



Milltech Marine

SMART RADIO SR161/SR162/SR162G AIS RECEIVER

OPERATION & INSTALLATION MANUAL

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INTRODUCTION

Thank you for choosing the Smart Radio AIS Receiver. The SR161 and SR162 receivers are high quality AIS receivers that use VHF technology. These units make it possible to receive information from ships, buoys, lighthouses, SAR helicopters, coast guard units, pilot boats, weather stations, etc. that are equipped with Automatic Identification System (AIS) transponders. According to current AMO and SOLAS regulations, all ships above 300 gross tons are required to carry AIS. This means that your receiver will detect many ships and navigational hazards or information providers, enhancing your navigation safety.

The SR161 is a single channel radio receiver that can scan between the two AIS frequencies and is designed to automatically use the frequency that has the best radio reception. The SR162 is a true dual channel receiver and is able to receive information from both AIS frequencies simultaneously. The SR162G includes all of the features of the SR162 and also includes an integrated GPS module. These three products share the same capabilities for most other features; therefore they are covered together in this manual.

It is very important that you read this manual before you install and use your Smart Radio AIS Receiver.

GLOSSARY

To make it easier to read the manual, we will begin by introducing commonly used abbreviations:

TERM	DEFINITION
AIS	Automatic Identification System
ATC	Air Traffic Control
DGPS	Differential Global Positioning System
ECDIS	Electronic Chart Display and Information System
ETA	Estimated Time of Arrival
GPS	Global Positioning System
GALILEO	European equivalent to GPS
GNSS	Global Navigation Satellite System
IMO	International Maritime Organization
NM	Nautical Mile = 1852 m
RX	Receive/Receiver
SOLAS	Safety Of Life At Sea
SOTDMA/STDMA	Self Organized Time Division Multiple Access
VHF	Very High Frequency
VTS	Vessel Traffic Services (Like ATC but for ships)

CONDITIONS

Before using the SR161 or SR162 product from Smart Radio Holdings Limited, it is important that you read and fully understand the installation manual and its instructions. Only proceed with the installation if you are confident that you will be able to do so.

Smart Radio Holdings Limited cannot be held liable for any injury or damage caused by, during or because of the installation of the unit. These AIS receivers are to be used at your own risk. Please be advised that AIS data depends on the full co-operation of other users and systems.

An AIS receiver is a navigation aid and works in co-operation with other similar systems, such as radar, visual lookout, etc. The user should both inspect the receiver installation and check on its operational quality regularly. Remember that navigation and life at sea always require proper seamanship and an AIS receiver is not a replacement for such qualities.

NOT ALL VESSELS CARRY AIS. IT IS THEREFORE IMPORTANT TO KEEP PROPER LOOKOUT AT ALL TIMES AND TO USE ALL AVAILABLE MEANS TO AVOID COLLISIONS AND ACCIDENTS.

WARRANTY

The SR161 and SR162 units are developed and manufactured to meet high technical requirements and user demands. If installed correctly and maintained regularly, your SR161/SR162 should provide you with several years of operation and be a very useful product. For further warranty information, please contact either Milltech Marine Inc. or Smart Radio Holdings Limited.

Warranty conditions

- The warranty belongs to the purchaser of the product and cannot be handed over to a third party or person.
- The warranty is not valid if the serial number is missing, the seal is broken, or if the SR161/SR162 has been incorrectly installed. The warranty is not valid if: the instructions for connection have not been followed, incorrect usage has caused faults, the product has been modified, or serviced by a non-authorized individual.
- **NOTE: DO NOT OPEN THE UNIT OR ATTEMPT TO SERVICE THE UNIT YOURSELF. IF THE SEAL IS BROKEN ON THE UNIT, YOU WILL INVALIDATE THE WARRANTY IT WILL NOT BE COVERED FOR REPAIR OR REPLACEMENT.**
- Smart Radio Holdings Limited acknowledges that at delivery, each SR161/SR162 has been tested and found operational.
- Smart Radio Holdings Limited agrees to repair or replace any faulty unit at no cost, according to the conditions set forth during a period of one (1) year from day of purchase.
- The warranty includes replacement or repair of a faulty unit due to flawed components or errors relating to the production of the product.
- The warranty covers costs for parts, labor, and return shipment. It does not include shipment to the repair facility.
- Smart Radio Holdings Limited will never be liable under the warranty conditions for incorrect use, misuse, and incidental, indirect or consequential damages of the SR161/SR162.
- Proof of purchase is required for any warranty claim of the SR161/SR162.

Warranty procedures

Smart Radio Holdings Limited repairs and replaces faulty parts or units. The customer is responsible for transport of the defective part or unit to Smart Radio or its retailer.

Warranty claims shall be made to the place where SR161/SR162 was purchased or directly to Smart Radio Holdings Limited through mail, fax or e-mail to our support department.

Other issues

Proper seamanship and common sense are essential when using a SR161 or SR162 receiver and the product shall only be used as a navigation aid. Smart Radio Holdings Limited reserves the right to change the specification of the product without prior notice.

IF YOU ARE UNABLE TO ACCEPT THE TERMS ABOVE, PLEASE RETURN THE SR161 OR SR162 TO YOUR RETAILER FOR FULL CREDIT BEFORE OPENING AND USING.

SUPPORT

If you need support, please contact Milltech Marine or your reseller where you acquired the product.

Milltech Marine can be contacted at:

Email: info@milltechmarine.com

Phone: +1 425 818-5246

Fax: +1 425 484-6218

The manufacturer can also provide direct support:

Email: smartradio@sz.net.cn

Fax: +86 755 88367618.

INFORMATION ABOUT AIS

General

AIS (Automatic Identification System) is the name of a system that enables ships to identify other ships and to monitor their movements. The AIS system offers the mariner more information about ships in the vicinity than what is provided by radar. AIS provides information about a ship's identity (name, call sign, IMO number and MMSI) and size, even for ships behind islands or otherwise undetectable by radar.

AIS is used to enhance safety for life at sea, improve safety and efficiency in navigation and to protect the marine environment.

AIS information transmitted from a ship contains of three (3) main types:

1. Static data that was programmed into the AIS equipment at installation. This only needs to be changed if the ship changes its name, flag or undergoes a major refit where size or ship type is changed
2. Dynamic data containing information that is automatically updated from ship sensors, such as the heading from the compass or position and speed from GPS equipment. Also, navigational status belongs to the group of dynamic data, but is updated manually by the crew.
3. Voyage related data that manually is updated by the crew along the voyage.

Initially, AIS was also referred to as UAIS or as the 4S transponder system (meaning Ship to Ship and Ship to Shore).

In 1998 IMO adopted a performance standard for AIS within the SOLAS requirement that described in general how AIS should work. Below follows a brief description of the main requirements for AIS from the performance standard:

- Automatically provide information to AIS land stations, other ships and airborne units such as search and rescue (SAR) helicopters about the ships identity, type of ship, position, course, speed, navigational status (e.g. under way using engine, at anchor) and other important safety related information.
- Be able to receive the same type of information from other ships.
- Be able to monitor and track other ships.
- Exchange information with land based AIS systems.

AIS is an automatic system that continuously and simultaneously transmits on two channels in the maritime VHF frequency band.

AIS can handle several reports in a rapid continuous sequence. To accomplish this AIS uses a technique called Self Organized Time Division Multiple Access (SOTDMA) that guarantees high transmission safety and operational robustness.

AIS also allows for other types of information from sensors such as a gyro compass, GPS and echo sounders to be transmitted automatically.

Important areas where AIS is used are:

- Information exchange between ships within VHF range (normally 20-30 NM) to enhance safety at sea and to improve situation awareness.
- Information exchange between ships and AIS land stations as a VTS that controls and monitors maritime traffic in an area.
- Automatic reporting in areas with mandatory reporting of different kinds.
- Exchange of safety related information between ships, and between ships and land stations.

- Services like real-time weather information, identity and position of navigation aids.

Short technical description of AIS

AIS operates primarily on two dedicated VHF-frequencies (AIS1 – 161,975 MHz and AIS2 – 161,025 MHz). In areas where these two channels are unavailable, AIS can automatically switch to other alternatively available frequencies.

AIS uses two VHF radio channels, where the information is transmitted in short data packages or slots in predefined and synchronized time frames. The dynamic information (position, speed, heading etc) is transmitted in intervals from 2 seconds up to 10 seconds, depending on the speed and maneuvers of the transmitting ship where the AIS is mounted. Static and voyage related information (type of ship, size, cargo, destination etc.) is transmitted every six minutes or upon request from other units. Position, course and speed are normally collected from the same sensor systems that provide the information used in radar navigation or ECDIS, and this is normally based on GPS or DGPS. All ships within VHF coverage will be able to receive AIS data, and authorities that have installed networks with coastal AIS coverage can receive the information. The capacity for ships to report is defined by the IMO performance standard to a minimum of 2000 data packages or slots per minute. ITU (the Technical Standard for the Universal AIS) has doubled this and has provided AIS with 4500 data packages or slots per minute. The transmission is based on the SOTDMA (Self-organized Time Division Multiple Access) technique. This allows the system to be overloaded by up to 500% and still give almost a 100% message throughput between ships closer together than 8 to 20 nautical miles. In the case of system overload, close targets will be selected in favor of distant targets. In reality, the system capacity is unlimited and allows for a large number of ships to communicate simultaneously.

Limitations with AIS

You should always be aware that not all ships (e.g. pleasure craft, fishing boats, warships, some coastal stations and VTS centers) will be equipped with AIS. Ships that have been mandated to carry AIS may also, under certain conditions, turn off their AIS equipment at the master's discretion. Therefore it is important to be aware that the information that AIS provides might not be a full and complete picture of the situation around your ship.

Users of AIS must also be aware that transmission of false data can occur and that this can be hazardous not only to your own ship, but to others as well. The user is responsible for all data that is entered into the system and for information provided by external sensors. The accuracy of received AIS data is only as good as the information transmitted from the source of information.

You should always be aware that incorrectly configured or calibrated ship sensors (positions, speed or heading sensors) could lead to the transmission of false information. Faulty information from another ship can cause dangerous situations.

SMART RADIO SR161/SR162/SR162G AIS RECEIVER

General description

With your SR161/SR162/SR162G you will be able to "see" other AIS equipped ships within your VHF coverage area. The transmitted information includes ship's name, call sign, heading, speed, course, destination and type. The SR161/SR162 complies with the NMEA 0183 and IEC 61161-1 standards, and can be connected to any electronic chart system or radar system that supports these formats and has the capacity to display AIS targets and

data. The installation is quick and easy since it only requires proper setup of a power connection, a VHF antenna and a data cable to your display system. SR161/SR162 is a good complement to radar, since ships with AIS transponders will be easy to identify on the radar screen.

Technical specification

The SR161 unit is a compact, two-channel scanning receiver with a synthesized VHF receiver that operates in the maritime VHF frequency band. It has been designed to receive and decode transmissions from other AIS transceivers. When the SR161 detects that there is strong interference in the receiving AIS channel, it will switch to the alternative AIS channel for better performance.

The SR162 unit is similar to the SR161 with one major exception. It is a true two-channel receiver and therefore is able to receive information from both AIS channels simultaneously. It then consolidates the data stream from both channels and transfers the result as output on the serial port.

The SR162G unit has all of the features of the SR162 but also includes an integrated 12 channel GPS receiver. The GPS receiver connects to the included active GPS antenna via a dedicated GPS port on the SR162. The serial data stream from the SR162G includes AIS vessel traffic information from both AIS channels and GPS position information.

Electrical data

Power: 9 - 15 volt DC
Power consumption: 1.5 watts

Data output

Data Speed: 38400 baud (default)
Format: NMEA 0183 version 3
NMEA output data format: VDM, standard GPS sentences (SR162G only)

Receiver

Frequency: AIS1 161.975 MHz, AIS2 162.025 MHz
Sensitivity: -112dBm
Antenna impedance: 50 ohm
GPS: 12 channel integrated GPS receiver (SR162G only)

Physical data

L x W x H: 115 x 75 x 28 (mm)
Weight: 400g
Antenna Connectors: VHF BNC, GPS antenna port (SR162G only)
Data output port: 9 pin D-sub connector

HOW TO INSTALL THE SR161/SR162/SR162G AIS RECEIVER

Introduction

SR161/SR162 is easy to install. You will need antenna cables and connectors for a VHF antenna (not included) and access to 12 volt DC power. When this is in place, your SR161/SR162 can easily be connected to your PC or any other type of supported display system, such as a chartplotter. Please be aware that the software that you use to display AIS data must be compatible with the standard messages that AIS provides on its data output port. The data output port sends serial data through a serial cable to the display system so that AIS targets can be displayed.

The SR162G includes an integrated GPS unit, a connection port for a GPS antenna and an active GPS antenna.

NOTE: Before connecting the AIS receiver to a computer or chartplotter, please ensure that the power is OFF to the AIS receiver while making the connection. Once you are sure that the wiring to the external device is correct, proceed with powering on the AIS receiver. Failure to follow these instructions can result in damage to the AIS receiver.

Installation

This section describes the most important information you need to install your SR161/SR162 receiver. You should read the entire manual to get a full understanding of how to install and operate your SR161/SR162.

If you want your SR161/SR162 to operate with monitoring software, chartplotter, or PC-based software, please do the following:

Checking your material

Check that you have received all the equipment with your SR161/SR162 and that the delivered equipment has not been damaged during delivery. If the equipment has been damaged, please contact your reseller or our support.

Installing your receiver

SR161/SR162 is designed to be installed in a protected indoor environment and needs to be placed where it is well protected from humidity and water. Do not place SR161/SR162 close to generators or compressors (e.g. refrigerators) since they can interfere with reception. Normally a suitable placement of the SR161/SR162 is together with other types of navigation equipment and the PC or chartplotter that will be used to display the AIS data. A position close to an accessible power outlet is a good idea. SR161/SR162 also contains led indicators for AIS reception on both channels and output on the data port; therefore it is a good idea to have these indicators visible to ensure performance and functionality. SR161/SR162 is easy to mount on the bulkhead or on panels.

Antenna installation

Install the VHF antenna at a suitable position onboard (see further information below).

The shortest possible antenna cabling should be used. The cable type selected should be based on the cable length to avoid power loss. All connectors should be properly joined to avoid power loss and thoroughly sealed with self-amalgamating rubber tape to avoid humidity in the connectors. Excessive humidity may interfere with the correct operation of the SR161/SR162.

Quick guide for cable selection:

Length	Cable types
< 10 m cables	RG58C/U
> 10 m cables	RG213/U

VHF antenna

SR161/SR162 is not delivered with a VHF antenna since requirements for the antenna and cables can be different in various types of installations. Milltech Marine does sell a short portable VHF antenna that may be appropriate for short range applications. A VHF antenna

is necessary for the AIS receiver to work properly. VHF antennas can normally be provided by marine electronic shops. The antenna cable type should be at least RG58C/U or better.

The VHF antenna installation is often a compromise of the following requirements:

- Separation between different antennas
- Free line of sight 360 degrees
- Antenna height

Antenna separation

The AIS receiver uses frequencies in the upper part of the maritime band. Normally channel 87B, AIS 1 (161.975 MHz) and channel 88B, AIS 2 (162.025 MHz). AIS frequencies are situated in the duplex band close to coastal stations transmit channels. To avoid interference, separate the SR161/SR162 antenna as much as possible from the VHF radio antenna. This will be best accomplished if the antennas are placed at different heights or on different sides of the mast or boat. An active VHF splitter can also be used as an effective solution for antenna placement. Milltech Marine sells an active VHF antenna splitter that has been specially designed to work with the Smart Radio AIS receiver family of products.

Line of sight

To have the best possible reception for the SR161/SR162 place the antenna with free line of sight around the full horizon. Larger objects can block the signals from certain directions.

Antenna height

AIS uses frequencies in the maritime VHF band. The area of coverage in this frequency band is almost the same as line of sight. This means that the higher you put your antenna, the longer range you will have.

The VHF antenna should be of a standard marine type for full functionality of the SR161/SR162.

- Antenna type: Vertical radiator
- Antenna gain: 0 – 3 dBd
- Impedance: 50 ohm

The VHF antenna for the SR161/SR162 should be placed as high as possible and with proper separation from other transmitting antenna equipment onboard. A suitable solution is to use an active VHF antenna splitter that allows you to use existing VHF antenna installations. The VHF splitter solution will save both time and installation cost, and an existing VHF antenna is normally already placed on the most favorable onboard location. Active VHF antenna splitters are available from Milltech Marine as an optional accessory.

The VHF antenna connection should be connected to the right connector (BNC) on the SR161/SR162.

GPS antenna (SR162G only)

The SR162G includes a magnet mount active GPS antenna with a 16 foot cable that attaches to the SR162G unit. The GPS antenna should be installed in a location that has a clear line of sight to the sky.

Simply connect the GPS cable to the port that is labeled GPS on the SR162G unit.

Power

Connect the SR161/SR162 to 12 volts DC via a 0.5A fuse. The SR161/SR162 comes with a power cable already fitted with a fuse, and with a 2-pole DC connector that locks automatically when fitted.

- Red cable is positive
- Black cable is negative

When SR161/SR162 is connected to 12 volts DC the DATA led indicator should flash green momentarily.

Connection to external GPS

The SR161/SR162 can be connected to an external GPS sensor to provide position data through the SR161/SR162 AIS receiver. This is useful since it means that you can use one port on your display system. It will also solve the problem of having different data speeds from the GPS (normally 4800 baud) and AIS (38400 baud). The SR161/SR162 automatically mixes the GPS and the AIS data and outputs a seamless stream of data into your display system, presenting your own position and AIS information. The SR161/SR162 will not filter any data from the external GPS and will output the full throughput of all transmitted data from the GPS. The connection is made in the following way.

SR161/SR162	RS232 port	Data
2	2	Data output - 38400 baud to computer
3	3	Data input – 4800 baud from GPS
5	5	Signal ground

The connection can be made with a splitter that takes data from the GPS into the SR161/SR162 AIS receiver on pin 3 and transmits data from the SR161/SR162 AIS receiver to the display system on pin 2 as shown. Milltech Marine sells cables to address this need. See www.milltechmarine.com for more information.

Connection to PC

Use the included serial cable for the RS232 serial connection. Connect the cable to the connector on the SR161/SR162 and then to the PC or chartplotter port. If your PC does not have a serial port, a Serial to USB converter can be used. (If a serial cable other than the included one is used, it should use the same pin-to-pin connection i.e. 2-2, 3-3, 5-5)

Start your navigation system or plotter and set the baud rate to 38400 baud on the serial port where you connect your SR161/SR162.

Note: If you do not have any AIS software you can use the HyperTerminal program supplied with Windows. This can be found by selecting:

Start → Programs → Accessories → Communications → HyperTerminal

Set the COM port for:

- Baud rate: 38400 baud
- Data bit: 8
- Parity: None
- Stop bits: 1

When your port is set to receive data as described above, you should be able to see NMEA data for AIS, with the VDM label, following normal NMEA structure. Make sure you hit "Call" to connect Hyperterminal to the port. For example:

```
! AI VDM, 1, 1, , B, 169?; >000089Jap<nvS<2r2d0H<q, 0*13
! AI VDM, 1, 1, , B, 177CQd800q`9C8D<n4A=L: bf0D0o, 0*0E
! AI VDM, 1, 1, , B, D04SGT1@qNL8, 0*1F
! AI VDM, 1, 1, , B, 19NWp8h00289HGt<ni i`L4JI 0<0k, 0*67
```

```

! AI VDM, 2, 2, 4, B, H888888888888880, 2*53
! AI VDM, 1, 1, , B, 403tAeQuBU8=N`9E; p<noc70050I , 0*6D
! AI VDM, 1, 1, , B, D04SGTOI i NL8, 0*2A
! AI VDM, 1, 1, , B, 14RI 1JOP0089GU0<nG@=B?w<0@HB, 0*27
! AI VDM, 1, 1, , B, 14RE3POP0089E; h<nTgoCwwF0@JL, 0*5E
! AI VDM, 1, 1, , B, 177CQd800q`9C4p<n5`eI beJ0@Jm, 0*44
! AI VDM, 1, 1, , B, D04SGTOI 1NL8, 0*57
! AI VDM, 1, 1, , B, 403tAeQuBU8=j`9E; p<noc70050I , 0*49
! AI VDM, 1, 1, , B, D03tAePF4ffpF5N9H0, 4*18

```

If you are using the SR162G product or have integrated a GPS data feed into the SR161 or SR162, then you will see data that includes GPS information as well as AIS information.

Connection to a Chartplotter

The Smart Radio AIS Receiver can be used with most chartplotters and other equipment that support AIS. Ensure that your chartplotter supports AIS data. Only recent chartplotter models support AIS. It is possible your model will support AIS with a ROM upgrade. Contact your chartplotter manufacturer to confirm that AIS data is supported by your model or if an upgrade is available.

You will need to connect wires from pins 2 (data) and 5 (ground) on the AIS Receiver to the NMEA input on my chartplotter. Use an Ohm meter to ensure that the wire connected to pin 2 of the AIS Receiver serial output is connected to the terminal on the chartplotter for NMEA "data in" and pin 5 from the AIS Receiver is connected to the ground terminal on the chartplotter. In some case, pin 2 will be connect to "NMEA DATA IN +" and pin 5 will be connected to "NMEA DATA IN -" Do not connect pin 3 to any connection on the chartplotter. When looking at a DB9 male serial connector with the pins facing you, pin 2 is the second from the left on the top row and pin 5 is the pin furthest to the right on the top row. If you are using the cable that came with your Smart Radio AIS Receiver and have cut it to expose the bare wires, the RED or BROWN wire is normally connected to pin 2 or data out and the GREEN or YELLOW wire is normally connected to pin 5 or ground. **HOWEVER**, please double check this with an Ohm meter before connecting your equipment together. We can not guarantee this color coding is correct as serial cable manufacturers do not follow a color coding standard. Connecting the wrong wires can damage your AIS Receiver, your chartplotter or both.

Next, ensure that the baud rate for the inbound NMEA port on the chartplotter is set to 38400 baud. This is sometimes referred to as a "high speed serial" setting (e.g. on some Garmin models). See the instructions with your chartplotter for information on how to do this.

If your chartplotter supports AIS but does not support NMEA inbound data at 38400 baud, then you will need to change the baud rate on the AIS Receiver to match the supported baud rate on the chartplotter. This is usually 4800 baud. To change the baud rate on the AIS Receiver to 4800 baud, do the following:

- 1) Disconnect the VHF antenna from the AIS Receiver.
- 2) Connect the AIS Receiver to a computer running a terminal emulation package such as Hyperterminal and set it to the correct COM port and baud rate (38400).
- 3) In the terminal emulation session, hit <SPACE> then <ENTER>. You should see something similar to the following on the screen:

```

SR162 AIS Receiver
RECE FRQ      R1F1619750
RECE FRQ      R2F1620250
INT RATE      I 38400
&

```

- 4) Enter the following in the terminal window to switch the unit to 4800 baud:

```

I 4800

```

- 5) Hit <ENTER> and then "Q" to save the change.
- 6) Turn the power off to the AIS Receiver. Reset the baud rate in your terminal emulation package to 4800 baud. Turn the power on again to the AIS Receiver. Hit <SPACE> then <ENTER> to ensure that the new baud rate is active.
- 7) The receiver should now be operating at the new baud rate. Reconnect it to the chartplotter and test for AIS functionality.

In some cases, the chartplotter will not display any indication that AIS is working except to display vessels on the screen if you are in range of transponders. Be sure to test your chartplotter in an area where transponder signals can be received.

Programming new settings for the AIS receiver

Certain settings for the Smart Radio AIS Receiver can be changed by the user by entering Programming Mode.

To enter Programming Mode, you first must ensure that the AIS Receiver is properly connected to computer. Use HyperTerminal or another terminal emulation package with the following settings: COM port = the port the AIS receiver is connected to, baud rate = 38400 baud, data bit = 8, parity = None, stop bits = 1. Supply power to the AIS Receiver. In the terminal session, press the "SPACE" key then the "ENTER" key. The screen will display:

```
SR162 AIS Receiver
RECE FRQ      R1F1619750
RECE FRQ      R2F1620250
INT RATE      I 38400
&
```

To change selected parameters, just input the right half of the information line with the new setting that you wish to use followed by the "ENTER" key. For example, to change the AIS1 frequency to 156.5250Mhz, input:

```
R1F1565250
```

And then press "ENTER". If the command is accepted, a "&" will be displayed. To change the RS232 baud rate to 4800 baud, input:

```
I 4800
```

After checking that the parameter is properly set using "SPACE" followed by "ENTER", press "Q" to save the changed parameters and to put the AIS Receiver back into Receiver Mode. Turn the unit off and on once it has been reprogrammed.

Note: If you have changed the RS232 interface baud rate, be sure to set your navigation software or device communications settings to the new baud rate as well. Also, if you need to program the unit again, be sure to set the terminal emulation package with the correct baud rate.

Operational Guidelines for SR161/SR162

SR161/SR162 has two (2) led indicators to help with status monitoring of the AIS receiver.

The A/B light flashes **RED** when the SR161/SR162 is receiving data on the AIS radio channels. In some cases, spurious transmissions can cause this LED to flash even if no AIS data is being output.

The DATA light flashes **GREEN** only when the SR161/SR162 is transferring data to your application on the data port. The DATA LED will also light momentarily when power is turned on to the receiver. If no vessels are within range, then the LED will not flash. You may need to reduce the ambient light and look at the LED straight on in order to verify that it is flashing. Each flash is very short in duration and corresponds to a data packet being transmitted over the serial port.

If the A/B light shows a constant light it means that there is interference on one or both of the frequencies. You need to investigate the cause of the problem.

SR161/SR162 offers several ways to enhance navigational safety as a complement to radar and electronic charting systems. With an AIS receiver, you will improve safety during navigation in low visibility or at night. At sea, AIS provides enhancement to using radar alone, especially during rain, snow and sea clutter conditions. With AIS, it is also possible to “see” behind islands and areas blocked by land.

Several Maritime authorities will also transmit safety related information using land based AIS networks. These are messages that will contain information about sudden threats in fairways, navigational warnings, meteorological data, etc. Meteorological information will also be transmitted in real-time from certain strategic positions along coastlines. These broadcasts will contain information such as wind speed, wind direction, water level, temperature, currents, and tides.

AIS transponders will transmit the following data that can be received from your unit:

Static Information	Dynamic Information	Voyage related Information
Name	Position	Destination
Type of ship	Speed Over Ground	Depth
Call sign	Course Over Ground	ETA
MMSI number	Rate Of Turn	Navigational Status
IMO number	Heading	Size

Note: Some ships may not have properly programmed their AIS transponders and parts of the above-mentioned information can be missing.

FAQ

Q: What is AIS?

A: AIS or the Universal Shipborne Automatic Identification System (AIS) is a ship transponder system that is currently used by most of the commercial shipping industry. AIS uses two marine VHF channels. Each ship equipped with an AIS transponder sends out a packet every few seconds with information about the ship and its voyage. With an AIS receiver, you can pick up these radio signals and have them translated into a NMEA data sentence that can be accessed using a standard RS232 serial interface.

Q: How can I use the data stream from an AIS receiver?

A: Many modern computer-based marine navigation software packages, such as Rose Point Coastal Explorer 1.1 and Nobeltec Visual Navigation Suite 9.0, can be configured to interpret the incoming AIS data stream and convert the information into human readable information. These packages also support plotting nearby ships on digital charts and can show your position (via a separate GPS) in relation to the other vessels in the area that have AIS transponders.

Q: Is it possible to connect my AIS receiver to a chartplotter?

A: Today most modern chartplotters support being connected to an AIS receiver and are able to display AIS targets. Some of the manufacturers that support this today include Raymarine E and C Series, Garmin, Standard Horizon, Furuno, Seiwa and Interphase. Other manufacturers are working on this feature and have stated they will be able to support AIS in future models. For further information contact your supplier and ask about AIS support in their product.

Q: Do these AIS receivers work with Raymarine's E Series and C Series chartplotters?

A: Yes, the Smart Radio AIS receivers work well with Raymarine E series and C series chartplotters with the latest ROM upgrade from Raymarine. Normally, you would connect the AIS Receiver to the high speed NMEA input on the chartplotter. For information on connecting these devices can be found in our documentation and our online troubleshooter.

Q: What electronic chart programs can handle AIS today?

A: Today several software packages support AIS. The ones known to work are:

- Rose Point Coastal Explorer 1.1
- Maptech Chart Navigator Pro
- Nobeltec Visual Navigation Suite 8.0 or above
- Nobeltec Admiral
- Memory Map Navigator Pro
- Boatcruiser 2.0
- Seaclear
- Capn 8.0
- Global Navigation Software NavPak Y-tronic Yacht-AIS
- Navicon AIS Navigator

- COAA Ship Plotter
- DigiBOAT Software-On-Board
- MacENC and GPSNavX for Macintosh
- MaxSea v12.5.3 with Mobiles Module

Software that can handle the NMEA VDM messages and display the data should work with the SR161/SR162 AIS Receiver. Ask your provider for further information.

Q: Will an AIS receiver work with my network solution onboard?

A: All networks that can handle NMEA VDM serial data at the speed 38400 baud will be able to handle AIS data. We have been informed that Silva and Navnet are able to do so. Ask your network provider for further information.

Q: What are the basic steps to install an AIS receiver?

A: The receiver has three connections:

One connection is for a standard marine VHF antenna. The Smart Radio AIS receivers use a BNC connector so if you need to connect to typical VHF radio antenna cable that uses a PL-259 cable, you'll need a BNC to PL-259 adapter. Both Milltech Marine and Radio Shack sell these.

The second connection is a 9 pin serial port which can be connected to a computer serial port using a standard serial cable (all AIS receivers from Milltech Marine include a serial cable).

The third connection is for 12 volt DC power.

Once these connections have been made, simply configure your marine navigation software to utilize the new serial port connection as an incoming "listener" serial data stream. Note that the Smart Radio AIS receivers use 38400 baud by default so make sure you configure your software program appropriately.

For the SR162G, you will need to also connect the included GPS antenna and make sure it is placed in a location that has a clear path to the sky.

Q: I don't have a spare serial port on my computer. How do I hook up the AIS receiver to my computer?

A: You typically have two options.

The first option is to use a serial to USB adapter. Connect the serial end to the AIS receiver and the USB end to a spare USB port on your computer. Make sure you know which COM port has been assigned to the USB serial port and configure your software appropriately. Note that some cheaper serial to USB adapters can be unreliable or cause system crashes. The Keyspan High Speed USB Serial adapter has been tested with Smart Radio AIS receivers and works well. These can be purchased separately from Milltech Marine. Test the adapter thoroughly before deploying it on your boat.

The other option you have with the Smart Radio AIS receiver, is to use the unit as a NMEA data stream consolidator. What does this mean? You can direct the GPS NMEA data stream into the input pin on the AIS receiver serial port and the unit will then combine the GPS sentences with the AIS sentences and output on the output pin of the serial port a combined data stream. You would then only need one serial port on your computer and this port would have both GPS and AIS data coming through it. Full details are in the installation manual that comes with the Smart Radio AIS receiver. You can also purchase this cable separately from Milltech Marine.

Q: What type of VHF antenna do I need for my SR161/SR162?

A: The VHF antenna should fulfill at least the following requirements:

- Antenna type: Vertical radiator
- Antenna gain: 0 – 3 dBd
- Impedance: 50 ohm

Q: Can I use an existing marine VHF antenna?

A: Yes, you can use a splitter to share your existing VHF antenna to your VHF/DSC radio and your AIS receiver. It is highly recommended that you use an active splitter that automatically disconnects the signal to the AIS receiver if a transmission is detected from the VHF radio. If you use a common T-splitter and then broadcast on the VHF radio, it is possible that you could damage the AIS receiver. Since you have two receiving devices on one antenna, you may also experience some signal degradation. While broadcasting on the VHF radio, you will likely see some interruption of incoming AIS signals. Since AIS broadcasts from each ship are repeated every few seconds, this is not normally noticeable in your tracking software. Milltech Marine sells an active VHF antenna splitter. Visit www.milltechmarine.com for more information. For best performance, use a dedicated VHF antenna that is mounted away from your VHF radio antenna. This will mean less interference and will allow both the AIS receiver and the VHF radio receiver to get maximum receiving distances. Another option is to attach a portable VHF antenna to the AIS receiver. Milltech Marine sells a portable VHF antenna that works well for this purpose. Note: since this antenna is fairly small, reception will not be as good as a full size VHF antenna.

Q: Speaking of distances, does the AIS receiver “see” ships that are far away?

A: Since AIS uses the same VHF frequencies as marine VHF, it has similar radio reception capabilities – which basically means “line of sight”. This means that the higher your VHF antenna is mounted, the greater the reception area will be. Reception from ships that are 20 miles away on open water is not uncommon. Note that AIS has a major advantage over radar since it can “see” ships within radio reception range that are behind large objects, such as other ships or points of land.

Q: I am interested in buying an AIS receiver but I do not own a compatible PC software package yet. How can I get started?

A: Again, you have at least a couple of options. If you want a “free” solution, Milltech Marine bundles an AIS resource CD with every AIS receiver. The CD includes the Seaclear marine navigation package, which supports displaying your position on digital charts, route planning and display of AIS information. The CD also includes digital planning charts for all of the US coastal areas.

If you are just getting started with computer based marine navigation, then consider one of the software bundles that is offered by Milltech Marine. We feature the Rose Point Coastal Explorer 1.1 product, bundled with either the Smart Radio SR161 or SR162 at very competitive prices. These products work great together.

If you are a current Nobeltec Visual Navigation Suite user, consider upgrading to version 8.0 which now supports AIS. The latest version of Memory Map Navigator Pro also supports AIS on both the PC and the Pocket PC.

Q: What type of ships show up on an AIS display?

A: Just about every commercial vessel will have an AIS transponder. Specifically, AIS is mandatory on all ships of 300 gross tonnage and upwards engaged on international

voyages, cargo ships of 500 gross tonnage and upwards not engaged on international voyages and passenger ships irrespective of size. See the US Coast Guard web page on AIS for more information. Other smaller commercial ships, such as fishing vessels, will equip themselves with AIS transponders voluntarily since there are major safety benefits to using AIS.

Q: I have hooked up my AIS receiver. Why don't I see ships immediately?

A: It normally takes a few seconds for ships to appear since the receiver needs to pick up a transmission from the remote ships' transponders. The system allows for ships to rebroadcast their information every few seconds so within a minute you will typically see nearby ships appear on your navigation package.

Q: The ships show up as numbers? I thought I would also see the name of the ship.

A: Just wait. Ships broadcast voyage information every few seconds but also broadcast full ship information every 6 minutes. So after a few minutes, you should see complete information for every ship that the AIS receiver has picked up.

Q: So what kind of information is broadcast for each ship and how often is it updated?

A: A Class A AIS transponder broadcasts the following information every 2 to 10 seconds while underway, and every 3 minutes while at anchor:

- MMSI number - unique referenceable identification
- Navigation status - "at anchor", "under way using engine" or "not under command"
- Rate of turn - right or left, 0 to 720 degrees per minute
- Speed over ground - 1/10 knot resolution from 0 to 102 knots.
- Position accuracy - differential GPS or other and an indication if RAIM processing is being used
- Longitude - to 1/10000 minute and Latitude - to 1/10000 minute
- Course over ground - relative to true north to 1/10th degree
- True Heading - 0 to 359 degrees derived from gyro input
- Time stamp - The universal time to nearest second that this information was generated

In addition, an Class A AIS unit broadcasts the following information every 6 minutes:

- MMSI number - same unique identification used above, links the data above to described vessel
- IMO number - unique referenceable identification
- Radio call sign - international call sign assigned to vessel for voice radio
- Name - name of ship, 20 characters are provided
- Type of ship/cargo - there is a table of possibilities that are available
- Dimensions of ship - to nearest meter
- Location on ship where reference point for position reports is located
- Type of position fixing device - various options from differential GPS to undefined
- Draught of ship - 1/10 meter to 25.5 meters (note "air-draught" is not provided)
- Destination - 20 characters are provided
- Estimated time of arrival at destination - month, day, hour and minute in UTC

Q: Which VHF channels or frequencies are used with AIS?

A: AIS transponders and receivers use two VHF radio frequencies: 161.975 MHz (AIS1, or channel 87B) and 162.025 MHz (AIS2, or channel 88B). The USCG has asked the Federal Communications Commission to authorize any US vessel to operate AIS on these two channels under its existing ship station license. The FCC released a Notice authorizing operation of AIS under a ship's existing station license.

Q: Milltech Marine sells a dual channel scanning receiver (SR161) and full time dual channel receivers (SR162/SR162G). What are the differences between these models?

A: All the units can receive AIS information from either AIS channel. The SR161 can only receive information on one channel at a time but will automatically switch to the alternate channel if it detects interference on the current channel.

The SR162/SR162G can receive all AIS broadcast information from both AIS channels simultaneously and consolidate the information from both channels into a single data stream. It is a true dual radio receiver. This generally means you will acquire new vessels sooner with the SR162 and you will also get the full information about a vessel in a shorter period of time.

The SR162G also includes an integrated 12 channel GPS module as well as a detachable GPS antenna with a 16 foot cable. With this model you can receive AIS traffic information and GPS position information as a single consolidated data stream over the RS232 serial port.

Q: If I am only receiving AIS information from one channel at a time, does this mean the SR161 will not pick up the transponder broadcasts from half the ships in my area?

A: No – the AIS system uses two channels for redundancy. Ships broadcast information alternating between the two channels. Therefore, you will eventually pick up information on for every ship, even if the AIS receiver can receive on one channel.

Q: How does the SR161 dual channel scanning receiver compare to a single channel receiver such as the Nasa AIS Engine.

A: Both units are single channel AIS receivers, however the SR161 has the advantage that it can scan between the two AIS channels and will automatically use the channel with the best radio reception. Other brands of single channel AIS receivers typically must be set to use one channel or the other and do not scan for the best signal. The SR161 from Milltech Marine is also significantly less expensive than other single channel AIS receivers.

Q: Can I get more information on how the dual channel system works?

A: The best source for more information is to look at the documents related to the AIS standard. On the subject of dual channel support, the standard states:

“The normal default mode of operation should be a two-channel operating mode, where the AIS simultaneously receives on both channels in parallel. In order to accomplish this performance, the AIS transponder should contain two TDMA receivers.

Channel access is performed independently on each of the two parallel channels.

For periodic repeated messages, including the initial link access, the transmissions should alternate between AIS 1 and AIS 2. This alternating behavior is on a transmission by transmission basis, without respect to time frames.

Transmissions following slot allocation announcements, responses to interrogations, responses to requests, and acknowledgements should be transmitted on the same channel as the initial message.

For addressed messages, transmissions should utilize the channel in which messages from the addressed station were last received.

For non-periodic messages other than those referenced above, the transmissions of each message, regardless of message type, should alternate between AIS 1 and AIS 2.

Base stations could alternate their transmissions between AIS 1 and AIS 2 for the following reasons:

- To increase link capacity.
- To balance channel loading between AIS 1 and AIS 2.
- To mitigate the harmful effects of RF interference.”

Also the US Coast Guard site has the following information:

“Although only one radio channel is necessary, each station transmits and receives over two radio channels to avoid interference problems, and to allow channels to be shifted without communications loss from other ships.”

Q: Where can I find out more specific information about AIS?

A: See the US Coast Guard site: <http://www.navcen.uscg.gov/marcomms/ais.htm>

The full text for the AIS standard: “RECOMMENDATION ITU-R M.1371-1 - Technical characteristics for a universal shipborne automatic identification system using time division multiple access in the VHF maritime mobile band” is on:

<http://www.itu.int/rec/recommendation.asp?type=items&lang=E&parent=R-REC-M.1371-1-200108-1>