GPS frequency.

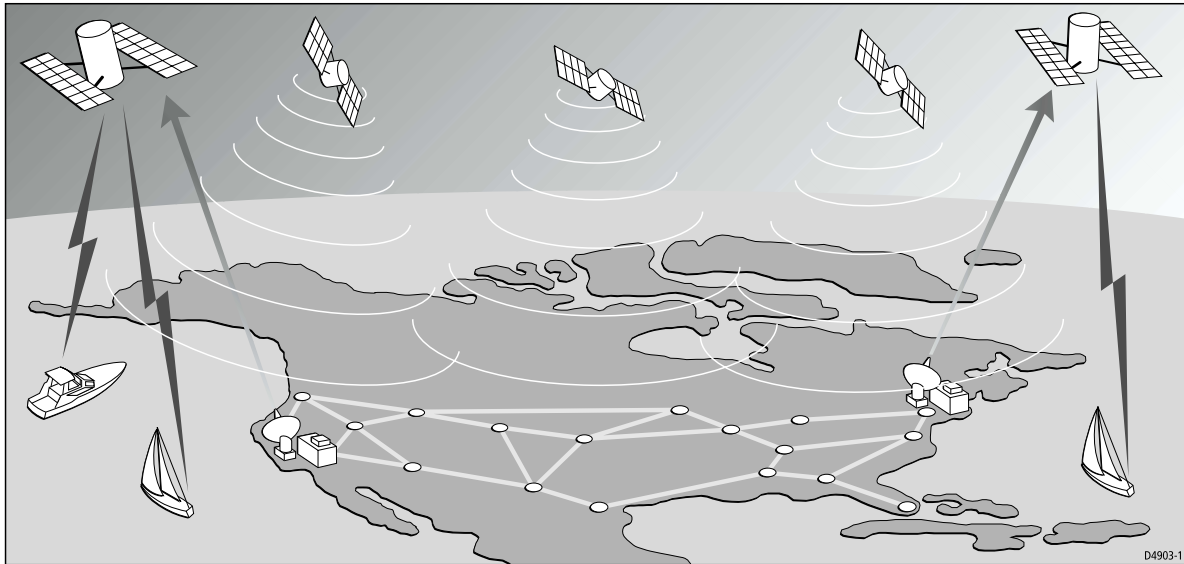


Figure 1-1: The WAAS System

Your Raystar 120 SD-GPS Receiver can then use this correctional data to refine the GPS positional data it receives. This results in improved accuracy (typically less than 3 metres) compared with standard GPS (typically 15 m) or land-based DGPS (typically 10 m).

Availability of WAAS in North America

The area coverage of WAAS includes the entire United States of America (see *Figure 1-2*).

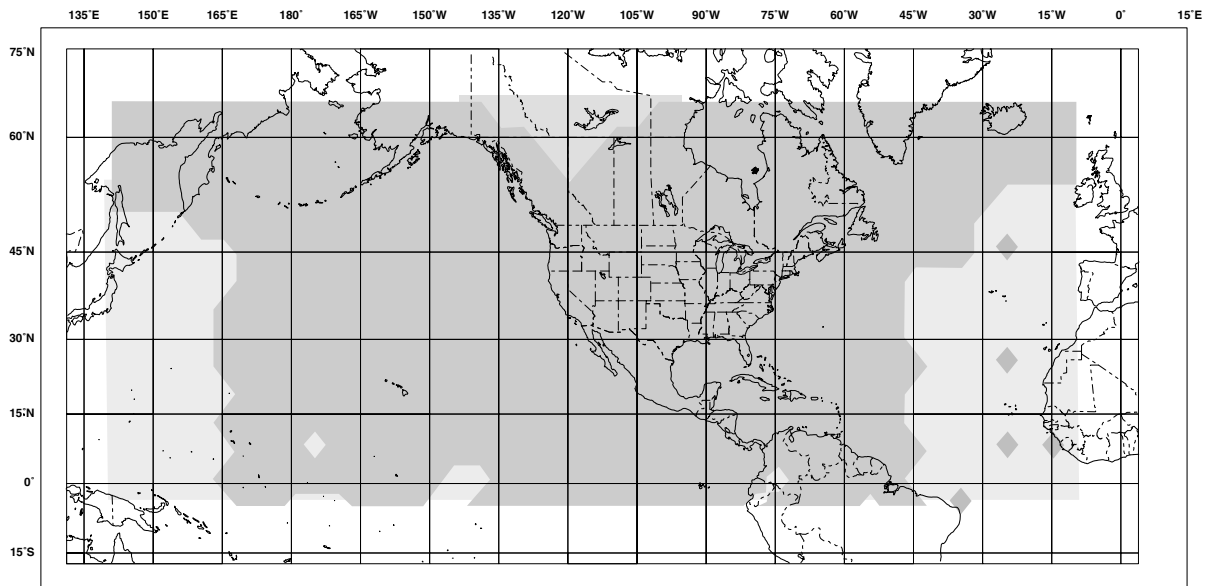


Figure 1-2: WAAS Coverage Map

At the time of going to print, WAAS was being tested for aviation use. During this testing and certification period, continuous service is expected although brief signal outages may occur as refinements and upgrades are made to the system.

Information about the status of WAAS and any planned outages are available via the Raymarine website at:

<http://www.raymarine.com>

1.3 SD-GPS coverage outside North America

As well as being WAAS compatible, the Raystar 120 is also compatible with the SD-GPS networks being developed for Europe (EGNOS) and Asia (MSAS). The combination of the WAAS, EGNOS and MSAS systems will provide global satellite based differential GPS augmentation into the future.

Europe (EGNOS)

At the time of going to print, EGNOS was in early testing and qualification phases. As a result, signal outages may occur at any time. The status of EGNOS and any planned outages are available on-line at the Raymarine website:

<http://www.raymarine.com>

Satellite differential is currently disabled outside the WAAS reception area. When EGNOS is qualified for navigational use, we will publish a procedure on the Raymarine website to enable EGNOS operation.

Asia (MSAS)

An Asian satellite differential system (MSAS) is also being developed. When MSAS is qualified for navigational use, we will publish a procedure on the Raymarine website to enable MSAS operation.

1.4 Accuracy & continuation of broadcast coverage

CAUTION:

The navigational accuracy of equipment using these satellite broadcast SD signals during the testing and qualification phases is not guaranteed by Raymarine Limited, nor is the continuation of the broadcast SD signals the responsibility of Raymarine Limited.

1 About SD-GPS (RS120 only)

Chapter 2: Installation

The sections in this chapter explain how to install the Raystar 120/112LP receivers:

Section	Page
Section 2.1, Planning the installation	5
Section 2.2, Selecting a suitable location	8
Section 2.3, Mounting the receiver	9

CAUTION:

Before starting installation ensure you have the correct unit for your application. The *Raystar 120/112LP compatibility table on page 18* identifies the correct version of the Raystar 120/112LP Receiver for compatible Raymarine, Autohelm and Apelco units. Raymarine cannot be held responsible for incorrect operation due to incorrect unit specification. Always state which model you have when contacting Raymarine or a registered service agent.

2.1 Planning the installation

Before starting to install the Raystar 120/112LP, read through the following information about:

- Parts supplied
- Cabling guidelines
- Electromagnetic compatibility (EMC) installation guidelines

Parts supplied

The Raystar 120/112LP package contains the following items:

1. Low profile GPS Receiver, with 10 m (33 ft) cable
2. Flush mount gasket
3. Mounting studs (x2) and thumb nuts (x2)
4. Pole mount kit *
5. Owner's Handbook (includes warranty documents)

Note: * *If you intend to mount the receiver on a pole, you will need to obtain a suitable pole with 1 inch 14 TPI thread.*

Items missing?

If any of the pack items is missing or damaged, please contact your Raymarine dealer or our Technical Services Department to obtain replacement parts. **Please note that missing or damaged items cannot be replaced without proof of purchase.**

Cabling guidelines

When running cable, always observe the following guidelines:

- if a cable has to be fed through the deck, use a good quality deck gland
- where cables are fed through holes, use grommets to prevent chafing
- secure long cable runs so they do not present a hazard
- wherever possible, route cables away from fluorescent lights, engines and radio transmitting equipment, as these may cause interference

Electromagnetic compatibility (EMC) installation guidelines

All Raymarine equipment and accessories are designed to the best industry standards for use in the recreational marine environment. Their design and manufacture conforms to the appropriate Electromagnetic Compatibility (EMC) standards, but correct installation is required to ensure that performance is not compromised. Although every effort has been taken to ensure that they will perform under all conditions, it is important to understand what factors could affect the operation of the product.

The guidelines given here describe the conditions for optimum EMC performance, but it is recognized that it may not be possible to meet all of these conditions in all situations. To ensure the best possible conditions for EMC performance within the constraints imposed by any location, always ensure the maximum separation possible between different items of electrical equipment.

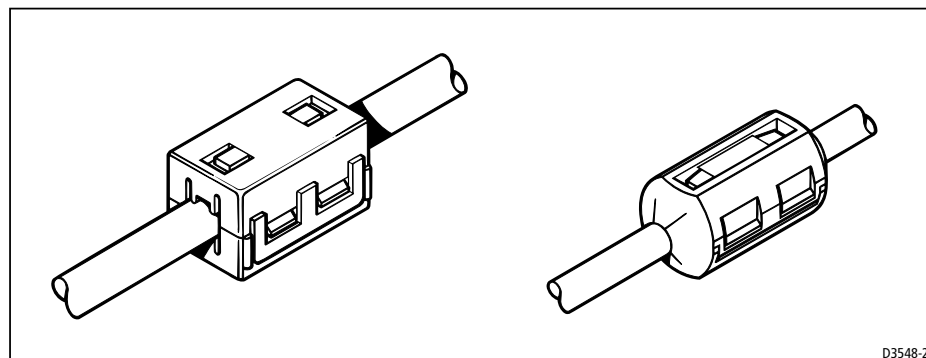
For **optimum** EMC performance, we recommended that **wherever possible**:

- Raymarine equipment and cables connected to it are:
 - At least 3 ft (1 m) from any equipment transmitting or cables carrying radio signals e.g. VHF radios, cables and antennas. In the case of SSB radios, the distance should be increased to 7 ft (2 m).

- More than 7 ft (2 m) from the path of a radar beam. A radar beam can normally be assumed to spread 20 degrees above and below the radiating element.
- The equipment is supplied from a separate battery from that used for engine start. Voltage drops below 10 V, and starter motor transients, can cause the equipment to reset. This will not damage the equipment, but may cause the loss of some information and may change the operating mode.
- Raymarine specified cables are used. Cutting and rejoining these cables can compromise EMC performance and must be avoided unless doing so is detailed in the installation manual.
- If a suppression ferrite is attached to a cable, this ferrite should not be removed. If the ferrite needs to be removed during installation it must be reassembled in the same position.

Suppression ferrites

The following illustration shows typical cable suppression ferrites used with Raymarine equipment. Always use the ferrites supplied by Raymarine.



Connections to other equipment

If your Raymarine equipment is to be connected to other equipment using a cable not supplied by Raymarine, a suppression ferrite **MUST** always be attached to the cable near to the Raymarine unit.

2.2 Selecting a suitable location

Receiver location

The Raystar 120/112LP receiver is designed to receive the signals emitted from satellites in a direct path. It should be mounted:

- On a **horizontal** surface.
- In a location that is **open and clear of any obstructions** (such as masts, search lights, or other structures) that could block line-of-sight reception of signals.
- **As low as possible:** the height of the receiver is not as important as it having a clear view horizon to horizon for optimum signal reception. In fact, the lower the unit can be mounted and have a clear view to satellites, the better. The more stable the unit, the more effectively it will track satellites low to the horizon.

Note: *Do NOT mount the receiver up a mast, as the receiver will swing with the boat, leading to significant COG/SOG errors.*

- As far as possible from any **sources of interference:** the receiver should be separated by at least 1 m (3 ft) from other antennas and electronic equipment. It should not be mounted in the direct path of a radar's beam.

Mounting options

You can mount the Raystar 120/112LP on a pole or flush on a suitable horizontal surface. When mounting the receiver flush to a surface:

- select a suitable area which allows access to the underside of the mounting surface for fixing
- avoid areas where the receiver might be trodden upon or where it might present a tripping hazard

Cabling route

When planning the location for the unit, consider the best route for running the cable between the receiver and GPS display unit or to the rest of an integrated system. Ideally, you should try to route the cable so it is:

- hidden from view
- separated as far as possible from other cables (to prevent interference)

2.3 Mounting the receiver

When you have selected a suitable location, follow the relevant installation instructions for *Pole mounting* or *Surface mounting*.

Pole mounting

Note: You will need to obtain a suitable pole with 1 inch 14 TPI thread.

1. Securely attach the pole mount base to a suitable pole or rail mount bracket.
2. Pass the cable through either:
 - A:** the center hole of the pole mount base, or
 - B:** the cable exit hole alongside the center hole, or
 - C:** the side exit channel

Note: If you intend to use the side exit channel, remove the two plastic tabs obstructing the channel. If you do not remove these tabs before using the cable channel, you could damage the cable.

3. Check the cable is positioned correctly, then secure the receiver to the pole mount base using the two screws provided.

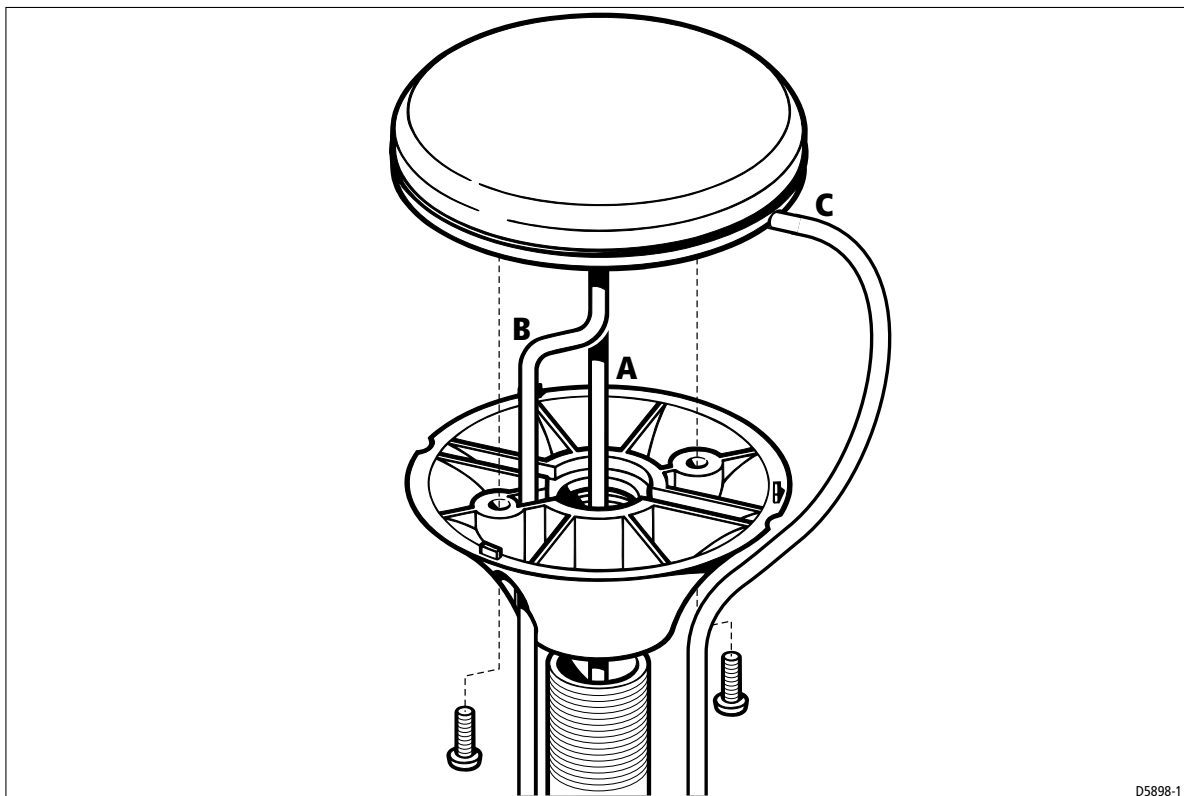


Figure 2-1: Pole mounting

Surface mounting

1. Use the template supplied in this handbook to mark the two 6 mm (0.25 in) fixing holes, and then drill
2. **OPTION A:**
If the cable is going to **pass through** the mounting surface drill either:
 - 6 mm (0.25 in) center hole (for bare-ended SeaTalk cables), or
 - 19 mm (0.75 in) center hole (for NMEA plugged cables)**OPTION B:**
If the cable is going to exit **from the side** of the receiver **above** the mounting surface, remove the two plastic tabs (1) obstructing the cable channel. **If you do not remove these tabs before using the cable channel, you could damage the cable.**
3. Screw the two mounting studs (2) into the underside of the receiver.
4. Stick the supplied gasket (3) to the mounting surface, ensuring that the holes on the gasket correspond with the drilled holes
5. Pass the cable down through the center hole (Option A) or route it through the cable exit channel (Option B).
6. Carefully position the receiver so the mounting studs pass through the holes in the mounting surface.
7. Secure the receiver to the surface using the two thumb nuts (4).

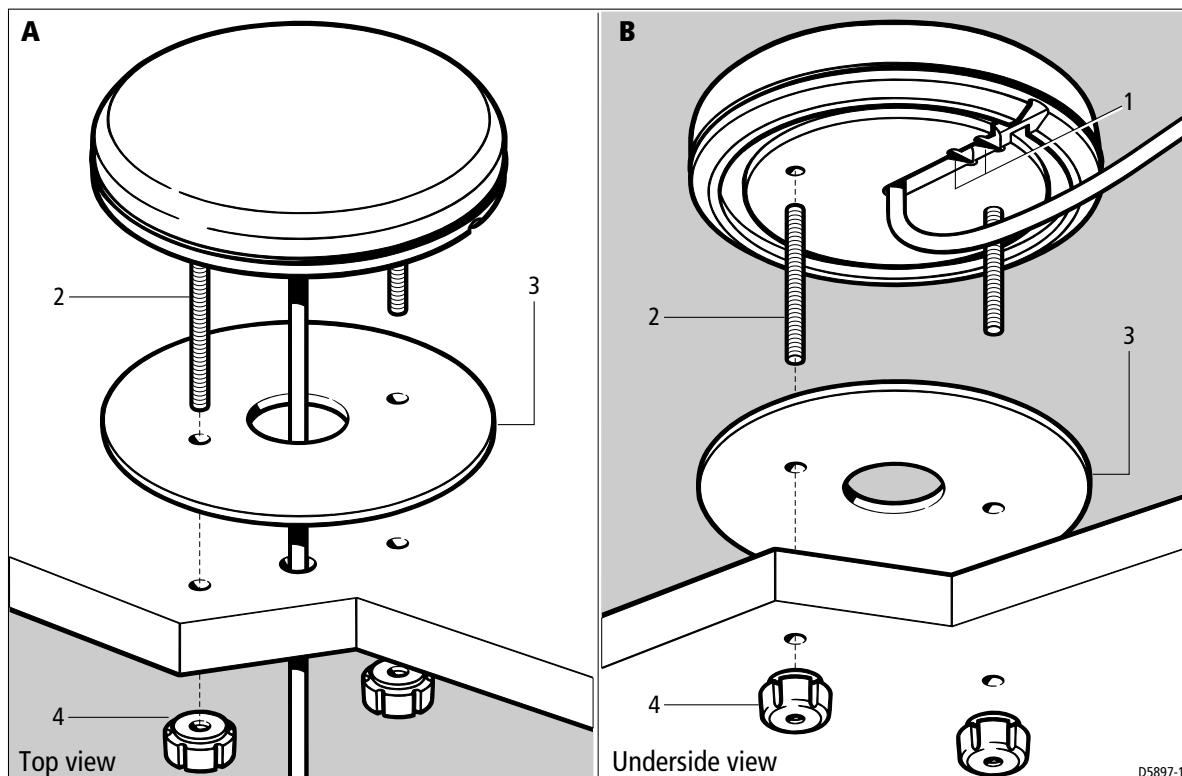


Figure 2-2: Surface mounting

Chapter 3: NMEA/SeaTalk Connections

The sections in this chapter explain how to connect the NMEA and SeaTalk versions of the Raystar 120/112LP to other equipment:

Section	Page
Section 3.1, Raystar 120/112LP - NMEA versions	11
Section 3.2, Raystar 120/112LP - SeaTalk versions	12
Section 3.3, Using a connector block	13

3.1 Raystar 120/112LP - NMEA versions

Note: As with all on-board marine equipment, you must ensure that the power supply connection to the Raystar 120/112LP is adequately protected by a suitably rated fuse or circuit breaker. Usually this will be achieved by providing power via a fused display unit.

Using the moulded 6-pin NMEA connector

The unit is normally connected to an NMEA system via the 10 m (33 ft) cable terminated with a moulded 6-pin connector (see *Figure 3-1*). Use this connector if your equipment has a compatible GPS port.

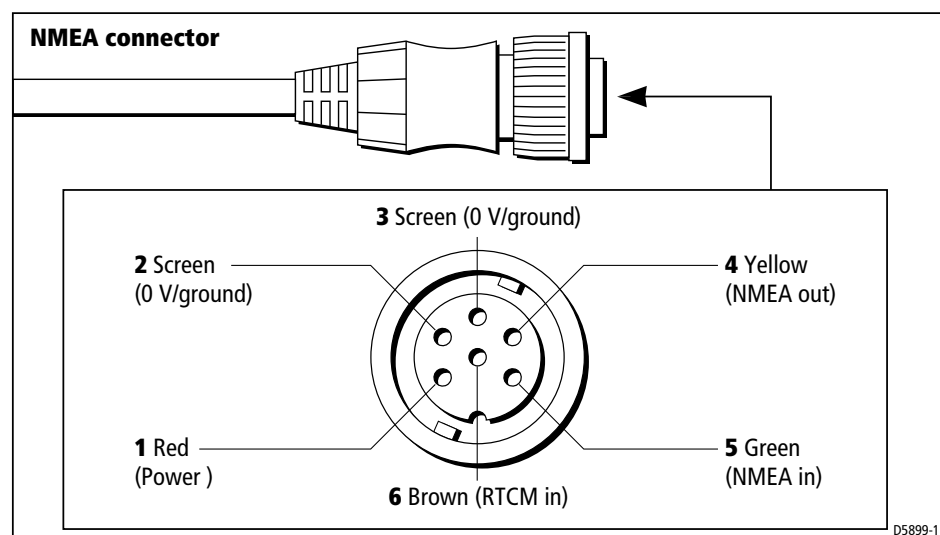


Figure 3-1: NMEA connector pin-outs

Using an alternative NMEA connector

If your equipment is not compatible with the supplied connector, remove it and then either:

- use a connector block to re-connect the cable
- connect the cable to another type of NMEA connector.

Refer to *Table 3-1* for information about cable colors. The cable can be cut as necessary to the required length, or coiled and stored out of the way.

Note: *Insulate and tape back any unused wires.*

Table 3-1: Raystar 120/112LP NMEA cable colors

Pin No	Color	Function
1	Red	Power
2 & 3	Screen	0 V / ground
4	Yellow	NMEA out
5	Green	NMEA in
6	Brown	RTCM in

3.2 Raystar 120/112LP - SeaTalk versions

The SeaTalk versions of the Raystar 120/112LP have a 10 m (33 ft) cable with bare ends. Use this cable to connect to your existing SeaTalk bus, using the cable color information detailed in *Figure 3-2*.

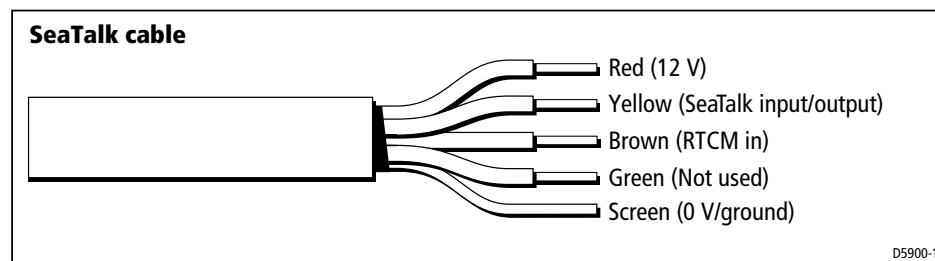


Figure 3-2: SeaTalk cable connections

3.3 Using a connector block

When connecting a Raystar 120/112LP into an existing instrument system or to certain Raymarine chartplotters (e.g. Raychart 630), you can use a connector block to:

- connect into the SeaTalk bus
- supply power to the SeaTalk bus for this and other applications (if DC power is not already available via an existing SeaTalk instrument)

Figure 3-3 shows how you can use a connector block to make the interconnections between the Raystar 120/112LP, the SeaTalk bus and, if required, an external DC power supply.

CAUTION:

Use a multimeter (set to an appropriate range) to check correct polarity and connections to the 12 V DC supply before you apply power to the Raystar receiver.

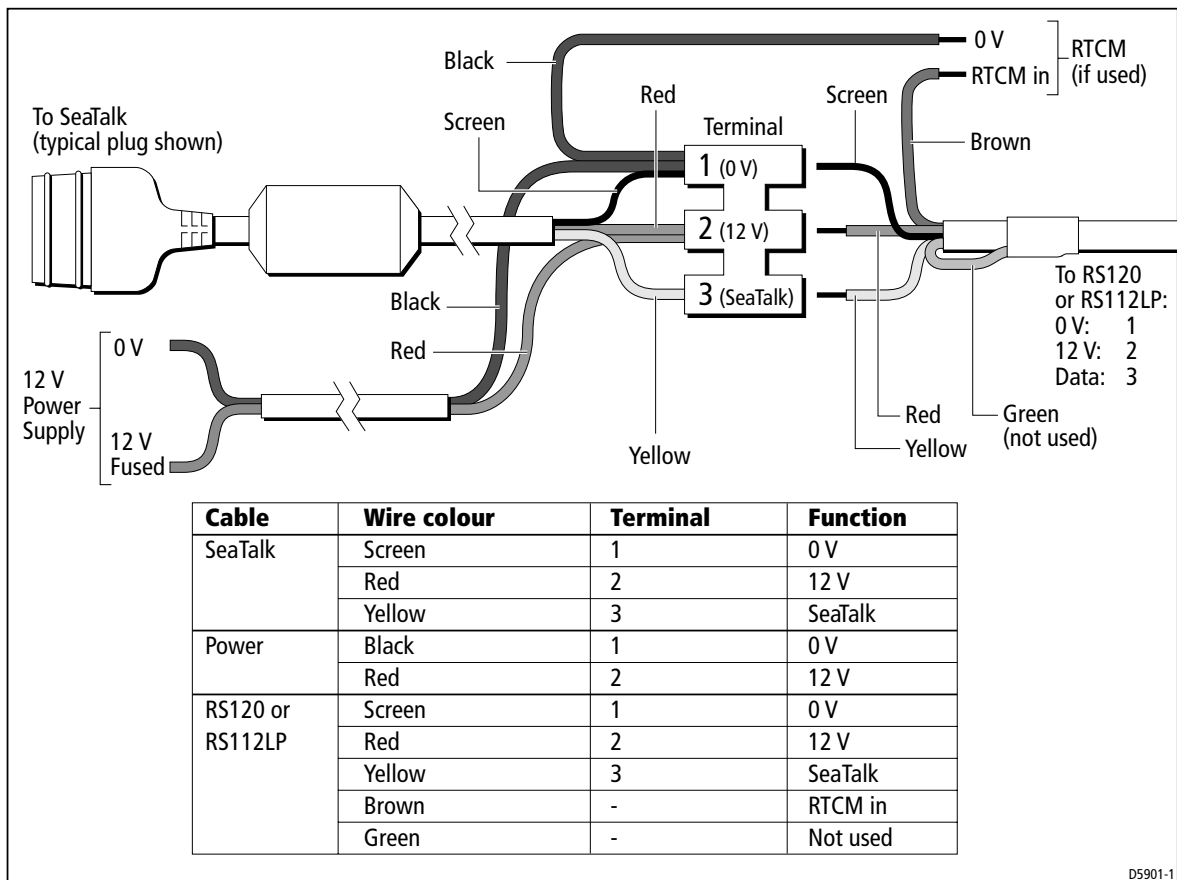


Figure 3-3: NMEA/SeaTalk wiring interconnections

Note: You can obtain a suitable SeaTalk Auxiliary Junction Box from your Raymarine agent. It is supplied with certain chartplotter products.

D5901-1

NMEA inputs/outputs

Information transfer between units is determined by various data sentences transferred via NMEA as detailed in *Table 3-2*.

Table 3-2: NMEA sentences

NMEA sentences	
Output sentences	GPGGA, GPGSA, GPGSV, GPGLL, GPRMC, GPDTM, GPVTG, PRAYA
Input sentences	PRAYI, PRAYE, PRAYA

For further technical information, please visit the Raymarine web site at:

<http://www.raymarine.com>

Chapter 4: Product Support & Servicing

All Raymarine products are designed to provide many years of trouble-free operation. We also put them through comprehensive testing and quality assurance procedures before shipping.

CAUTION:

The Raystar 112LP and Raystar 120 receivers DO NOT contain user-serviceable parts. They should be serviced only by authorized Raymarine service technicians.

4.1 EMC, servicing and safety guidelines

- Raymarine equipment should be serviced only by authorized Raymarine service technicians. They will ensure that service procedures and replacement parts used will not affect performance. There are no user serviceable parts in any Raymarine product.
- Some products generate high voltages: never handle the cables/connectors when power is being supplied to the equipment.
- When powered up, all electrical equipment produces electromagnetic fields. These can cause adjacent pieces of electrical equipment to interact with one another, with a consequent adverse effect on operation. In order to minimize these effects and enable you to get the best possible performance from your Raymarine equipment, guidelines are given in the installation instructions, to enable you to ensure minimum interaction between different items of equipment, i.e. ensure optimum Electromagnetic Compatibility (EMC).
- Always report EMC-related problems to your nearest Raymarine dealer. We use such information to improve our quality standards.
- In some installations, it may not be possible to prevent the equipment from being affected by external influences. In general this will not damage the equipment but it can lead to spurious resetting action, or momentarily may result in faulty operation.

4.2 Product support

Raymarine products are supported by a worldwide network of distributors and Authorized Service Representatives. If you encounter any difficulties with this product, please contact either your national distributor, or your service representative, or the **Raymarine Technical Services Call Center**. Refer to the back cover or the Worldwide Distributor List for contact details.

Specifications & Compatibility

Raystar 120/112LP specifications

Raystar 120 and 112LP	
Receiver type:	Raystar 112LP: GPS, 12 parallel channels Raystar 120: SD-GPS, WAAS/EGNOS/MSAS ready, 12 parallel channels
Frequency:	1575.42 MHz \pm 1 MHz (C/A code), L1
Sensitivity:	-130 dBm
Signal acquisition:	Automatic
Time to first fix (TTFF):	< 8 seconds (typical); < 45 seconds from cold start (average)
Position accuracy:	Raystar 112LP: <15 m 95% (L1, C/A code HDOP < 2 without SA) Raystar 120 (with WAAS/EGNOS/MSAS): <3 m 95% (L1, C/A code HDOP < 2 without Selective Availability)
Speed accuracy:	0.1 kts RMS (L1, C/A code HDOP < 2.5 without Selective Availability)
Geodetic datum:	WGS-84 (227 selectable alternatives)
Power requirement:	NMEA versions: 9 V to 30 V NMEA @ 1.5 Watts SeaTalk versions: 9 V to 18 V SeaTalk @ 1.5 Watts
Data input/output:	NMEA versions: NMEA 0183 Ver2.3 output; non-isolated NMEA input; RTCM SC-104 Ver 2.1 input. SeaTalk versions: SeaTalk bus; RTCM SC-104 Ver 2.1 input
Operating conditions:	temperature range: -10°C to 70°C (14°F to 158°F) water protection: waterproof to CFR46
Storage conditions:	temperature range: -10°C to 70°C (14°F to 158°F)
Cable length:	10 m (33 ft)
Dimensions:	diameter: 95 mm (3.7 in) height: 30 mm (1.2 in); 62 mm (2.4 in) with pole mount kit
Weight:	0.435 kg (15.3 oz)
Memory backup:	Lithium battery (10 year life)
CE approvals - conforms to:	89/336/EC (EMC), EN60945:1997

CAUTION:

Take care when disposing of this unit, as it contains a lithium battery. You must follow any local regulations relating to the disposal of hazardous materials.

Raystar 120/112LP compatibility

The Raystar 120 and 112LP receivers are available in two versions: SeaTalk or NMEA. Each version is easily identified with **NMEA** or **SEATALK** printed on the top of the receiver case.

- **NMEA versions** of the Raystar 120 (Part no: E32026) and 112LP (Part no: E32002) receivers can be used to replace the Raystar 100, 900, 105, 108, 112, Apelco 1100, 180, 182 and 182XT GPS antennas
- **Seatalk versions** of the Raystar 120 (Part no: E32025) and 112LP (Part no: E32001) can be used to replace the Autohelm Black Box Z146, Autohelm Z197 and Z260 GPS antennas

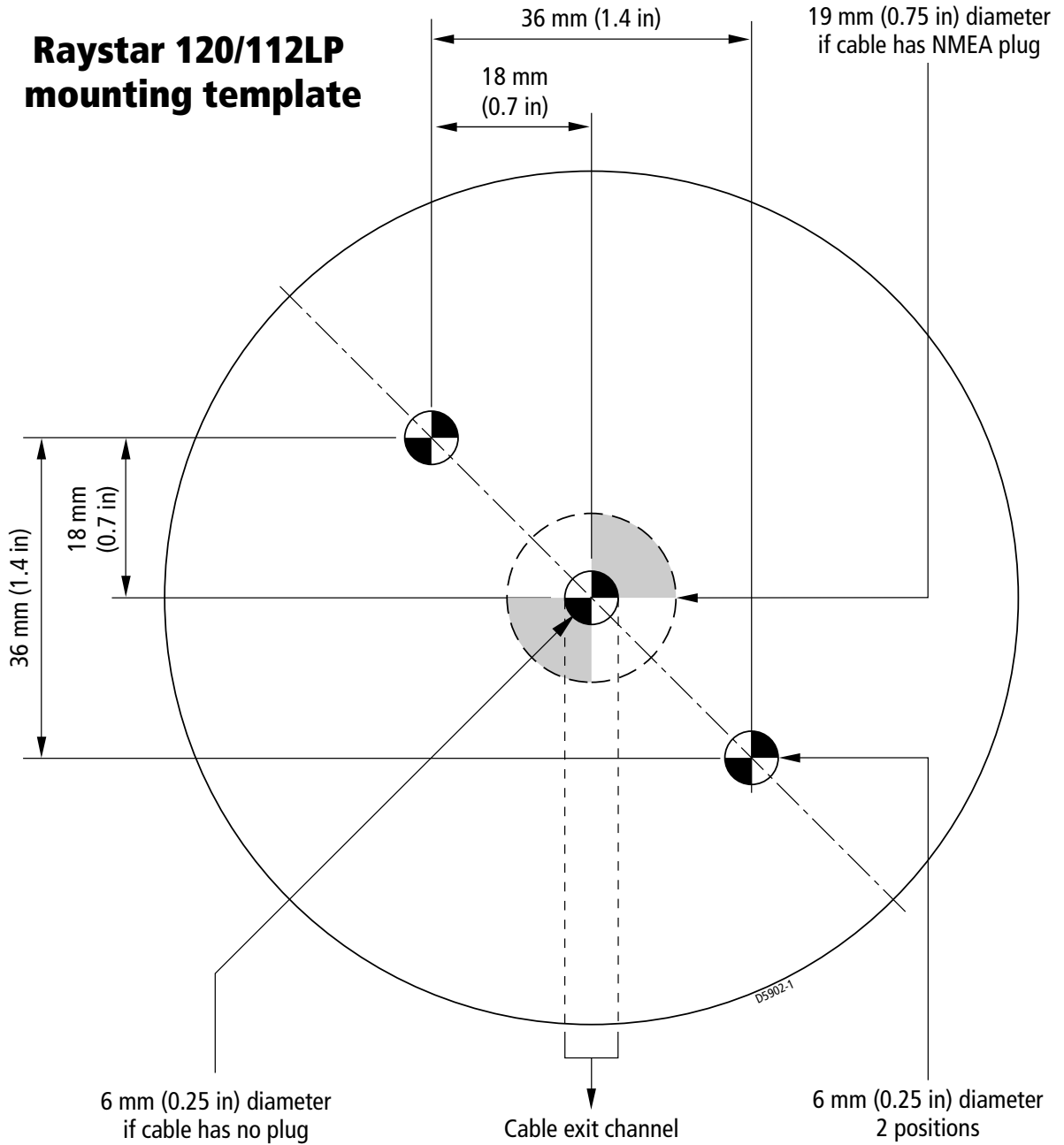
The following table identifies the recommended Raystar 120 or 112LP receiver version for compatible Raymarine, Autohelm and Apelco units.

Raystar 120 NMEA (E32026) Raystar 112LP NMEA (E32002)	Raystar 120 SeaTalk (E32025) Raystar 112LP SeaTalk (E32001)
NAV298, 398	Autohelm ST50 GPS*
Raynav 575	Autohelm ST50 Navdata*
Raystar 390, 790	Autohelm ST80 GPS (Masterview/ Navigator)
Fishfinder V850, 8010	Autohelm Navcenter 300*, 500*, 700*
Raychart 600*, 610*, 611*, 620*, 630*	Fishfinder L755*, L760*
Raychart 420	Raychart 520*, 530*, 631*
Autohelm Navcenter 600*	Pathfinder (LCD) RL70*, RL70RC*, RL70C*, RL70CRC*, RL80*, RL80RC*
Apelco 530, 560	Pathfinder (CRT) R70*, R70RC*, R80*, R80RC*
Apelco 6400, 6700, 6760, 6800, 7000	
Apelco GXL 1100	

*Model is both Seatalk and NMEA compatible, however the recommended RS120 or RS112LP version should be used for complete functionality and to simplify installation.

Note: On some earlier units (e.g. Raychart 630) designed before WAAS and similar systems were available, a satellite differential fix (SD-FIX) will be reported as D-FIX. In such cases a satellite differential fix will still be acquired and the enhanced navigational accuracy of the satellite differential system will still be utilized.

Raystar 120/112LP mounting template



This equipment uses certain elements of software supplied to Raymarine by SiRF Technology Inc., to which the following licence agreement applies. Please read it carefully.

SiRF LICENSE AGREEMENT

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4. TERM AND TERMINATION. This Agreement shall be effective on the date that you use the Software, and shall continue in effect until terminated in accordance with this Section 4. SiRF may terminate this Agreement for material breach by providing thirty (30) days written notice to you. Upon termination of this Agreement, all rights granted by this Agreement shall revert to SiRF, and you shall cease and desist all use of the Software. The following provisions of this Agreement shall survive its termination: Sections 2 through 11.

5. ASSIGNMENT. This Agreement shall inure to the benefit of and be binding upon each party's permitted successors and assigns.

6. GOVERNING LAW. The validity, interpretation, construction and performance of this Agreement shall be governed by the laws of the State of California, excluding its conflict of laws principles.

7. LEGAL REQUIREMENTS. You may not export, re-export, divert, transfer or disclose, directly or indirectly the Software and any related technical information or materials without complying strictly with all legal requirements. You agree to comply with all applicable federal, state and local orders, laws, regulations and ordinances, including specifically United States federal government regulations relating to use of products containing global positioning systems technology.

8. U.S. GOVERNMENT RESTRICTED RIGHTS. The Software and Documentation are provided with Restricted Rights. Use, duplication, or disclosure by the Government is subject to restrictions as set forth in this Agreement, pursuant to DFARS 227-7202-3 or subparagraphs (c)(i) and (2) of the Commercial Computer Software-Restricted Rights at 48 CFR 52.227-19, as applicable, or as set forth in the particular department or agency regulations or rules that provide SiRF with protection equivalent to or greater than the above-cited clause. The Manufacturer is SiRF Technology Incorporated, 3970 Freedom Circle, Santa Clara, California 95054.

9. MISCELLANEOUS. This Agreement contains the entire understanding and agreement between the parties respecting the subject matter hereof and all prior understandings, representations and agreements of the parties, whether oral or written, with respect to the subject of this Agreement are superseded in their entirety. If any provision of this Agreement shall be held by a court of competent jurisdiction to be illegal, invalid or unenforceable, the remaining provisions shall remain in full force and effect. This Agreement may not be supplemented, modified, amended, released or discharged except by an instrument in writing signed by each party's duly authorized representative. This Agreement is in the English language only, which language shall be controlling in all respects. The rights and obligations of each party to this Agreement shall not be governed by the provisions of the United Nations Convention on Contracts for the International Sale of Goods. If any action at law or in equity, including an action for declaratory relief or injunctive relief is brought to enforce or interpret the provisions of this Agreement, the prevailing party shall be entitled to reasonable attorneys' fees in addition to any other relief to which the party may be entitled. Any waiver by either party of any default or breach hereunder shall not constitute a waiver of any provision of this Agreement or of any subsequent default or breach of the same or a different kind.

Limited Warranty Certificate

Raymarine warrants each new Light Marine/Dealer Distributor Product to be of good materials and workmanship, and will repair or exchange any parts proven to be defective in material and workmanship under normal use for a period of 2 years/24 months from date of sale to end user, except as provided below.

Defects will be corrected by Raymarine or an authorized Raymarine dealer. Raymarine will, except as provided below, accept labor cost for a period of 2 years/24 months from the date of sale to end user. During this period, except for certain products, travel costs (auto mileage and tolls) up to 100 round trip highway miles (160 kilometres) and travel time of 2 hours, will be assumed by Raymarine only on products where proof of installation or commission by authorized service agents, can be shown.

Warranty Limitations

Raymarine Warranty policy does not apply to equipment which has been subjected to accident, abuse or misuse, shipping damage, alterations, corrosion, incorrect and/or non-authorized service, or equipment on which the serial number has been altered, mutilated or removed.

Except where Raymarine or its authorized dealer has performed the installation, it assumes no responsibility for damage incurred during installation.

This Warranty does not cover routine system checkouts or alignment/calibration, unless required by replacement of part(s) in the area being aligned.

A suitable proof of purchase, showing date, place, and serial number must be made available to Raymarine or authorized service agent at the time of request for Warranty service.

Consumable items, (such as: Chart paper, lamps, fuses, batteries, styli, stylus/drive belts, radar mixer crystals/diodes, snap-in impeller carriers, impellers, impeller bearings, and impeller shaft) are specifically excluded from this Warranty.

Magnetrons, Cathode Ray Tubes (CRT), TFT Liquid Crystal Displays (LCD) and cold cathode fluorescent lamps (CCFL), hailer horns and transducers are warranted for 1 year/12 months from date of sale. These items must be returned to a Raymarine facility.

All costs associated with transducer replacement, other than the cost of the transducer itself, are specifically excluded from this Warranty.

Overtime premium labor portion of services outside of normal working hours is not covered by this Warranty.

Travel cost allowance on certain products with a suggested retail price below \$2500.00 is not authorized. When/or if repairs are necessary, these products must be forwarded to a Raymarine facility or an authorized dealer at owner's expense will be returned via surface carrier at no cost to the owner.

Travel costs other than auto mileage, tolls and two (2) hours travel time, are specifically excluded on all products. Travel costs which are excluded from the coverage of this Warranty include but are not limited to: taxi, launch fees, aircraft rental, subsistence, customs, shipping and communication charges etc. Travel costs, mileage and time, in excess to that allowed must have prior approval in writing.

TO THE EXTENT CONSISTENT WITH STATE AND FEDERAL LAW:

(1) THIS WARRANTY IS STRICTLY LIMITED TO THE TERMS INDICATED HEREIN, AND NO OTHER WARRANTIES OR REMEDIES SHALL BE BINDING ON RAYMARINE INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

(2) Raymarine shall not be liable for any incidental, consequential or special (including punitive or multiple) damages.

All Raymarine products sold or provided hereunder are merely aids to navigation. It is the responsibility of the user to exercise discretion and proper navigational skill independent of any Raymarine equipment.

Raymarine

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Stick barcode label here

Purchased from

Purchase date

Dealer address

Installed by

Installation date

Commissioned by

Commissioning date

Owner's name

Mailing address

This portion should be completed and retained by the owner.