Saab TransponderTech AB

R4 AIS Transponder System

Troubleshooting Guide

This page is intentionally left blank

Troubleshooting Guide - Draft

Copyright

Trademarks

Contact Details

For a complete list of our dealers and service stations, please visit our web page at www.saabgroup.com/transpondertech

Troubleshooting Guide - Draft

This page is intentionally left blank

Table of Contents

Troubleshooting Guide - Draft

This page is intentionally left blank

1 INTRODUCTION

Amongst the hundreds of issues with the R4 AIS system reported to Saab TransponderTech each year, it is just a handful in which the R4 Transponder or the Display is the cause of the problem. Many of the units returned to Saab TransponderTech AB are shown to be fully functional and without failure. Units often arrive with strange I/O settings for external sensors and for the communication between the display and the transponder.

There are many ways to troubleshoot the R4 AIS system depending on the type of failure and the information available. Troubleshooting the R4 AIS system can be difficult and time consuming. Quite often they are integrated with several advanced on-board sensors and information systems and subject to a harsh radio environment.

Using the latest software available is always recommended to get the best performance from the R4 AIS Transponder System.

This document describes several methods to help you troubleshoot and rectify the fault, if possible, before you return a suspect unit to Saab TransponderTech. The Saab TransponderTech helpdesk is available should you need further assistance.

Troubleshooting Guide - Draft

This page is intentionally left blank

2   R4 TRANSPONDER LED INDICATORS

This method is useful to get a fast verification that the R4 transponder is up and running and receiving and transmitting as expected. This will only take a few minutes and should be the first step in any troubleshooting of the R4 AIS system.

2.1   Green LED

The green LED is constantly lit when power is supplied to the transponder. Note that the transponder starts up as soon as power is supplied to it. The transponder does not have a power switch and is NOT automatically turned on or off when the display is. If the green LED is not lit:

- Check the power supply, make sure that:
  - The voltage and current are correct.
  - It has enough capacity to handle start-up and transmissions.
  - The polarity is correct, make sure that it is not switched.
- Check the external fuse.
- Check the cable and connectors, make sure that:
  - There are no damaged or broken pins.
  - The cables are not damaged.
  - They are correctly connected.

2.2   Yellow LED

The yellow LED flashes when the transponder is receiving an AIS target transmission on the VHF-link. If the yellow LED is not flashing despite knowing that AIS transmissions are within range, do a check and make sure that there are no active Rx-alarms in the alarm list. If there are, see the section on alarm troubleshooting based on this alarm.

If only the yellow LED is constantly lit (green and red off) a severe HW error has occurred.

2.3   Green and Yellow LED

If both the green and yellow LEDs are simultaneously and constantly lit, the transponder is in boot-mode, normally due to a failed software upgrade. This is normally corrected by performing another software upgrade. When the transponder is in boot-mode the baud rate on the serial PILOT-port (to where the upgrade is made) is 9600.

2.4   Red LED

The red LED flashes with an interval of between 2 - 360 seconds and indicates that the transponder is transmitting data on the VHF-link. The different information types are valid

Troubleshooting Guide - Draft

for a different time period and thus need a different update rate. The transmission intervals are listed in table 1. If the red LED is not flashing, do a check and make sure:

- That transmissions are not disabled in the VHF-radio settings.

- The R4 AIS system is not in "Silent Mode" (This only applies to the R4 AIS Silent, Secure, Coast Guard and products with similar functions).

- That there are no active Tx-alarms in the alarm list. If there are, see the section on alarm troubleshooting based on this alarm.

Table 1 - Reporting Rates in accordance with ITU 1371-1

Static Information	
Every 6 minutes or when data has been amended on request.	
Dynamic Information	
Ship at anchor or moored and not moving faster than 3 knots	3 minutes
Ship at anchor or moored and moving faster than 3 knots	10 seconds
Ship 0-14 knots	10 seconds
Ship 0-14 knots and changing course	3 1/3 seconds
Ship 14-23 knots	6 seconds
Ship 14-23 knots and changing course	2 seconds
Ship > 23 knots	2 seconds
Ship > 23 knots and changing course	2 seconds

Troubleshooting Guide - Draft

3 R4 TRANSPONDER AND DISPLAY INTERCONNECTION

Use the following checklist to verify that the transponder and display are communicating. Do a check and make sure:

1. That there is no "broken stick"-symbol or "AIS crossed-out"-symbol in the upper part of the LCD.
2. The AIS-targets are shown in the Target List page.
3. The own ship data is shown in the Own Ship Data page.
4. All the baud rates are visible in the Port Rate page.

If any of the above points fail:

1. Check the signal wiring and connectors between the transponder and display.
2. If the signal wiring and connectors are good, check the baud rate settings for the Display and Transponder communication ports.
3. As a last check run the system with another R4 Transponder or R4 Display unit to determine which part may have a problem.

3.1 Software Upgrades

A software upgrade to the display and transponder will reset all the configuration settings to the default settings. This can be the best method to verify an interconnection problem between the display and transponder caused by an incorrect configuration (generally a baud rate mismatch).

Using the latest software available is always recommended to get the best performance from the R4 AIS Transponder System. See the Support News on the Saab TransponderTech web page for the latest information about the system software. All our service stations are qualified to perform software upgrades

Troubleshooting Guide - Draft

This page is intentionally left blank

4 TROUBLESHOOTING WITH THE R4 DISPLAY

4.1 Alarm list

The Alarm List page of the display shows all the available alarms. An Active alarm is shown at the top of the list and is marked with an exclamation mark. See Section 6 for an explanation of the alarms and what measures to be taken if an alarm is shown. The information about when an alarm became active is shown in the Alarm Log page of the display.

4.2 Own Ship Data Page

When the R4 transponder transmits data on the AIS-link it simultaneously outputs this data on the serial ports. This information is displayed on the Own Ship Data page.

4.3 Target List

The target list is primarily useful when analyzing the receiving functionality. The propagation characteristics of VHF radio frequencies are close to line of sight. A harsh radio environment, reflections in cables, connectors or the antenna will shorten the effective range. Note that it can take up to 6 minutes before static data is received (see table 1).

4.4 Date and Time

The Date and Time (UTC) in the upper right corner of the R4 Display is provided by the R4 transponder internal GPS (never by external GPS except for the R4 AIS GLONASS System). If the time and date are not correct, the transponder internal GPS does not have a position fix. This will also be indicated by message "UTC clock lost" in the Status List page. This problem is normally caused by a GPS-antenna failure or damaged antenna cables. This problem may also be caused by interference from radio equipment on-board. See the R4 AIS system manual for recommendations on how to position the AIS-GPS antennas and cables.

4.5 View Raw Data

The *View Raw Data* function in the display is used to verify data is received on the ports and that the integrated external sensors provide the correct sentences.

Troubleshooting Guide - Draft

This page is intentionally left blank

Troubleshooting Guide - Draft

5   RANGE PROBLEMS AND MISSING AIS DATA

When experiencing a range problem or intermittent loss of information in the AIS target a common sign may not be an alarm but missing static data at the receiving target. This is explained in table 1. If one transmission of static data is lost, it will take another 6 minutes until it is received again. If there are no active Tx or Rx alarms, this can be caused by interference from radio equipment on-board. See the R4 AIS system manual for recommendations on how to position the AIS-VHF antennas and cables.

Troubleshooting Guide - Draft

This page is intentionally left blank

Troubleshooting Guide - Draft

6   HOW TO INTERPRET ALARM MESSAGES

6.1   Alarm Message

The alarms (unless disabled) are not only shown in the R4 display alarm list, but are also output on the transponder ECDIS- and PILOT-port. The alarms can be viewed or recorded in for example a hyper terminal. Note that all the alarms are output, including the inactive ones.

An active alarm is recognised on "….,A,V,…" or "…,A,A,…" in the alarm sentence. If there is "…,V,V,…" or "…,V,A,…" in the sentence, the alarm is inactive. See the examples below:

$AIALR,000000.00,001,V,V,AIS: Tx malfunction: Alarm is inactive.

$AIALR,000000.00,001,V,A,AIS: Tx malfunction: Alarm is inactive.

$AIALR,000000.00,001,A,A,AIS: Tx malfunction: Alarm is active and acknowledged.

$AIALR,000000.00,001,A,V,AIS: Tx malfunction: Alarm is active and not acknowledged.

6.2   Alarms

6.2.1   Tx Malfunction

This alarm is active if:

- The antenna VSWR exceeds the allowed ratio (an even lower ratio than what is required to trigger Antenna VSWR Exceeds limit-alarm).

- There is a malfunction in the radio transmitter or other R4 transponder hardware.

If the radio transmitter returns to normal operation or if the VSWR returns to a value below the allowed ratio, the alarm is cleared. If this alarm is active check the antenna and cabling (especially the connectors) for damage or corrosion. If the antenna system is in good order and the alarm is still active the R4 transponder may have a hardware fault.

6.2.2   Antenna VSWR Exceeds limit

The VSWR of the antenna is checked during every transmission and at a given ratio the VSWR alarm is generated. If the VSWR goes below the allowed ratio, the alarm is cleared. If this alarm becomes active, do a check of the antenna and cabling (especially the connectors) for damage or corrosion.

Troubleshooting Guide - Draft

6.2.3 Rx Malfunction

The radio receivers inside the R4 transponder are continuously monitored and if any part of the receiver hardware should malfunction, an Rx Malfunction alarm is generated for that receiver. If the radio receiver returns to normal operation, the alarm is cleared. If this alarm is active the R4 transponder may have a hardware fault.

6.2.4 General Failure

This alarm is generated if the R4-AIS Transponder fails to initiate the radio. If this alarm is active the R4 transponder probably has a hardware fault and must be repaired.

6.2.5 MKD Connection Lost

This alarm is active if the R4 Display to R4 Transponder communication is lost but the transponder to display communication still works. If this alarm is active:

1. Check the signal wiring and connectors between the transponder and display.
2. If the wiring is good, do a check of the baud rate settings for the Display and Transponder communication ports.
3. Run the system with another R4 Transponder or R4 Display unit to determine which part may have a problem.

6.2.6 R4 Transponder Lost Communication with R4 Display

This alarm is active if the R4 Display to R4 Transponder communication works but the transponder to display communication does not work. If this alarm is active:

1. Check the signal wiring and connectors between the transponder and display.
2. If the wiring is good, do a check of the baud rate settings for the Display and Transponder communication ports.
3. Run the system with another R4 Transponder or R4 Display unit to determine which part may have a problem.

6.2.7 External EPFS Lost

This alarm is generated if the position from the External Electronic Position Fixing System is invalid (i.e. no external GPS). Due to the fallback arrangement for the positioning sensor this alarm can be inactive for up to 30 seconds (during which the internal GNSS is used) before the alarm becomes active. If this alarm is active, constant or intermittent, do a check and make sure:

1. The signal wiring between the EPFS and the R4 transponder sensor port (1,2 or 3) is correct.
2. The correct sentences are input (GLL or GGA and VTG).
3. The sentences are received correctly by using the Raw Data mode in the R4 display, change the baud rate if necessary

Troubleshooting Guide - Draft

4. The sentences are only input on one port (i.e. sensor port 1) and not on any of the PI-ports (ECDIS-, PILOT- or MKD-port).

5. The sentences are sent with a checksum. (Checksum control may be disabled through the R4 display).

6. The sentences are of the format specified in IEC 61162-1. One easy check is to count the comma characters in the sentences. GLL: 7 commas, GGA: 14 commas, VTG: 9 commas. The data input can of course be invalid for other reasons that require a deeper analysis.

6.2.8   No Sensor Position In Use

This alarm is active if the AIS system does not have a valid position source. In other words neither the transponder internal GPS nor the EPFS provides a valid position. The R4 transponder internal GPS is automatically used as backup when the EPFS is lost. Consequently this alarm also means that the R4 transponder internal GPS does not have a position fix or this is not used for another reason.

This problem may be caused by interference from on-board radio equipment. See the R4 AIS system manual for recommendations on how to position the AIS-GPS antennas and cables.

If this alarm is active:

1. Disconnect the EPFS (external GPS) from the transponder by turning of the GPS or disconnecting the signal wires.

2. Do a check and make sure:

   a) The cables and antenna for the R4 transponder internal GPS are good. Temporarily connecting another GPS antenna system.

   b) That there is 5 VDC at the R4 Transponder GPS antenna connector (TNC).

   c) The position is shown on the Own Ship Data page and the date and time shown in the upper right corner is correct.

3. Connect the EPFS when troubleshooting is complete.

6.2.9   No Valid SOG Information/No Valid COG Information

These two alarms are active if the AIS system does not have a valid SOG or a valid COG respectively from any sensor. The SOG and COG is based on the speed log data if external GNSS provided and at the same time valid heading is available. If speed log data is not available it is based on the GNSS (external GPS) VTG message. If valid VTG is not input from EPFS the SOG and COG is taken from the transponder internal GPS.

This alarm is normally active at the same time as an External EPFS Lost alarm and No Sensor Position In Use alarm. If not, closely analyze the messages provided by the EPFS, Speed Log and Gyro and verify it is complete according to IEC 61162-1 and does not contain invalid values.

Troubleshooting Guide - Draft

If this alarm is active:

1. Disconnect all sensors (if any) from the transponder.

2. Do a check and make sure:

    a) The cables and antenna for the R4 transponder internal GPS are good. Temporarily connecting another GPS antenna system.

    b) That there is 5 VDC at the R4 Transponder GPS antenna connector (TNC).

3. Connect each of the external sensors (if any) one by one and verify that the sensors data is accepted by the R4 transponder.

6.2.10   Heading Lost/Invalid

This alarm is active if either the heading information is lost, invalid or if the heading is undefined. The R4 transponder only accepts HDT as a heading message. If this alarm is active, analyze the data provided by the heading sensor (normally gyro) and verify it is complete according to IEC 61162-1 and does not contain invalid values.

6.2.11   No Valid ROT Information

This alarm is active if a Rate of Turn is undefined or if no valid ROT information is available from the external sensor or internal calculations. If this alarm is active, analyze the data provided by the rate of turn sensor and verify it is complete according to IEC 61162-1 and does not contain invalid values. The Talker Id for the Rate of turn indicator must be TI, if this is not correct the data is rejected.

Troubleshooting Guide - Draft