How AIS Works

Automatic Identification System (AIS) is a reporting system used in the identification of marine vessels and its location. Vessels equipped with this system allows each other to communicate automatically, dynamically and regularly update their position, speed, course and information such as vessel identity.

How does AIS function as a radar?

The AIS radar function does not refer to its own AIS system and its features such as the VHF T/R and Letter Machine but by serial interface through (NMEA) which will be received by the AIS and sent to the radar on a real time displayed on the radar screen.

How to start the AIS radar feature?

1. Press [MENU] key to open the main menu.

    ✶ Select by omnipad & press ENT. ✶
    
    RINGS  EBL OFFSET  SHIFT  ZOOM
    MODE  DISP DATA  ECHO TRAIL  ECHO STRETCH
    AIS MENU  OTHER MENU

    Figure 1  Main menu

[Figure 2  AIS menu]

<table>
<thead>
<tr>
<th>Item</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Display</td>
<td>Off  On</td>
</tr>
<tr>
<td>2. Simulation</td>
<td>Off  On</td>
</tr>
<tr>
<td>3. AIS Ship listing</td>
<td></td>
</tr>
<tr>
<td>4. Vector Length</td>
<td>30s 1M 3M 6M</td>
</tr>
<tr>
<td></td>
<td>6M 15M 30M</td>
</tr>
<tr>
<td>5. History</td>
<td>Off 15s 30s</td>
</tr>
<tr>
<td></td>
<td>1M 2M 3M 6M</td>
</tr>
<tr>
<td>6. CPA. Set</td>
<td>Off 0.5 1nm</td>
</tr>
<tr>
<td></td>
<td>2nm 3nm 5nm 6nm</td>
</tr>
<tr>
<td>7. TCPA. Set</td>
<td>30s 1M 2M 3M</td>
</tr>
<tr>
<td></td>
<td>4M 5M 6M 12M</td>
</tr>
<tr>
<td>8. Target Size</td>
<td>L M S Auto</td>
</tr>
<tr>
<td>9. In/out Harbour</td>
<td>In Out</td>
</tr>
<tr>
<td>10. Loss Target Alarm</td>
<td>Off On</td>
</tr>
<tr>
<td>11. Own Ship Data</td>
<td></td>
</tr>
</tbody>
</table>

| Name:                     | MMSI:         |
| L/L: 22.45.123N           | Depth: 5m     |
| 115.21.369E               | Height: 12m   |
| COG: 120.0                | SOG: 10kt     |

NOTE: If the AIS signal is received, the AIS function is still at work even when the signal does not appear and still continues to ensure real time AIS information.
How to check the information received from Ships with AIS?

In the AIS menu, select “3. AIS Ship Listing” and press [ACQ/ENTER]. The AIS tabulation will appear and demonstrate the other ships basic information.

<table>
<thead>
<tr>
<th>Nation</th>
<th>MMSI</th>
<th>Dist.</th>
<th>COG</th>
<th>Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>012345678</td>
<td>92.9</td>
<td>305</td>
<td>A</td>
</tr>
<tr>
<td>China</td>
<td>012345678</td>
<td>92.9</td>
<td>305</td>
<td>A</td>
</tr>
<tr>
<td>China</td>
<td>123456789</td>
<td>92.9</td>
<td>305</td>
<td>A</td>
</tr>
<tr>
<td>China</td>
<td>012345678</td>
<td>92.9</td>
<td>305</td>
<td>A</td>
</tr>
<tr>
<td>China</td>
<td>012345678</td>
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</tr>
<tr>
<td>China</td>
<td>012345678</td>
<td>92.9</td>
<td>305</td>
<td>A</td>
</tr>
<tr>
<td>China</td>
<td>012345678</td>
<td>92.9</td>
<td>305</td>
<td>A</td>
</tr>
</tbody>
</table>

Name: 123456789   C/N: 1234567  AIS: A  
BRG: 208.6°T  LAT: 22.45.123N  
RNG: 999.9nm  LON: 115.21.369E  
TCOG: 128.0°T  HDG: 048.0°T  
TSOG: 28.2kt  ROT: 100.1°/min  
CPA: 100.65nm  TCPA: 20:32:33

Figure 3  AIS Ship Listing

How to determine the target ships detailed information?

There are two methods by which we can view a ships sailing detailed information:

1. By keyboard

From the list of AIS information, select the direction key and press [ACQ/ENTER] , on Figure 3 , the detailed data of the current selected ship information shall be displayed.
2. By cursor
When the cursor is moved to the target ship and press [ENTER] key, the selected ship will appear as shown in Figure 4 and the AIS data shall appear as shown in Figure 5.

Note: If the display setting of the radar screen is at “ALL” mode, it will briefly display the AIS information as shown in Figure 6.

Figure 4  Selected target display

<table>
<thead>
<tr>
<th>Name</th>
<th>AIS: A</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMSI: 123456789</td>
<td>C/N: 1234567</td>
</tr>
<tr>
<td>BRG: 208.6°T</td>
<td>LAT: 22.45.123N</td>
</tr>
<tr>
<td>RNG: 999.9nm</td>
<td>LON: 115.21.369E</td>
</tr>
<tr>
<td>TCOG: 128.0°T</td>
<td>HDG: 048.0°T</td>
</tr>
<tr>
<td>TSOG: 28.2kt</td>
<td>ROT: 100.1°/min</td>
</tr>
<tr>
<td>CPA: 100.65nm</td>
<td>TCPA: 20:32:33</td>
</tr>
</tbody>
</table>

Figure 5  AIS Detailed data frame

<table>
<thead>
<tr>
<th>OWN SHIP</th>
<th>+CURSOR</th>
<th>WAYPOINT</th>
</tr>
</thead>
<tbody>
<tr>
<td>22°46.177N</td>
<td>32°23.326N</td>
<td>36°17.289N</td>
</tr>
<tr>
<td>SPD 0.2 kt</td>
<td>TTG 19:30:00</td>
<td>TTG 19:30:00</td>
</tr>
<tr>
<td>MMSI 123456789</td>
<td>BRG 301.8°T</td>
<td>TCOG 0.6°T</td>
</tr>
<tr>
<td>RNG 0.5 NM</td>
<td>TSOG 0.2 kt</td>
<td>CPA 0.4 NM</td>
</tr>
<tr>
<td>CPA 0.4 NM</td>
<td>TCPA 00:30:00</td>
<td></td>
</tr>
</tbody>
</table>

Figure 6  AIS brief information
How to view your ships AIS information?

Press AIS menu, select “10. Own Ship Data” then AIS detailed information will appear as shown in Figure 7.

<table>
<thead>
<tr>
<th>Name</th>
<th>MMSI: 213456852</th>
</tr>
</thead>
<tbody>
<tr>
<td>L/L</td>
<td>22.45.123N</td>
</tr>
<tr>
<td></td>
<td>115.21.369E</td>
</tr>
<tr>
<td>COG</td>
<td>120.0</td>
</tr>
<tr>
<td>SOG</td>
<td>10kt</td>
</tr>
</tbody>
</table>

Figure 7 Own Ship data

Setting vector length of time

This function is used to set your ship and target ships vector length. The mark represents the vector in accordance with the present voyage. This value is just an estimate and it will follow the ships movement. However it can help simplify the radar operators intuitive navigation judgement.

SOG (Speed over ground) → COG (Course over ground)

Turning direction (ROT)

Heading line

(If there is no heading data, the line points in direction of COG.)

Figure 8 Activated target

Setting method:

Enter AIS menu, select “4. Vector length” and press [ACQ/ENTER] key, then use the direction key choose corresponding time, and press the [ACQ/ENTER] key.
Past Position Display

The past position display shows equally time-spaced dots marking past positions of activated AIS targets. A new dot is added at preset time intervals until the preset number is reached. If a target changes its speed, the spacing will be uneven. If it changes course, its plotted course will not be a straight line.

Below are sample past position displays.

Figure 9  Sample past position displays

Past position plot interval

Enter AIS menu, select “5.History” to select plot interval desired: Off, 15 s, 30 s, 1, 2, 3 or 6 min. Select OFF to erase all past position points and turn off the past position display.
**AIS Collision Alarm (CPA, TCPA)**

The AIS continuously monitors the predicted range at the Closest Point of Approach (CPA) and predicted time to CPA (TCPA) of each AIS target. When the predicted CPA of an AIS target becomes smaller than a preset CPA range and its predicted TCPA less than a preset TCPA limit, the audio alarm sounds and the symbol of the offending AIS target becomes red, bold 2 times and flashes together with its vector.

CPA/TCPA alarm ranges must be set up properly taking into consideration the size, tonnage, speed, turning performance and other characteristics of own ship.

**Setting the CPA and TCPA ranges**

Enter AIS menu, select “6. CPA. Set” & “7. TCPA. Set”, then press direction key choose the value you want.

Below are CPA & TCPA can be setup value

CPA. Set Off, 0.5, 1, 2, 3, 5, 6 nm
TCPA. Set 30 s, 1, 2, 3, 4, 5, 6, 12 min

**AIS symbol size setup**

AIS symbols default has three different sizes, which can be according to actual condition, and can also be set to automatic. When set to automatic the size of AIS symbol will automatically change the range.

**Setting the AIS symbol size**

To set the AIS symbol size, enter AIS menu, select “8. Target Size” and press direction key choose L(long), M(medium), S(small) or AUTO, then press [ACQ/ENTER] key to confirm.
**In/Out harbour**
This function is used to avoid ships in the harbour because too many AIS boats nearby may cause continuous alarm. Upon entering the port you may select "ON", CPA and TCPA alarm will be disabled.

**Setting IN/OUT harbour**

**Loss target alarm function**
If the current range of AIS targets within the information given by the maximum update interval had not yet received, will be loss target alarm function is triggered, in this case, the target becomes the symbol shown below loss target mark, symbol color is red and flash, while the radar alarm will sound to remind the operator out to pay attention. To manually stop the audible alarm, press the [SELECT/CANCEL] key once.

![Figure10 loss target display symbol](image)

**How to open the loss target alarm function**
Did not turn this function on the LOSS target symbol will still be displayed, but does not trigger the alarm. Start as follows:
1. Into the AIS menu and select "10. Lost target alarm";
2. Press the arrow keys to select "On" and press the [ACQ/ENTER];
3. Press [MENU] key 2 times to exit.
**Prompted of data processing**
The radar system can access a variety of NMEA data, including AIS / GPS, direction and water depth data. At boot time, if not turned on AIS, the radar will appear on-screen prompts such as: "No AIS device." To know there are many, such as "AIS signal loss" etc. To turn off the prompt, press the [ACQ/ENTER] key.

**AIS symbol colour**
When the background color is black, the echo color is yellow, AIS symbol colors are set as follows:

![Image of radar screen showing AIS symbol colours](image)

**Figure 11 Black background & yellow echo**

- **Own ship:** White triangle
- **CLASS A:** Blue triangle
- **CLASS B:** Green triangle
- **BASE STATION:** Blue square
- **Selected ship:** Broken square is overlaid on
- **Alarm ships:** Red triangle bold 2 times & flash
- **ALL circles:** Without direction information target

**Echo color is green:**
- **CLASS A:** Yellow triangle
- **BASE STATION:** Yellow square
Blue background color & multi echo color

Figure 12 Blue background & multi color echo
### AIS ship symbol status description

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>STATUS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="triangle.png" alt="Triangle" /></td>
<td>Sleeping target</td>
<td>An isosceles, acute-angled triangle should be used with its centroid representing the target's reference position. The most acute apex of the triangle should be aligned with the heading of the target, or with its COG, if heading information is not available. The symbol of the sleeping target may be smaller than that of the activated target.</td>
</tr>
<tr>
<td><img src="triangle_with_line.png" alt="Triangle with line" /></td>
<td>Activated target</td>
<td>All AIS symbols shown with thick line. Color is selectable from menu.</td>
</tr>
<tr>
<td><img src="line_triangle.png" alt="Line and triangle" /></td>
<td>ROT higher than preset ROT</td>
<td>Displayed for turning ship.</td>
</tr>
<tr>
<td><img src="triangle_with_line.png" alt="Triangle with line" /></td>
<td>Target selected for data display</td>
<td>Broken square is overlaid on target selected to display its data.</td>
</tr>
<tr>
<td><img src="dangerous.png" alt="Triangle with line" /></td>
<td>Dangerous target</td>
<td>Displayed when CPA/TCPA is within CPA/TCPA LIMIT. Red in color. Flashing until acknowledged.</td>
</tr>
<tr>
<td><img src="lost_target.png" alt="Triangle with line" /></td>
<td>Lost target</td>
<td>“\” overlaid on a lost target. Erased after acknowledged.</td>
</tr>
</tbody>
</table>

**Figure 13 AIS ship symbol description**

### Other symbol description

Other AIS symbols that may appear are shown in the table below.

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="plus_sign.png" alt="Plus sign" /></td>
<td>Real AIS AtoN</td>
</tr>
<tr>
<td><img src="down_triangle.png" alt="Down triangle" /></td>
<td>Virtual AIS AtoN</td>
</tr>
<tr>
<td><img src="base_station.png" alt="Base station" /></td>
<td>Base Station</td>
</tr>
<tr>
<td><img src="airborne_sar.png" alt="Airborne SAR" /></td>
<td>Airborne SAR aircraft</td>
</tr>
</tbody>
</table>

**Figure 14 Other symbol**
Menu Tree

- **MENU KEY**
  - RINGS (Off, 1, 2, 3, max)
  - EBL OFFSET (Off, On)
  - SHIFT (Off, On)
  - ZOOM (Off, On)
  - MODE (HU, CU, NU, TM)
  - DISP DATA
  - ECHO TRAIL (Off, On)
  - ECHO STRTCH (Off, ES1, ES2)

- **AIS MENU**
  - 1. Panel Dimmer (1, 2, 3, 4)
  - 2. Mark Brill (1, 2, 3, 4)
  - 3. HD Mark (1, 2, 3, 4)
  - 4. Characters (1, 2, 3, 4)
  - 5. Trail Tone (Single, Multi)
  - 6. Int Reject (Off, 1, 2, 3)
  - 7. Pulselength (Short, Long)
  - 8. Noise Reject (Off, On)
  - 9. Trail Time
    - 15S, 30S, 1M, 3M, 6M, 15M, 30M, Cont
  - 10. Tone (Auto, Manu)
  - 11. Disp Data (Off, Nav, ARP, All)
  - 12. WPT Mark (Off, On)
  - 13. EBL Ref (Rel, True)
  - 14. VRM Unit (nm, km, sm)
  - 15. Watchman (Off, 5M, 10M, 20M)
  - 16. STBY DISP (Norm, Econo, Nav)
  - 17. Guard Mode (In, Out)
  - 18. Cursor Posi (B/R, L/L)
  - 19. Alm Sense LV (Low, Mid, High)
  - 20. Dead Sector (Off, On)
  - 21. Range
    - 1/8, 1/4, 1/2, 3/4, 1, 1.5/2, 3, 4, 6, 8, 12, 16, 24
  - 22. Color Setting
  - 23. Self Test
  - 24. Installation Setup

- **OTHER MENU**
  - 1. Display
  - 2. Simulation
  - 3. AIS Ship listing
  - 4. Vector Length
  - 5. History
  - 6. CPA, Set
  - 7. TCPA, Set
  - 8. Target size
  - 9. In/out Harbour
  - 10. Loss Target Alarm
  - 11. Own ship Data

**Panel Configuration**

- **Disp DA TA**
  - 1: ES2
  - 2: 1, 2, 3, 4
  - 3: 1, 2, 3, 4
  - 4: 1, 2, 3, 4
  - 5: 1, 2, 3
  - 6: 1, 2, 3
  - 7: 1, 2, 3
  - 8: 1, 2, 3
  - 9: 1, 2, 3
  - 10: 1, 2, 3
  - 11: 1, 2, 3
  - 12: 1, 2, 3
  - 13: 1, 2, 3
  - 14: 1, 2, 3
  - 15: 1, 2, 3
  - 16: 1, 2, 3
  - 17: 1, 2, 3
  - 18: 1, 2, 3
  - 19: 1, 2, 3
  - 20: 1, 2, 3
  - 21: 1, 2, 3
  - 22: 1, 2, 3
  - 23: 1, 2, 3
  - 24: 1, 2, 3

**Other Setting Options**

- **1 GPS**
  - 2: 1, 2, 3, 4
  - 3: 1, 2, 3, 4
  - 4: 1, 2, 3, 4

- **Other Setting Options**
  - 5: 1, 2, 3, 4
  - 6: 1, 2, 3, 4
  - 7: 1, 2, 3, 4
  - 8: 1, 2, 3, 4

**Installation Setup**

- 1. Nav Talker (All, GPS)
- 2. Depth unit (m, ft)
- 3. Temp Unit (°C, °F)
- 4. Hdg Sensor (Magnet, Gyro)
- 5. Key Beep (Off, On)
- 6. Scan Stop (Rotate, Stop)
- 7. Dead Sector
- 8. Tune/Video Adjustment
- 9. Heading Alignment
- 10. Sweep Timing Adjustment
- 11. MBS Adjustment
- 12. Ant Height (Low, Mid, High)
- 13. STC Curve (Sharp, std, GntI)
- 14. Ope Mode (Master, Slave)
- 15. Hours in Use
- 16. TX Hours
NMEA Interface specifications

1. NMEA1 (6 pins connector):
   1. +3.3V  2. NMEA1 Input+  3. NMEA1 Input−  4. GND
   5. AIS/GPS select
   Note:
   When NMEA1 is used for AIS connection, short-circuit pin 4 and pin 5. Otherwise, leave open for GPS connection.

   ![NMEA1 Connector for AIS connection](image1)
   ![NMEA1 Connector for GPS connection](image2)

2. NMEA2 (8 pins connector):
   1. +12V  2. NMEA2 Input+  3. NMEA2 Input−  4. GND
   5. +12V  6. NMEA3 Input+  7. NMEA3 Input−

   ![Figure 15 Display connect](image3)

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**CAUTION**
Ground the equipment. Ungrounded equipment might emit or receive electromagnetic interference or cause electrical shock.

**CAUTION**
Replace the fuses to 5A for 24/32VDC operation.