

Technical Manual

Automatic Identification System

AIS 3410

Electronics Unit

© SAM Electronics GmbH 2009

This document is our property for which we reserve all rights, including
those relating to patents or registered designs. It must not be
reproduced or used otherwise or made available to any third party without
our prior permission in writing.

Alterations due to technical progress are reserved.

SAM Electronics GmbH
D - 22763 Hamburg

Service
Customer Support Center

Phone: + 49 (0) 18 03 00 85 53
Fax: + 49 (0) 18 03 00 85 54
E-mail: shipservice@sam-electronics.de

List of Contents

List of Contents	3
List of Figures	5
List of Abbreviations	7
1 General	9
1.1 Software Releases	9
1.2 General Recommendations for Installation, Maintenance and Repair Work	9
1.3 Safety Warnings	9
2 Overview	11
2.1 Compatibility with Other Systems	11
2.2 AIS 3410 in RADARPILOT 1000/1100 Systems	12
2.3 AIS 3410 in 1000/1100 Series Systems (NACOS xx-4 and xx-5)	13
2.4 AIS 3410 in CHARTPILOT Stand-alone Systems	14
2.5 AIS 3410 in NACOS xx-3 Systems (Radar 9xxx and CHARTPILOT)	15
2.6 AIS 3410 in Radar 9xxx Systems with RADARPILOT 1000/1100	16
2.7 AIS 3410 in Radar 9xxx Systems	17
2.8 Housing of the 3410 Electronics Unit	18
2.9 Replacement of AIS Electronics Unit	19
2.9.1 Open the Housing of AIS 3410	19
2.9.2 Open the Housing of UAIS DEBEG 3400	19
2.9.3 Merge the AIS 3410 Electronics Unit into the UAIS DEBEG 3400 Housing	20
2.10 Media Converter Installation (necessary for ships with BNC LAN networks)	20
3 Installation Recommendations	21
3.1 General Recommendations	21
3.1.1 Cables	21
3.1.1.1 Maximum Cable Length	22
3.1.1.2 Cable Sets	23
3.1.2 Electronics Units	23
3.2 Specific Recommendations	24
3.2.1 Recommendations Concerning AIS Systems	24
3.2.2 Recommendations Concerning the Installation of the Electronics Unit	25
3.2.3 Recommendations Concerning the Installation of the Antennas	25
3.2.3.1 Recommendations Concerning the Installation of the VHF Antenna	26
3.2.3.2 Recommendations Concerning the Installation of the GPS Antenna	27
3.2.4 Recommendations Concerning Redundancy	28
3.2.5 Recommendations Concerning the Connection of a (D)GPS to AIS 3410	28
3.2.6 Emergency Power Source	28
3.2.7 Pilot Port, Connector/Cable Kits	28
3.2.8 Recommendations Concerning AIS Stand-alone with Radar 9xxx / NACOS xx-2/-3	29
3.2.9 Recommendations Concerning the Connection to a Radar 1000/1100 Series System	29
3.2.10 Recommendations Concerning the Connection to a Radar 1100 Series System	29
4 Functional Description	31
4.1 Block Diagram	31
4.2 Termination	32
4.3 Description of the Components	33
4.3.1 AIS 3410 Electronics Unit	33
4.3.1.1 Interfaces	34
4.3.1.2 Internal Connectors	35
4.3.1.3 Supported Sensor Input Sentences	35
4.3.1.4 Supported Sentences for the AIS Primary Display Port and the Pilot Port	37
4.3.1.5 Supported Sentences for the Long Range Port	38
4.3.1.6 Supported Sentences for the Internal Position Sensor	40
4.3.1.7 IEC 61162 -1/-2 Interfaces, Electrical Characteristics	41
4.3.1.8 Example for the Interconnection	42
4.3.2 VHF Antenna	42

4.3.3	GPS Antenna	43
4.3.4	Pilot Port	43
5	Setting-to-Work/Configuration	45
5.1	Setting-to-Work	45
5.2	Software Versions	45
5.3	Configuration	45
5.3.1	Configuration with RADARPILOT/CHARTRADAR/MULTIPILOT 1000/1100 - NACOS xx-4/5 Systems	45
5.3.2	Configuration with CHARTPILOT 93xx in NACOS xx-3 Systems	46
5.3.3	Configuration with Radar 9xxx	46
5.4	Testing	46
5.5	LEDs for Ethernet LAN, Alarm, GPS and Telegram	46
6	Repair/Maintenance	47
6.1	Trouble Shooting	47
6.1.1	Hints	47
6.1.2	Fault Tree	48
6.1.3	Trouble Shooting for AIS 3410 connected to a RADARPILOT 1000/1100	49
6.1.3.1	Indication: System Fault Message 3617 Displayed on Indicator	49
6.1.3.2	Indication: System Fault Message 3616 Displayed on Indicator	54
6.2	Test of the Antenna Performance	54
6.3	Software Update	54
6.3.1	Software download from SAM-CMIS	54
6.3.2	Determination of the Current Software Versions	55
6.3.3	Serial Cable Connection	55
6.3.4	Software Update by means of a Laptop	56
6.3.5	Software Update by means of a CHARTPILOT or MULTIPILOT 91x0	57
6.4	Opening the Housing	58
6.4.1	Fuses	58
6.4.2	Antennas	58
6.5	Spare Parts	58
7	Technical Data	59
7.1	Conformity to Standards, Environmental Conditions	59
7.2	Performance	59
7.2.1	Performance Data of the Electronics Unit	59
7.2.2	Performance Data of the VHF Antenna CLX 2-1/150-170 MHz	60
7.2.3	Performance Data of the GPS Antenna	61
7.3	Dimensions and Weights	61
7.4	Compass Safe Distances	61
8	Fault Code List	63
9	Cabling Documents	67
10	Outline Drawings	79
	Notes	83

List of Figures

Fig. 2-1	AIS 3410 in RADARPILOT 1000/1100 systems	12
Fig. 2-2	AIS 3410, SAM Electronics 1000/1100 series systems (NACOS xx-4/NACOS xx-5)	13
Fig. 2-3	AIS 3410 with CHARTPILOT stand-alone	14
Fig. 2-4	AIS 3410 in NACOS xx-3 systems	15
Fig. 2-5	AIS 3410 in Radar 9xxx systems with RADARPILOT 1000/1100	16
Fig. 2-6	AIS 3410 in Radar 9xxx systems	17
Fig. 2-7	AIS 3410 Electronics Unit (current version)	18
Fig. 2-8	UAIS DEBEG 3400 Electronics Unit (old versions)	18
Fig. 2-9	AIS 3410 Electronics Unit (without housing)	20
Fig. 3-1	Cable inlet consisting of a hole with brackets	22
Fig. 3-2	Minimum distances for GPS and VHF Antenna	25
Fig. 3-3	Positioning of the VHF Antenna	26
Fig. 3-4	Positioning of the GPS Antenna	27
Fig. 3-5	Minimum distances for the GPS Antenna from a Radar Scanner	27
Fig. 4-1	Block diagram of the AIS System	31
Fig. 4-2	Principle of wiring for Ethernet LAN	32
Fig. 4-3	Block diagram of the Electronics Unit	33
Fig. 4-4	Interfaces of the AIS 3410 Electronics Unit	34
Fig. 4-5	Internal connectors	35
Fig. 4-6	AIS and Gyro Interface 9401	42
Fig. 4-7	Pilot Port, connector assignment, front view (pins)	43
Fig. 5-1	Status LEDs	46
Fig. 6-1	Cable connection for the interface monitoring Radar > AIS	50
Fig. 6-2	Protocol Radar TxD	51
Fig. 6-3	Cable connection for the interface monitoring AIS > Radar	52
Fig. 6-4	Protocol AIS TxD	53
Fig. 6-6	Service Interface	56
Fig. 9-1	Cable Diagram, connection to RADARPILOT 1x00, NACOS xx-4/5 via ...	68
Fig. 9-2	Cable Diagram, connection to CHARTPILOT, NACOS xx-4/5, RADAR /...	69
Fig. 9-3	Cable Diagram, connection to CHARTPILOT stand-alone	70
Fig. 9-4	Cable Diagram, connection to Radar 9xxx via Radar 9xxx AIS Interface (NACOS xx-3)	71
Fig. 9-5	Detailed Cable Diagram, connection to RADARPILOT 1x00, NACOS xx-4/5 via ...	72
Fig. 9-6	Detailed Cable Diagram, Wheelhouse Console	73
Fig. 9-7	Detailed Cable Diagram, connection to NACOS xx-4/5, RADAR / ...	74
Fig. 9-8	Detailed Cable Diagram, connection to CHARTPILOT stand-alone systems	75
Fig. 9-9	Detailed Cable Diagram, connection to RADAR 9xxx AIS Interface	76
Fig. 9-10	Detailed Cable Diagram, connection to RADAR 9xxx AIS Interface PCB GE 3044 G 220	77
Fig. 10-1	AIS 3410 Outline Drawing	79
Fig. 10-2	AIS GPS antenna, 1/2	80
Fig. 10-3	AIS GPS antenna, 2/2	81
Fig. 10-4	AIS VHF antenna	82

List of Abbreviations

This list also contains abbreviations which are not used in this manual but in additional documentation.

A

AIS Automatic Identification System

B

BIIT Built-In Integrity Test

C

COG Course Over Ground

D

DSC Digital Selective Call

E

ECDIS Electronic Chart Display and Information System

H

HDG Heading

L

LR Long Range

M

MAC Medium Access Control

MKD Minimum Keyboard and Display

MMSI Maritime Mobile Service Identity

P

PDP Primary Display Port (Presentation Interface)

PP Pilot Port (Auxiliary Display Port)

S

SOG Speed Over Ground

U

UAIS =AIS

V

VDL VHF Data Link

VDM Serial output message containing VDL information (IEC 61162-2)

VDO Serial output message containing VDL information (IEC 61162-2) (from own ship)

VSWR Voltage standing wave ratio

1 General

This Technical Manual is the technical reference manual for the following components:

- AIS 3410 Electronics Unit

The manual contains further information about the antennas (GPS, VHF).

1.1 Software Releases

This manual is valid for all software versions of the AIS 3410. See also [Section 5.2](#).

1.2 General Recommendations for Installation, Maintenance and Repair Work

SAM Electronics gives advice and recommendations for the arrangement of SAM Electronics equipment and the installation sites. A prerequisite is that the necessary drawings of the ship should be made available in good time.

This advice and these recommendations are given on the basis of our up-to-date practical experience and to the best of our knowledge. However, they are given without any commitment. As far as is permissible, any liability on the part of SAM Electronics for resulting damage is expressly ruled out, regardless of whether the damage is of a direct or indirect nature.

Unusual shipbuilding shapes, additions or superstructures as well as environmental influences can impair the functioning of the equipment. We are, of course, willing to help the customer with optimizing solutions subject to suitable commercial arrangements.

The customer is responsible for ensuring that SAM Electronics equipment is installed properly according to our instructions and in compliance with the regulations issued by the relevant classification society and national authorities.

1.3 Safety Warnings



WARNING

**This unit contains electrostatic sensitive devices.
Observe precautions for handling.**



The discharge of electrostatic energy into a semiconductor can destroy the semiconductor or change its properties. Before a unit's housing is opened to remove or touch a board, the service equipment, Order No. 586-5011, must be used.

1. The mat must be positioned at the workplace.
2. The potential equalization cable must be connected to the snap fastener and the clamp to a suitable protective earth contact. The cable contains a $1 \text{ M}\Omega$ resistor which must not be removed.
3. The wrist band must be put on. When the spiral cable is connected to the snap fastener, the discharge line is established.
4. Thoroughly grounded soldering, measurement and test tools must be used. If these tools are supplied with power from the 230 VAC mains, this supply must be protected by a fault current plug, stock No. 593-8099.

Boards and units that contain ESD-endangered semiconductors are marked with the symbol shown above.

All assisting persons who might come into contact with the endangered boards must also use the ESD equipment.

DANGER

It is not permissible to connect the ship's mains to the system before setting-to-work by a qualified technician. The mains must be switched off (e.g. by means of a common isolating switch or a circuit breaker) in the ship's supply or the mains cable must be disconnected until setting-to-work takes place.

If a synchro is connected to the Analog Interface or Interface Expander, dangerous voltages might be present, even although all supplies to the system are switched off.

Capacitors and tubes can store dangerous voltages for several hours, even when they have been disconnected from the supply voltage.

WARNING

Pay attention to the regulations for the prevention of accidents.

DANGER

Even when the system is switched off, there might be a dangerous voltage present on exposed contacts. Therefore, before a unit is opened, it must be ensured that the electrical supply to all units is, and remains, disconnected from the ship's mains.

2 Overview

The 3410 is an AIS Electronics Unit which receives data from other vessels by means of a VHF radio and sends these data to the radar/navigation system. In the opposite direction, the AIS receives data from the radar/navigation system and the ship's sensors and transmits these data by means of the VHF radio.

Access to these data and access to the VHF radio for a pilot is prepared by means of an additional pilot port.

The AIS has a long range port to connect a long distance communication system, for instance a satellite communication system. In this way, the AIS can be called to send the ship's data. These data are sent back via the long range port to the questioner.

The AIS 3410 is equipped with a 16 channel GPS receiver and provides position data according to IEC 61162 Edition 3, so that it is suitable for the use as a position sensor. In areas where the VTS stations provide differential correction data via VHF link the AIS 3410 switches automatically into DGPS mode.

For further details see [Section 4](#).

2.1 Compatibility with Other Systems

The AIS 3410 can be used in the following system:

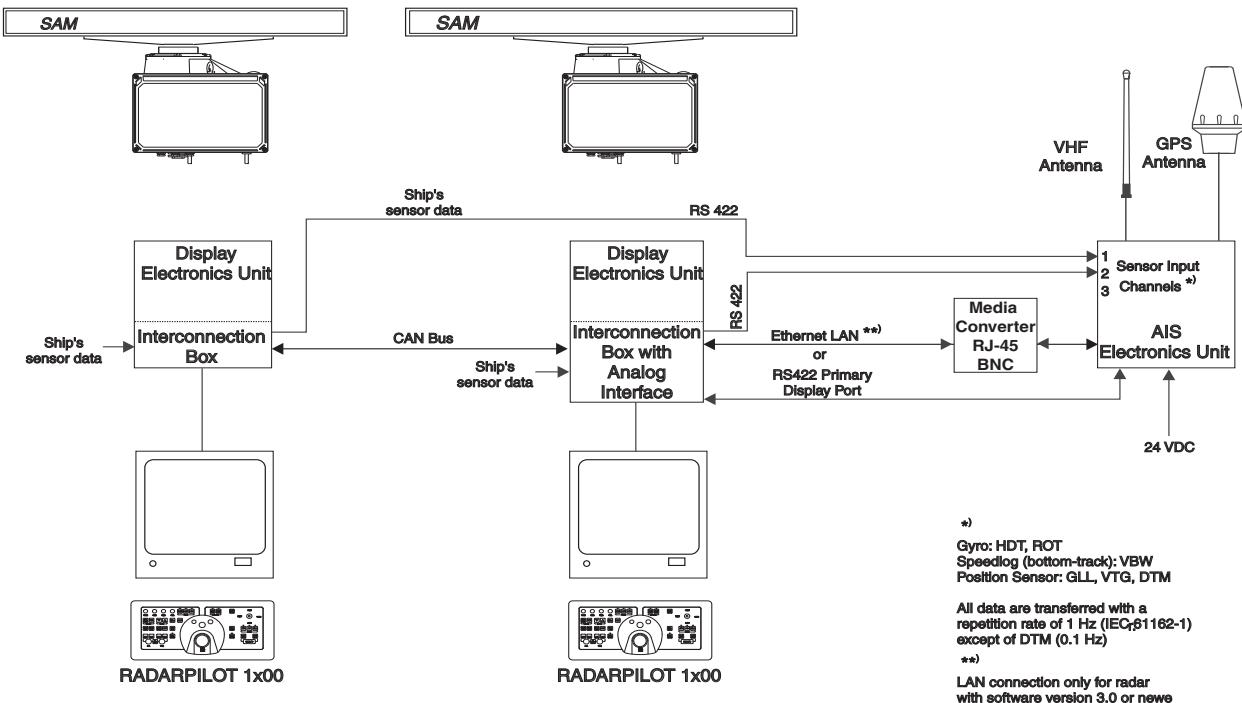
- RADARPILOT/CHARTRADAR 1000/1100
- NACOS xx-5
- NACOS xx-4
- CHARTPILOT Stand-alone
- NACOS xx-3 (Radar 9xxx AIS Interface needed for the display of AIS targets at Radar 9xxx indicators and MULTIPILOTs in radar mode)
- mixed systems consisting of Radar 9xxx and RADARPILOT 1000
- Radar 9xxx (with Radar 9xxx AIS Interface)

The AIS might not work with SAM Electronics systems/components which are running with older software versions. For further information, see the Technical Manuals of these systems or the Software Release Notes.

It is also possible to use the AIS 3410 within systems from other manufacturers which support the IEC-defined interfaces.

2.2 AIS 3410 in RADARPILOT 1000/1100 Systems

Fig. 2-1 AIS 3410 in RADARPILOT 1000/1100 systems



The AIS 3410 is connected to the Interconnection Box of the RADARPILOT 1000/1100. The ship's sensors are connected to the radar(s). The sensor data are transferred from the radar(s) to the AIS (in dual or multiple installations, from two radars as redundancy, if possible).

The repetition interval of the ship's sensor data is set automatically if the indicator's serial interface is configured as AIS Navigation Data interface.

If the RADARPILOT 1000/1100 has a software of version 3.0 or newer, it is also possible to connect the AIS by means of the Ethernet LAN.

2.3 AIS 3410 in 1000/1100 Series Systems (NACOS xx-4 and xx-5)

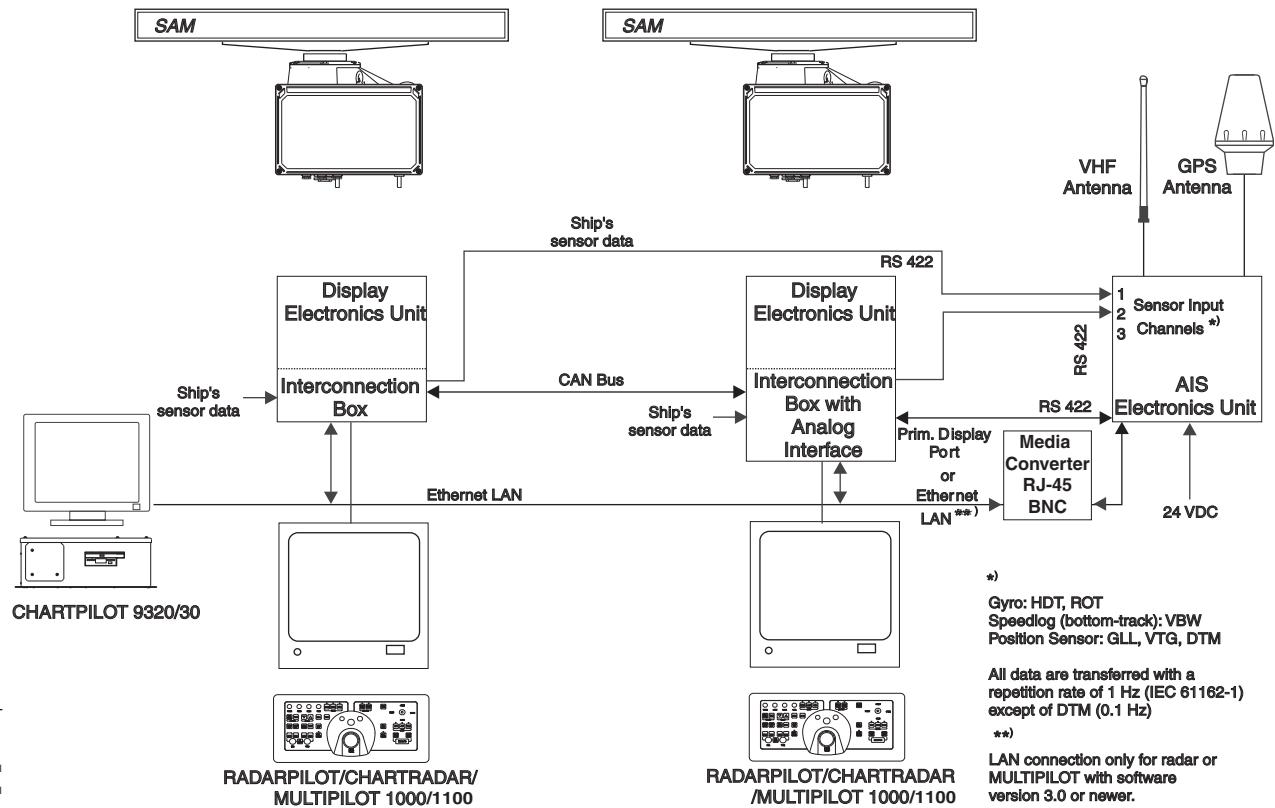


Fig. 2-2 AIS 3410, SAM Electronics 1000/1100 series systems (NACOS xx-4/NACOS xx-5)

The AIS 3410 is connected to the Interconnection Box of the RADARPILOT/CHARTRADAR 1000/1100. The ship's sensors are connected to the radars. The sensor data are transferred from the radar(s) to the AIS (in dual or multiple installations, from two radars as redundancy, if possible).

The repetition interval of the ship's sensor data is set automatically if the indicator's serial interface is configured as AIS Navigation Data interface.

If the RADARPILOT 1000 and/or MULTIPILOT 1000 has a software of version 3.0 or newer, it is also possible to connect the AIS by means of the Ethernet LAN (always possible in 1100 series systems).

All CHARTPILOT systems receive the AIS data via the Ethernet LAN. If the AIS Electronics Unit is not connected to the LAN, only the activated targets can be displayed at the CHARTPILOT. If the AIS Electronics Unit is connected to the LAN and a Software Version 5.2 or newer is installed on the CHARTPILOT, the complete AIS functionality is available at the CHARTPILOT (always fulfilled at CHARTPILOT 1100).

2.4 AIS 3410 in CHARTPILOT Stand-alone Systems

*
Gyro: HDT, ROT
Speedlog (bottom-track): VBW
Position Sensor: GLL, VTG

All data are transferred with a repetition rate of 1 Hz (IEC 61162-1)

**
except for CHARTPILOT 9300 with Electronics Unit GE3022

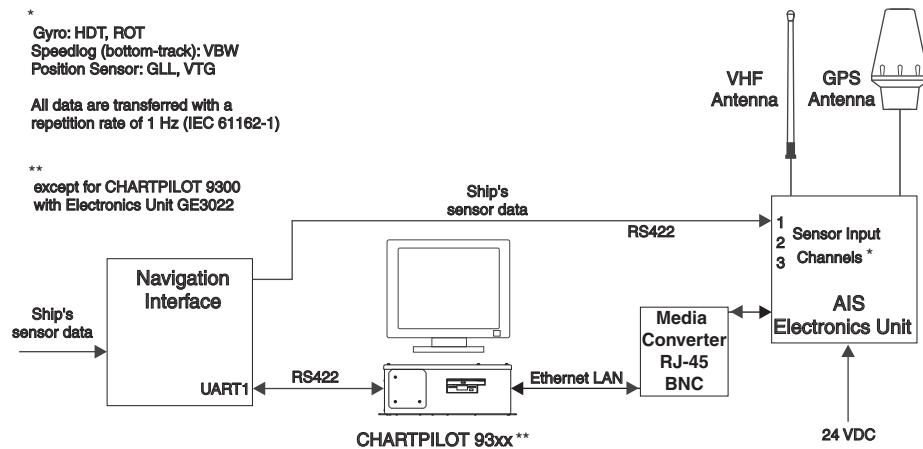


Fig. 2-3 AIS 3410 with CHARTPILOT stand-alone

The AIS 3410 is connected to the CHARTPILOT via Ethernet LAN. The ship's sensors are connected to the Navigation Interface. The sensor data are transferred to the CHARTPILOT via an RS422 interface.

NOTE:

If the AIS Electronics Unit receives the ship's sensor data from Ship's Interface, the output interfaces of the Ship's Interface must be configured as follows:

- Select "IEC 61162-1 edition 3, 04/2007 (NMEA0183 version 3.01)" as driver
- Set a repetition interval of **1 s** for the following telegrams:
 - GLL
 - VTG
 - HDT
 - ROT
 - VBW (if bottom-track log is available)

2.5 AIS 3410 in NACOS xx-3 Systems (Radar 9xxx and CHARTPILOT)

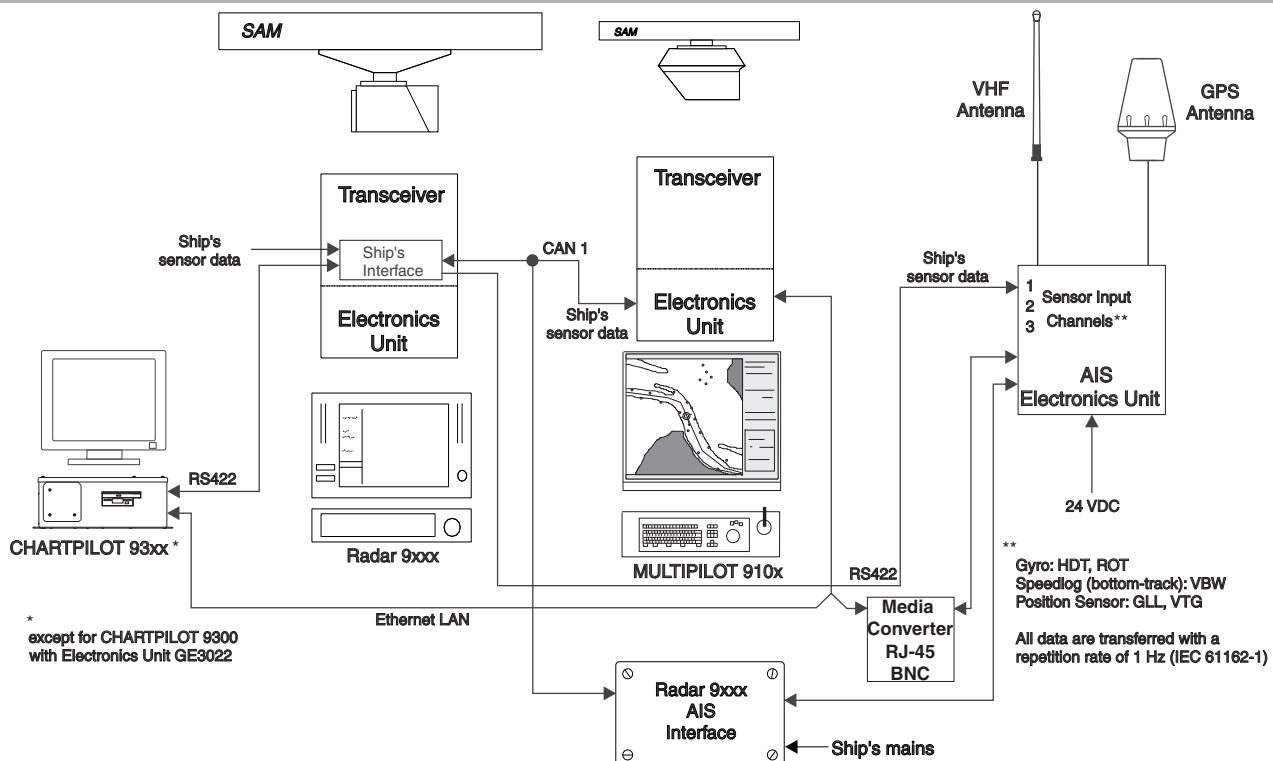


Fig. 2-4 AIS 3410 in NACOS xx-3 systems

The AIS 3410 is connected to the CHARTPILOT via Ethernet LAN.

The ship's sensors are connected to the Ship's Interface. The sensor data are transferred to the AIS, to the CHARTPILOT and to other radars or MULTIPILOTS.

If two Ship's Interfaces are existing because of redundancy purposes, the ship's sensor output(s) of both Ship's Interfaces must be connected to the Electronics Unit.

Without the Radar 9xxx AIS Interface it is not possible to display the AIS data at the Radar 9xxx or at the MULTIPILOT 910x in radar mode. One interface is sufficient for the complete system, regardless of the number of Radars 9xxx/MULTIPILOTS.

NOTE:

If the AIS Electronics Unit receives the ship's sensor data from Ship's Interface, the output interfaces of the Ship's Interface must be configured as follows:

- Select "IEC 61162-1 edition 3, 04/2007 (NMEA0183 version 3.01)" as driver
- Set a repetition interval of **1 s** for the following telegrams:
 - GLL
 - VTG
 - HDT
 - ROT
 - VBW (if bottom-track log is available)

2.6 AIS 3410 in Radar 9xxx Systems with RADARPILOT 1000/1100

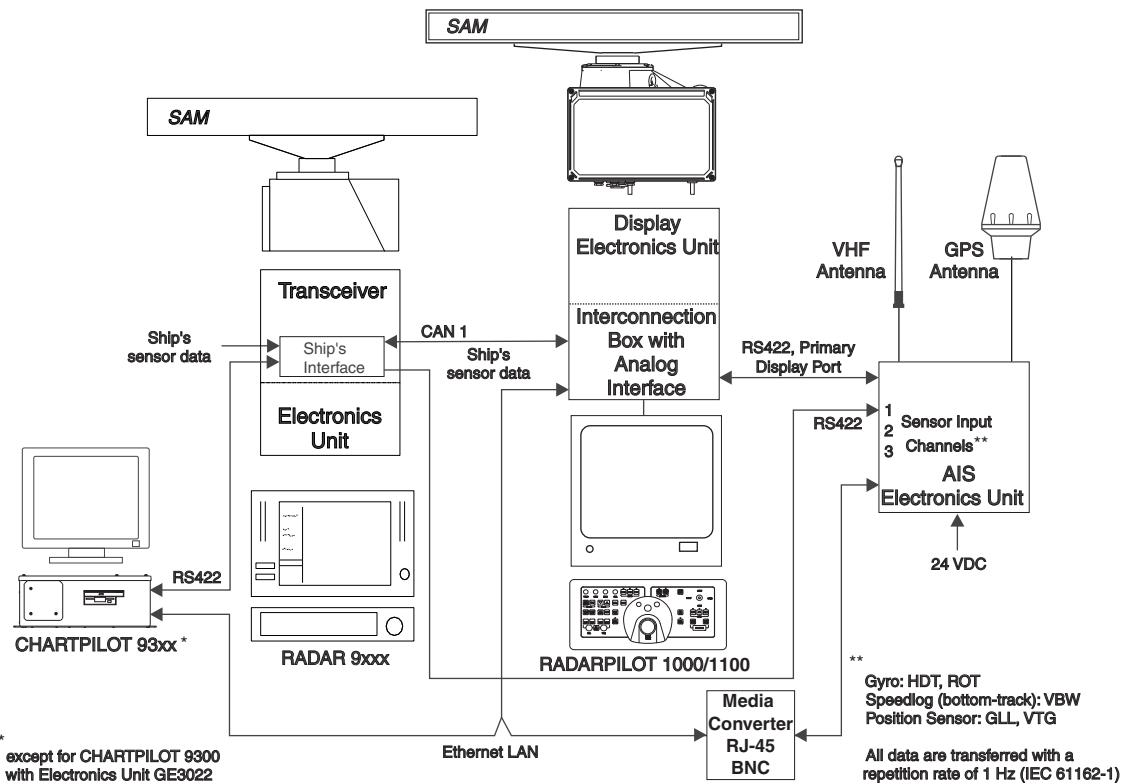


Fig. 2-5 AIS 3410 in Radar 9xxx systems with RADARPILOT 1000/1100

The AIS 3410 is connected to the CHARTPILOT via Ethernet LAN and to the Analog Interface of the RADARPILOT 1000/1100. The RADARPILOT 1000/1100 transfers the AIS data via CAN1, so that the data can be displayed also at the Radar 9xxx (or at a MULTIPilot 91x0). It is not necessary to install the Radar 9xxx AIS Interface. If the RADARPILOT 1000/1100 is connected via LAN instead of Primary Display Port, the AIS data is not available on CAN1 for the Radar 9xxx.

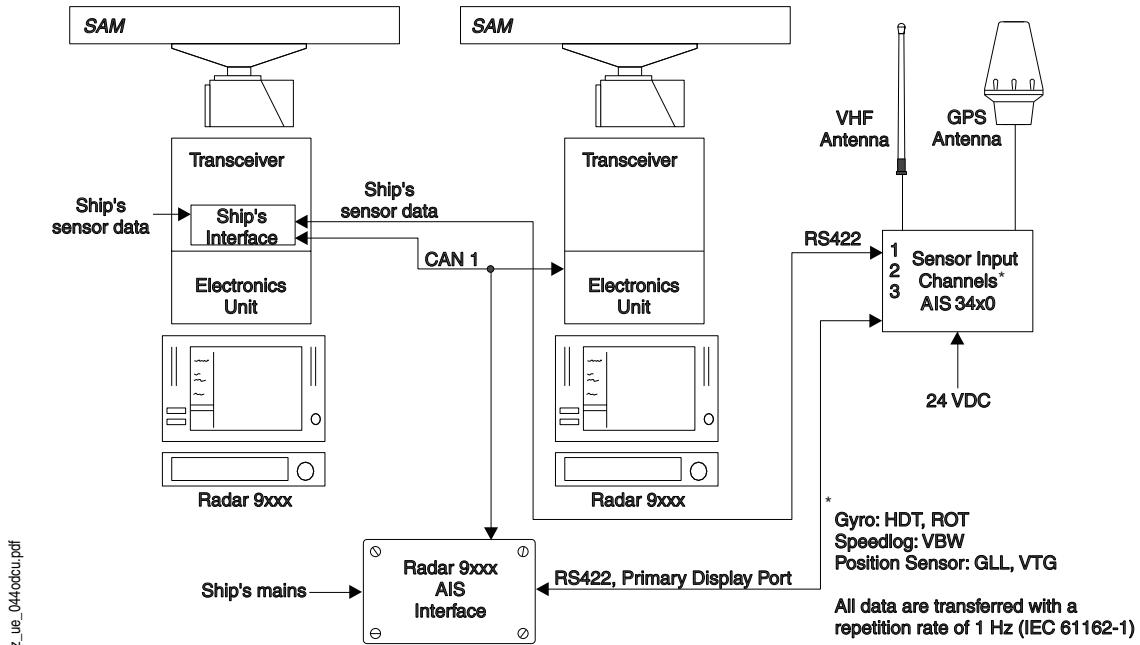
The ship's sensors are connected to the Ship's Interface. The sensor data are transferred to the AIS, to the CHARTPILOT and to a MULTIPilot.

NOTE:

If the AIS Electronics Unit receives the ship's sensor data from Ship's Interface, the output interfaces of the Ship's Interface must be configured as follows:

- Select "IEC 61162-1 edition 3, 04/2000 (NMEA0183 version 3.01)" as driver
- Set a repetition interval of **1 s** for the following telegrams:
 - GLL
 - VTG
 - HDT
 - ROT
 - VBW (if bottom-track log is available)

2.7 AIS 3410 in Radar 9xxx Systems



2.8 Housing of the 3410 Electronics Unit



Fig. 2-7 AIS 3410 Electronics Unit (current version)

The plastic housing of the 3410 contains a single Electronics Unit which consists of the controller, the interfaces, the VHF transmitter/receiver and the GPS receiver. The Electronics Unit has five cable inlets for ship's cables and two coaxial connectors for the connection of GPS and VHF antennas. One of the five cable inlets will be used for the Ethernet LAN (RJ-45) connector, being inside the housing of the Electronics Unit.



Fig. 2-8 UAIS DEBEG 3400 Electronics Unit (old versions)

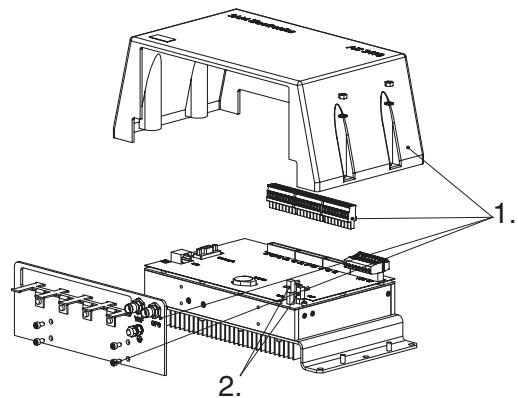
The aluminium housing contains a single Electronics Unit which consists of the controller, the interfaces, the VHF transmitter/receiver and the GPS receiver. The UAIS DEBEG 3400 version of the housing has five cable glands for ship's cables and three coaxial connectors for the connection of Ethernet LAN (BNC), GPS and VHF antennas. The UAIS DEBEG 3400 version (steel housing) has cable inlets instead of the cable glands.

2.9 Replacement of AIS Electronics Unit

In case of replacing the UAIS DEBEG 3400 Electronics Unit with a AIS 3410 Electronics Unit there is no need to remove the old housing. Therefore proceed as described below. To ensure the correct display of all data please refer to *Technote T-0908-3400-023*.

2.9.1 Open the Housing of AIS 3410

1. Remove these parts from the AIS 3410.
2. Disconnect the GPS and the VHF connecting cable.

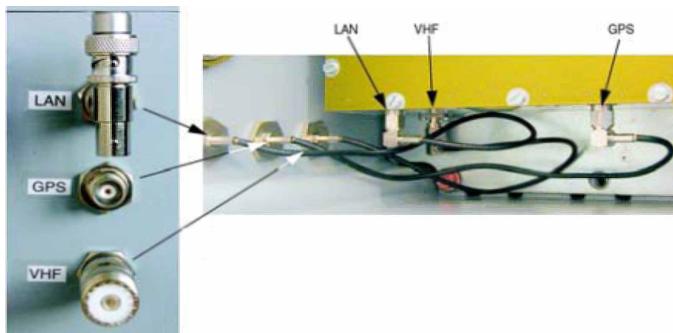


2.9.2 Open the Housing of UAIS DEBEG 3400

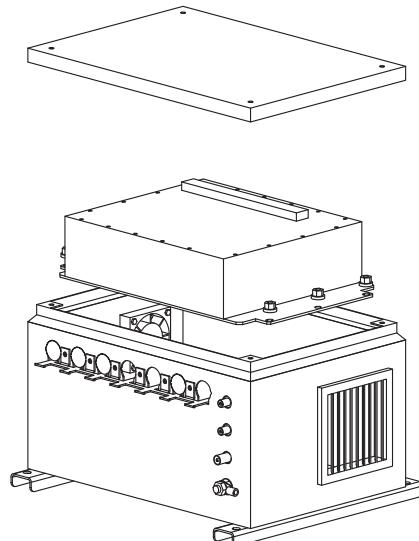
1. Disconnect the UAIS DEBEG 3400 from power supply.
Undo all ship cables from the bracket.
Disconnect the Phoenix plugs from the Electronics Unit.
Unplug the cables from the Phoenix plug (connector 4) and remove the Phoenix plug.



2. Disconnect the LAN-, VHF- and GPS connecting cable from the Electronics Unit.



3. Dismount the Electronics Unit and remove it.



2.9.3 Merge the AIS 3410 Electronics Unit into the UAIS DEBEG 3400 Housing

1. Insert the Electronics Unit from the AIS 3410 and mount it on the distance bolts with the six M6 nuts.
2. Take the new Phoenix plug (connector 4) and connect the cables again. Connect to the 24V interface the cables from 24V power supply, fan and media converter.
3. Connect the GPS- and the VHF connecting cable to the internal GPS- and VHF-connector. The LAN network has to be connected via the media converter. The coaxial connector of Ethernet LAN, mounted on the housing, cannot be used any more (GE4034G010, Mat-Nr.: 271259883).
4. Fasten all ship cables at the bracket again.

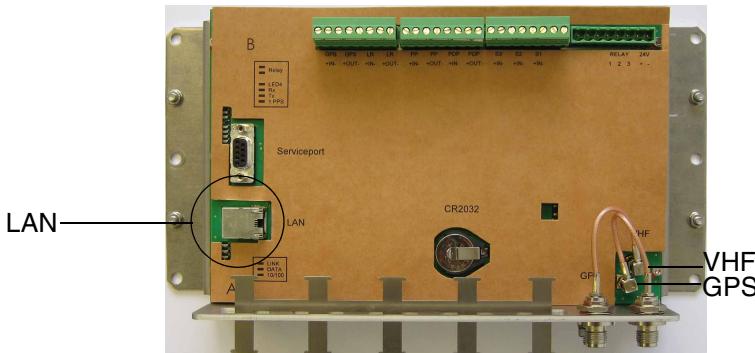
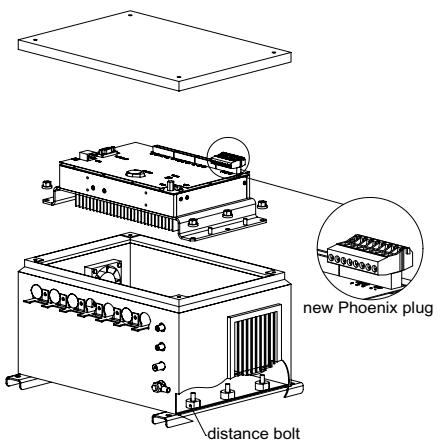
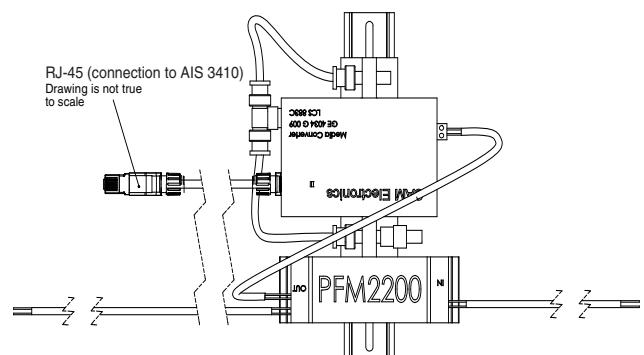


Fig. 2-9 AIS 3410 Electronics Unit (without housing)

2.10 Media Converter Installation (necessary for ships with BNC LAN networks)

The media converter has to be installed between the AIS 3410 and the BNC LAN plug of the ship's network.

1. Mount the mounting plate including the media converter on the wall or on the ground near to the AIS 3410 Electronics Unit.
2. Put the BNC LAN plug of the ship's network into the BNC jack of the media converter.
3. Put one side of the Ethernet LAN cable (with 2 RJ-45 plugs) into the RJ-45 jack of the media converter.
4. Undo the 4 screws of the casing cover of the AIS 3410 and take the casing cover off.
5. Put the other side of the Ethernet LAN cable into the LAN jack of the AIS 3410 rear panel (Figure 2-9).
6. Put the casing cover on and fasten the 4 screws.



3 Installation Recommendations

3.1 General Recommendations

3.1.1 Cables

Cable types, cable data, maximum cable length, special instructions for cable laying and connection details are defined in the **Cabling Documents** of the corresponding equipment (consisting of schematic diagram, remarks, cable list and connection diagram).

Interface connections should be discussed and agreed with SAM Electronics

In order to ensure proper functioning of the equipment, the cable types should be selected according to the cable lists.

In general, the following points must be taken into account:

- For the **cables inside the units** (cabinets), an extra length of 1 metre is necessary at each end. If the height of the unit exceeds 0.5 metre, an extension by 1 m plus the height of the cabinet is necessary.
- All cables should be kept as short as possible, especially coaxial cables to minimize attenuation of signal.

In order to fulfil all abovementioned requirements, install cables in two steps:

Install cables and leave extra length of 1 metre or more as described above

Cut cables to correct length in order to reach its terminal, but **do not leave extra lengths furled inside or outside the cabinet**

- The **cables must be marked** by the electrician at both ends with the cable numbers corresponding to the SAM Electronics cabling documents.
- Where necessary, **particular cable glands** - marked with letters and/or numbers - are assigned to the cables. The identification letters and numbers are stated in the connection diagrams; they are either fixed to the unit or can be seen from the outline drawings (...BZ or ...MB).
- All connectors installed outdoors (e.g. on coaxial cables) should be waterproof by design to protect against water penetration into the cable.
- Coaxial cables should be installed in separate signal cable channels/tubes and at least 10 cm away from power supply cables. Crossing of cables should be done at right angles (90°). Coaxial cables should not have any sharp bends, which may lead to a change in the characteristic impedance of the cable. The minimum bend radius should be 5 times the cable's outside diameter.
- It must be ensured that all **cables - including their screens - are passed into the units in continuous lengths** and are not terminated before reaching the destination equipment.
- With **multicore cables**, it is useful to strip down and lace the single wires according to the terminal sequence.
- Existing **cable grippers** in the units must be used.
- All cable connections must be carefully **checked** after completion of the cable work and all cable **screens must be grounded via the shortest possible connections** - if not stated otherwise in the Cabling Documents/Connection Diagram.

- All **cables** must be secured by means of suitable clamps (pull-relief) before entering the units.
- It must be ensured that cables do not block any **moving parts** within a unit.
- **Power leads** must be protected by "slow-blow" fuses according to their cross section.
- In the case of a unit whose **cable inlet consists of a hole with brackets** attached on the inside and outside, the cable must be dressed as shown in [Figure 3-1](#).

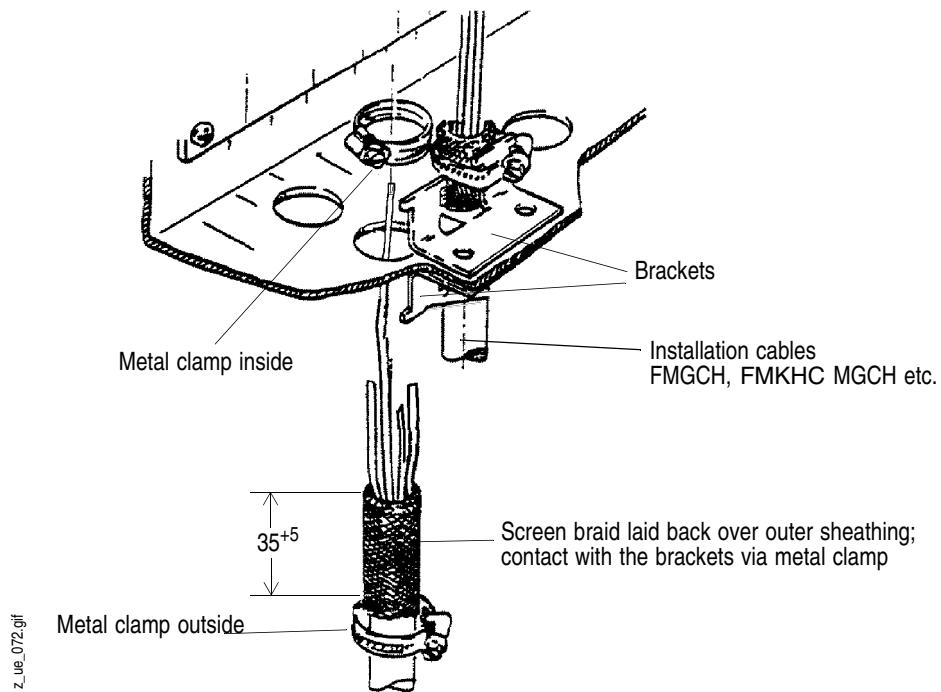


Fig. 3-1 Cable inlet consisting of a hole with brackets

3.1.1.1 Maximum Cable Length

Coaxial Antenna Cable for the VHF Antenna

The maximum length of this cable (LCF 12-50) is 80 m. See [Section 9, Cabling Documents](#).

Coaxial Cable for the GPS Antenna

The length of this cable is defined by the cable sets. Prefabricated cables with a length of 20, 30, or 40 m can be delivered.

If a length of more than 40 m is needed, the cable LCF 12-50 of the VHF antenna must be used in combination with TNC-N plug adapters. See [Section 9, Cabling Documents](#).

Ethernet LAN

The Ethernet LAN thin wire cabling (RG-213/U ship's cable or RG58) must not exceed a length of 185 m.

3.1.1.2 Cable Sets

The following cable sets are available:

Purpose/Description	Quantity/m	Order No.
LAN network, cable RG 213/U, 2 BNC connectors	on request	300005394
Connection of the GPS antenna, cable HF2,3LZ/7,3DZ with 2 plugs 11TNC-50-7-2C	20	271256324
Connection of the GPS antenna, cable 02Y(ST)C2Y2.7/7.3AF with 2 TNC plugs	30	300005391
Connection of the GPS antenna, cable 02Y(ST)C2Y2.7/7.3AF with 2 TNC plugs	40	300005392
For the connection of the GPS antenna with cable length >40 m, cable of type Cellflex LCF 12-50 50 Ω must be used.	on request	271257679
Connection of the VHF antenna, cable HF2,3LZ/7,3DZ with 2 plugs 11TNC-50-7-2C	20	271256324
Connection of the VHF antenna, cable 02Y(ST)C2Y2.7/7.3AF with 2 TNC plugs	30	300005391
Connection of the VHF antenna, cable 02Y(ST)C2Y2.7/7.3AF with 2 TNC plugs	40	300005392
For the connection of the VHF antenna with cable length >40 m, cable of type Cellflex LCF 12-50 50 Ω must be used.	on request	271257679

3.1.2 Electronics Units

Dimensions, weights, spaces required for service and maintenance and special installation instructions are stated in the outline drawings and installation drawings of the corresponding unit. In general, the following points also apply:

- The useful life of the components of all Electronics Units (Pulse Generators, Transceivers etc.) generally decreases with increasing **ambient temperature**; it is therefore advisable to install such units in air-conditioned rooms. If there are no such facilities - e.g. deckhouse or space near or below the water line - these rooms must at least be dry, adequately ventilated and kept at a suitable temperature in order to prevent the formation of condensation inside these units.
- With most Electronics Units, **cooling** takes place via the surface of the casing.

The cooling must not be impaired by partial covering of the unit as a result of insulation (if any) of the room (the wall on which the casing is mounted), or by installation of the unit in a confined cabinet.

Furthermore, the distance from the ceiling and the floor or from a unit situated underneath must be at least 300 mm.

- For service purposes, a **power socket** (AC 220/230 V) and adequate lighting are necessary in the vicinity of each Electronics Unit.
- In the area of the wheel house, the **distance of each Electronics Unit from the magnetic standard compass or the magnetic steering compass** must not be less than the permitted magnetic protection distance.

This distance is measured from the centre of the magnetic system of the compass to the nearest point on the corresponding unit concerned.

- Units which are to be used on the **bridge wing** must be installed inside the "wing control console" - protected against the weather - if they do not at least correspond to the enclosure type IP 56. In order to avoid misting of the viewing screen, 25 ... 50 W console-heating (power depending on the volume) is recommended.
- When selecting the site of a unit, the **maximum cable lengths** have to be considered according to the notes in the cabling documents (remarks, cable list).
- The **accessibility for maintenance and service** (stated in the outline drawings or installation drawings) must be considered.
- The impairment of a digital read-out or a display screen by **direct light from lamps or the sun** must be avoided. Rear windows must be blacked out by means of roller blinds or Venetian blinds.
- **Disturbing reflections** on the screen of a display caused by pilot lamps and illuminated signs must be prevented by suitable measures (screening or relocating).
- When a unit is being installed, **the base, floor or bulkhead must be checked to ensure that it is flat** in order to avoid twisting of the unit when the fixing screws are tightened, because such twisting would impair mechanical functions. Any unevenness should be compensated for by means of spacing-washers.
- The **grounding screws** of the units must be connected to the body of the ship (ground); the wire used should have a cross sectional area of at least 6 mm.

Aboard fibreglass (GRP) vessels, a "grounding network" with a high conductance - taking into consideration the working frequencies of the other equipment - must be provided in order to achieve satisfactory EMC (electromagnetic compatibility).

- In the interests of safety during maintaining or servicing, the shipyard should provide a **common isolating switch or circuit breaker** (in conjunction with a contactor, if necessary) for all interconnected equipment.
- **Transportation damage**, even if apparently insignificant at first glance, must immediately be examined and be reported to the freight carrier. The moment of setting-to-work of the equipment is too late, not only for reporting the damage but also for the supply of replacements.
- **The equipment should never be switched on by the electricians who did the installation work - not even just for a moment - never!**

This is a job for the authorised SAM Electronics service engineer.

- **After hand-over** of the equipment in good operating condition to the customer, the Installation Report (Annex of the Warranty Certificate) should be filled in completely and then forwarded to SAM Electronics, Hamburg, as proof of such fulfilment. It is important that these requirements be fulfilled in order to avoid the risk of losing the warranty.

3.2 Specific Recommendations

3.2.1 Recommendations Concerning AIS Systems

Recommendations for the installation of AIS systems are published in the document IMO Circular SN227 "Guidelines for the Installation of a Shipborne Automatic Identification System (AIS)". See this document for further information. The following sections also contain information which has been taken from this document.

3.2.2 Recommendations Concerning the Installation of the Electronics Unit

The Electronics Unit should be mounted on a vertical bulkhead. A distance of at least 300 mm from other devices must be ensured around the housing for sufficient air circulation. See also [Section 10, Outline Drawings](#).

3.2.3 Recommendations Concerning the Installation of the Antennas

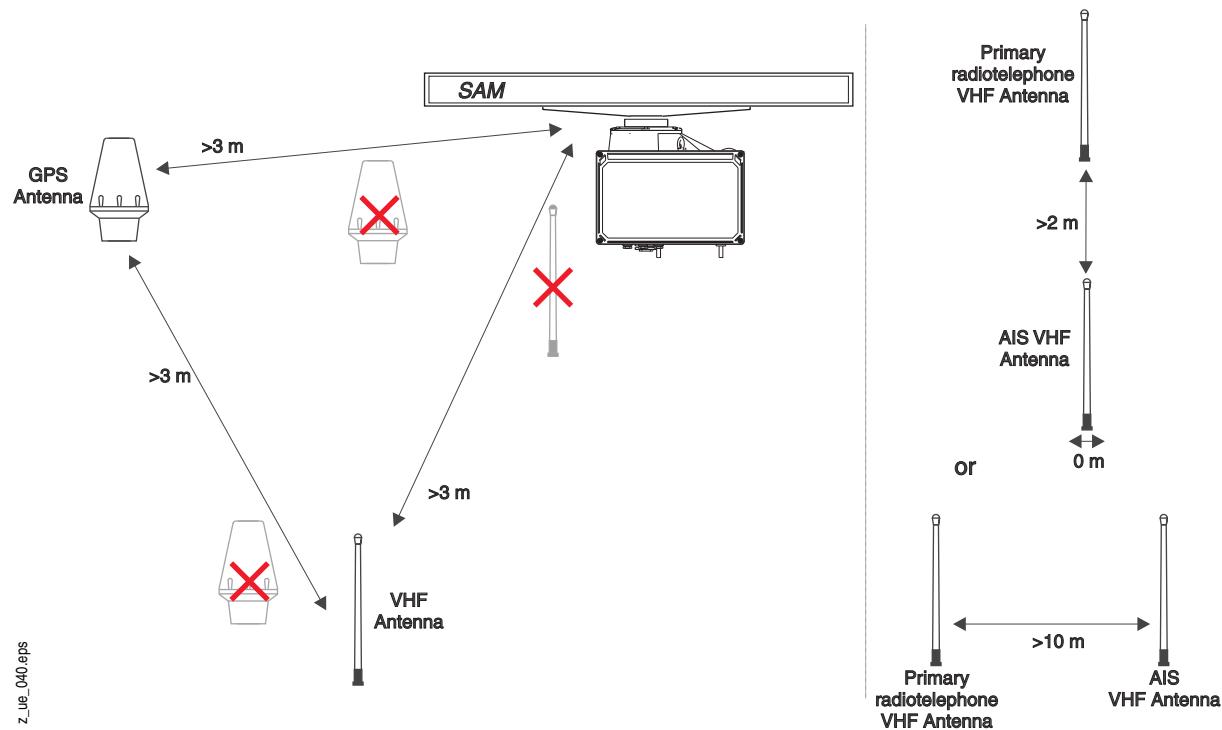


Fig. 3-2 Minimum distances for GPS and VHF Antenna

3.2.3.1 Recommendations Concerning the Installation of the VHF Antenna

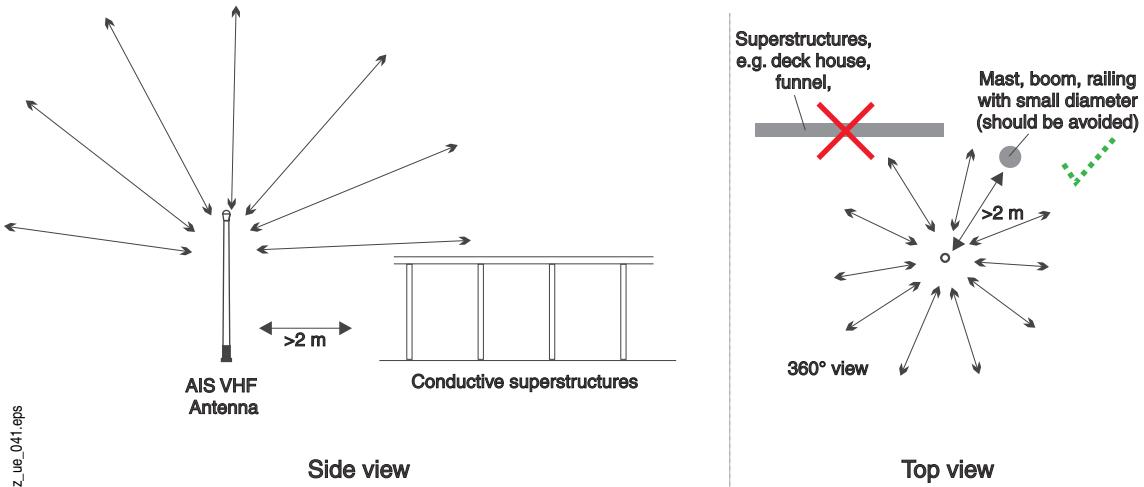


Fig. 3-3 Positioning of the VHF Antenna

The digital signals of the AIS may occur as a periodic clicking sound on a ship's radiotelephone. This effect may become stronger when the VHF antenna of the AIS is located near the VHF radiotelephone antenna and when the radiotelephone is operating on channels near the AIS operating channels (for example channels 27, 28, 86).

The antenna should be placed in an elevated position that is as unobstructed as possible, with a minimum of 2 m in the horizontal direction from any structures made of conductive materials. The antenna should not be installed close to any large vertical obstruction. The objective for the VHF antenna is that it should "see" the horizon freely through 360°.

The VHF antenna should be installed safely away from interfering high-power energy sources such as the radar scanner and other transmitting radio antennas, preferably at least 3 m away from and out of the transmitting beam.

Ideally there should not be more than one antenna on the same level. The AIS VHF antenna should be mounted directly above or below the ship's primary VHF radiotelephone antenna, with no horizontal separation and with a minimum of 2 m vertical separation. If it is located on the same level as other antennas, the distance apart should be at least 10 m.

For further information, see [Figure on page 82](#).

3.2.3.2 Recommendations Concerning the Installation of the GPS Antenna

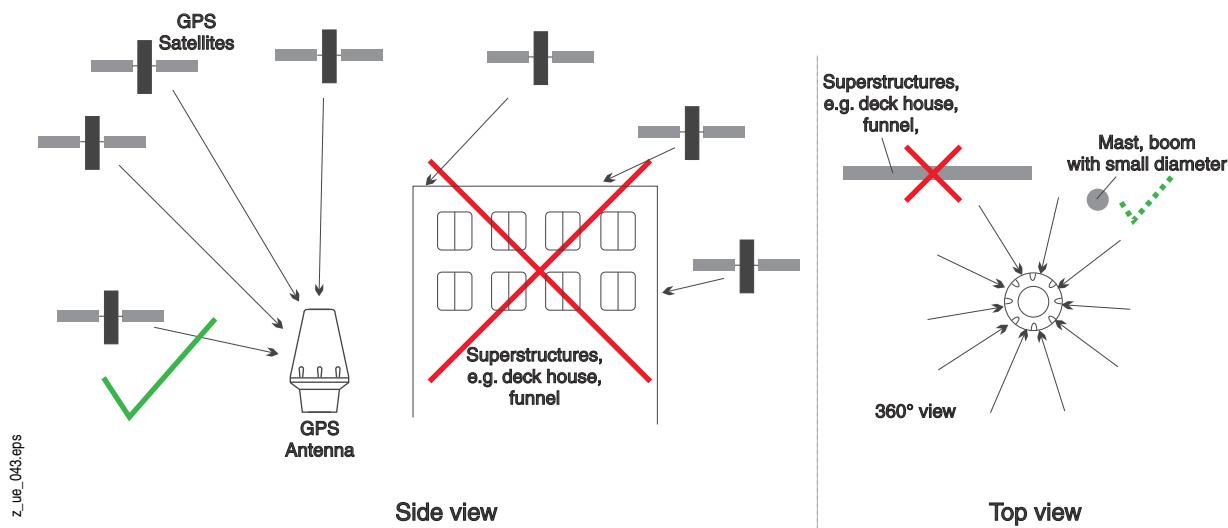


Fig. 3-4 Positioning of the GPS Antenna

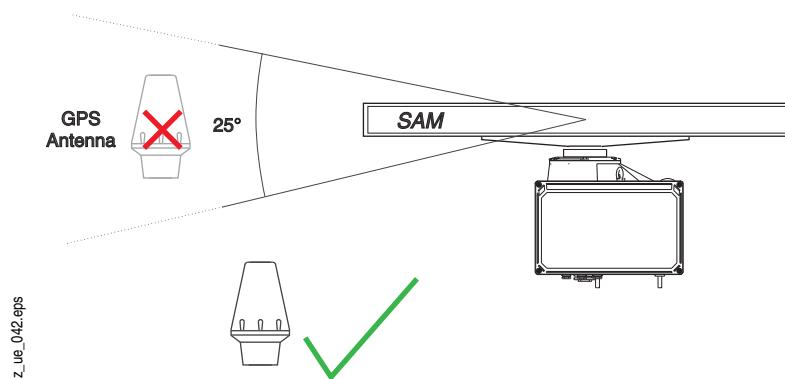


Fig. 3-5 Minimum distances for the GPS Antenna from a Radar Scanner

The GPS antenna should be installed where it has a clear "view" of the sky. The objective is that it should "see" the horizon freely through 360° with a vertical observation sector of 5...90° above the horizon. Small diameter obstructions, such as masts and booms, do not seriously degrade signal reception, but such objects should not eclipse more than a few degrees of any given bearing.

Locate the antenna at least 3 m away from and out of the transmitting beam of high-power transmitters (S-Band radar and/or Inmarsat systems). This includes the ship's own AIS VHF antenna.

3.2.4 Recommendations Concerning Redundancy

If possible, the Electronics Unit should be supplied with the ship's sensor data from two different sources, e.g. in a dual installation with RADARPILOT 1000 or 1100 the AIS can be supplied with sensor data from both radars.

NACOS xx-3 only:

If two Ship's Interfaces are existing because of redundancy purposes, the ship's sensor output(s) of both Ship's Interfaces must be connected to the AIS Electronics Unit.

3.2.5 Recommendations Concerning the Connection of a (D)GPS to AIS 3410

For an AIS stand-alone installation with the connection of an external (D)GPS position sensor, the following prerequisites must be fulfilled:

NMEA Version

NMEA version 2.01 edition 04/1994 or newer is required. In addition to this, the optional checksum is required. The AIS requires status information to check the data integrity.

All NMEA versions lower than 2.01 are not allowed for the use with AIS. To verify, that the NMEA version is 2.01 or higher, check the settings of the GPS sensor.

Data Telegrams

For all NMEA versions lower than 2.3 the GGA message must be transmitted. Only the GGA message transmits the information, that the differential mode is activated. This is set at the GPS receiver. If this telegram is not transmitted, it is not indicated that a DGPS is connected to the AIS.

To check, that a DGPS is connected correctly, check the AIS **State** Menu of the connected RADAR-PILOT/CHARTRADAR.

3.2.6 Emergency Power Source

It is recommended that an emergency power source such as an uninterruptible power supply is used. See [Section 7](#) for information about the power consumption of the Electronics Unit.

3.2.7 Pilot Port, Connector/Cable Kits

The regulations for AIS systems prescribe a connector for the Pilot Port. This connector is standardized. The following kits are available:

Kit	Consisting of	Order No.
Panel mounting	Connector 9 pole (male), for panel mounting with 3 m cable (NG3030G014)	300006056
Free hanging	Connector 9 pole "free hanging" (male) with 10 m cable (NG3030G013)	300006049

3.2.8 Recommendations Concerning AIS Stand-alone with Radar 9xxx / NACOS xx-2/-3

An AIS 3410 can be used with an existing Radar 9xxx installation without any additional software update if the following prerequisites are fulfilled:

- All necessary ship's sensors are connected additionally to the AIS Electronics Unit. The sensors must be connected directly (a Gyro Converter Unit may be necessary). It is not permissible to connect the output channels of the Ship's Interface to the AIS Electronics Unit.
or
- **Only** the heading information may be derived from the Ship's Interface. For this purpose, at least one free output channel must be available and the system software must be 039 (or higher) for NACOS xx-2 or 071 (or higher) for NACOS xx-3.

If the AIS derives its position sensor data from the Ship's Interface, a software update for the complete navigation system must be performed. The software version must be 096 or higher. Older versions do not comply to IEC 61162-1 edition 3, 04/2007 (NMEA0183 version 3.01). In these versions source and status of the position data is not indicated. Such versions must not be used with an AIS.

If the AIS is installed in combination with a MULTIPilot 91x0 or a CHARTPILOT 9320/9330, the complete navigation system has to be updated to software version 097A or higher.

NOTE:

CHARTPILOTs with a software version 4.0 or newer require an 8-channel Ship's Interface.

3.2.9 Recommendations Concerning the Connection to a Radar 1000/1100 Series System

In a single installation, an Analog Interface must be existing to connect the AIS system. In dual or multiple installations with two Analog Interfaces, the AIS must be connected as follows:

Radar software version \leq 2.6: Analog Interface No. 1 (usually at Indicator No. 1)

Radar software version \geq 2.6.1: Analog Interface No. 2 (usually at Indicator No. 2)

The AIS Electronics Unit must **not** be connected to both Analog Interfaces!

At a radar with software version 3.0 or newer or a MULTIPilot 1000, the AIS can be connected also by means of the Ethernet LAN. In this case, an Analog Interface is not necessary (if it is not needed for an analog gyro).

3.2.10 Recommendations Concerning the Connection to a Radar 1100 Series System

In a single installation, an Analog Interface must be existing to connect the AIS system. In dual or multiple installations with two Analog Interfaces, the AIS must be connected to Analog Interface No. 2 (usually at Indicator No. 2).

The AIS Electronics Unit must **not** be connected to both Analog Interfaces!

The AIS can be connected also by means of the Ethernet LAN. In this case, an Analog Interface is not necessary (if it is not needed for an analog gyro).

4 Functional Description

The AIS system consists of the following components:

- AIS 3410 Electronics Unit
- GPS antenna 1330FW
- VHF antenna CXL 2-1

The functionality is described in [Section 4.1](#) by means of the block diagram ([Figure 4-3](#)).

4.1 Block Diagram

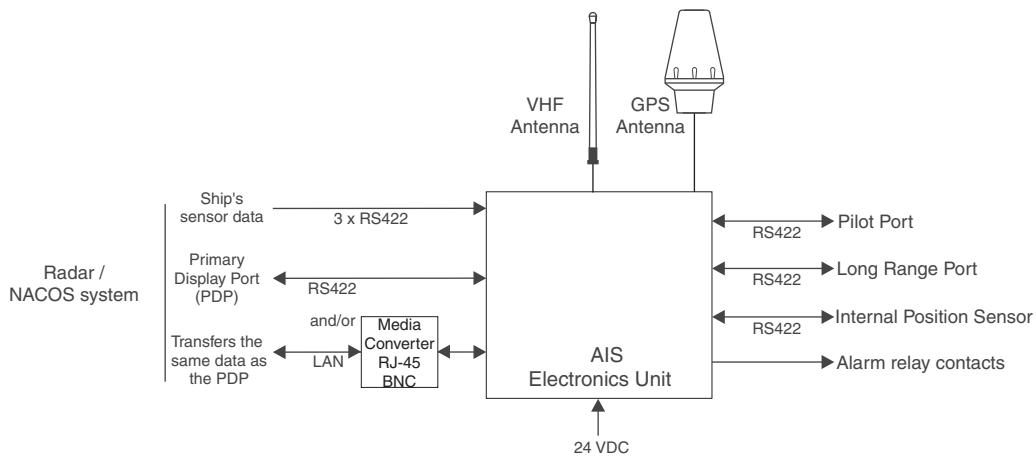


Fig. 4-1 Block diagram of the AIS System

The AIS Electronics Unit contains a VHF radio, a GPS receiver and a Mainboard with the interfaces. The AIS Electronics Unit has three inputs for the essential ship's sensor data such as position, speed and heading. These data are supplied by means of the navigation system such, as a RADARPILOT 1000/1100. The AIS communicates with the navigation system via the primary display port and/or the Ethernet LAN. In this way the AIS is supplied with additional data such as the ship's data, administration data and configuration data.

The ship's data, the ship's sensor data and the position data (from external or internal GPS receiver) are transmitted via VHF.

In the opposite direction, the corresponding data of other ships equipped with AIS systems are received by means of the VHF receiver. These data are processed and sent to the navigation system via the primary display port or the Ethernet LAN.

The functions of the pilot port correspond to the functions of the primary display port, but the pilot port must be made accessible for pilots on the ship's bridge. It must not be used for other purposes.

The DSC Receiver receives messages from external stations such as VTS. By means of the DSC messages, specific settings such as a change of the VHF channels can be controlled.

The VHF transmitter/receiver has a limited range. By means of the connection of a long range communication system (such as a satellite communication system) to the long range port, this limitation can be eliminated. In this way, the AIS can be called to send the ship's data. The requested data are sent via the long range port and the long range communication system to the questioner. The operator can decide whether a long range request is answered or not.

4.2 Termination

The wiring must be done in accordance with [Figure 4-2](#) with 50Ω coaxial cable (for example inside the enclosures, RG 58, for ship's cabling RG 213 / U, see cabling diagrams). The network is a 10 Mbit network.

The BNC-T plugs must be connected directly into the Ethernet Module. It is not admissible to connect the T-plug and the network adapter by means of a coaxial cable.

Proper termination with a 50Ω BNC termination plug at both ends of the Ethernet line is very important.

It is not permissible to use cable with a characteristic impedance different from 50Ω .

If no cable is connected to the Ethernet connector, it must also be terminated.

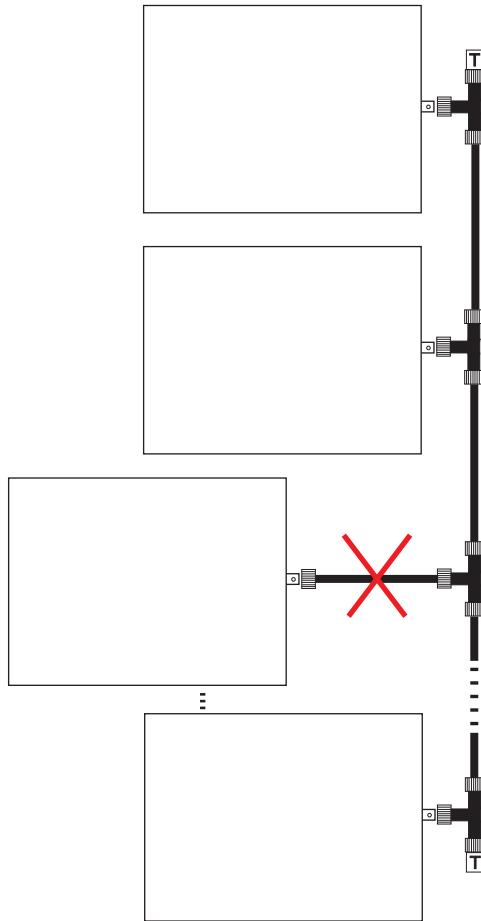


Fig. 4-2 Principle of wiring for Ethernet LAN

4.3 Description of the Components

4.3.1 AIS 3410 Electronics Unit

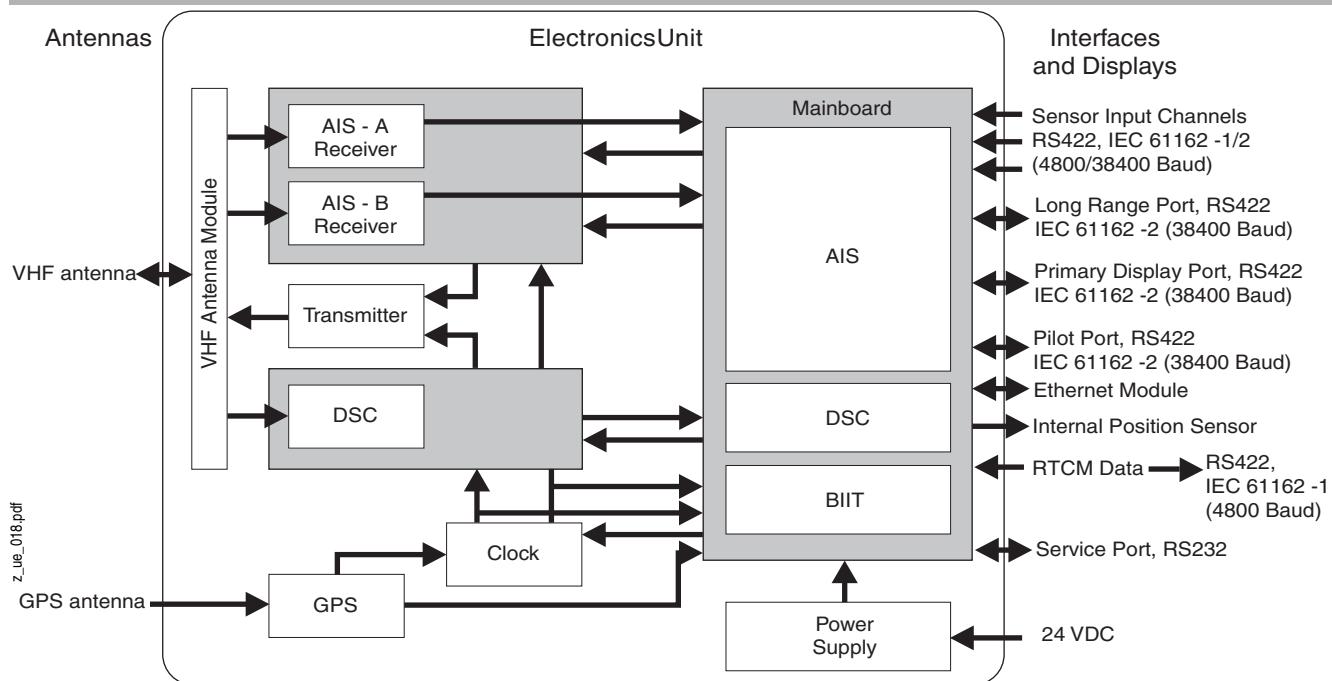


Fig. 4-3 Block diagram of the Electronics Unit

The diagram Figure 4-3 shows the internal structure of the AIS Electronics Unit with the following parts:

VHF Radio

- VHF Receiver:
 - AIS Channel A
 - AIS Channel B
 - DSC Channel 70
- VHF Transmitter:
 - AIS Channel A
 - AIS Channel B
 - DSC Channel 70

GPS

- 16-channel GPS chip

Motherboard and Peripheral Components

- Motherboard pcb
- Processors for the digital signal processing
- 3 interfaces IEC 61162-1/2 for ship's sensor data input
- Long range port IEC 61162-2
- Primary display port IEC 61162-2 and pilot port IEC 61162-2
- Ethernet interface
- Built-in Integrity Test (BIIT)
- Power supply (input 24 VDC -20%, +20%)

4.3.1.1 Interfaces

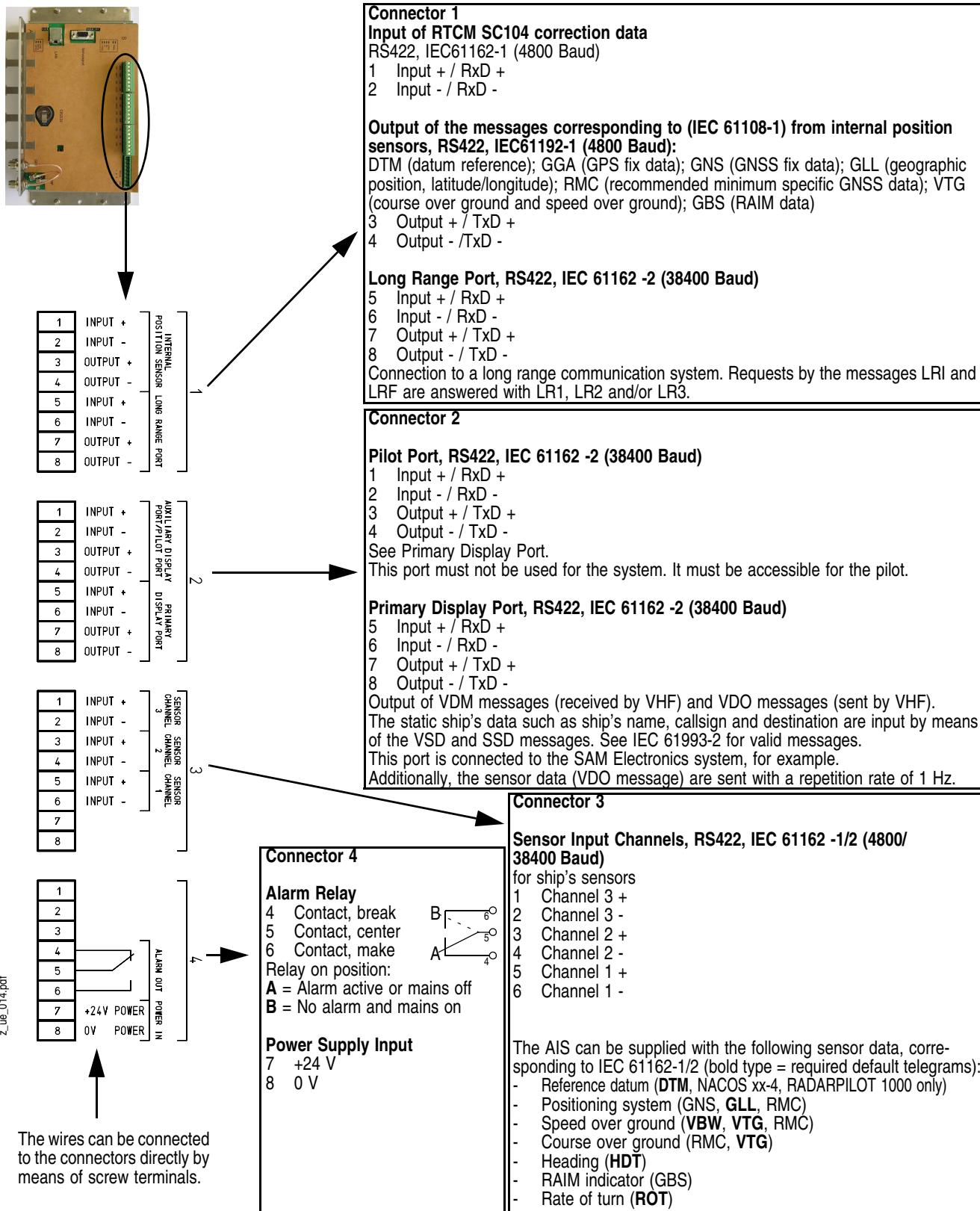


Fig. 4-4 Interfaces of the AIS 3410 Electronics Unit

4.3.1.2 Internal Connectors

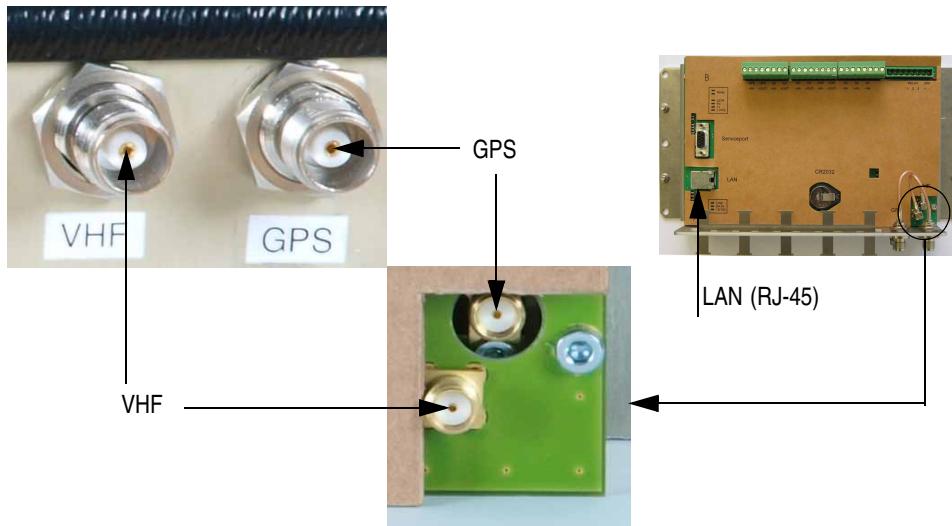


Fig. 4-5 Internal connectors

For retrofit of older housings (UAIS DEBEG 3400) refer to [Section 2.9](#).

Installation of the Media Converter refer to [Section 2.10](#).

4.3.1.3 Supported Sensor Input Sentences

Prerequisites:

NMEA Version

2.01 edition 04/1994 (corresponds to the first edition of IEC 61162) or higher is required. In addition the optional checksum is required. AIS requires status information to check the data integrity.

All NMEA versions below 2.01 are not allowed for the use with AIS.

Data Telegrams

For all NMEA versions below 3.01 (corresponds to IEC 61162-1 edition 3/2007) the GGA message must be transmitted.

Only the GGA message transmits the information that differential mode is activated. This is set at the GPS receiver.

If this telegram is not transmitted, it is not indicated that a DGPS is connected to the AIS.

Input sentences in compliance with IEC 61162-1/-2

Data	Required Sentence (Identifier and Description)	Optional Sentence (Identifier and Description)
Reference Datum	DTM (Datum reference)	
Positioning System: - Time of Position - Latitude/Longitude - Position accuracy	- GNS (GNSS fix data) - GLL (Geographic position latitude/longitude)	- RMC (Recommended minimum specific GNSS data)
Speed over Ground (SOG)	- VBW (Dual ground/water speed)	- VTG (Course over ground and ground speed) - RMC (Recommended minimum specific GNSS data)
Course over Ground (COG)	- RMC (Recommended minimum specific GNSS data)	- VTG (Course over ground and ground speed)
Heading	- HDT (Heading, true)	
RAIM indicator	- GBS (GNSS satellite fault detection)	
Rate of Turn (ROT)	- ROT (Rate of turn)	

NOTE:

If the AIS Electronics Unit receives the ship's sensor data from Ship's Interface, the output interfaces of the Ship's Interface must be configured as follows:

- Select "IEC 61162-1 edition 3/2007 (NMEA 3.01)" as driver
- Set a repetition interval of **1 s** for the following telegrams: GLL, VTG, HDT, ROT, VBW

4.3.1.4 Supported Sentences for the AIS Primary Display Port and the Pilot Port

Input

Input sentences in compliance with IEC 61162-1/-2

Data	Sentence Identifier/Description
Normal Access - Parameter Entry	
Voyage information: - Vessel type and cargo category - Navigational status - Draught, max. actual static - Destination - ETA date and time - Regional application flags	VSD (Voyage static data)
Station information: - Vessel name - Call sign - Antenna location - length and beam	SSD (Ship static data)
Initiate VHF Data Link Broadcasts	
Safety messages	ABM (Addressed binary message) BBM (Broadcast binary message)
Binary messages	ABM (Addressed binary message) BBM (Broadcast binary message)
Interrogation message	AIR (AIS interrogation information)
AIS Equipment - Parameter Entry	
AIS VHF channel selection AIS VHF power setting AIS VHF channel bandwidth Transmit/Receive mode control	ACA (AIS channel assignment message) ACA (AIS channel assignment message) ACA (AIS channel assignment message) ACA (AIS channel assignment message)
BIIT Input	
Alarm/Indication acknowledgement	ACK (Acknowledgement message)
LR acknowledge	
Manual LR acknowledge	LRF (Long range function)
Proprietary Sentences	
AIS Electronics Unit configuration - MMSI - IMO number - Other AIS equipment controls	AISCFG (AIS configuration)
AIS serial input/output configuration	AISSIO (AIS serial input/output)
AIS transmitter on/off, acknowledged by AISTXD from the Electronics Unit	AISTXD (AIS transmitter status)
AIS alive message (every 20 s)	AISALV (AIS alive)
Transversal and longitudinal offset of the internal AIS position sensor relative to the ship's system position	AISPOF (AIS offset, relative to system position)
Any telegram which is sent by long range function must be acknowledged by means of AISLRA	AISLRA (AIS long range acknowledgement)
Queries - Query ACA - Query PSAEAIStXD - Query PSAEAIslFS - Query PSAEAIslVER	Q Query for ACA data Query for transmitter status Query for Electronics Unit log file Query for firmware version

Output

Output sentences in compliance with IEC 61162-1/-2

Data	Sentence Identifier/Description
Prepared by AIS Unit	
Notification that a session initiated by the messages ABM, BBM, AIR is terminated	ABK (Acknowledgement message)
AIS own-ship broadcast data (all transmissions available)	VDO (VHF data link own-vessel message)
Channel management data	ACA (AIS channel assignment message (using query mechanism))
Received on VHF Data Link by AIS Unit	
All VDL AIS messages received Broadcast or addressed to own station	VDM (VHF data link message)
Received on LR Communication System	
LR interrogation message received	LRI (Long range interrogation) and LRF (Long range function identification)
Proprietary Sentences	
AIS Electronics Unit power on	AISPWR (AIS power)
Log file data	AISLFS (AIS log file send)
Acknowledge to AIS transmitter status on/off	AISTXD (acknowledge to AIS transmitter status)
Report on a long range interrogation to the MKD	AISLRF (AIS long range function request)
AIS firmware version	AISVER (AIS version)

4.3.1.5 Supported Sentences for the Long Range Port**Input**

Input sentences in compliance with IEC 61162-1/-2, edition 3, 04/2007 (NMEA0183 version 3.01)

Data	Sentence Identifier/Description
Long range interrogation: - Type of request - Geographic area request - AIS unit request	LRI (Long range interrogation)
Long range function identification, Requester MMSI and Name Request for: - Ship's name, call sign, IMO number - Date and time of message composition - Position - Course over ground - Speed over ground - Destination and ETA - Draught - Ship/Cargo - Ship's length, breadth and type - Number of persons on board	LRF (Long range function identification)

Output

Output sentences in compliance with IEC 61162-1/-2

Data	Sentence Identifier/Description
Long range function identification, MMSI and Name - Ship's name, call sign, IMO number - Date and time of message composition - Position - Course over ground - Speed over ground - Destination and ETA - Draught - Ship/Cargo - Ship's length, breadth and type - Number of persons on board	LRF (Long range function identification)
MMSI of responder MMSI of requester Ship's name Ship's call sign IMO number	LR1 (Long range response, line 1)
MMSI of responder Date and time of message composition Position Course over ground Speed over ground	LR2 (Long range response, line 2)
MMSI of responder Destination and ETA Draught Ship/Cargo Ship's length, breadth and type Number of persons on board	LR3 (Long range response, line 3)

4.3.1.6 Supported Sentences for the Internal Position Sensor

Output

Output sentences in compliance to IEC 61162-1, edition 3, 04/2007 (NMEA0183 version 3.01)

Data	Sentence Identifier/Description
Datum reference <ul style="list-style-type: none"> - Local datum (e.g. WG84) - Local datum subdivision code (not used) - Lat offset, min, N/S (not used) - Lon offset, min, E/W (not used) - Altitude offset, m (not used) - Reference datum (e.g. WG84) 	DTM (Datum reference)
Global positioning system (GPS) fix data <ul style="list-style-type: none"> - UTC (hhmmss.ss) - Latitude N/S (data and "N" or "S" or empty fields) - Longitude E/W (data and "E" or "W" or empty fields) - GPS quality (0=fix not available 1=GPS SPS mode 2=Differential mode 3=GPS PSS mode 4=Real Time Kinematic 5=Float RTK 6=Estimated mode 7=Manual input mode 8=Simulator mode) - Number of satellites (00...12) - Horizontal dilution (x.x data or empty field) - Antenna altitude (x.x data or empty field) - Units of antenna altitude (M or empty field) - Geoidal separation (x.x data or empty field) - Units of Geoidal separation (M or empty field) - Age of diff. GPS data (x.x data or empty field) - Diff. reference station (xxxx data or empty field) 	GGA (Global positioning system)
Geographic position - latitude/longitude <ul style="list-style-type: none"> - Latitude N/S (data and "N" or "S" or empty fields) - Longitude E/W (data and "E" or "W" or empty fields) - UTC of position (hhmmss.ss) - Status ("V" or "A") - Mode indicator (A=Autonomous mode D=Differential mode E=Estimated mode M=Manual input mode S=Simulator mode N=Data not valid) 	GLL (Geographic position - latitude/longitude)
Global positioning system <ul style="list-style-type: none"> - UTC (hhmmss.ss) - Latitude N/S (data and "N" or "S" or empty fields) - Longitude E/W (data and "E" or "W" or empty fields) - Mode indicator (N=No fix A=Autonomous D=Differential P=Precise R=Real Time Kinematic F=Float RTK E=Estimated M=Manual input S=Simulator mode) - Number of satellites (00...99) - Horizontal dilution (x.x data or empty field) - Antenna altitude (x.x data or empty field) - Geoidal separation (x.x data or empty field) - Age of diff. GPS data (x.x data or empty field) - Diff. reference station (x.x data or empty field) 	GNS (Global positioning system)

Data	Sentence Identifier/Description
Recommended minimum specific GNSS data - UTC (hhmmss.ss) - Status ("V" or "A") - Latitude, N/S (III.II.a) - Longitude, E/W (YYYYYY.YY.a) - Speed over ground, knots (x.x) - Course over ground, degrees true (x.x) - Date; dd/mm/yy (xxxxxx) - Magnetic variation, degrees, E/W (data and "E" or "W" or empty fields) - Mode indicator (A=Autonomous mode D=Differential mode E=Estimated mode M=Manual input mode S=Simulator mode N=Data not valid	RMC (Recommended minimum specific GNSS data)
Course over ground and ground speed - Course over ground, degrees true (x.x data and "T" or empty fields) - Course over ground, degrees magnetic (x.x data and "M" or empty fields) - Speed over ground, knots (x.x data and "N" or empty fields) - Speed over ground, km/h (x.x data and "K" or empty fields) - Mode indicator (A=Autonomous mode D=Differential mode E=Estimated mode M=Manual input mode S=Simulator mode N=Data not valid	VTG (Course over ground and ground speed)
Time and date - UTC (hhmmss.ss) - Day, 01 to 31 (xx) - Month, 01 to 12 (xx) - Year (xxxx) - Local zone hours (xx data or empty field) - Local zone minutes (xx data or empty field)	ZDA (Time and date)

The AIS 3410 is equipped with a 16 channel GPS receiver and provides position data according to IEC 61162, edition 3, 04/2007 (NMEA0183 version 3.01), so that it is suitable for the use as a position sensor. In areas where the VTS stations provide differential correction data via VHF link the AIS 3410 switches automatically into DGPS mode.

4.3.1.7 IEC 61162 -1/-2 Interfaces, Electrical Characteristics

The interfaces comply with IEC 61162-1, edition 3, 04/2007 (NMEA0183 version 3.01) and IEC 61162-2:1998.

The designation "--" in this manual corresponds to the designation "Line A" of IEC 61162 -1/-2.

The designation "+" in this manual corresponds to the designation "Line B" of IEC 61162 -1/-2.

Output Current and Input Load

Maximum output current: 25 mA at 3.0 V

Listener, receiver load: 0.8 mA at 0.3 V differential voltage
1.25 mA at 2.0 V differential voltage

4.3.1.8 Example for the Interconnection

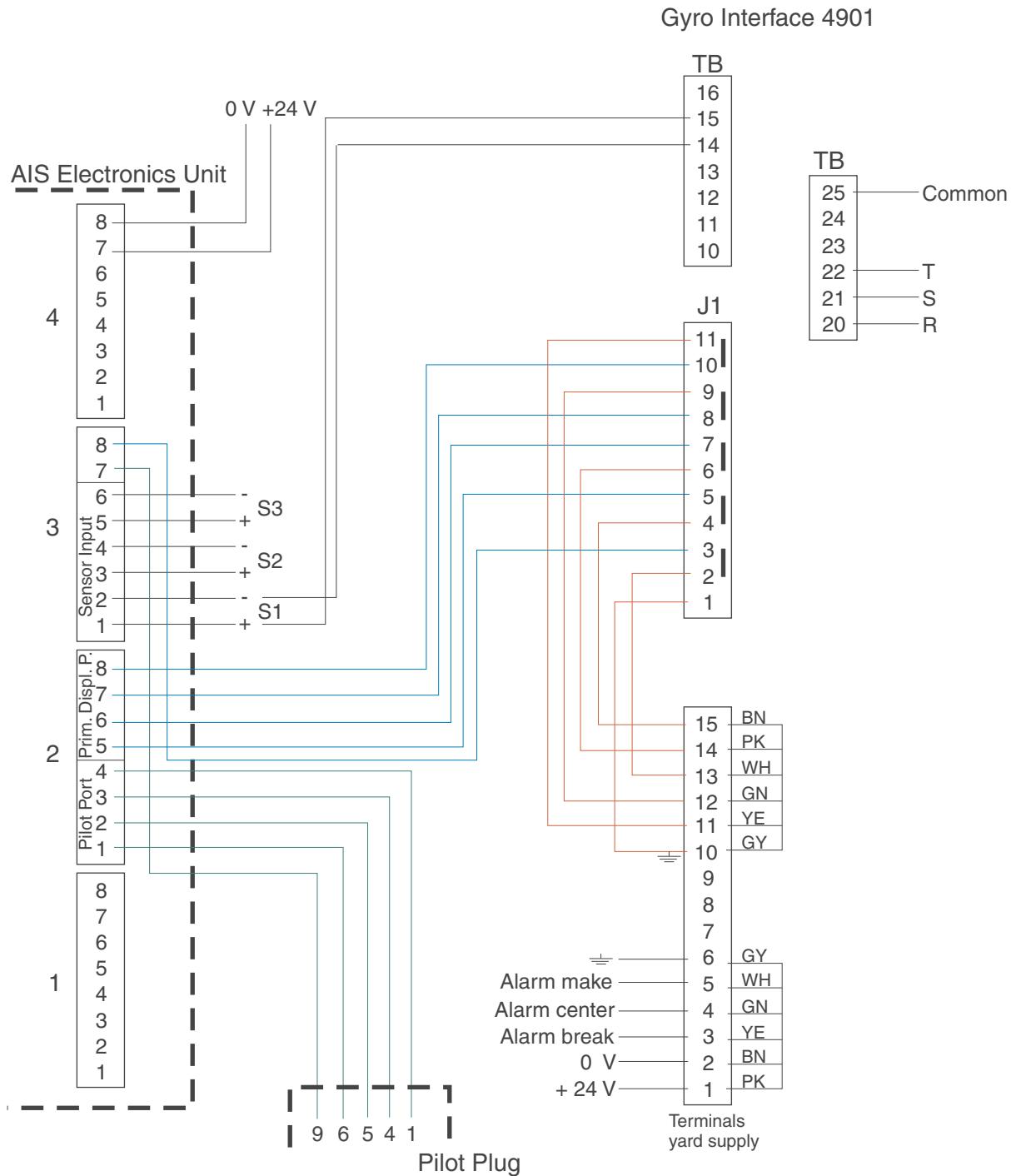


Fig. 4-6 AIS and Gyro Interface 9401

4.3.2 VHF Antenna

The VHF antenna CXL 2-1 is a $\frac{1}{2}\lambda$ coaxial, broad band antenna with $50\ \Omega$ impedance. For the technical data see [Section 7.2.2](#), for installation instructions see [Section 3](#).

4.3.3 GPS Antenna

The GPS antenna 1330 is a GPS L1 antenna for a frequency of 1575.42 ± 10 MHz with an integrated amplifier. For the technical data see [Section 7.2.3](#), for installation instructions see [Section 3](#).

4.3.4 Pilot Port

The Pilot Port must be connected as prescribed in the regulations. The connector/cable kits are described in [Section 3.2.7](#) on [page 28](#). The wires of the cable are marked and must be connected to connector 2, terminal 1...4.

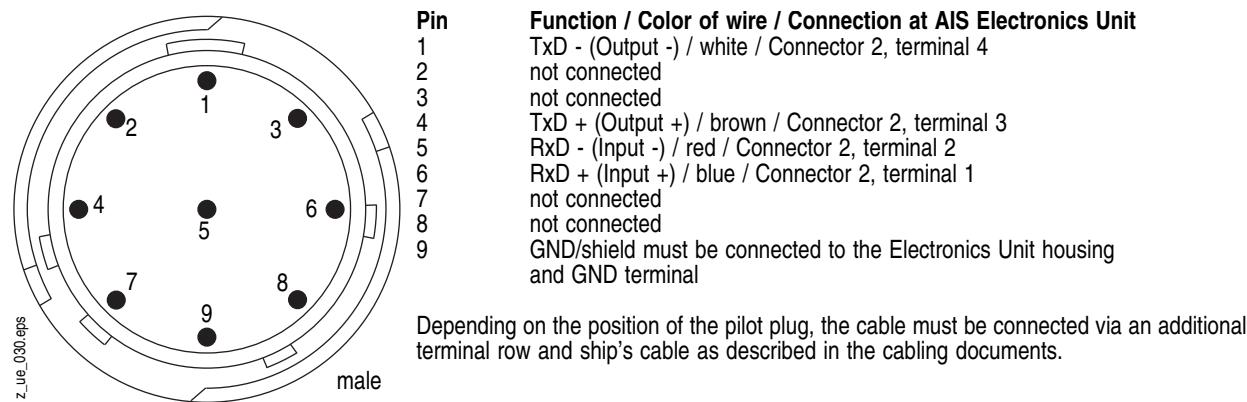


Fig. 4-7 Pilot Port, connector assignment, front view (pins)

For passages of the Panama Channel a 125 V AC supply (NEMA 5-15) must be available for the pilot. For ships with 230 V mains, the transformer 271257903 can be ordered from SAM Electronics.

5 Setting-to-Work/Configuration

5.1 Setting-to-Work

1. The AIS Electronics Unit and the antennas must be installed as described in [Section 3 \(Installation Recommendations\)](#). For information about the dimensions see [Section 10 \(Outline Drawings\)](#).
2. The cabling and connection must be performed corresponding to the Cabling Documents in [Section 9](#).
3. Depending on the system in which the AIS has to be integrated, the configuration has to be performed as described in [Section 5.3](#).

5.2 Software Versions

The software versions can be downloaded as packages with the software components for all units of the AIS system. For further information about the download and the update see [Section 6.3](#) on page 54.

5.3 Configuration

No adjustments have to be performed on the antennas. These components are ready for use.

The AIS Electronics Unit must be parameterized via a connected RADARPILOT 1000/1100, CHARTPILOT 9320/30, MULTIPilot 1000/1100.

For information in detail, see the corresponding Technical Manuals and the Online Help of these systems.

The following descriptions are an aid for the configuration of the AIS.

NOTE:



Valid for NACOS xx-3 Systems only:

The AIS Electronics Unit is connected to the Ship's Interface. The output interfaces of the Ship's Interface must be configured as follows:

- Select "IEC 61162-1 edition 2/2000 (NMEA 2.3)" as driver
- Set a repetition interval of **1 s** for the following telegrams:
 - GLL
 - VTG
 - HDT
 - ROT
 - VBW (if bottom-track log is available)

NOTE:

The system from which the AIS Electronics Unit has been configured and the AIS itself must be restarted after any change in the configuration. Otherwise modifications may have no effect.

5.3.1 Configuration with RADARPILOT/CHARTRADAR/MULTIPILOT 1000/1100 - NACOS xx-4/5 Systems

It is necessary to configure the radar and the interfaces. For information in detail see the Technical Manual of the RADARPILOT/CHARTRADAR 1000/1100 and MULTIPilot 1000/1100.

5.3.2 Configuration with CHARTPILOT 93xx in NACOS xx-3 Systems

It is necessary to configure the CHARTPILOT 93xx and the interfaces of the Ship's Interface. For information in detail see the Technical Manual of the CHARTPILOT 93xx.

5.3.3 Configuration with Radar 9xxx

It is necessary to configure the interfaces of the Ship's Interface. For information in detail see the Service Manual of the Radar 9xxx Electronics Unit.

5.4 Testing

The Electronics Unit has neither operating elements nor a display. Correct functioning cannot be made visible directly.

To test the interfaces of the ship's sensor inputs and the interface to the display unit (which can be the RADARPILOT 1000/1100, CHARTPILOT 9330 or the MULTIPILLOT 1000/1100), set the system in operation and select the own ship's symbol. If the own ship AIS data are displayed, the interfaces are working properly.

The VHF Transceiver can only be tested if a second AIS system is within the range of the Transceiver. The signals of this AIS must be received and this second AIS must receive the signals of your own AIS.

The pilot port can be tested by means of a PC with a terminal software, a RS422/RS232 converter and cable with the suitable connector. The connector consists of the following components which can be purchased from most specialist dealers:

- Plug assembly, AMP part No. 206485-1
- Socket contact, AMP part No. 66569-3
- Cable clamp kit, AMP part No. 182928-1

5.5 LEDs for Ethernet LAN, Alarm, GPS and Telegram

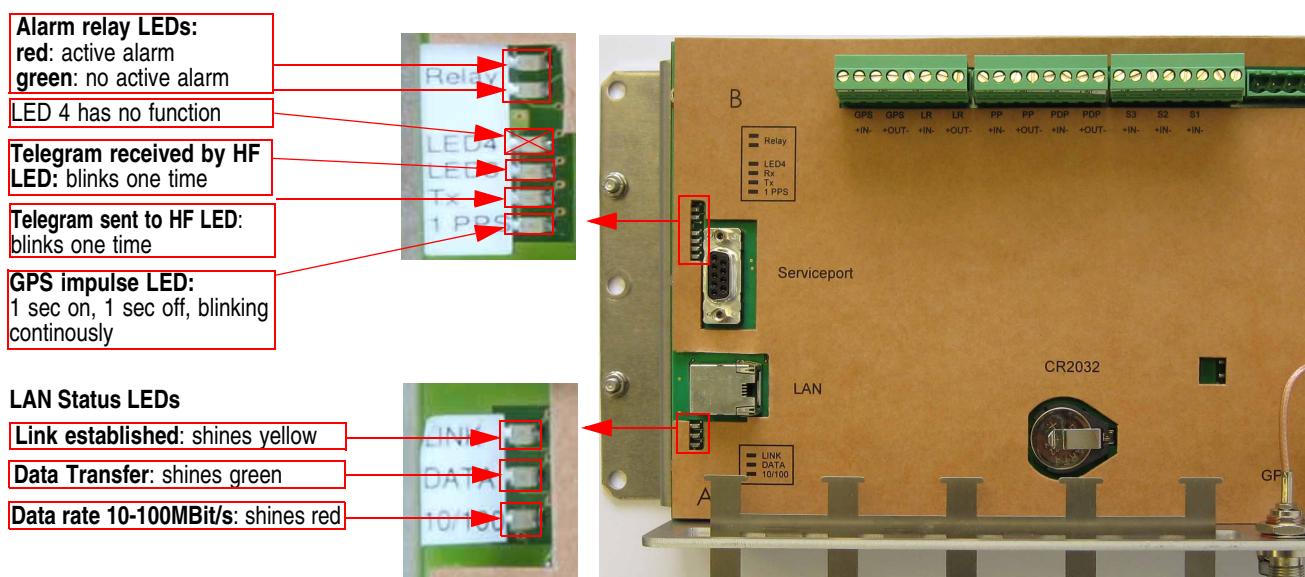


Fig. 5-1 Status LEDs

6 Repair/Maintenance

GENERAL:



The jumper settings and switch settings on a replacement pcb must be the same as on the defective pcb. The wire connections must be made in exactly the same way. Exceptions are explained in this manual.

6.1 Trouble Shooting

6.1.1 Hints

In the case of problems during setting-to-work, the cabling should be checked again. All components must be supplied with power.

- To get more information about the problem, read the system fault messages on the screen and refer to [Section 8 on page 63](#).

Watchdog

In various error conditions the internal watchdog of the system causes a reset. During the reset the message "AIS offline" may be displayed (e.g. CHARTPILOT).

Problems after Software Update

If the Electronics Unit does not restart after a software update, the alarm **AIS OFFLINE** is displayed and a repeat of the software update is not possible, the Disk On Module is in an undefined status and must be exchanged. See [Section 6.3.5 on page 57](#) for further information. This happens in rare cases, when the supply voltage for the Electronics Unit has been interrupted during the software update.

6.1.2 Fault Tree

Failure Description	Possible Causes	Service Measure	Spare Part No.
Unusual behaviour of AIS application	Software hung up	Reset Electronics Unit	-
	Software failure caused e.g. by external data telegrams	Software update	(can be downloaded in LiveLink)
AIS Offline	Software hung up	Reset electronics unit	-
	Power supply off	Check power supply	271259234
	Software failure caused e.g. by external data telegrams	Software update	(can be downloaded in LiveLink)
	Internal fan broken (only old housing)	Replace internal fan (only old housing)	271178645
	Media Converter defective	Replace Media Converter	271259883
	Electronics Module defective	Replace Electronics Module	271259341
	Analog Interface Radar 1000/ 1100 broken	Replace Analog Interface	300005388
	Radar 9xxx AIS Interface broken	Replace Radar 9xxx AIS Interface	300005903
	RS 422 Interface broken	Replace RS422 interface	1877061
Internal Clock lost	GPS antenna defective	Replace GPS antenna	271257889
	Internal GPS antenna cable broken	Replace internal GPS antenna cable	271178666
	GPS antenna connector defective	Replace internal GPS antenna cable	271178666
	External GPS antenna cable broken	Replace external GPS antenna cable	Contact service department
	GPS module defective	Replace Electronics Module	271259341
No AIS data on Radar (Software version < 3.0.0)	See AIS offline	-	-
No AIS data on Radar (Software version > 3.0.0)	If the AIS is connected to Sensor Interface see "AIS offline".	-	-
	If the AIS is connected to LAN see "No AIS Targets on ECDIS"	-	-
No AIS data on ECDIS (Chartpilot, MP2 & 3)	Software hung up	Reset electronics unit	-
	Power supply off	Check power supply	271259234
	Software failure caused e.g. by external data telegrams	Software update	(can be downloaded in LiveLink)
	Electronics Module defective	Replace Electronics Module	271259341
	Media Converter defective	Replace Media Converter	271259883
	Ethernet cable broken	Replace Ethernet cable	Contact service department
	Ethernet connector ECDIS defective	Replace Ethernet connector	-
	Ethernet card AIS broken	Replace Electronics Module	271259341
	Ethernet card ECDIS broken	Replace Ethernet card	-
	Check LAN termination	Replace resistor	-

Failure Description	Possible Causes	Service Measure	Spare Part No.
No AIS targets visible but no alarm messages are given	VHF antenna broken	Replace VHF antenna	Replace Electronics Module
	VHF antenna cable broken	Replace VHF antenna cable	Contact service department
	VHF antenna connector broken	Replace VHF antenna connector	271178666
	VHF module defective	Replace Electronics Module	271259341
Hot Housing	Housing fan (only old housing)	Replace external fan (only old housing)	300006159
	Wrong installation	Check installation	-
No heading data	Gyro Interface DEBEG 4901 defective	Replace DEBEG 4901	300005797
	Connection to gyro system broken	Check gyro system and connection to AIS	-
	Wrong configuration	Check configuration	-
	Connection to radar system broken	Check connection AIS/radar	
No external GNSS data	Connection to GPS broken	Check GPS and connection to AIS	-
	Wrong configuration	Check configuration	-
	Connection to radar system broken	Check connection AIS/radar	

6.1.3 Trouble Shooting for AIS 3410 connected to a RADARPILOT 1000/1100

6.1.3.1 Indication: System Fault Message 3617 Displayed on Indicator

NOTE:

The following instructions are valid only, if the AIS is connected via the Primary Display Port. The AIS 3410 Electronics Unit can also be connected via the Ethernet LAN (RADARPILOT/CHARTRADAR 1000/1100: with software 3.0 or newer or MULTIPILOT 1000/1100).

Procedure:

1. Check the cabling of the Sensor Input Channels and the Primary Display port. See the Technote T0211-340x-002 or [Section 3.1.1](#) for further information.
2. Check the correct setting of the S1 and the jumpers of the Interface Assembly SH3014G203. S1 must be set to position 2. No jumpers should be connected to the pins 1...4. See the Technical Manual of the RADARPILOT 1000/1100 for further information.

If the system fault message is still existing, the communication on the Primary Display Port must be checked. Proceed as follows:

Test of the RADARPILOT/CHARTRADAR/MULTIPILOT Output

1. Power Down the system

2. Connect the AIS output TB14 and TB15 of the Analog Interface additionally to an indicator serial interface (TB1) of the radar. If there is a free input, this one should be used. If all inputs are used, one of them must be disconnected. [Figure 6-1](#) shows the connection to the serial interface No. 4 as an example.

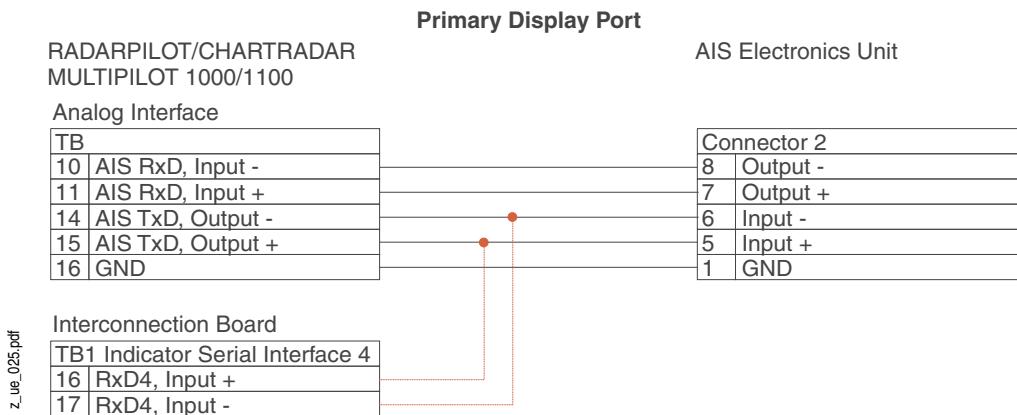


Fig. 6-1 Cable connection for the interface monitoring Radar > AIS

3. Power on the radar. Configure the concerned indicator serial interface by means of the System Maintenance Manager as follows

Path:

Configure > Radar > Indicator > Indicator x > Serial Interfaces > Serial I/O x

Parameters:

- **Driver**, set to **NMEA183 (IEC 61162-1/2)**
- **Baud Rate**, set to **38400**
- **Wind**, set to **Connected** (if the interface has been used for a ship's sensor with NMEA183 (IEC 61162-1/2) protocol beforehand, it is not necessary to modify this parameter.)

4. The Serial I/O Monitor must be started.

Path:

Service > Indicator > Serial I/O Monitor

Select the used interface from the drop down list and mark the check box **Rx**. Start the monitoring by clicking on **Run**. The protocol can be saved on a diskette.



Fig. 6-2 Protocol Radar TxD

If the AIS voyage data is modified or safety related messages are sent, the protocol must show telegrams corresponding to the telegrams in [Figure 6-2](#). If there is no communication on the interface, the Analog Interface is defective or has a wrong software version (The software version must be F or newer. To check the software version, use the **Telemonitoring Data** menu of the System Maintenance manager. The line for the Analog Interface must look as follows: SIR10T GE3044P207 F) or the configuration of the radar is faulty. See the Technical Manual of the radar for further information.

NOTE:

If a ship's sensor is connected to the interface which has been used for the test, it must be made sure, that all modifications of the parameterization of this interface that were necessary for the test are cancelled.

Test of the AIS 3410 Output

1. Power Down the system
2. Connect the AIS Primary Display Port TB7 and TB8 additionally to an indicator serial interface (TB1) of the radar. If there is a free input, this one should be used. If all inputs are used, one of them must be disconnected. [Figure 6-1](#) shows the connection to the serial interface No. 4 as an example.

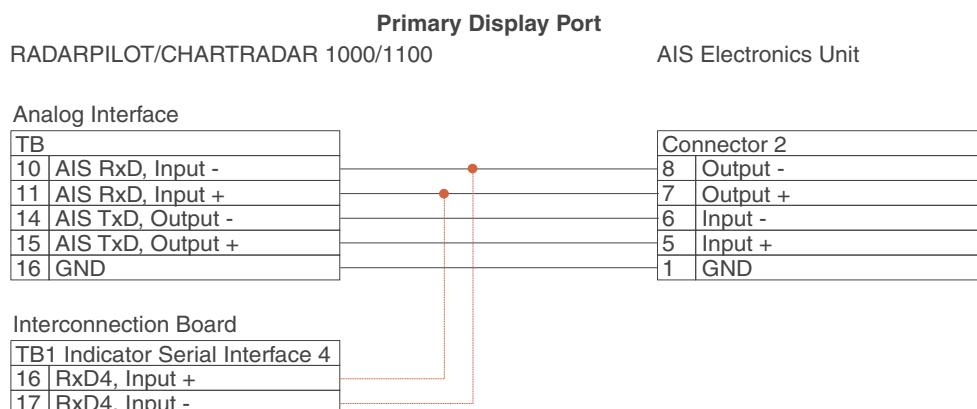


Fig. 6-3 Cable connection for the interface monitoring AIS > Radar

3. Power on the radar. Configure the concerned indicator serial interface by means of the System Maintenance Manager as follows

Path:

Configure > Radar > Indicator > Indicator x > Serial Interfaces > Serial I/O x

Parameters:

- **Driver**, set to **NMEA183 (IEC 61162-1/2)**
- **Baud Rate**, set to **38400**
- **Wind**, set to **Connected** (if the interface has been used for a ship's sensor with NMEA183 (IEC 61162-1/2) protocol beforehand, it is not necessary to modify this parameter.)

4. The Serial I/O Monitor must be started.

Path:

Service > Indicator > Serial I/O Monitor

Select the used interface from the drop down list and mark the check box **Rx**. Start the monitoring by clicking on **Run**. The protocol can be saved on a diskette.

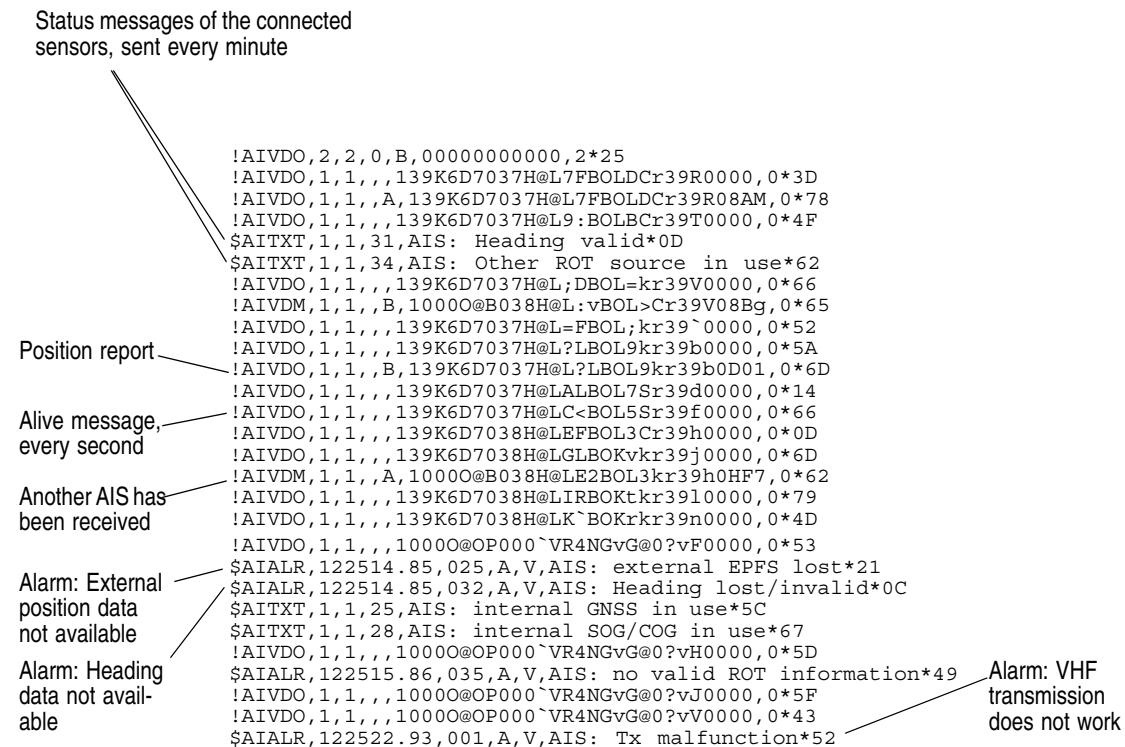


Fig. 6-4 Protocol AIS TxD

Figure 6-4 shows the protocol which has been transmitted by a AIS. The alarm messages can be forced by disconnecting the sensors and/or the VHF antenna.

If there is no communication on the interface, the AIS is not working. If the power supply and the cable connection are correct, the AIS Electronics Unit seems to be defective.

NOTE:

If a ship's sensor is connected to the interface which has been used for the test, it must be made sure, that all modifications of the parameterization of this interface that were necessary for the test are cancelled.

6.1.3.2 Indication: System Fault Message 3616 Displayed on Indicator

If the system fault message 3616 is displayed, it is likely that the problems are caused by the Analog Interface if the AIS is connected via the Primary Display Port.

Procedure:

1. Check the configuration of the Analog Interface. See the Technical Manual of the RADARPILOT 1000/1100 for further information.
2. Check the correct setting of the S1 and the jumpers of the Interface Assembly SH3014G203. S1 must be set to position 2. No jumpers should be connected to the pins 1...4. See the Technical Manual of the RADARPILOT 1000/1100 for further information.
3. Check the software version of the Analog Interface. The software version must be F or newer. To check the software version, use the **Telemonitoring Data** menu of the System Maintenance manager. The line for the Analog Interface must look as follows:

SIR10T GE3044P207 F

6.2 Test of the Antenna Performance

With the AIS 3410 Electronics Unit is possible to measure the voltage standing wave ratio (VSWR) of the VHF antenna.

The measured values have the following meaning:

- 1.0...1.5: The antenna installation and cabling is good.
- 1.6...2.0: The antenna installation and cabling (cabling laying, antenna position and connectors) should be checked and improved.
- >2.0: Poor antenna installation

6.3 Software Update

A software update can be performed by means of a laptop (or any other PC with Windows 95, 98, XP, Vista as its operating system), a cable and the service software, which is available in the SAM-CMIS system (see [Section 6.3.1](#)).

If the AIS is connected to a CHARTPILOT or MULTIPROFILE, it is also possible to update the software by means of the CHARTPILOT/MULTIPROFILE and the CHARTPILOT Application Software CD. See the Technical Manuals of the CHARTPILOT or MULTIPROFILE for further information.

6.3.1 Software download from SAM-CMIS

The current and previous versions of the software and the documentation for all components of the AIS system can be downloaded from the internet.

Preconditions:

- Internet Explorer 5.5 (with Virtual Machine) or newer
- "Cookies" must be accepted

Only authorized person have access to SAM-CMIS. To gain access enter the address:

<https://www.sam-cmis.de/livelink/lisapi.dll?func=ll&objId=4826402&objAction=browse>

You are now requested to fill in your **username** and **password**. Afterwards you are redirected to the folder with the newest zip file containing the software for all components of the AIS system. The unpacked zip file can be saved on a CD ROM.

It is not permissible to modify any settings in the SAM-CMIS system. To leave the system click on **Tools** -> **Log-out**.

Overview/Hints

A table of the software versions, their compatibility and the corresponding versions of the manuals is shown in a **README-file** which is part of the downloaded zip file.

6.3.2 Determination of the Current Software Versions

AIS 3410 with RADAR/CHARTRADAR/MULTIPILOT 1000/1100

Open the System Maintenance Manager by clicking **Menu** -> **Utilities** -> **Maintenance**. Select the register card **Telemonitoring Data** and click on the **Version** button at the lower left.

The software versions of the radar and of connected systems are displayed. Use the scrollbar to search for the AIS software versions.

AIS 3410 with RADAR 9x00 and MULTIPILOT 910x (Radar Mode):

Press the **Menu** button. Select **Utilities** -> **Self Check** -> **Version**.

Use the CANCEL/MORE button to toggle through the pages until the AIS page is reached.

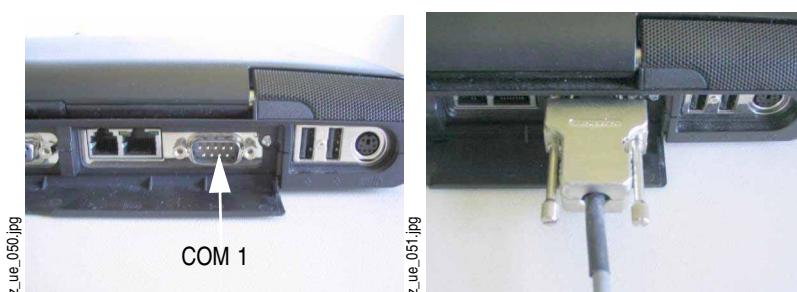
AIS 3410 with MULTIPILOT 910x (ECDIS Mode):

Open the tree structure by clicking the **Tree** button.

Click on **System Maintenance** -> **Version...** to display the software versions of the MULTIPILOT and all connected systems.

6.3.3 Serial Cable Connection

Connection at the PC/Laptop



The serial cable must be connected to COM 1 of the PC/Laptop.

Fig. 6-5 Connection to the Laptop

Connection at the Electronics Unit

The cable must be connected to the serial service interface of the computer and to the connector on the top of the Electronics Unit's port

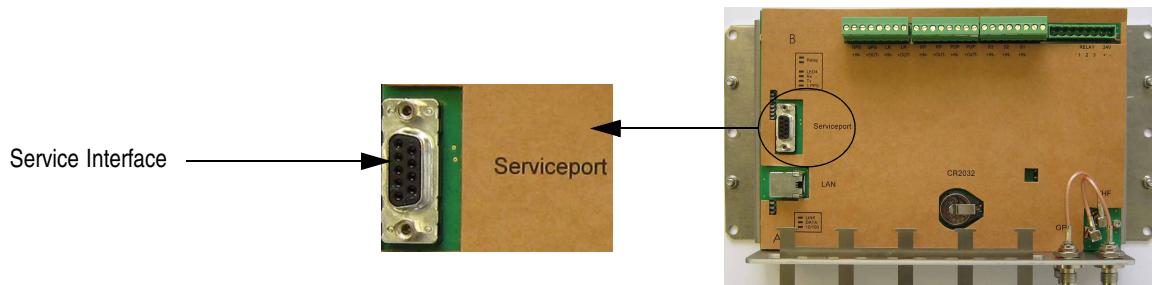


Fig. 6-6 Service Interface

6.3.4 Software Update by means of a Laptop

1. Disconnect the Electronics Unit from the power supply for about 5 s.
2. Connect the power supply and wait about 2 minutes until the Electronics Unit has been restarted.
3. Connect the update cable before the update software is started.
4. Download the update from the SAM-CMIS system (see [Section 6.3.1](#)), unzip the file and save the unzipped directory structure to the hard disk or on a CD ROM.
5. To start the update software open the directory of the software version which shall be installed (usually the newest version; for details see the readme file)

DOS command line:

CD X:\AIS\ElectronicsUnit3410\BuildNNN_YYYYMMDD\root

(DRIVE X name of the drive, NNN = release of the software, YYYY=year, MM=month, DD=day)

Type **aisupdate.exe** to start the software.

Type **aisupdate.exe** on the command line to start the program.

Windows Explorer:

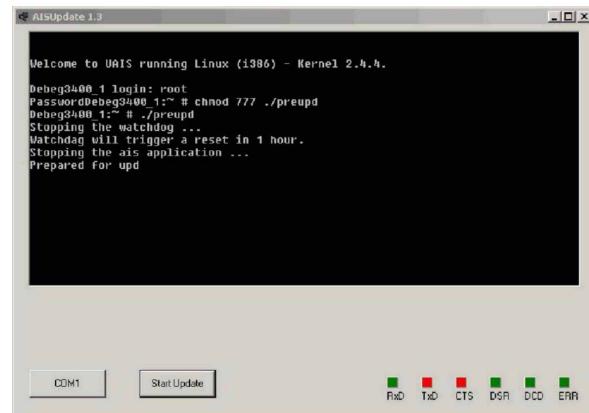
Open the Windows Explorer and select the drive with the update directory.

Select the following path by clicking twice on the directory names: **AIS -> ElectronicsUnit3410 -> BuildNNN_YYYY_MM_DD -> root**

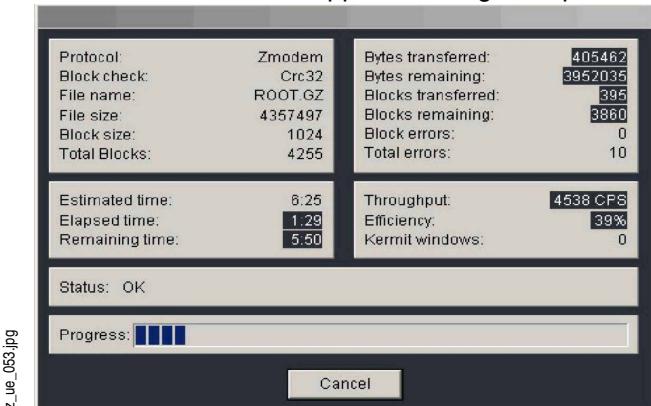
Start the program **aisupdate.exe** by clicking twice on the corresponding icon.

6. Click the **Start Update** button.

If a failure message appears, press the **COM 1** button to switch the serial port used by the program to COM 2.



7. A status windows appears during the update.



8. It must be waited until the message "**Flash programming finished, system is rebooting**" appears.
9. The Electronics Unit reboots automatically. The **OK** button closes the window of the update routine.
10. Verify the proper function of the system, make sure that AIS targets and sensor data will be displayed on the connected display system.
11. Verify that the Update was successful and the new software version is installed.

WARNING!

Do not interrupt the update! If update procedure is interrupted, the Electronics Unit may come into an undefined status, in which no further update or operation is possible. See [Section 6.3 on page 54](#) in this case.

During the update the new software is stored in the RAM module of the AIS. After the successful transfer the old version will be deleted by erasing the Flash ROM. Then the update file will be stored on the Flash ROM.

If the power supply was interrupted during the update process, it may occur in seldom cases, that the electronics unit is not restarting again. In this case it may necessary to exchange the Disk On Chip memory module.

6.3.5 Software Update by means of a CHARTPILOT or MULTIPROFILE 91x0

If a CHARTPILOT or MULTIPROFILE 91x0 is connected (the AIS Electronics Unit must be connected to the LAN), it is possible to update the AIS by means of one of these systems. The update of the AIS Electronics Unit is possible from CHARTPILOT/MULTIPROFILE software version 5.1 onwards.

WARNING!

Do not change any CHARTPILOT settings while doing the software update via CHARTPILOT or MULTIPROFILE. This may cause problems of the ECDIS application and can degrade the performance of your navigation system.

1. Put the Update CD ROM in the CD ROM drive of the CHARTPILOT.
2. Open the **System Maintenance** menu (**Tree => System Maintenance**).
3. Open the **Configuration** menu and input the service password.
4. Open the **AIS** menu and start the software update program.

6.4 Opening the Housing



Opening of the Electronics Unit housing of AIS 3410

Undo the four screws in the cover. To close the housing, proceed in the reverse order.

6.4.1 Fuses

Electronics Unit

The Electronics Unit contains no fuses.

6.4.2 Antennas

If one of the antennas is defective, it must be exchanged. See the Spare Part List for the order number.

6.5 Spare Parts

Some of the components may be modified at short intervals, so that it is likely that it will not be possible to deliver spare parts which are absolutely identical to the original part. In such cases, a Technote for the exchange is delivered with the spare part and new versions of components are added to this manual as soon as possible.

Description	Order Number
Electronics Unit	271259341
Battery,Lithium CR2032	271126851
Media Converter (BNC -> RJ-45)	271259883
RJ-45 Ethernet LAN patch cable (Kat.5e, SFTP, RJ45, 1m, grau)	390006203
GPS Antenna	271257889
VHF Antenna	271259204
Housing fan, external fan (only for UAIS DEBEG 3400 housing)	300006159
Filter pad for housing fan, set with 5 pcs (only for UAIS DEBEG 3400 housing)	300006161
Air inlet (filter holder for housing fan) (only for UAIS DEBEG 3400 housing)	300006160

7 Technical Data

7.1 Conformity to Standards, Environmental Conditions

The AIS 3410 Electronics Unit is compliant with DIN EN 60945 (Maritime navigation and radiocommunication equipment and systems - General requirements - Methods of testing and required test results).

The Electronics Unit belongs to the category "protected from the weather".

The antennas belong to the category "exposed to the weather".

The AIS 3410 complies with EN 61993-2:2002.

The interfaces of the AIS 3410 comply with IEC 61162-1:2007 (3rd Edition) and IEC 61162-2:1998.

7.2 Performance

7.2.1 Performance Data of the Electronics Unit

General

Housing:	IP22
Operating temperature:	-15...+55°C (DIN EN 60945)
Humidity:	Max. 95% at 40°C (DIN EN 60945)
DC voltage (supply):	24 VDC ±20%
DC current (consumption):	Typ. 0.76 A at 24 V, max. 2.5 A (momentarily during transmission)

GPS Receiver

Receiver architecture:	Single board receiver
Channels:	16, parallel
Time to first fix:	Hot start 3.5 s Warm start 33 s Cold start 36 s
Navigation modes:	3-D and 2-D, depending on the number of tracked satellites.
Accuracy:	Position 2.5m CEP

VHF Transceiver

The Transceiver corresponds to EN 61993-2:2002, chapter 15

Transmitting power: 2 W / 12.5 W / ≤1 W

Input sensitivity: -107 dBm (AIS and DSC)

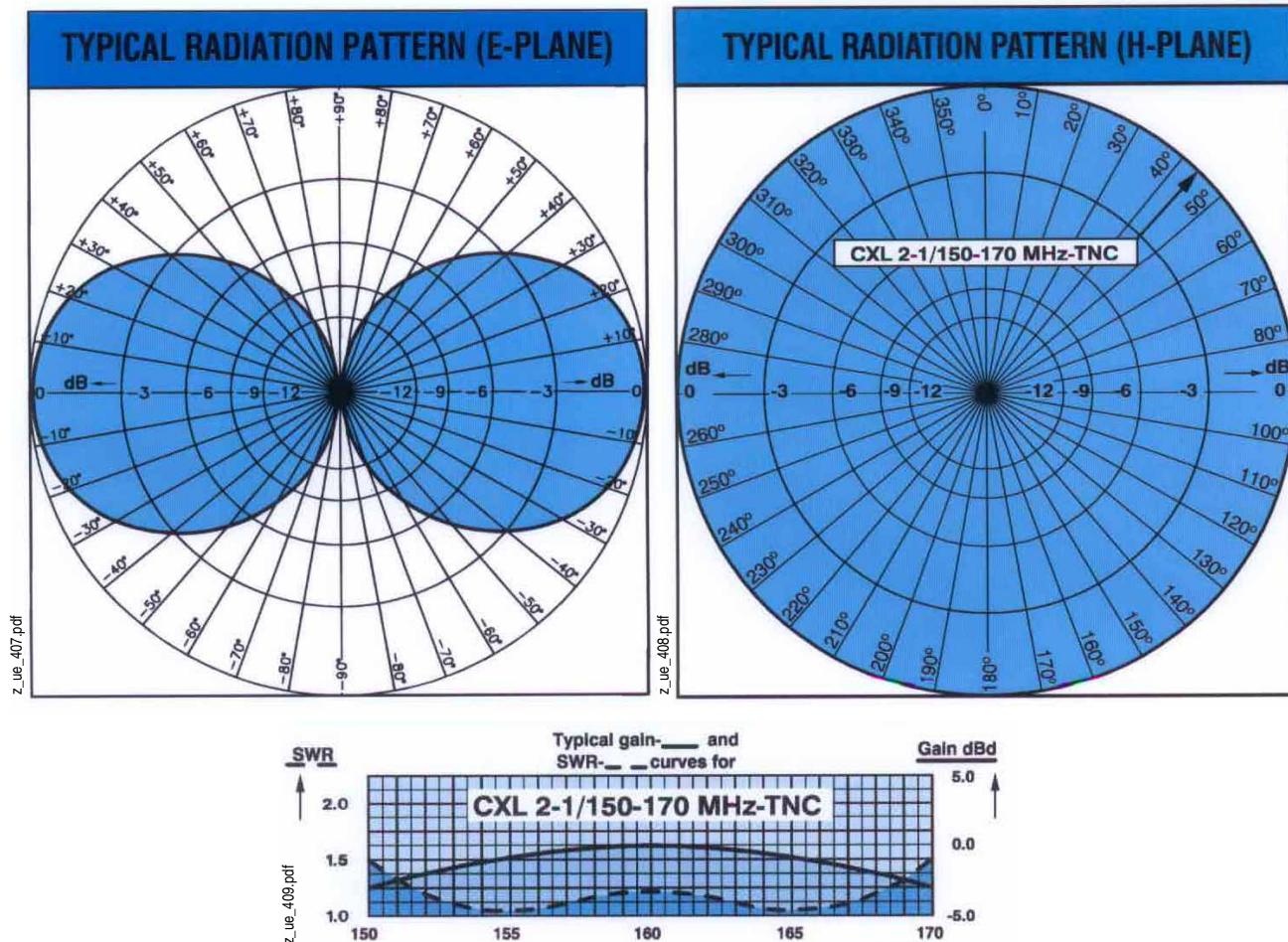
Low Power mode for Tanker

	Tanker	Normal
high	12.5 W	12.5 W
low	≤1 W	2 W

7.2.2 Performance Data of the VHF Antenna CLX 2-1/150-170 MHz

Antenna type:	1/2λ coaxial, broad band
Frequency:	150...170 MHz
Impedance:	Nom. 50 Ω
Polarization:	Vertical
Gain:	2 dBi, 0 dBd
Bandwidth:	20 MHz
SWR:	< 1.5
Max. power:	150 W
Connector:	TNC female
Wind load:	21.8 (at 150 km/h)
Material:	Whip = Glassfibre
Colour:	Marine white
Total length:	Approx. 1.2 m
Weight:	Approx. 340 g
Mounting:	1" threaded mast tube

For the outline drawings see [Section 10](#).



7.2.3 Performance Data of the GPS Antenna

General:

Color: White
 Weight: 163 g
 Nominal RF input: TNC female
 Operating temperature: -40...+85°C
 Humidity: 95% relative humidity

Antenna Element:

Frequency: 1575.42 ±10.0 MHz
 Impedance: 50 Ω
 Nominal VSWR: 1.5:1 max.
 Polarization: Right hand circular
 Gain: +4.5 dBiC nom.

Low Noise Amplifier:

Frequency: 1575.42 ±10 MHz (GPS L1)
 Impedance: 50 Ω
 Nominal output VSWR: 2.0:1
 Max. gain: 26.5 ±3 dB
 DC voltage (supply): 5...26 VDC through connector
 DC current (consumption): 25 mA typ., 40 mA max.
 Filtering: Dual ceramic filter

7.3 Dimensions and Weights

For dimensions and weights, see the technical drawings. The drawings are shown in [Section 10](#).

7.4 Compass Safe Distances

	Standard compass	Steering compass	Standard compass reduced	Steering compass reduced
Electronics Unit 3410	0.4 m	0.3 m	0.3 m	0.3 m
VHF Antenna CXL 2-1	0.3 m	0.3 m	0.3 m	0.3 m
GPS Antenna 1330FB	0.3 m	0.3 m	0.3 m	0.3 m

8 Fault Code List

The following fault codes (integrity alarm conditions) can be displayed at the connected display unit (for example a RADARPILOT 1000/1100). See also [Section 6](#) from [page 47](#) on for further information.

Fault	Messages at		Error Message generated by, Possible Cause/Source, Reaction of the System, Remedy
	1000/1100 Series, CHARTPILOT, MULTIPILOT 910x (Chart Mode)	Radar 9xxx, MULTIP- ILOT 910x (Radar Mode)	
001	AIS: Tx malfunction	AIS TX MALFUNCTION	Generated by: AIS Electronics Unit Cause/Source: VHF Antenna, cabling Reaction: The Electronics Unit stops the transmission. Remedy: Check of the antenna and the antenna cabling (short circuit or missing contact at the connectors)
002	AIS: Antenna VSWR exceeds limit (VSWR = Voltage Standing Wave Ratio)	AIS VSWR LIMIT	Generated by: AIS Electronics Unit Cause/Source: VHF antenna, installation Reaction: The Electronics Unit continues operation. Remedy: Check of the antenna and the antenna cabling (75 Ω cable instead of 50 Ω cable)
003	AIS: Rx channel 1 malfunction	AIS RX CH1 FAULT	Generated by: AIS Electronics Unit Cause/Source: Internal error Reaction: The Electronics Unit stops the transmission on the affected channel.
004	AIS: Rx channel 2 malfunction	AIS RX CH2 FAULT	Generated by: AIS Electronics Unit Cause/Source: Internal error Reaction: The Electronics Unit stops the transmission on the affected channel.
005	AIS: Rx channel 70 malfunction	AIS RX CH70 FAULT	Generated by: AIS Electronics Unit Cause/Source: Internal error Reaction: The Electronics Unit must be exchanged.
006	AIS: General failure	AIS GENERAL FAULT	Generated by: AIS Electronics Unit Cause/Source: Internal error Reaction: The Electronics Unit stops the transmission. Remedy: The Electronics Unit must be exchanged.
008	AIS: MKD connection lost (MKD = Minimum Keyboard Display)	AIS CONNECTION	Generated by: AIS Electronics Unit Cause/Source: No Operating/Display Unit connected Reaction: The Electronics Unit continues operation. Remedy: The Display Unit (for example a RADARPILOT 1x00) does not communicate with the Electronics Unit. Check the cabling/connection of the Primary Display Port. Check if the Display Unit is working.
025	AIS: External EPFS lost (EPFS = Electronic Position Fixing System such as GPS)	AIS EXTERNAL EPFS	Generated by: AIS Electronics Unit Cause/Source: No valid position data at interface S1, S2, S3 Reaction: The Electronics Unit continues operation with the position data of the internal position sensor. If there is no valid position data available from the internal position sensor, additionally error 026 is displayed. Remedy: The telegrams GLL, GNS, GGA, RMC can not be received. Check the sensor and the cabling; Check if the system that delivers the data is working (RADARPILOT 1x00); Check the baud rate settings of the sensor inputs.
026	AIS: No sensor position in use	AIS NO POSITION	Generated by: AIS Electronics Unit Cause/Source: No valid position from internal position sensor Reaction: The Electronics Unit continues operation. Remedy: Check the cabling and the antenna of the internal GPS sensor.

Fault	Messages at		Error Message generated by, Possible Cause/Source, Reaction of the System, Remedy
	1000/1100 Series, CHARTPILOT, MULTIPILOT 910x (Chart Mode)	Radar 9xxx, MULTIP- ILOT 910x (Radar Mode)	
029	AIS: No valid SOG information	AIS NO SOG	Generated by: AIS Electronics Unit Cause/Source: No data from external sensor and from internal position sensor Reaction: The Electronics Unit continues operation. Remedy: The telegrams VBW, VTG, RMC can not be received. Check the sensor and the cabling; Check if the system that transmits the data is working (RADARPILOT 1x00); Check the baud rate settings of the sensor inputs.
030	AIS: No valid COG information	AIS NO COG	Generated by: AIS Electronics Unit Cause/Source: No data from external sensor and from internal position sensor Reaction: The Electronics Unit continues operation. Remedy: The telegrams VTG, RMC can not be received. Check the sensor and the cabling; Check if the system that transmits the data is working (RADARPILOT 1x00); Check the baud rate settings of the sensor inputs.
032	AIS: Heading lost/invalid	AIS NO HEADING	Generated by: AIS Electronics Unit Cause/Source: No data from external sensor Reaction: The Electronics Unit continues operation. Remedy: The telegrams HDT can not be received. Check the sensor and the cabling; Check if the system that transmits the data is working (RADARPILOT 1x00); Check the baud rate settings of the sensor inputs.
035	AIS: No valid ROT information	AIS NO ROT	Generated by: AIS Electronics Unit Cause/Source: No data from external sensor Reaction: The Electronics Unit continues operation. Remedy: The telegrams ROT can not be received. Check the sensor and the cabling; Check if the system that transmits the data is working (RADARPILOT 1x00); Check the baud rate settings of the sensor inputs.
051	AIS: Channel management information not accepted	AIS SET CHANNELS	Generated by: AIS Electronics Unit Cause/Source: E.g. overlapping with an existing area Reaction: The Electronics Unit continues operation. Remedy: Check the channel management information.
052	AIS: GPS receiver fault	AIS GPS RECEIVER	Generated by: AIS Electronics Unit Cause/Source: Internal GPS receiver malfunction Reaction: The Electronics Unit continues operation without internal GPS data and without direct GPS time synchronization. Remedy: The Electronics Unit must be exchanged.
053	AIS: GPS antenna not connected or defective		Generated by: AIS Electronics Unit. Cause/Source: No connection with the GPS antenna Reaction: The AIS Electronics Unit continues operation without direct GPS synchronization. Remedy: Renew proper connection with the GPS antenna and/or substitute the defective GPS antenna.

Fault	Messages at		Error Message generated by, Possible Cause/Source, Reaction of the System, Remedy
	1000/1100 Series, CHARTPILOT, MULTIPILOT 910x (Chart Mode)	Radar 9xxx, MULTIP- ILOT 910x (Radar Mode)	
054	AIS: GPS antenna short circuit		<p>Generated by: AIS Electronics Unit.</p> <p>Cause/Source: Short circuit in the cable/connectors or within the GPS antenna.</p> <p>Reaction: The AIS Electronics Unit continues operation without direct GPS synchronisation.</p> <p>Remedy: Renew proper connection with the GPS antenna and/or substitute the defective GPS antenna. Restart the AIS Electronics Unit.</p>
0204	AIS: offline	AIS OFFLINE	<p>Generated by: AIS Electronics Unit</p> <p>Cause/Source: No connection between Display and Electronics Unit, no valid IEC 61162 data or reset caused by the watchdog</p> <p>Reaction: The Electronics Unit continues operation.</p> <p>Remedy: The cabling must be checked. It might be possible to eliminate the fault by switching the voltage supply to the AIS electronics unit off and then on again at the ship's mains.</p> <p>Reaction: The message was displayed for a short time during a reset of the system that was caused by the internal watchdog. The Electronics Unit continues operation.</p>
-	AIS Transmitter Off	AIS TRANSM. OFF	<p>Generated by: AIS Electronics Unit</p> <p>Cause/Source: The transmitter has been switched off completely by the operator, the MMSI number has not been configured in the Configuration menu or an error appeared which caused a stop of transmission (time out of 7 minutes).</p> <p>Reaction: The Electronics Unit continues operation.</p> <p>Remedy: The transmitter must be switched on or the MMSI number must be configured. If it has not been configured beforehand, it is set to 0 and no data is transmitted.</p> <p>Remedy: Check other error messages to find the reason for the alarm. If there are no further messages, restart the Electronics Unit by disconnecting the mains supply.</p>

9 Cabling Documents

Grounding

All components of the system have contacts such as bolts or terminals for grounding. Grounding is important for EMC purposes as well as for protecting people's lives. Both purposes are covered by the standard grounding of the system's housings to the ship's metallic structure (bolted or welded). Regardless of the type of ship's grounding (e.g. star pattern or ground plane pattern), no potential difference should be measurable between two different ground connectors. Potential differences cause compensation currents on the cable shields. If the ship has no metallic structure, all conductively connected metallic parts form an artificial ground.

All ground connections should be as short as possible. If possible, different units should be connected to individual ground connectors. Whenever possible, metallic housings should be screwed or welded directly to the ship's metallic structure. If a safe grounding contact is not ensured, additional conductors are necessary. Furthermore, all ground connections should have a low RF-impedance, and should be resistant against vibration and corrosion. Grounding conductors on an open-air deck must be made of corrosion-protected steel, and inside the ship they must be made of copper.

The grounding should be done in such a way that the connection can be inspected in a convenient manner.

EMC Purposes

The shields of all cables must be connected at both ends if no other instructions are given.

Protective Ground

All removable metallic parts of the housings are grounded by means of separate, flexible cables to the main structure of the housing. It is important to connect this ground-cable after parts have been dismounted or exchanged.

Title	Page
Cable Diagram, connection to RADARPILOT 1x00, NACOS xx-4/5 via Primary Display Port	68
Cable Diagram, connection to CHARTPILOT, NACOS xx-4/5, RADAR / MULTIPILOT 1x00 via LAN	69
Cable Diagram, connection to CHARTPILOT stand-alone	70
Cable Diagram, connection to Radar 9xxx via Radar 9xxx AIS Interface (NACOS xx-3)	71
Detailed Cable Diagram, connection to RADARPILOT 1x00, NACOS xx-4/5 via Primary Display Port	72
Detailed Cable Diagram, Wheelhouse Console	73
Detailed Cable Diagram, connection to NACOS xx-4/5, RADAR / MULTIPILOT 1x00 via LAN	74
Detailed Cable Diagram, connection to CHARTPILOT stand-alone systems	75
Detailed Cable Diagram, connection to RADAR 9xxx AIS Interface	76
Detailed Cable Diagram, connection to RADAR 9xxx AIS Interface PCB GE 3044 G 220	77

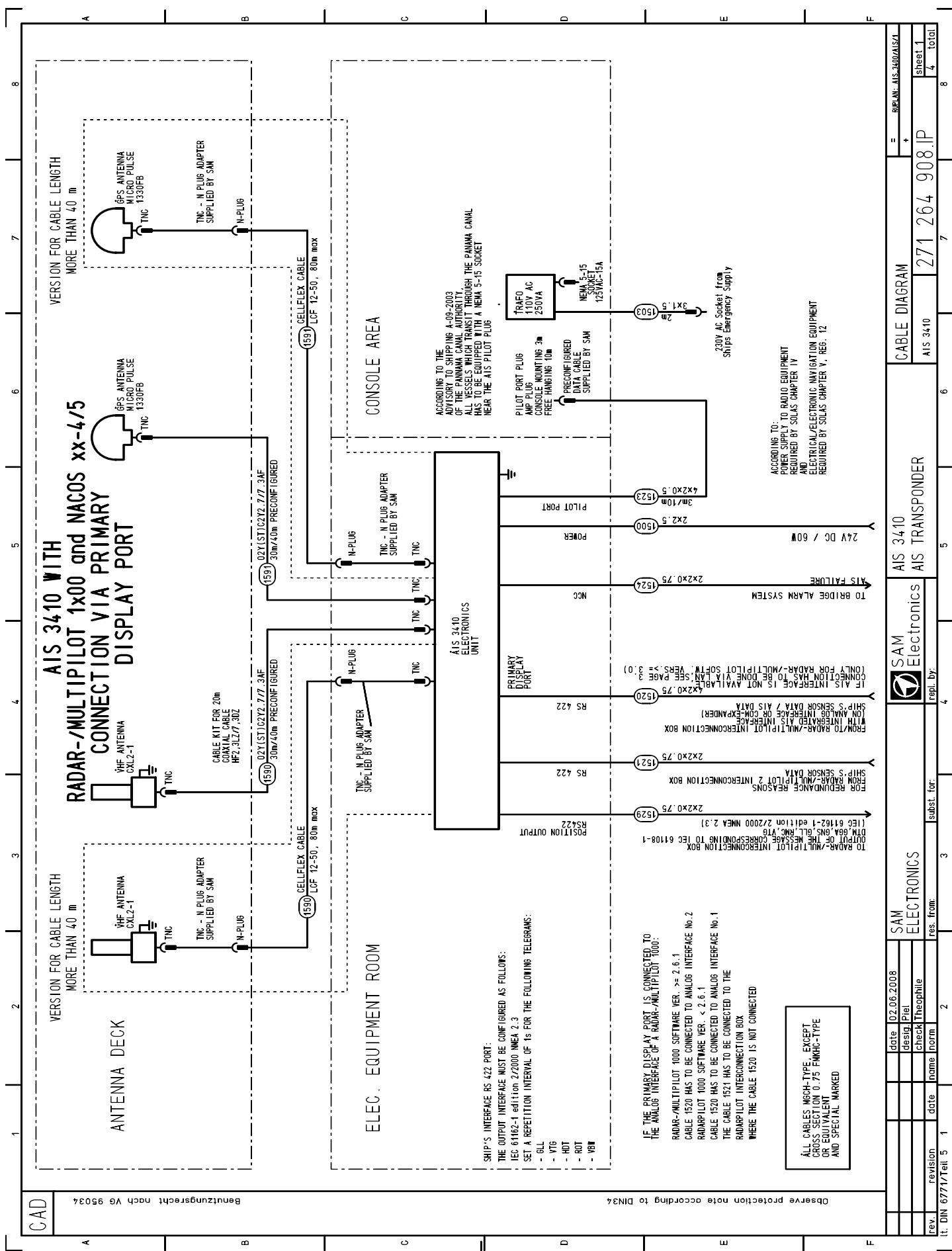


Fig. 9-1 Cable Diagram, connection to RADARPILOT 1x00, NACOS xx-4/5 via Primary Display Port

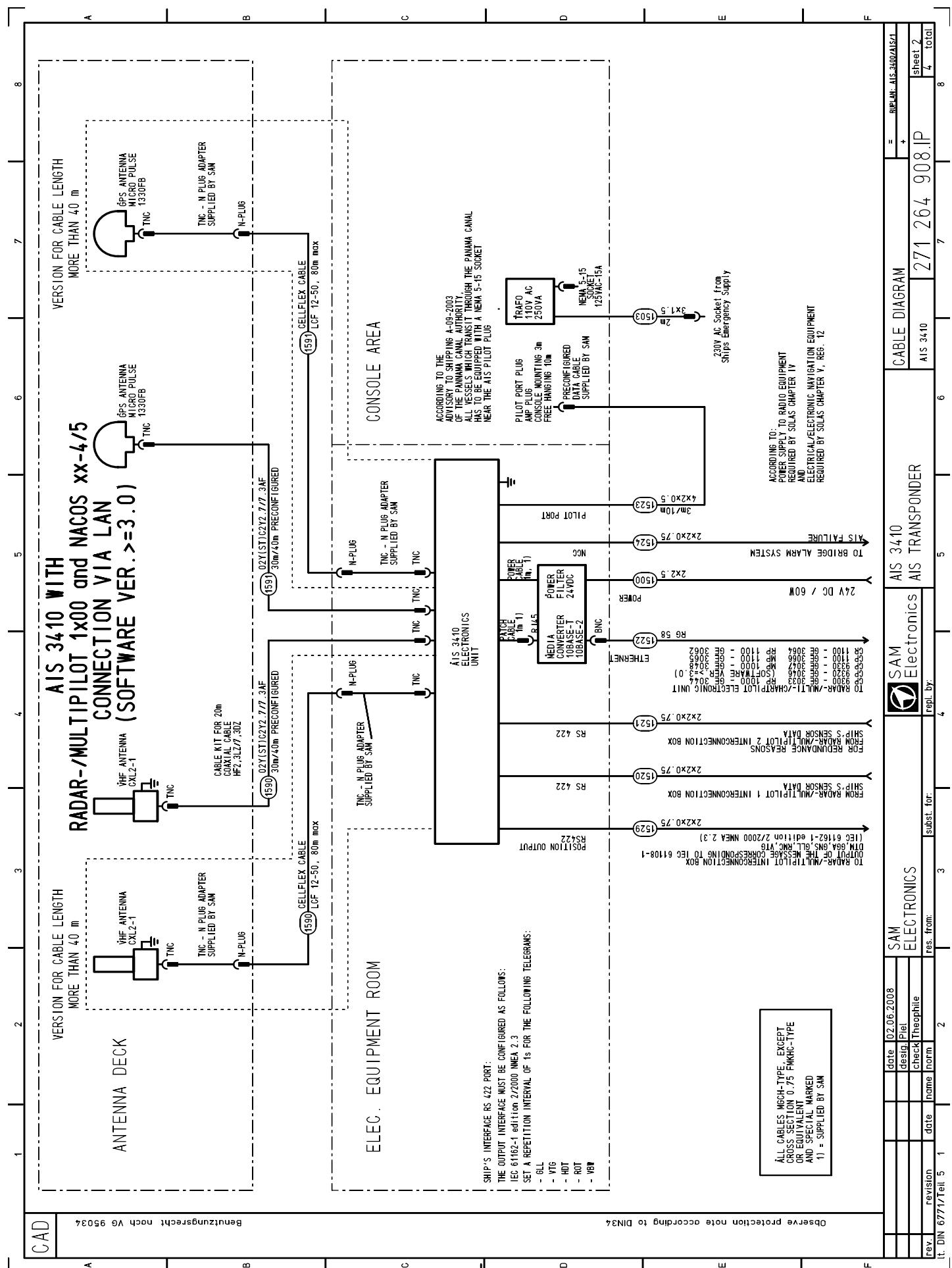


Fig. 9-2 Cable Diagram, connection to CHARTPILOT, NACOS xx-4/5, RADAR / MULTIPROCESSOR 1x00 via LAN

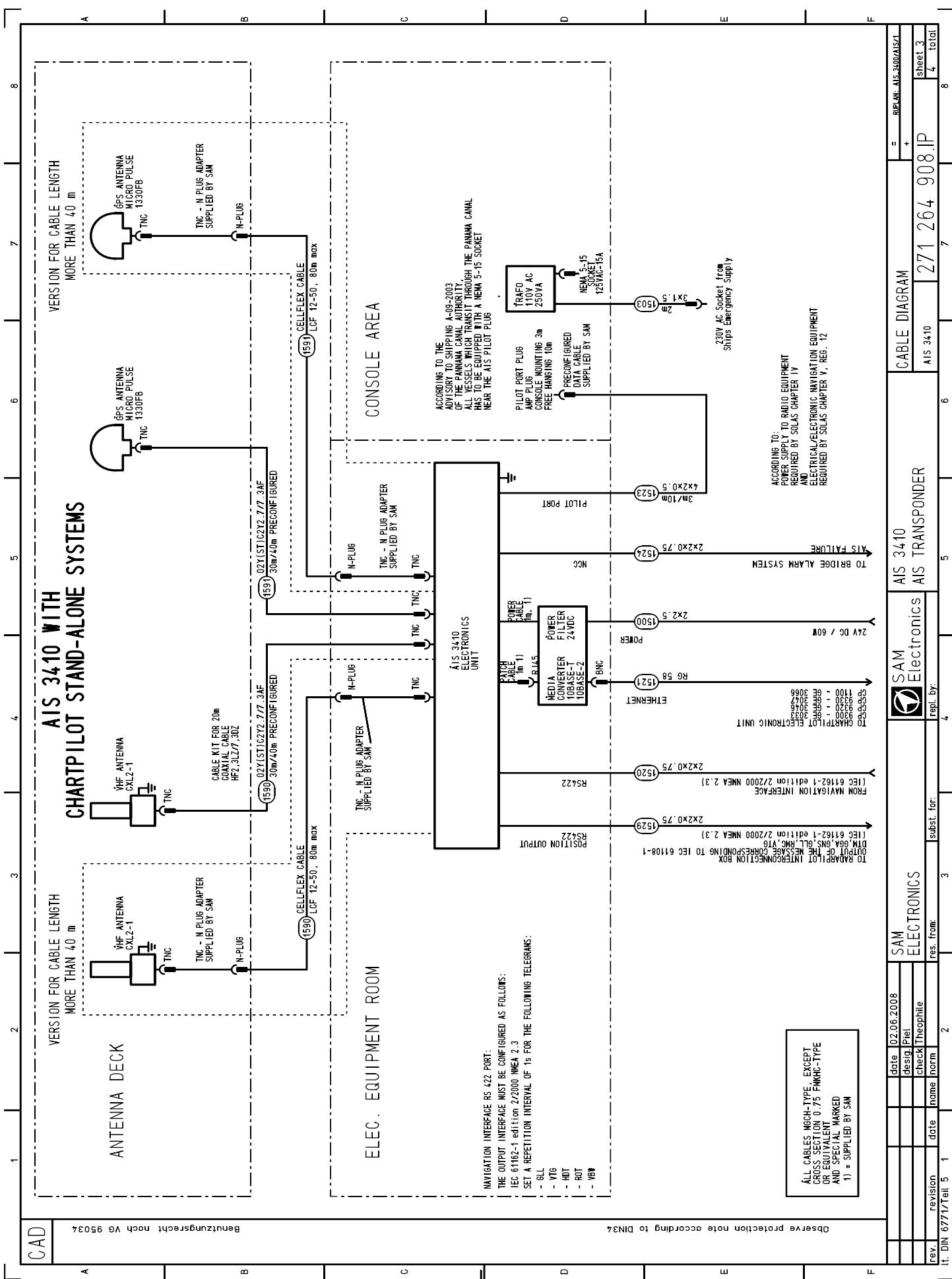


Fig. 9-3 Cable Diagram, connection to CHARTPILOT stand-alone

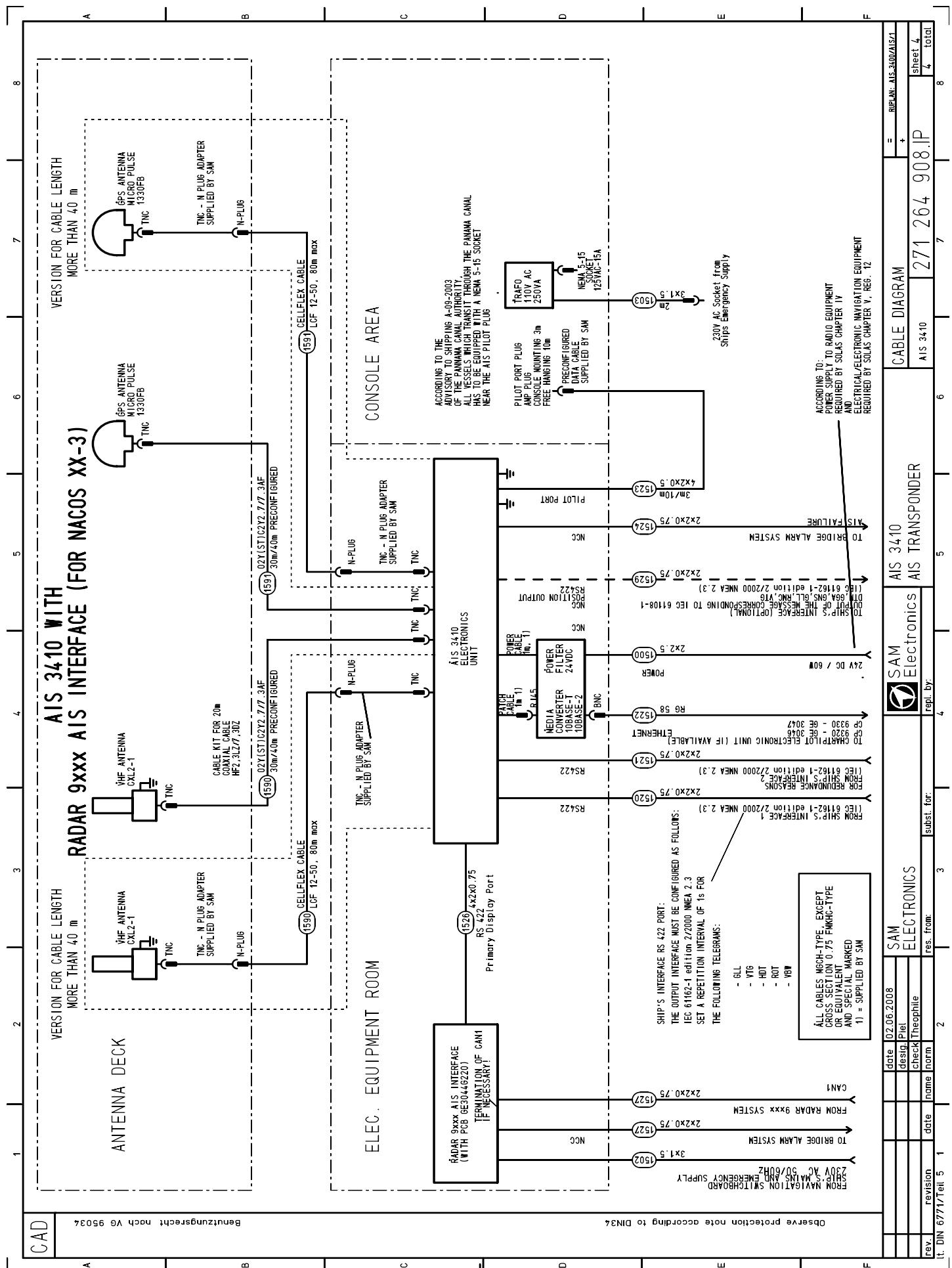


Fig. 9-4 Cable Diagram, connection to Radar 9xxx via Radar 9xxx AIS Interface (NACOS xx-3)

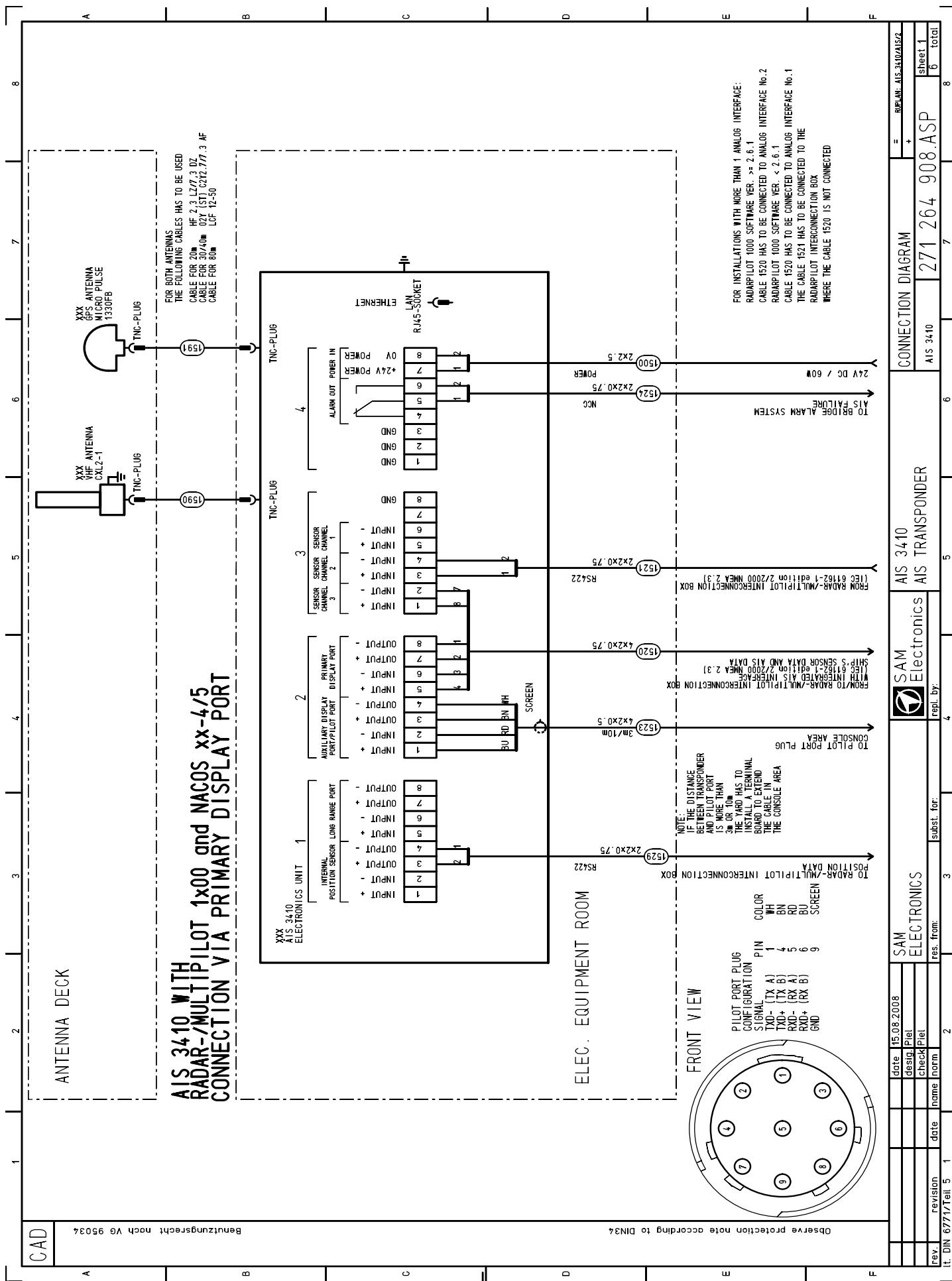


Fig. 9-5 Detailed Cable Diagram, connection to RADARPILOT 1x00, NACOS xx-4/5 via Primary Display Port

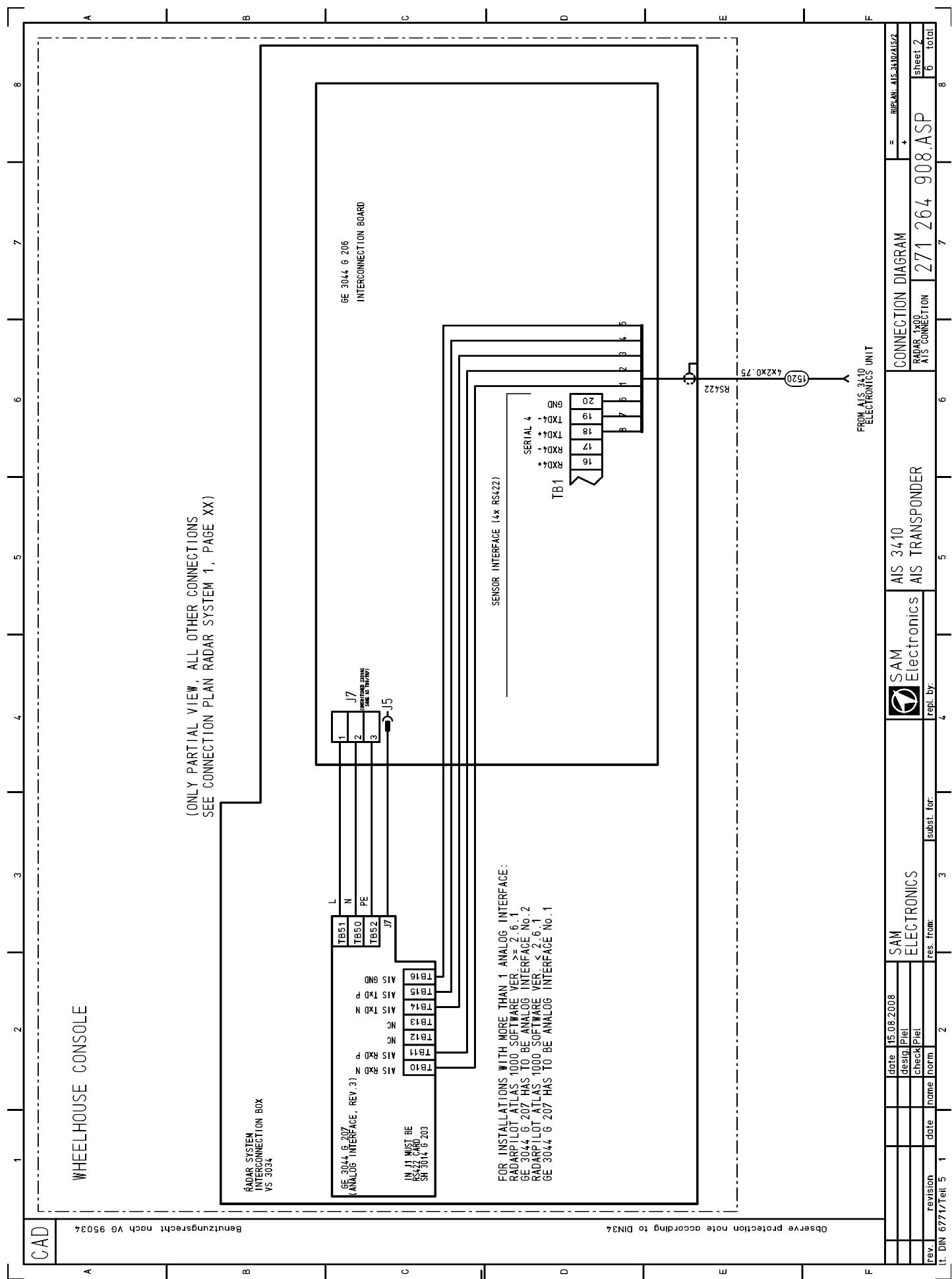


Fig. 9-6 Detailed Cable Diagram, Wheelhouse Console

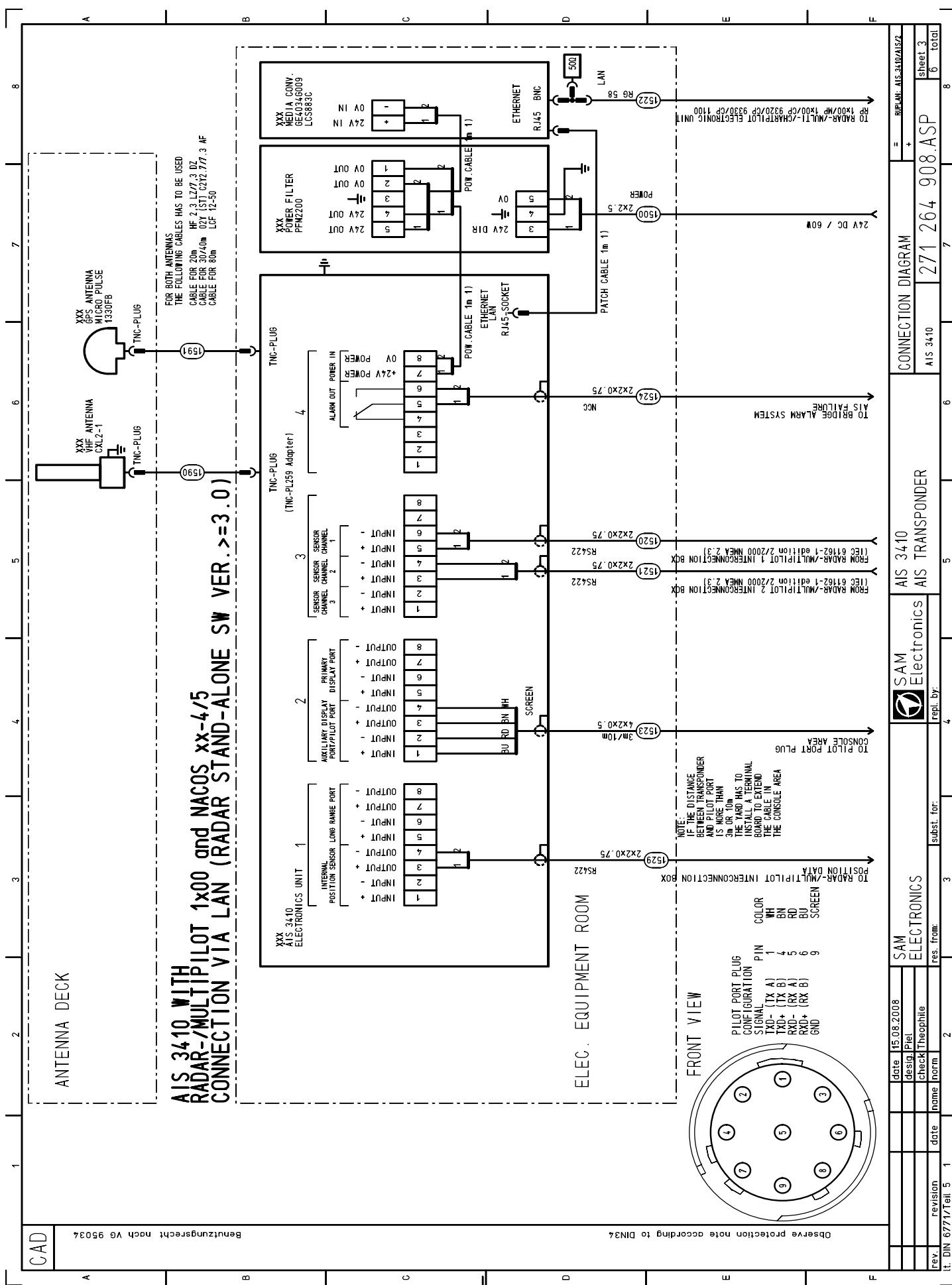


Fig. 9-7 Detailed Cable Diagram, connection to NACOS xx-4/5, RADAR / MULTIPILOT 1x00 via LAN

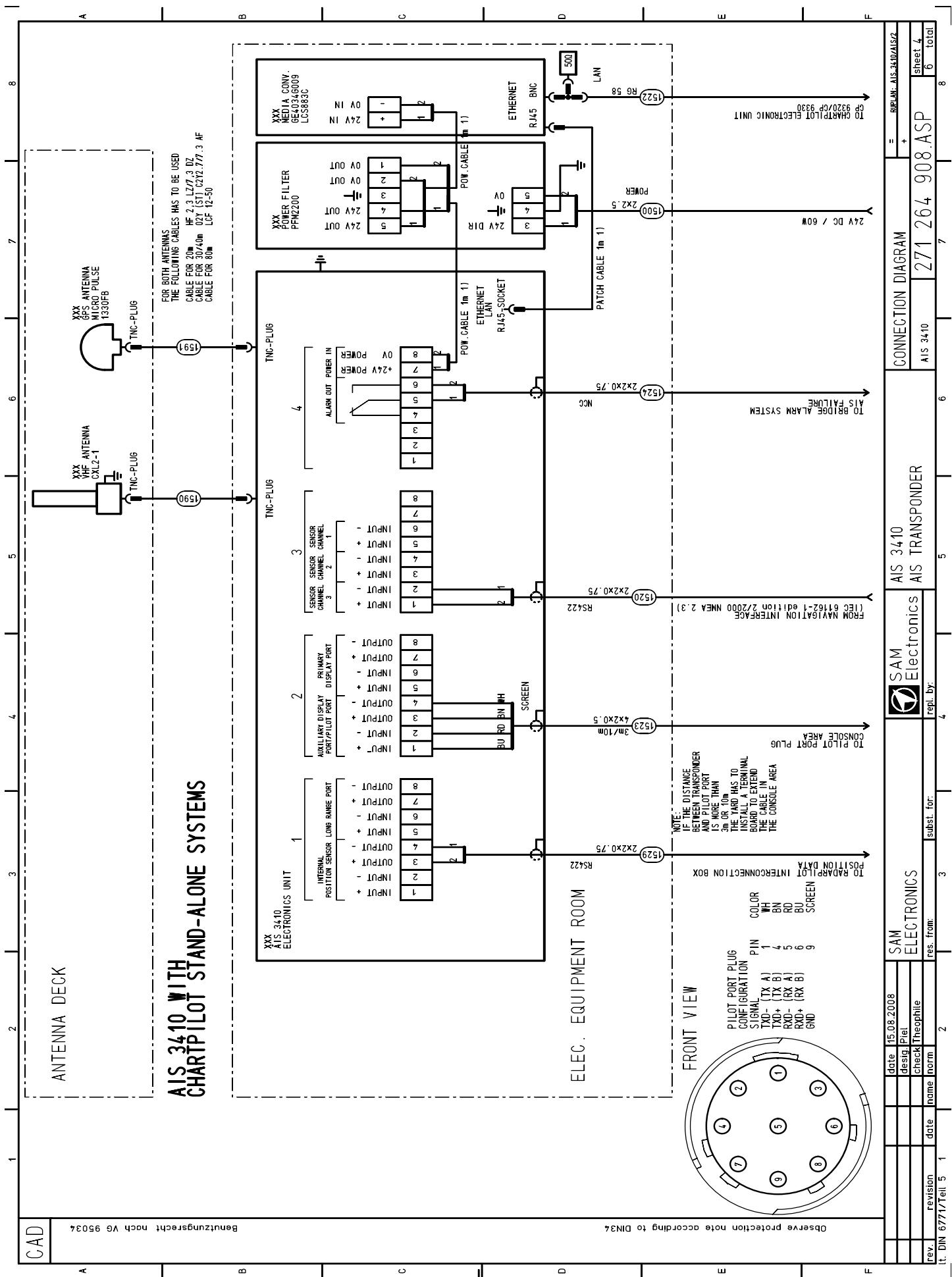


Fig. 9-8 Detailed Cable Diagram, connection to CHARTPILOT stand-alone systems

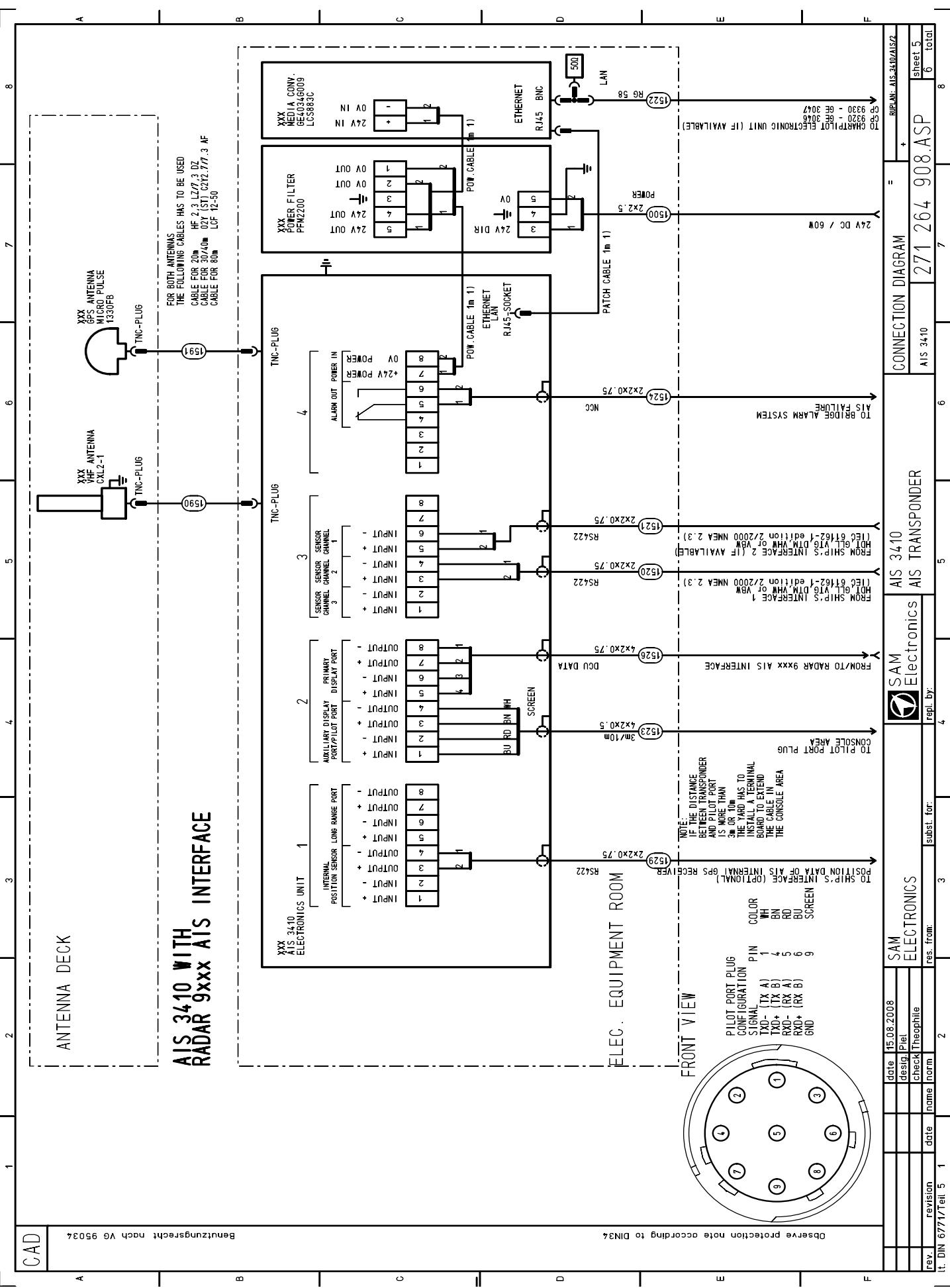


Fig. 9-9 Detailed Cable Diagram, connection to RADAR 9xxx AIS Interface

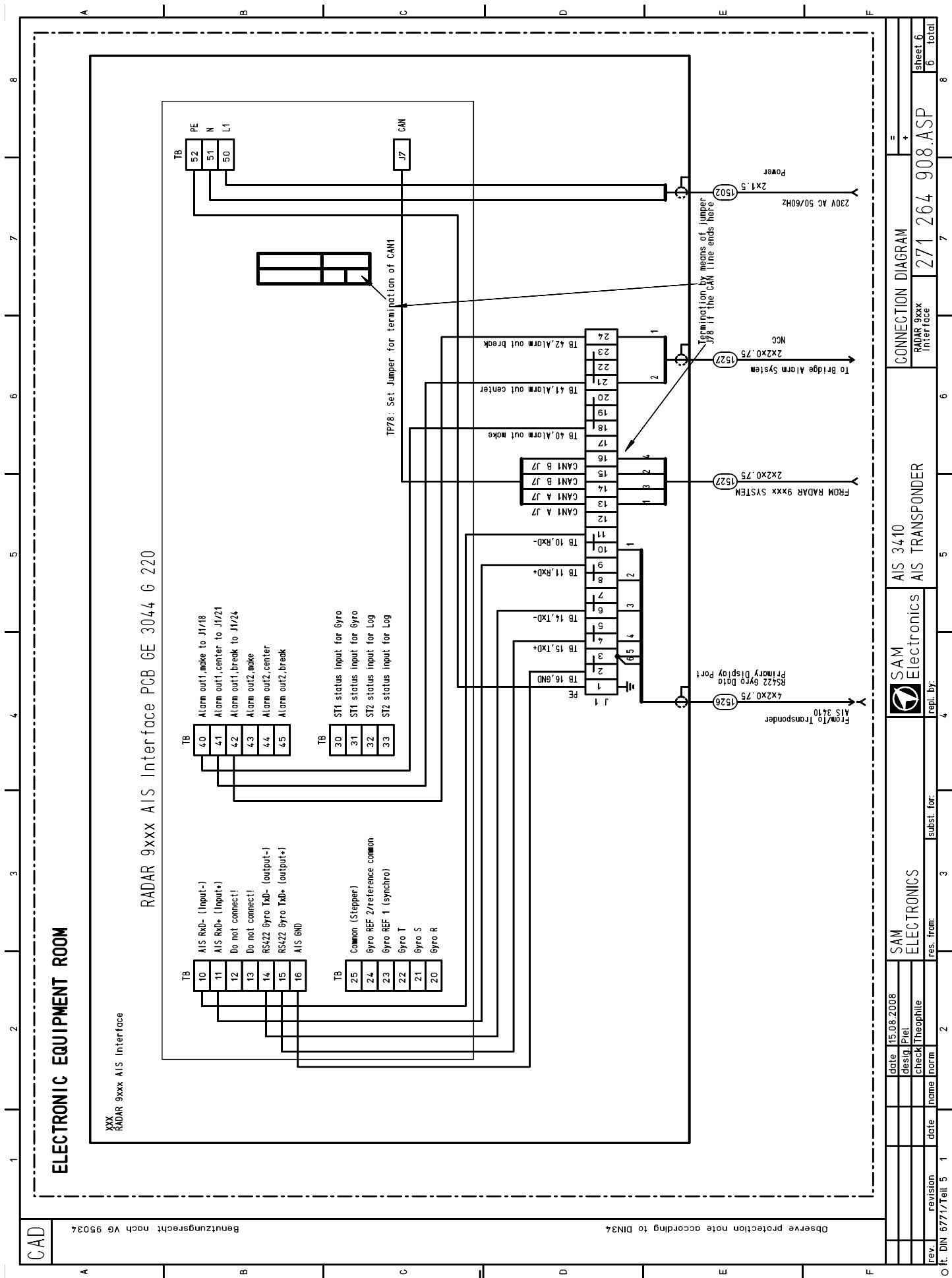


Fig. 9-10 Detailed Cable Diagram, connection to RADAR 9xxxx AIS Interface PCB GE 3044 G 220

10 Outline Drawings

Title	Page
AIS 3410 Outline Drawing	79
AIS GPS antenna, 1/2	80
AIS GPS antenna, 2/2	81
AIS VHF antenna	82

ONLY BULKHEAD MOUNTING

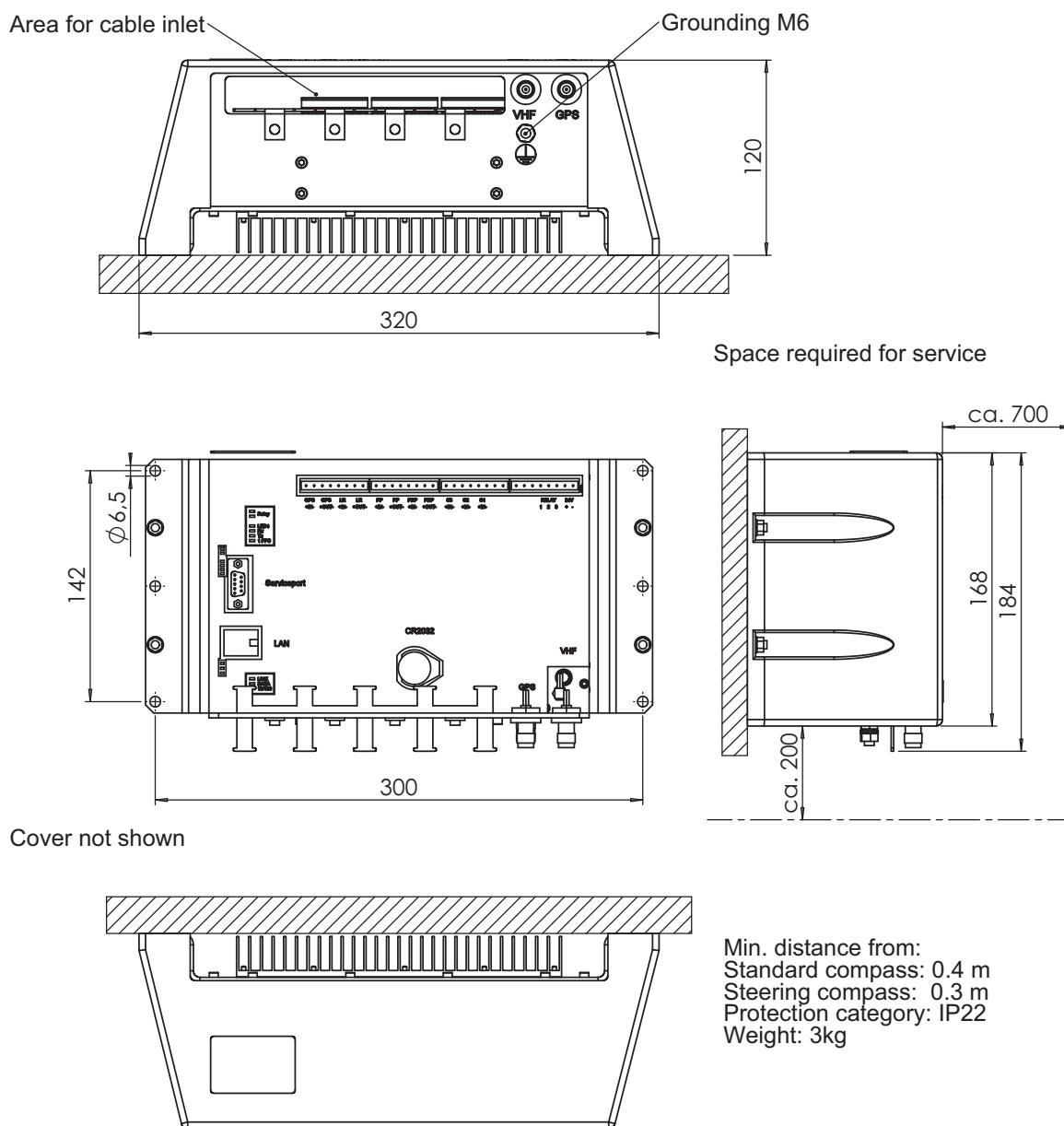
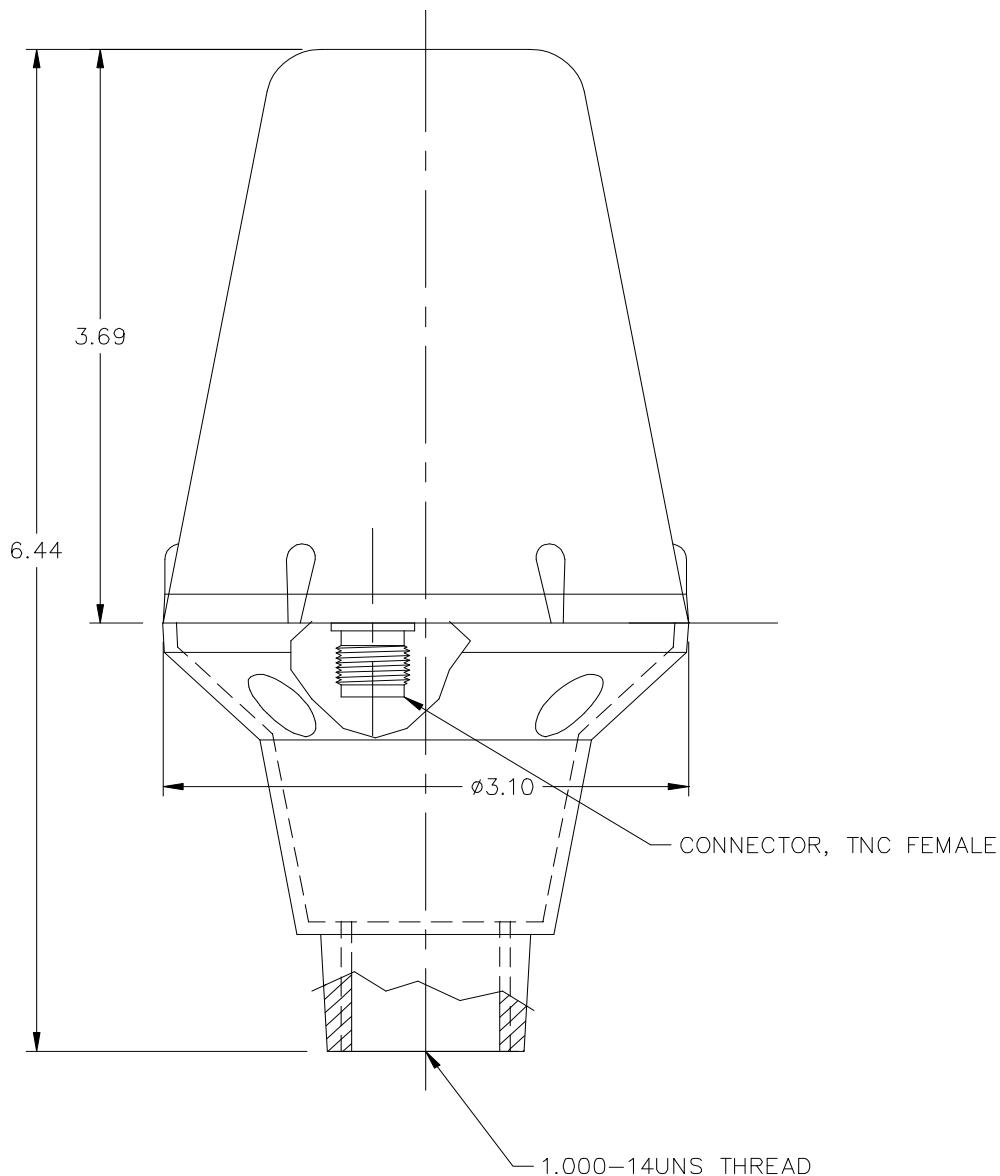


Fig. 10-1 AIS 3410 Outline Drawing

REVISIONS				
REV	DESCRIPTION	DATE	BY	APPVD
SEE SHEET 1				



All dimensions are indicated as inches.

MICRO	PULSE	SIZE	CAGE CODE	DWG NO.	
		A	OMML4	13300	D1
SCALE	1/1	WT.		SHEET	2

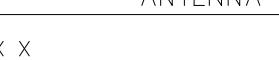
Fig. 10-2 AIS GPS antenna, 1/2

MICRO PULSE PROPRIETARY RIGHTS ARE INCLUDED IN THE INFORMATION DISCLOSED HEREIN AND ALL PATENT, COPYRIGHT, DESIGN, MANUFACTURING, REPRODUCTION, USE AND SALE RIGHTS THERETO ARE EXPRESSLY RESERVED. NEITHER THIS DOCUMENT NOR THE INFORMATION DISCLOSED HEREIN SHALL BE REPRODUCED OR TRANSFERRED TO OTHER DOCUMENTS OR USED OR DISCLOSED TO OTHERS FOR MANUFACTURING OR ANY OTHER PURPOSE, EXCEPT AS AUTHORIZED IN WRITING BY MICRO PULSE. THIS RESTRICTION DOES NOT APPLY TO INFORMATION FURNISHED BY PARTIES OTHER THAN MICRO PULSE.

REVISIONS				
REV	DESCRIPTION	DATE	BY	APPVD
C	DWG NO. 13300, REV B, DTD 11/16/95 REDRAWIN W/CHG. SEE ECO NO. 343	08/06/96	JL	09/03/96
D	SEE ECO No. 597	03/06/97	EA	
D1	ADD CODE "1" PASSIVE, ECO 1860	5/27/99	JB	

SPECIFICATIONS:

IDENTIFICATION INFO: 1. MICRO PULSE PN:	1330FB OR 1330FW	1332FB OR 1332FW	1333FB OR 1333FW	1331FW
GENERAL: 1. COLOR: 2. WEIGHT: 3. RF INPUT:	SEE TABLE 5.75 OZ, NOMINAL TYPE TNC FEMALE	SEE TABLE 5.75 OZ, NOMINAL TYPE TNC FEMALE	SEE TABLE 5.75 OZ, NOMINAL TYPE TNC FEMALE	SEE TABLE 5.75 OZ, NOMINAL TYPE TNC FEM
ENVIRONMENTAL: 1. OPERATING TEMP: 2. HUMIDITY:	-40°C TO +85°C 95% RELATIVE HUMIDITY	-40°C TO +85°C 95% RELATIVE HUMIDITY	-40°C TO +85°C 95% RELATIVE HUMIDTY	-40°C – +85°C 95% REL HUMIDTY
ANTENNA ELEMENT: 1. FREQUENCY: 2. IMPEDANCE: 3. VSWR: 4. POLARIZATION: 5. GAIN:	1575.42 ±10.0 MHz 50 OHMS NOMINAL 1.5:1 MAXIMUM RIGHT HAND CIRCULAR +4.5 dBIC NOMINAL	1575.42 ±10.0 MHz 50 OHMS NOMINAL 1.5:1 MAXIMUM RIGHT HAND CIRCULAR +4.5 dBIC NOMINAL	1575.42 ±10.0 MHz 50 OHMS NOMINAL 1.5:1 MAXIMUM RIGHT HAND CIRCULAR +4.5 dBIC NOMINAL	1575.42?10.0MHZ 500HMS NOMINAL 1.5:1 MAX RIGHT HAND CIRC +4.5 dBIC NOM
LOW NOISE AMPLIFIER: 1. FREQUENCY: 2. IMPEDANCE: 3. VSWR: 4. GAIN: 5. DC VOLTAGE: 6. DC CURRENT: 7. FILTERING:	1575.42 MHz 50 OHMS NOMINAL 2.0:1 MAX 26.5dB ±3.0 dB 5 TO 26 VDC 25 mA TYP, 40 mA MAX DUAL CERAMIC FILTERS	1575.42 MHz 50 OHMS NOMINAL 2.0:1 MAX 13dB ±3dB 5 TO 26 VDC 25 mA TYP, 40 mA MAX DUAL CERAMIC FILTERS	1575.42 MHz 50 OHMS NOMINAL 2.0:1 MAX 44dB ±4dB 5 TO 26 VDC 46 mA TYP, 55 mA MAX DUAL CERAMIC FILTERS	N/A N/A N/A N/A N/A N/A N/A

ANTENNA ORDERING INFORMATION							
 1 3 3 X X X	AMPLIFIER		CONNECTOR		COLOR		
	CODE	DESCR.	CODE	TYPE	CODE	COLOR	COLOR NO.
	0	26 dB	F	TYPE TNC FEMALE	B W	BLACK WHITE	N/A
	2	13 dB					N/A
	3	40 dB					
	1	PASSIVE					

APPROVALS	DATE	DO NOT SCALE DRAWING			ANTENNA— GPS, MARINE	
DRAWN J. LOWE	05/30/96	TOLERANCES ON:			SIZE	CAGE CODE
CHECKED		.X $\pm .10$	A	OMML4	13300	D1
ENGINEER		.XX $\pm .03$				
		.XXX $\pm .010$				
		FRACTIONS $\pm 1/16$				
		ANGLES $\pm 1^\circ$	SCALE	1/1	WT.	SHEET 1 OF 3

CXL 2-1/150-170 MHz-TNC

Marine VHF Antenna

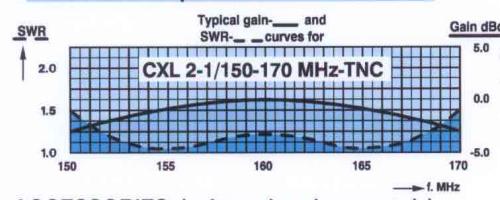
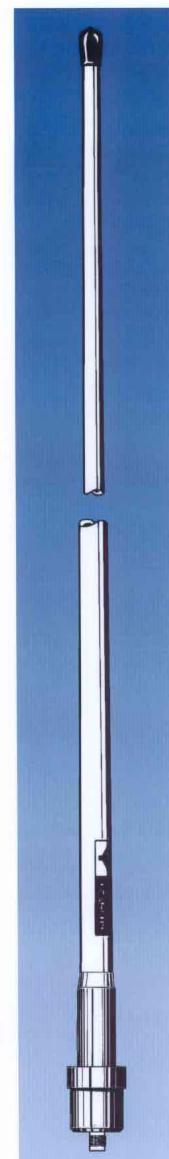
PROCOM

DESCRIPTION:

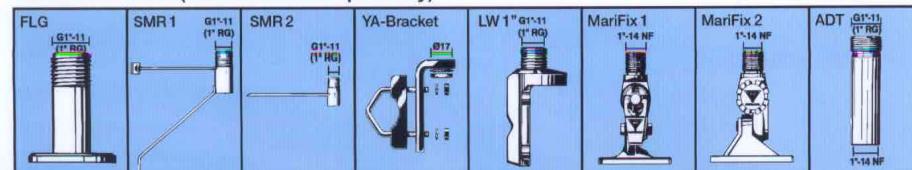
- ★ This maritime VHF antenna is developed for use on board ships as well as on masts and thanks to the 1" revolving nut mounting system it can be mounted in the mast, in the auxilliary mast as well as on the cross-beam. By means of PROCOM's flange mount it can also be mounted on deck or rooftop.
- ★ Bear in mind that the higher the antenna is mounted the better coverage.
- ★ Avoid mounting the antenna parallel with and in the neighbourhood of other metal parts, such as mast, supporting wires etc. Free mounting and as high as possible is most preferable, otherwise the SWR and the radiation diagram will be influenced.
- ★ The antenna is a $1/2 \lambda$ design and this means that it needs neither loading coils, ground-plane, radials nor other auxilliary arrangements.
- ★ CXL 2-1/150-170 MHz-TNC can, without problems, operate with duplex radios and on the semi-duplex channels, owing to the fact that it is broad-banded (see SWR diagram). In other words, CXL 2-1/150-170 MHz-TNC has a shipshape SWR on the RX-frequencies, which is just as important as it is for the TX-frequencies.
- ★ Furthermore, the antenna is a grounded radiator antenna and therefore it shows a DC-short across the coaxial cable.
- ★ A conical glassfiber tube completely encloses the carefully designed radiating element to assure long dependable service in all climates.

SPECIFICATIONS:

ELECTRICAL	
MODEL	CXL 2-1/150-170 MHz-TNC
ANTENNA TYPE	1/2 λ coaxial, broad-band
FREQUENCY	150-170 MHz
IMPEDANCE	Nom. 50 Ω
POLARISATION	Vertical
GAIN	2 dBi 0 dBd
BANDWIDTH	20 MHz
SWR	<1.5
MAX. POWER	150 watt
MECHANICAL	
TEMP. RANGE	-30° C → +70° C
CONNECTOR	TNC-female
WIND SURFACE	0.0196 m ²
WIND LOAD	21.8 (at 150 km/h)
COLOUR	Marine white
MATERIALS	Whip : Glassfiber Mounting bracket : Chromed brass
TOTAL HEIGHT	Approx. 1.2 m
DIA. IN TOP END	8 mm
DIA. IN BOTTOM END	16 mm
WEIGHT	Approx. 340 g
MOUNTING	On 1" RG (G1"-11) threaded water pipe or on optional mounting brackets (see below)



ACCESSORIES: (to be ordered separately)



PROCOM A/S reserve the right to amend specifications without prior notice.

Fig. 10-4 AIS VHF antenna

Notes

Space for your notes.

