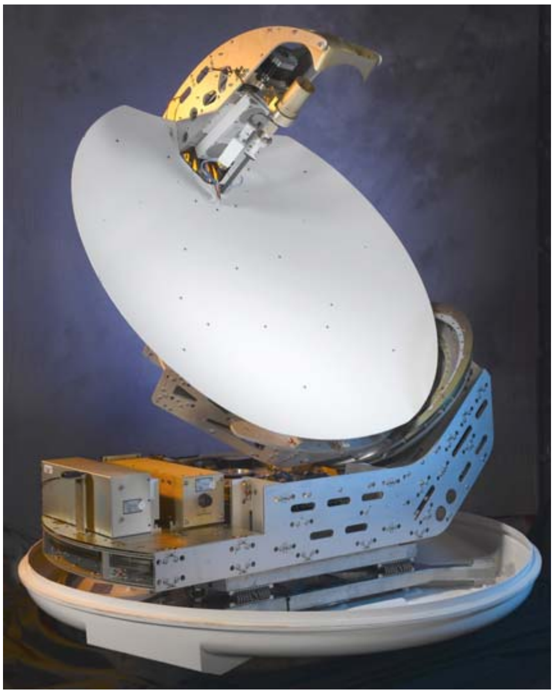
OrSat

AL-7103-Ku Mk II

1.15m (45") Ku-Band Antenna

Stabilized Marine Satellite Communication System



User and Installation Manual

Document: MAN26-1327 **Revision : B**

Revision History & Control

Revision History

Revision #	Date	Description
Rev: -	October 2006	Initial version
Rev: A	December 2006	Updated version
Rev: B	March 2007	Updated version

List of Effective Pages

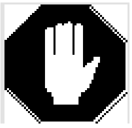
TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 165 CONSISTING OF THE FOLLOWING:

Page No.	Issue
Title	Revision B
i – xi	Revision B
1 – 157	Revision B

Safety Precautions

The following general safety information is for installing, operating, and servicing the system.

Specific warnings and cautions will be found throughout the manual where they apply, but may not appear in this summary. Observe the following list of safety precautions when installing, operating and maintaining the system:



- ♦ Keep clear of the moving Antenna, at all times.
- ♦ The Antenna Pedestal is equipped with high torque motors that develop considerable forces. These forces can be harmful.
- ♦ This equipment contains potentially harmful voltages when connected to the designated power sources. Never remove equipment covers except for maintenance or internal adjustments.
- ♦ Before removing the covers of any unit, verify that the CCU POWER switch is in the OFF position.

- ♦ Metal parts accessible to the operator are connected to the chassis' ground to prevent shock, and similar hazards. The chassis' ground conductor must not be removed. Ensure the enclosure is at ground potential.
- ♦ Only qualified and trained personnel should perform installation, operation and maintenance of this equipment.
- ♦ Although the Radome is not heavy, care should be taken when lifting it since it acts as a sail during windy conditions. At least two people should handle the Radome during installation.
- ♦ To prevent shock or fire hazard, when sub-units are open or cables are disconnected, do not expose the equipment (with the exception of the Radome) to rain or moisture.
- ♦ Avoid making unauthorized modifications to the circuitry. Any such changes to the system will void the warranty.
- ♦ Do not disconnect cables from the equipment while the system is powered-on.

- Interfacing this equipment requires the use of high quality connectors and cables.
- Use only ORBIT authorized parts for repair.

About this Manual

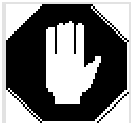
This manual is designed to guide you through the operating and installation procedures for the OrSat (AL-7103-Ku Mk II) system.

Conventions Used in this Manual

This text style…	Identifies…	Example
Text	Normal descriptive text.	
Text	Emphasized text.	
`Text`/**`Text`**	Words or figures that appear on the screen or that should be typed, or a key to be pressed < >. The name of a file or directory.	400
TEXT	The name of a software or hardware component.	ANTENNA
➢	The description of a procedure.	➢ **To configure…**

Notations in this Manual

This information is important and should be noted.



Information given in this message warns of a hazard.

Information given in this warning refers to the safest method of installation or operation and *must be adhered to.*

Acronyms & Abbreviations

ADE	Above Deck Equipment
ADMx	Above Deck MUX
BDE	Below Deck Equipment
BDMx	Below Deck MUX
BUC	Block Up Converter
B/W	Band Width
CCU	Central Control Unit
IMU	Inertial Measurement Unit
KB	Keyboard
LNA	Low Noise Amplifier
LNB	Low Noise Block
M&C	Monitor & Control
Mk	Mark
MMI	Man-Machine Interface
MUX	Multiplexer
PSU	Power Supply Unit
RJ	Rotary Joint
SBC	Single Board Controller
SDM	Servo Drive Module
SR	Slip Ring

Table of Contents

1 Overview

1.1 Introduction

The OrSat (AL-7103-Ku Mk II) system is a Stabilized Marine Communication System, carrying a dual-offset, 1.15m (45”) Tx/Rx Ku-Band composite material antenna, housed inside a low-loss 1.28m (50”) Radome.

The system is designed to maintain, at all times, an accurate look angle of a high-efficiency linear-polarized satellite communication antenna towards a pre-selected geo-stationary communication satellite, while the platform on which it is mounted rocks and rolls on the ocean waves, in any relevant geographical location on the Globe: +75 to –75 deg Latitude.

The look angle is maintained in three angular dimensions with respect to the satellite: Azimuth, Elevation and Polarization Skew.

All the above is to allow a continuous two directional Tx/Rx satellite communication data link brought to life by one of the industry standard satellite digital communication modems, able to interface with the signals produced by the OrSat (AL-7103-Ku Mk II) antenna on L-Band frequency band from one hand, and the user data network from the other.

The satellite modem is not part of the OrSat (AL-7103-Ku Mk II) system and is normally provided by the customer or system integrator.

1.2 System Architecture

The OrSat (AL-7103-Ku Mk II) system is comprised of equipment mounted both above decks (Above Deck Equipment - ADE) and below decks (Below Deck Equipment - BDE).

The ADE includes pedestal, antenna, RF package, controller, power supply, installed inside a weather-proof radome.

The BDE includes the Central Control Unit (CCU) that serves both as the system’s Man-machine interface and as interface to the ships Gyrocompass as well as the customer’s modem L-Band Tx/Rx.

The connection between ADE and BDE is by a single coaxial cable multiplexing L-Band Tx/Rx and Ethernet LAN control.

Both above decks and below decks equipment are fed by AC mains power.

The system functional layout is illustrated in the following Figure.

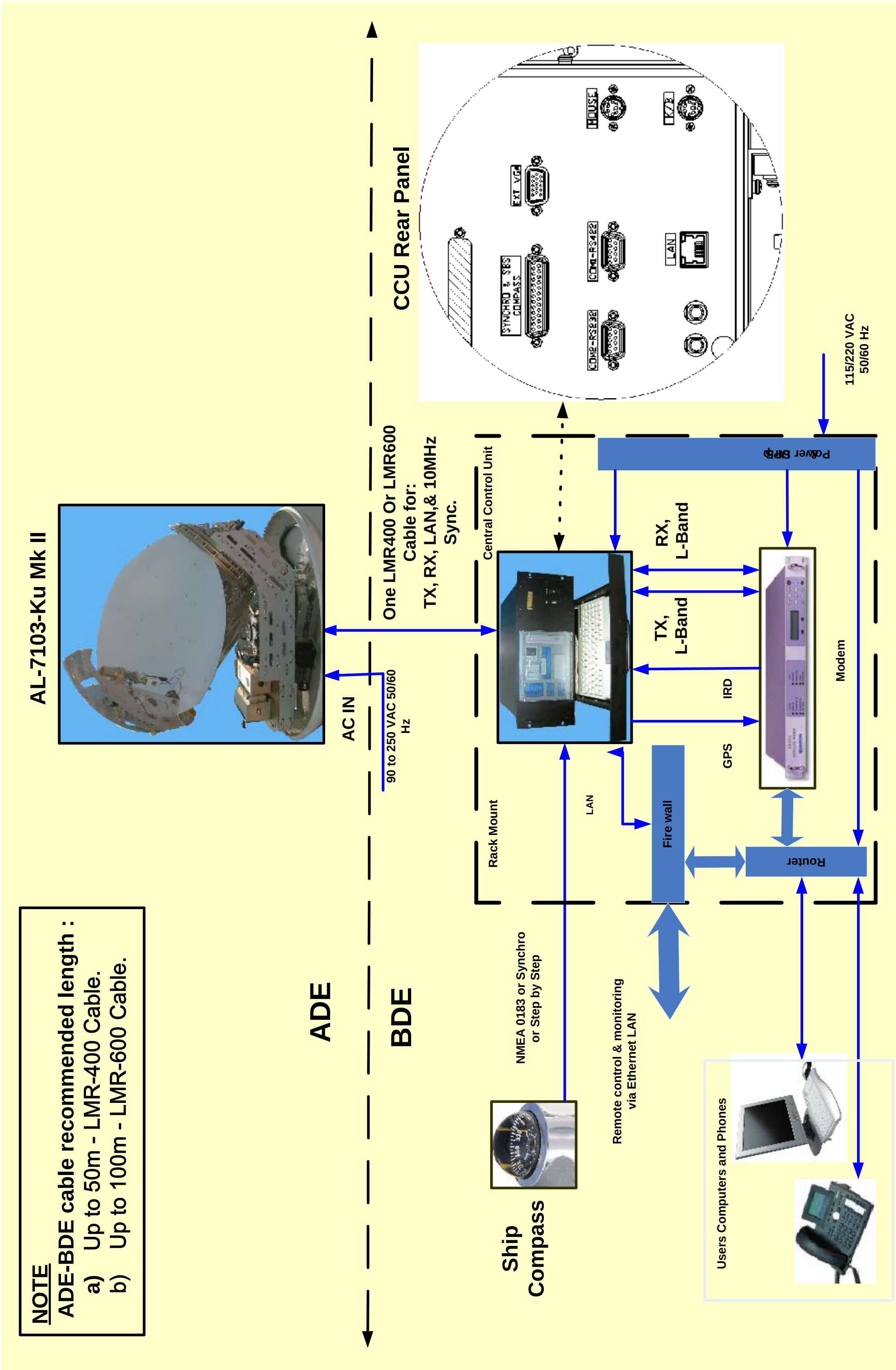


Figure 1-1: OrSat (AL-7103-Ku Mk II) System - Typical Layout

1.3 System Key Features

- Exclusive mechanical design, compact dimensions.
- Providing up to 1 Mbps transmit data rate (typical values, varies with actual satellite) in an unmatched performance ratio.
- Satellite automatic tracking capabilities, based on geographic position data received from system's GPS, and Ship's heading data received for the compass (either Ship's or dedicated compass).
- Extremely high efficient antenna-to-radome size ratio.
- Unique POL. over X over Y over Azimuth configuration, allowing full hemispherical coverage with no "keyholes" at horizon and Zenith.
- Eutelsat Approval for Antenna and RF Sub System.
- Built in Narrow Band receiver (NBR).
- IRD Interface to Modem.
- ADMx (Above Deck Mux) and BDMx (Below Deck Mux), used to transfer RF & Data between the ADE to the BDE via a single coaxial cable only.
- Plug & Play Installation.
- Easy maintenance, use of modular LRUs (field replaceable).
- Built in Satellite database, Maintenance and data logging features.
- Remote control and monitoring via Ethernet LAN.

2 System Description

2.1 Main System Components

2.1.1 Introduction

The OrSat (AL-7103-Ku Mk II) system components are divided into two groups:

- Above Deck Equipment (ADE)
- Below Deck Equipment (BDE).

2.1.2 Above Deck Equipment (ADE)

The ADE includes the following main assemblies and units:

- 1.28m (50 “) Radome and Radome Base
- Four-axes pedestal
- Servo drive modules (SDM) – one per axis
- Pitch/Roll sensor and short term Yaw (Inertial Measurement Unit-IMU)
- GPS Omni antenna
- 1.15m (45”) Composite material Ku-Band Tx/Rx Antenna, Linear Polarization
- Power Supply Unit (PSU)
- Tracking Single Board Controller (SBC), including a Narrow Band receiver (NBR) & GPS receiver
- RF Package – Including 4W/8W BUC, and RF front end, (OMT, Filter, LNB)
- BDMx, part of the ADMx / BDMx Link Sub system.

The following Figures show the location of the ADE assemblies and units (Radome removed).

The subsequent paragraphs provide brief technical description of each unit.

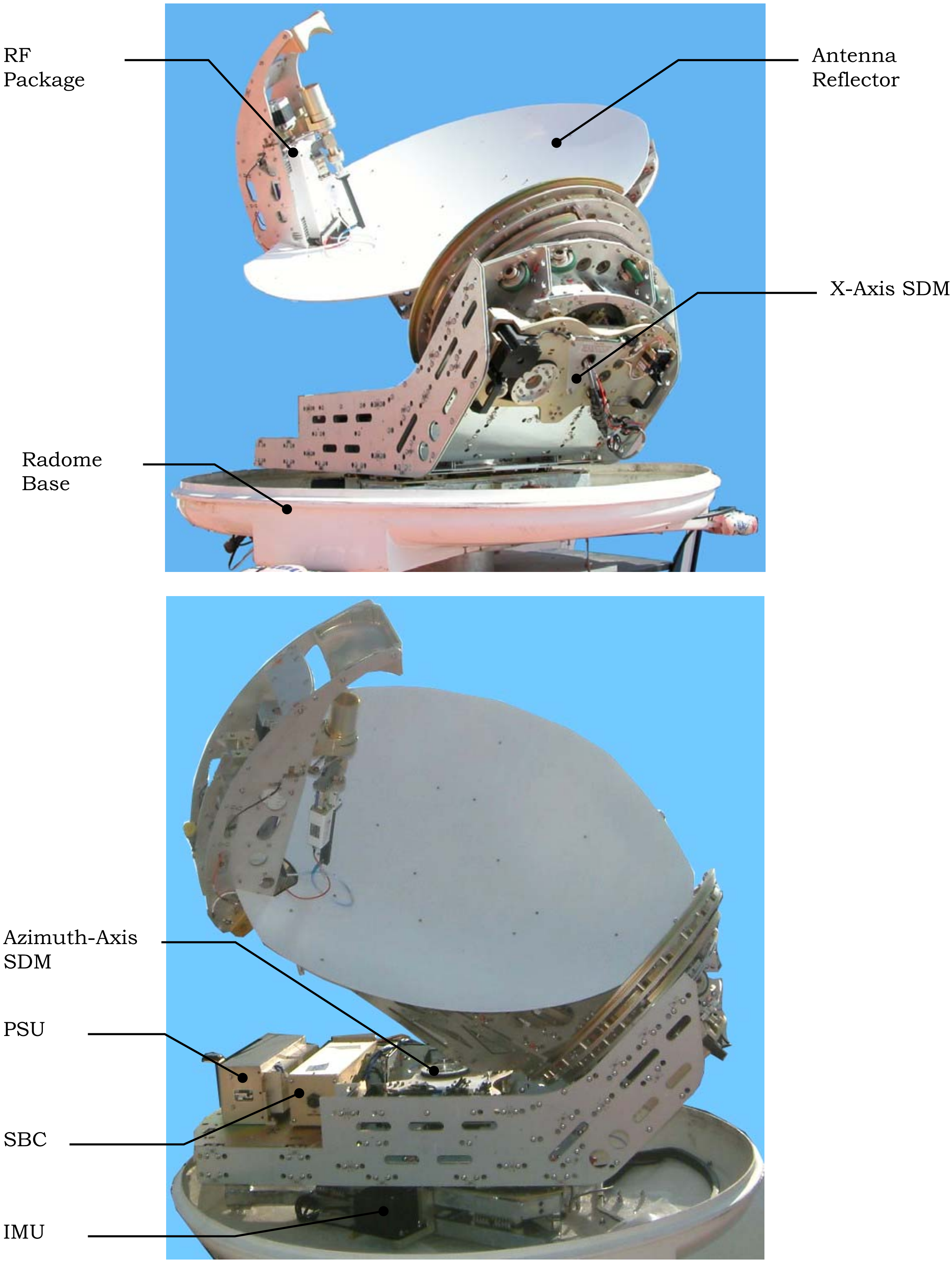


Figure 2-2: Above Deck Equipment (ADE) – sheet 1 of 3

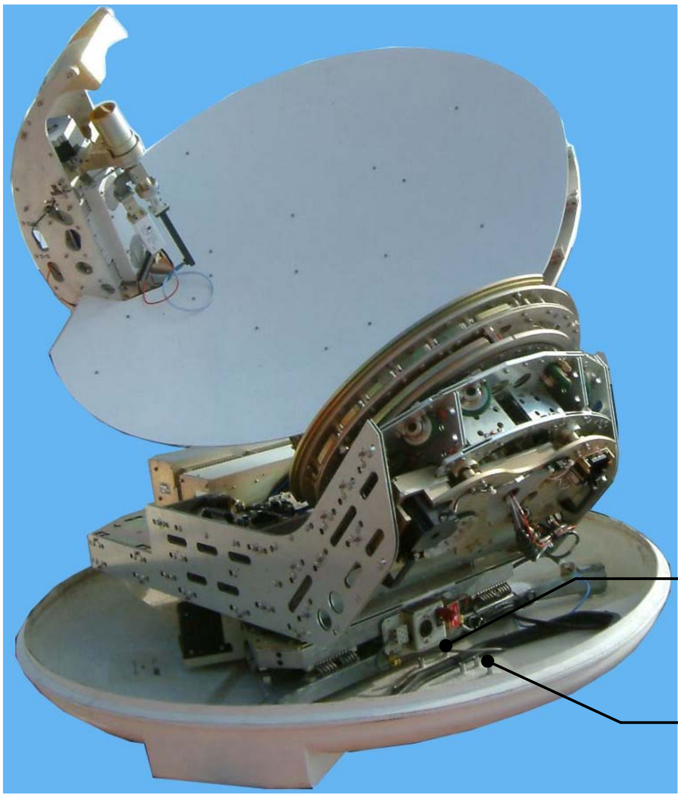


Figure 2-3: Above Deck Equipment (ADE) – sheet 2 of 3

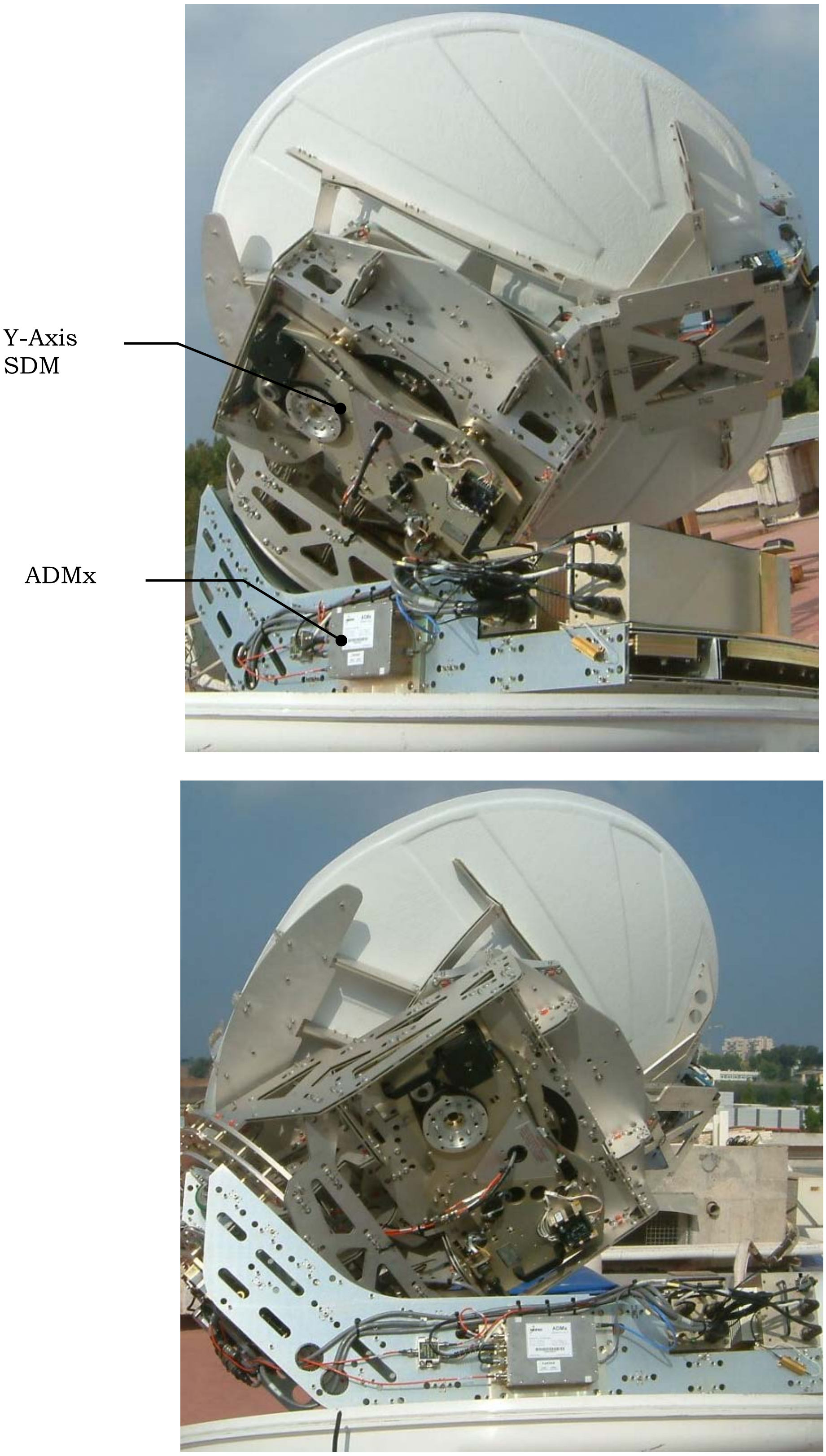


Figure 2-4: Above Deck Equipment (ADE) – sheet 3 of 3

Radome and Radome Base

The ADE assemblies and units are enclosed within a 1.28 m (50”) Radome, mounted on the Radome’s base.

The Radome covers and protects the complete ADE. A service hatch at the radome’s base provides access for maintenance tasks.

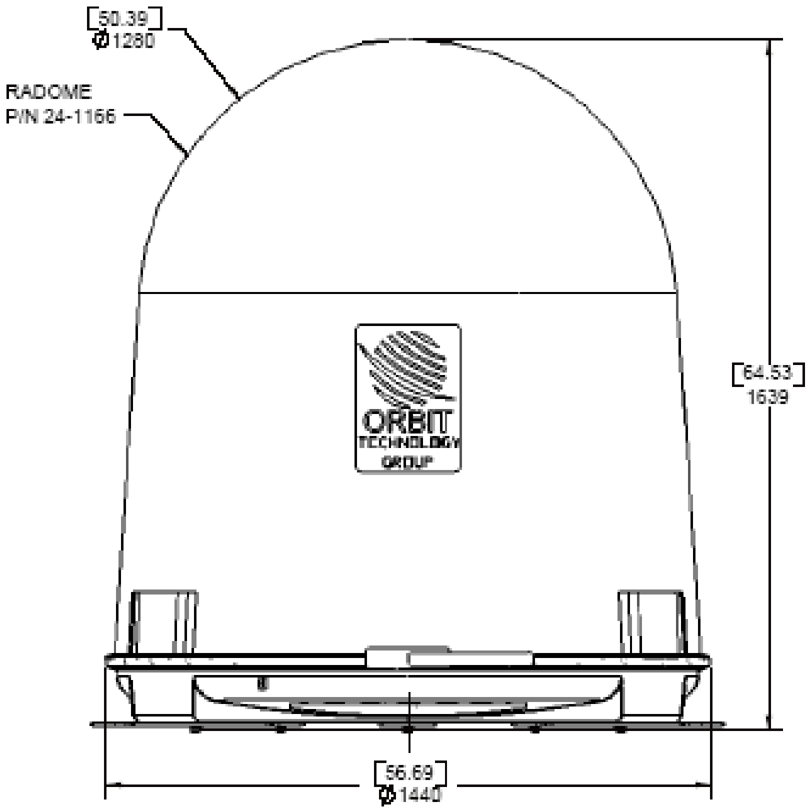


Figure 2-5: ADE Radome Outline Dimensions

Figure 2-6: ADE Radome – General View

Figure 2-7: ADE Radome – General Views (Mounted on a Support)

Figure 2-8: Radome Base Service Hatch

Pedestal

The Y-over-X-over-Azimuth Pedestal carries and moves the antenna to the required position.

The pedestal axes are not orthogonal. The relative notation angles between the axes are set to produce the tightest packaging factor possible: a 1.12m by 1.19m antenna is packed in a 1.28m radome.

The pedestal is mounted on the Radome Base using shock absorbers.

The pedestal axes are as follows:

- Azimuth Axis – provides continuous unlimited 360° rotation. The Azimuth axis includes a Single channel Rotary Joint as well as multiple slip-rings assembly.
- X Axis – provides 350 degrees of free rotation (-175° ÷ +175°).
- Y Axis – provides 350 degrees of free rotation.

The above axes are driven by identical Servo Drive Modules (SDMs).

In addition to these axes, a fourth Polarization Axis provides two discrete polarization positions: 0° or 90°.

The three axes and their range of angular movement together with the fact that there is a mechanical switch for the antenna polarization, allow pointing of the antenna towards the satellite in more then one possible axes angular location combination.

Actually eight different axes combinations are possible for every look angle of the antenna. The system controller (SBC) selects the best possible combination before each pointing command, so as to allow continuous pointing towards the satellite for all specified sea conditions without going into mechanical limits or geometrical keyholes.

Figure 2-9: Pedestal Axes

Servo Drive Modules (SDMs)

Each one of the Azimuth, X, and Y axes is equipped with an identical Servo Drive Module, which acts as a full self-contained turntable that rotates the axis.

Each SDM contains the following assemblies:

- ♦ Integral Stepper Motor
- ♦ Stepper driver with 1:16 micro-step control capability
- ♦ Back-EMF Over-voltage protection card
- ♦ Dynamic-brakes relay, applying the axes brakes when there is no power
- ♦ 1:1 Absolute17-bit resolution Encoder
- ♦ 1:60 reduction gear.

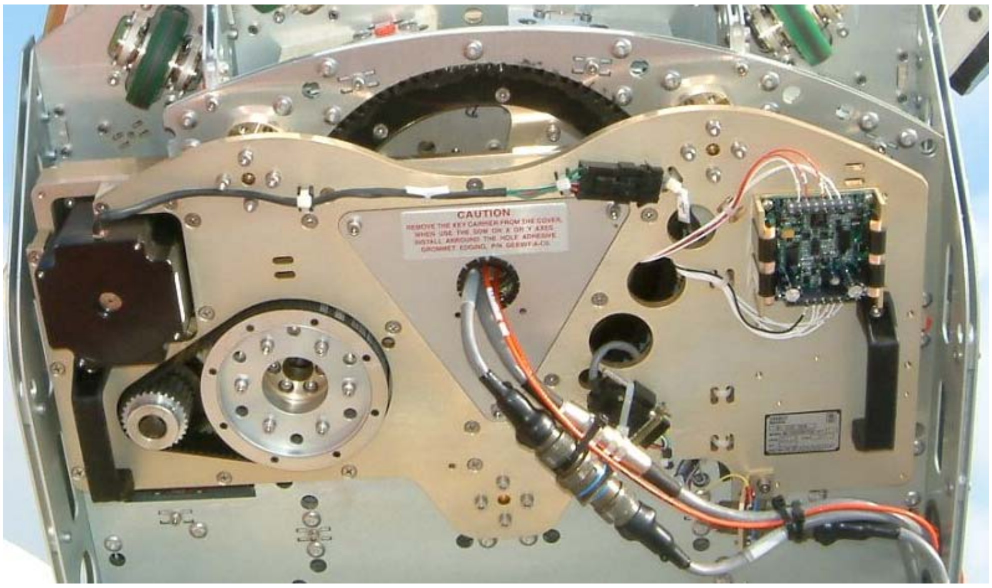


Figure 2-10: Servo Drive Module (SDM)

Single Board Controller (SBC)

The Single Board Controller (SBC) is a real-time tracking controller, based on an industry-standard CPU with on-board Flash and SDRAM memory that controls system operation according to CCU commands and system modes.

The SBC interfaces with the ADE components via its front-panel connectors.

The SBC runs a Real-Time OS reading all system sensors, performing 3D mathematical transformations, controlling (in closed position and velocity loops) the movement of the axes and providing on-line communication to the Below-decks Central Control Unit (CCU) by the means of standard Ethernet-LAN connection

The SBC is fed by +24VDC and incorporates an internal DC-DC power supply providing +5, +12 and –12VDC voltage to its internal circuits.

The SBC also incorporates a Wide-band as well as Narrow-band Tracking receiver for Step-track feedback.

CCU-SBC Operational Concept:

The operation of the system is fully controlled from the CCU. Using the CCU, the operator may select the desired satellite and channel from a list displayed on the CCU monitor.

The system automatically extracts the desired satellite information using the satellite database, acquires it and tracks the selected satellite by pointing the antenna towards the satellite, while compensating for the platform pitch, roll and yaw movements.

The SBC and CCU provide distributed control concept – SBC running real-time software for stabilization and control, while the CCU presents the man-machine interface to the operator.

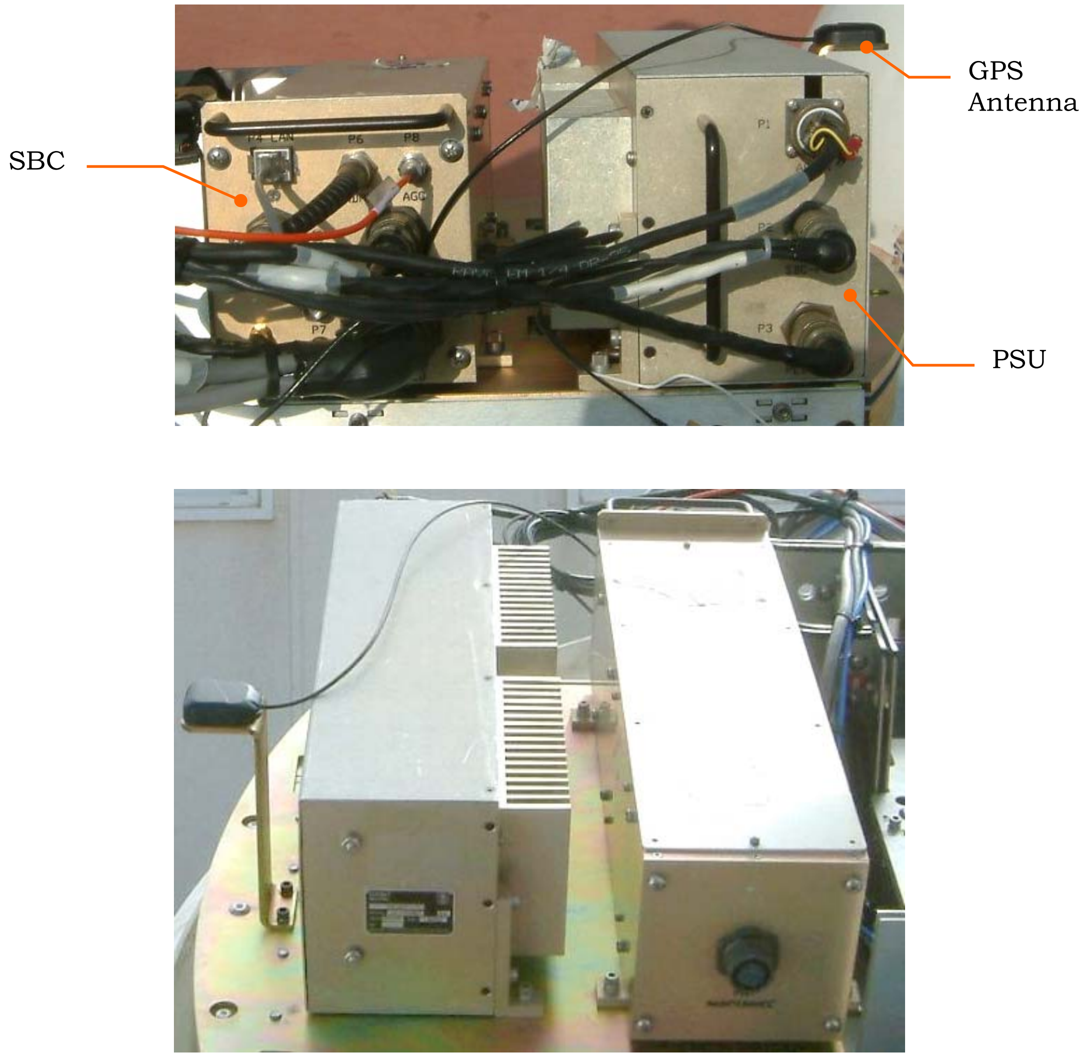


Figure 2-11:SBC, PSU and GPS Antenna Location

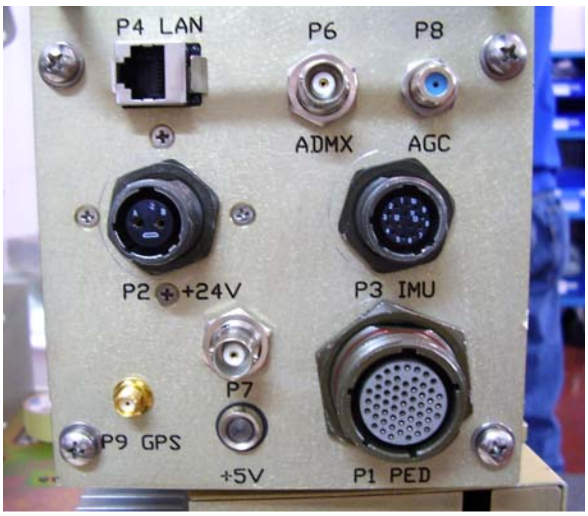


Figure 2-12:SBC Connectors

Power Supply Unit (PSU)

The PSU is an AC to DC Power Supply Unit, which converts the AC mains input voltage (90-260 VAC, 50/60 Hz) to DC voltages, distributed to the system components.

The AC mains input voltage, connected to the ADE, is fed via the Azimuth axis slip-ring to the PSU. The unit is contains two industry-standard 150W modules, one producing 24VDC and the other 51VDC.

The 24V output is (SBC-PWR Connector) used to feed the SBC and the BUC, while the 51V (PED-PWR) output is used to drive the SDM motors.

Figure 2-13: Power Supply Unit (PSU) Connectors

GPS Antenna

The GPS antenna is connected to the SBC, which contains a GPS receiver.

Figure 2-14: GPS Antenna

Inertial Measurement Unit (IMU)

A strap down, solid state Inertial Measurement Unit (IMU) provides accurate dynamic readings of the antenna platform roll, pitch, and yaw angles.

During operation, the Inertial Measurement Unit (IMU), installed inside the pedestal, provides the SBC with extremely accurate information on platform's motion:

- Pitch, Roll – measured by two rate-gyro sensors (short-term information) and two inclinometers (long-term information). The Pitch and Roll short-term data is integrated with the long-term data to provide a smooth and stable signal for antenna stabilization.
- Yaw variations – measured by a rate-gyro sensor (short-term information). The Yaw short-term data is integrated with the long-term Yaw data received from the ship's gyrocompass.

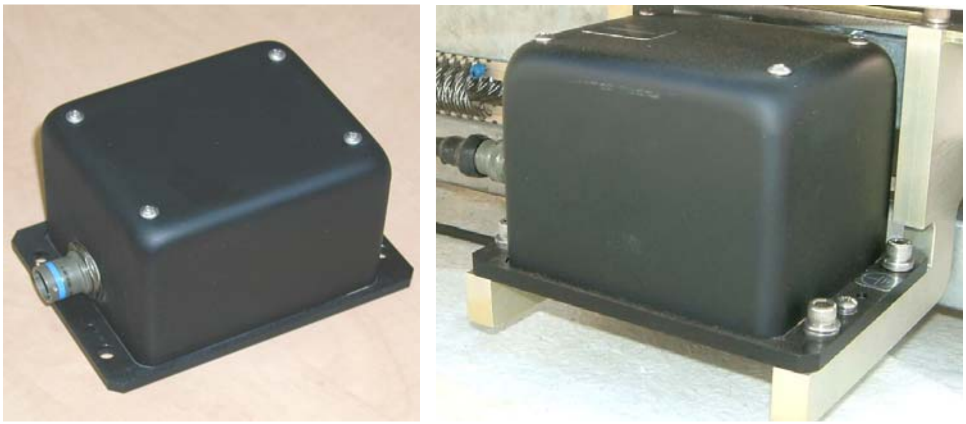


Figure 2-15: Inertial Measurement Unit (IMU)

Antenna and RF Front-end Assembly

The dual-offset, high efficiency, Gregorian 1.15m (45") composite material antenna, is installed on the Y axis, and carries the Tx/Rx Ku-Band RF front end and a mechanical Linear Polarization switch.

Figure 2-16: Antenna Reflector and RF Front-End

RF Package

The RF Package, mounted on the antenna reflector, includes the following components:

- 4W/8W BUC
- RF front end:
  - OMT
  - Rx and Tx Reject Filters
  - LNB
  - Waveguide
- Polarizer
- Splitter
- DC Inserter.

When the system is supplied with a BUC that does not require DC supply via the L-Band coax, the DC Inserter is not installed.

Note that there also may be a situation where the DC inserter, although physically present, is actually bypassed and not used. This may occur in case the system was upgraded on-site to include a BUC which does not require DC supply via its L-Band coaxial connector.

.

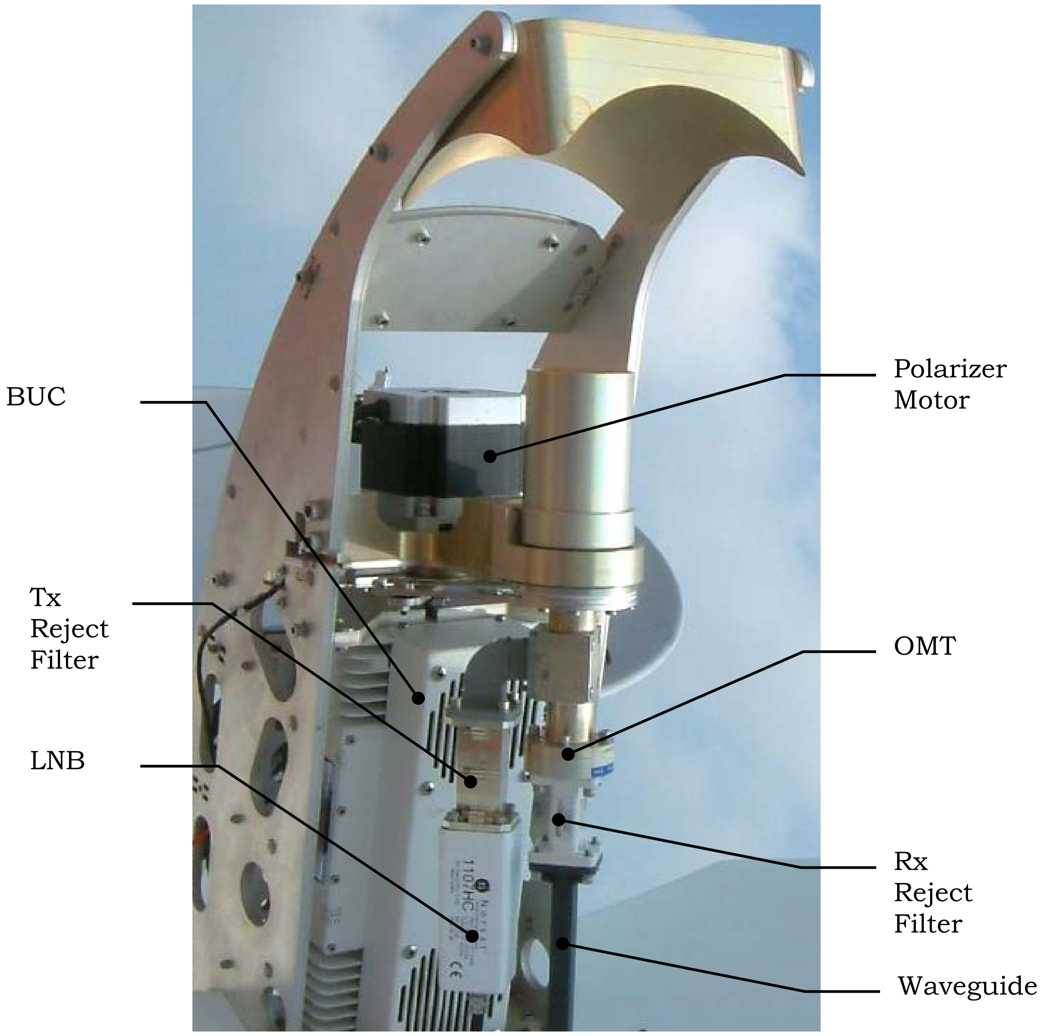


Figure 2-17: RF Package

Low Noise Block (LNB)

The system is supplied with 1-of-3 available Ku-Band PLL LNBs, covering the following Bands:

- ♦ 10.95 to 11.70 GHz
- ♦ 11.70 to 12.20 GHz
- ♦ 12.25 to 12.75 GHz.

The LNB can be easily replaced to match the required frequency range.

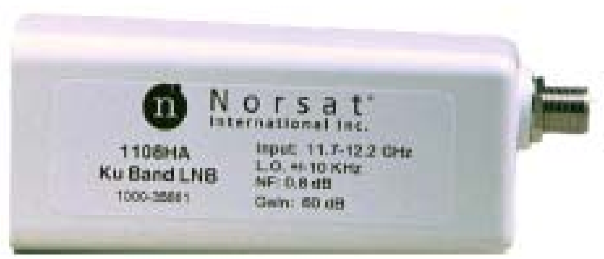


Figure 2-18: Ku-Band LNB (Typical)

Block-Up-Converter (BUC)

- ♦ The system is supplied with 4W or 8W Ku-Band Block-Up-Converter (BUC), which serves as the system's RF transmitter.
- ♦ The BUC up-converts and amplifies the IF signal origin from the Modem. The BUC is powered by the DC Inserter unit, which receives 24 VDC from the PSU unit and supplies BUC operating voltage.
- ♦ The BUC is suitable for both data and voice communication operating in different modulation formats including BPSK, QPSK, QAM and FM.
- ♦ The Ku-Band BUC comprises of Up-Converter, Solid State Power Amplifier, Phase Locked Oscillator and DC-DC power converter. It employs L-Band IF interface to the indoor unit.
- ♦ Choosing the Appropriate BUC:
  - ♦ Required Bandwidth - The smaller the bandwidth - less power required.
  - ♦ Geographic Location - The closer the system is to the equator – less power is required.
  - ♦ Power Limitations - 4W BUC can hold up to 512Kbps with relative efficient SNR; Higher Band Width requires 8W BUC.

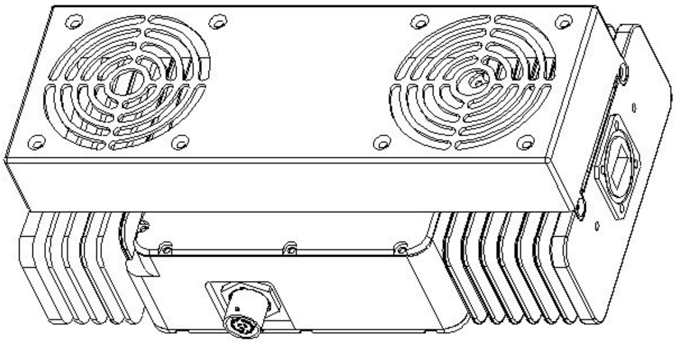


Figure 2-19:8W BUC (Typical)

Figure 2-20:4W BUC (Typical)

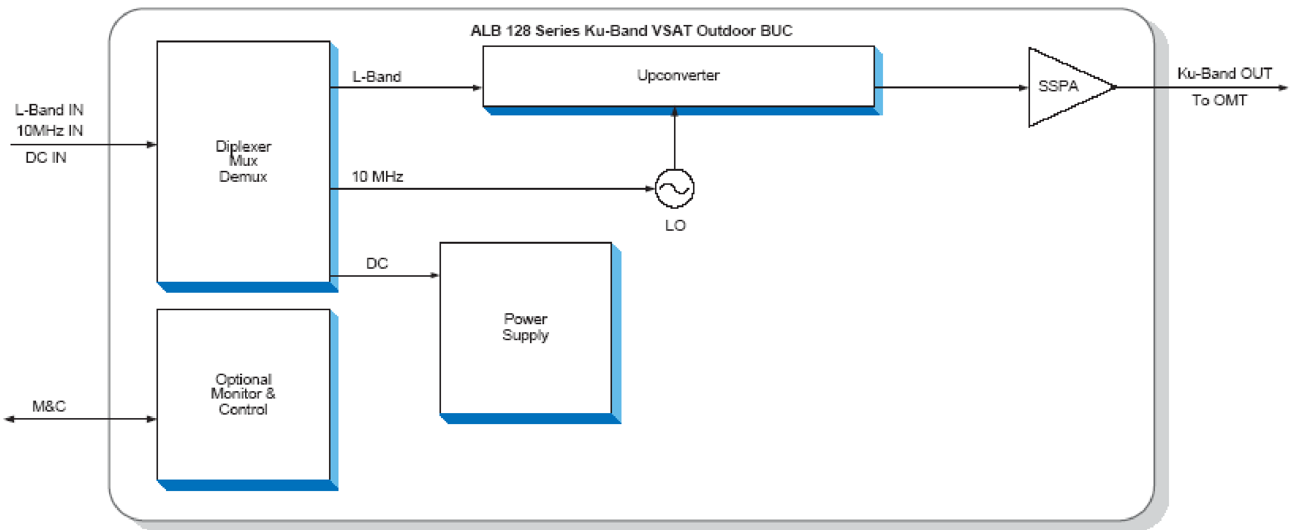


Figure 2-21:BUC – Typical Functional Block Diagram

DC Inserter

The DC inserter is used to feed 24VDC power supply voltage into the BUC, via the L-Band coaxial cable.

When the system is supplied with a BUC that does not require DC supply via the L-Band coax, the DC Inserter is not installed.

Note that there also may be a situation where the DC inserter, although physically present, is actually bypassed and not used. This may occur in case the system was upgraded on-site to include a BUC, which does not require DC supply via its L-Band coaxial connector.

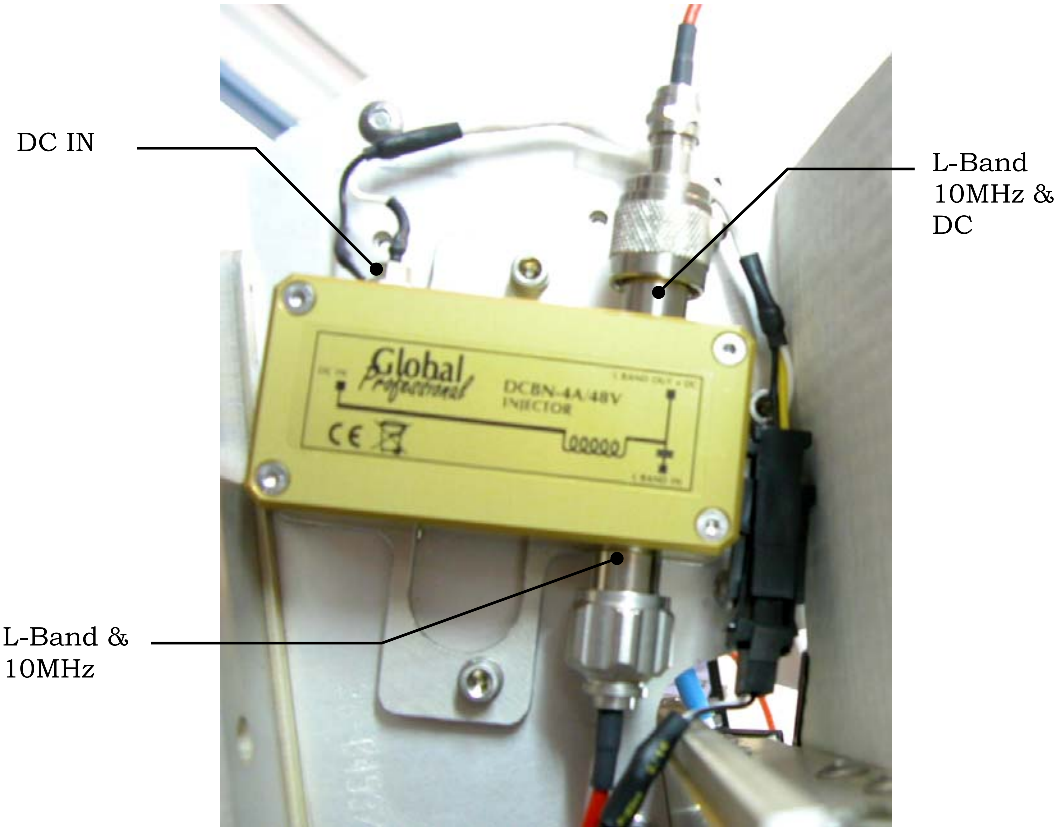


Figure 2-22: DC Inserter

Splitter

The 2-WAY splitter is used to split the LNB output signal between the ADMx and the tracking receiver in the SBC.

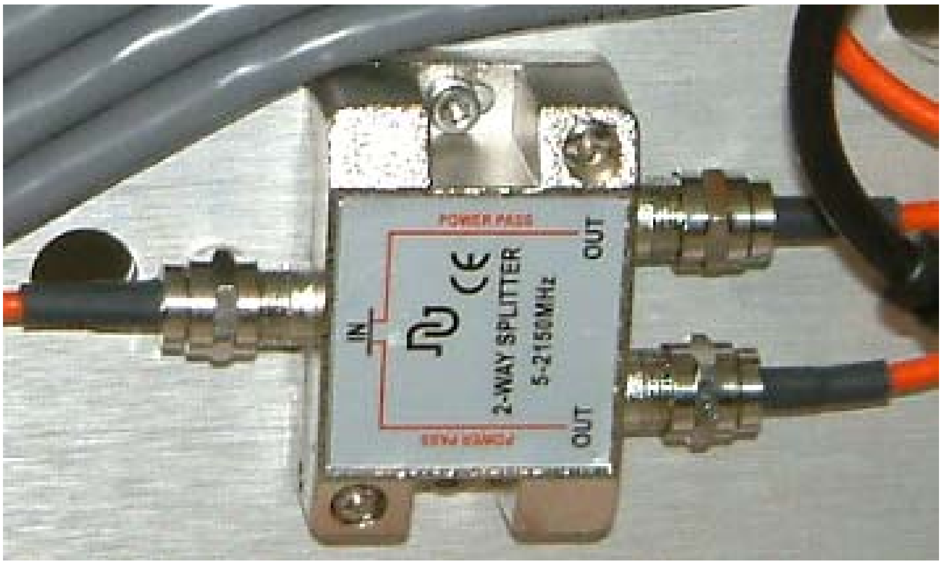


Figure 2-23: Splitter

Above Deck Mux (ADMx)

The ADMx (mounted on the pedestal) and the BDMx (inside the BDE CCU) multiplexer modules are used to establish a link between the ADE and BDE, which minimizes the required cabling and uses only a single coax cable (LMR-400 or LMR-600 cable, depending on cable length).

The ADMx also provides amplification of the Tx and RX paths.

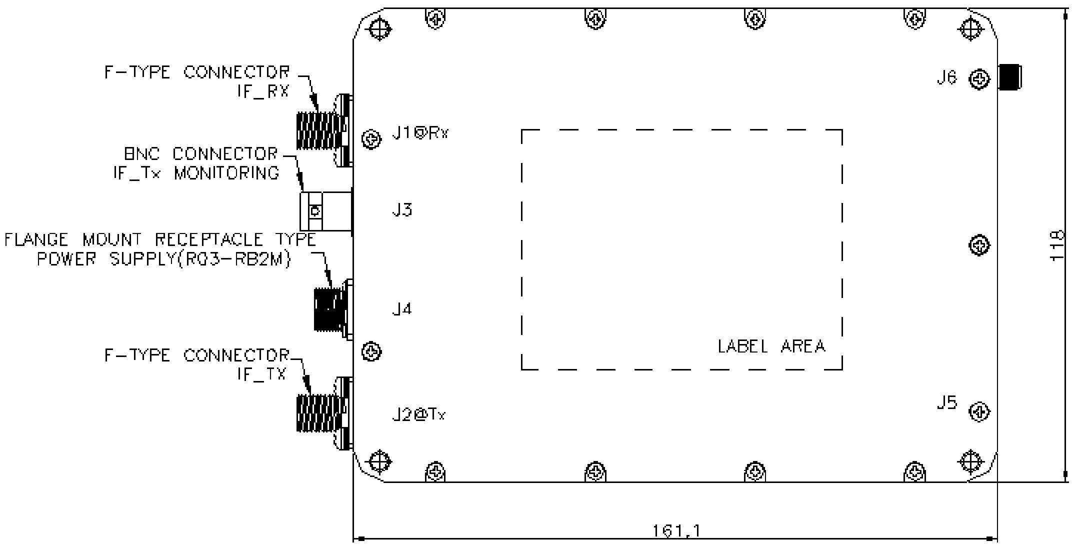


Figure 2-24:ADMx

ADE Power Connection Box

The ADE is fed with mains AC power, connected to the Power Connection Box.

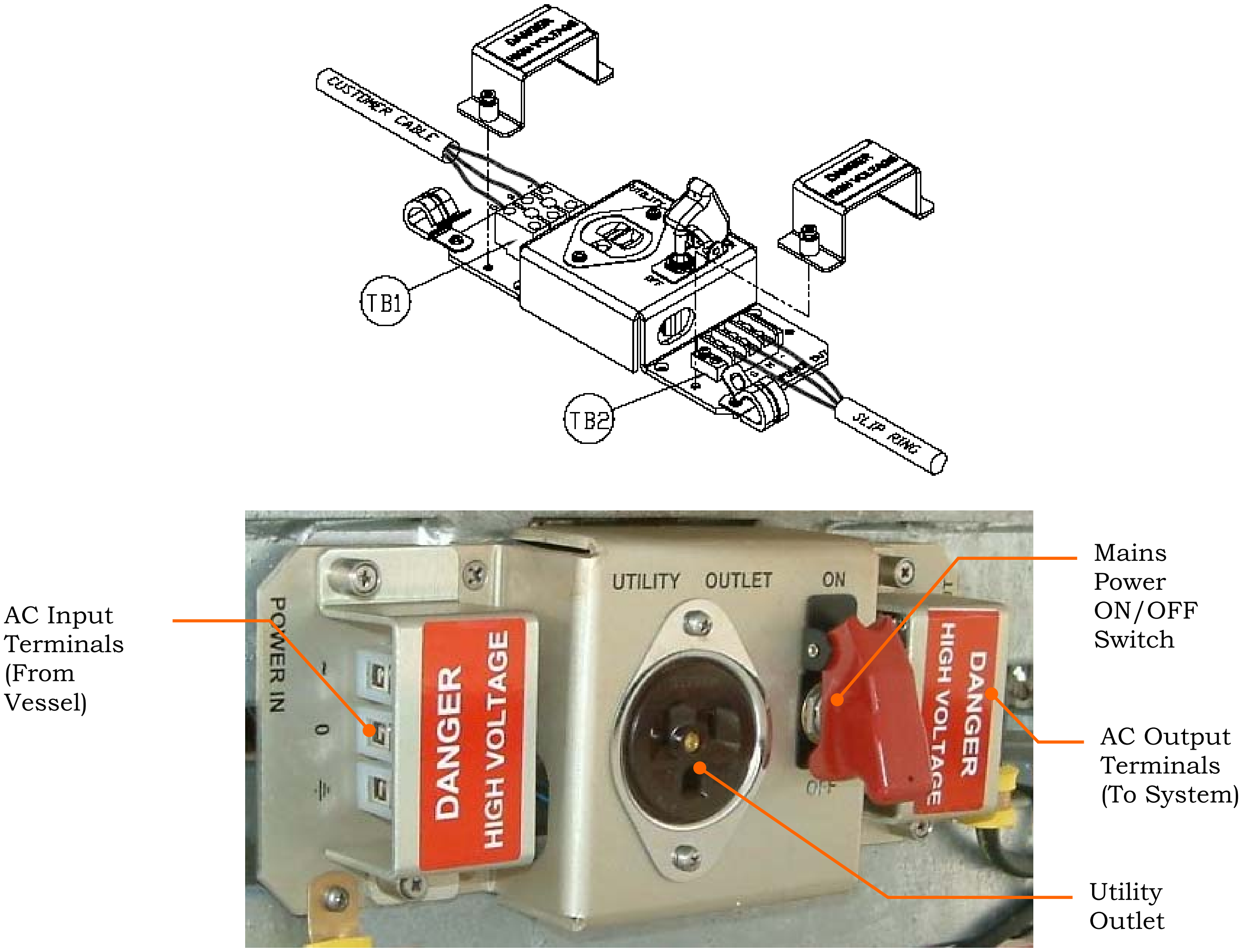


Figure 2-25:ADE Power Connection Box – Original Configuration

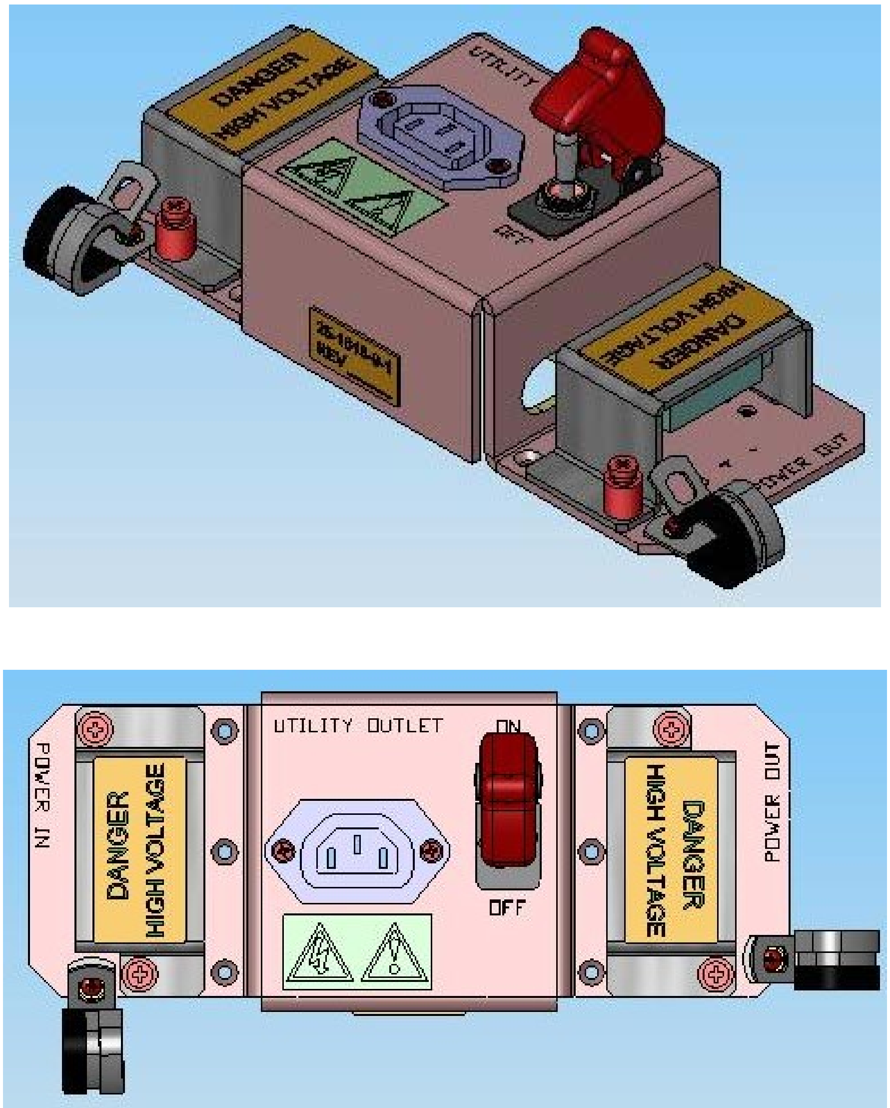


Figure 2-26:ADE Power Connection Box – Modified Configuration

---

WARNING!

The Utility Outlet is connected directly to the vessel's AC voltage input terminals (125 VAC / 250 VAC). Therefore, there still exists live voltage at the Utility Outlet after disconnecting the power supply to the ADE using the Mains Power On/Off Switch.

Note

Only qualified and authorized personnel are allowed to carry out system service / maintenance procedures.

2.1.3 Below Deck Equipment (BDE)

Central Control Unit (CCU)

The Central Control Unit serves both as the AL-7103 system Man-machine terminal as well as the interface to the ships Gyrocompass and the customer's modem L-Band Tx/Rx.

The CCU provides host-computer control via Ethernet communication link. Operating under a Windows operating system, the CCU uses the MtsLink software to control and monitor the system.

The CCU is based on a 19" rack-mounted 5U industrial PC (including a 1U keyboard-and-mouse drawer), and it is usually located in the Radio Room or the TV Distribution Room.

The front panel includes a TFT screen, and together with an external keyboard (mounted on a dedicated drawer), they both provide convenient Man-Machine Interface (MMI) with the CCU.

The rear panel includes several connectors, which are used for interface with the ADE, with the modem, and with the ship/vessel, e.g. interface to ship gyro compass (NMEA-0183, Synchro & S.B.S).

The CCU contains the BDMx module, which provides single-cable interface with the ADMx.

The CCU is also able to provide on-line GPS info to the satellite modem, if needed.

The following Figures provide external and internal views of the CCU.

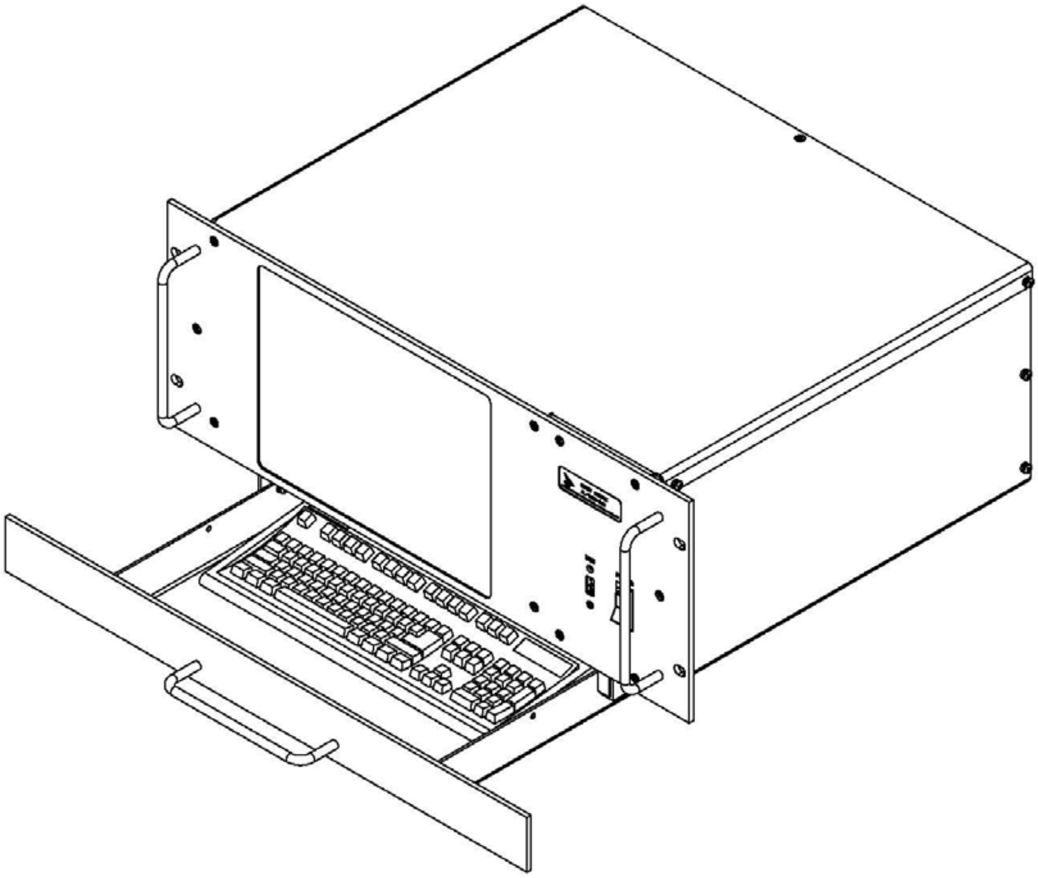


Figure 2-27: CCU General View

Figure 2-28: CCU Front Panel

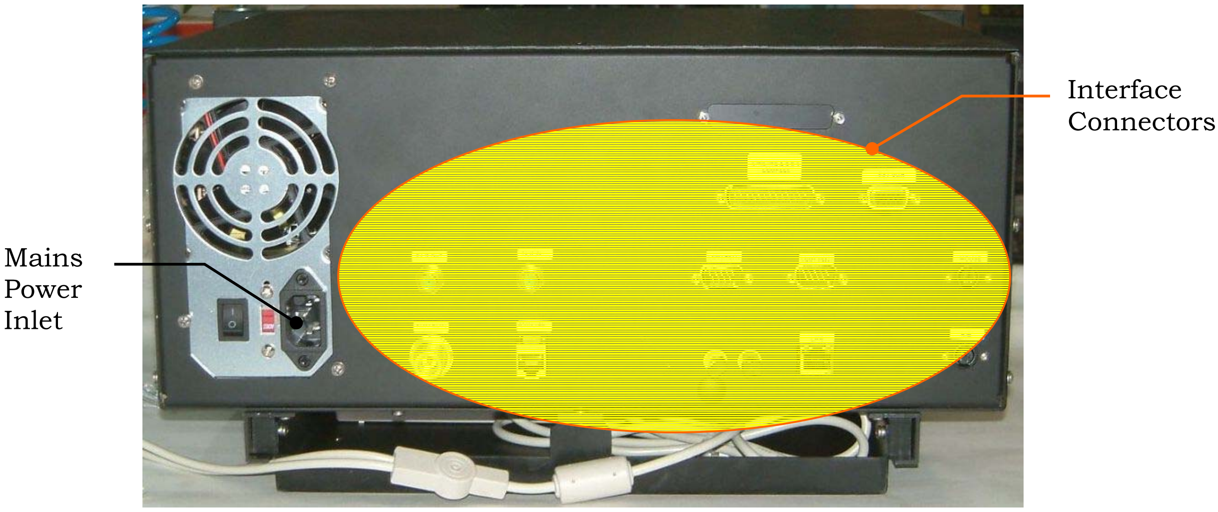


Figure 2-29: CCU Rear Panel

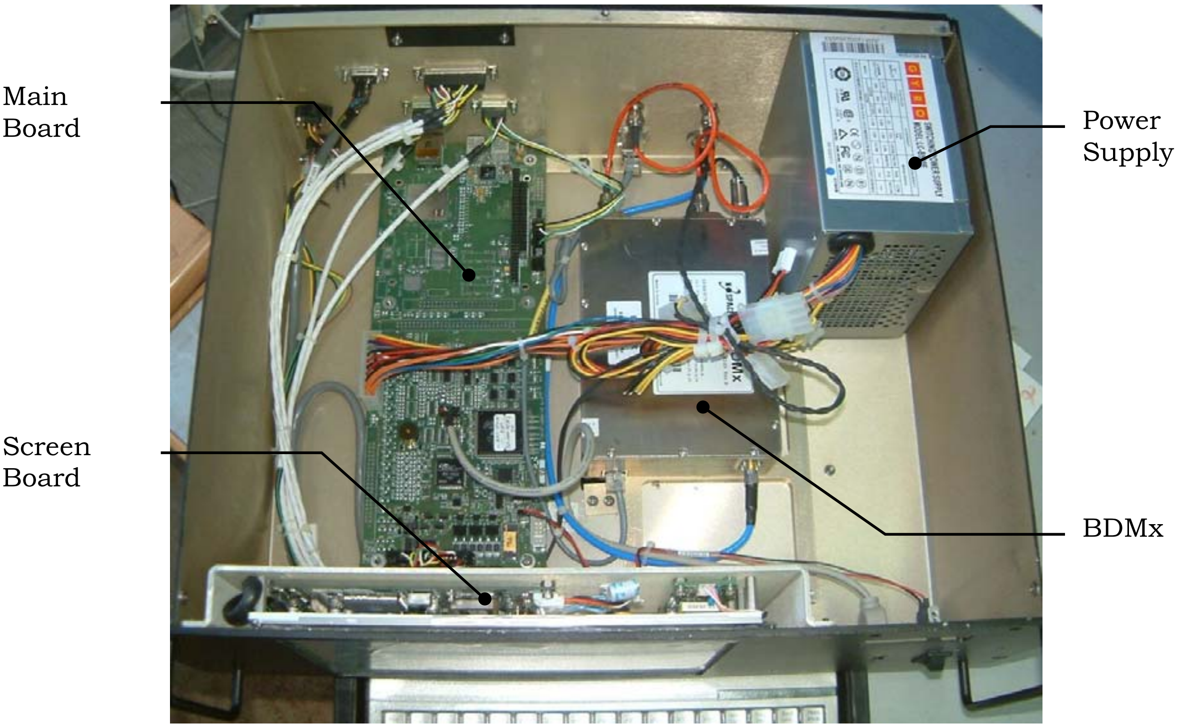


Figure 2-30: CCU Internal View

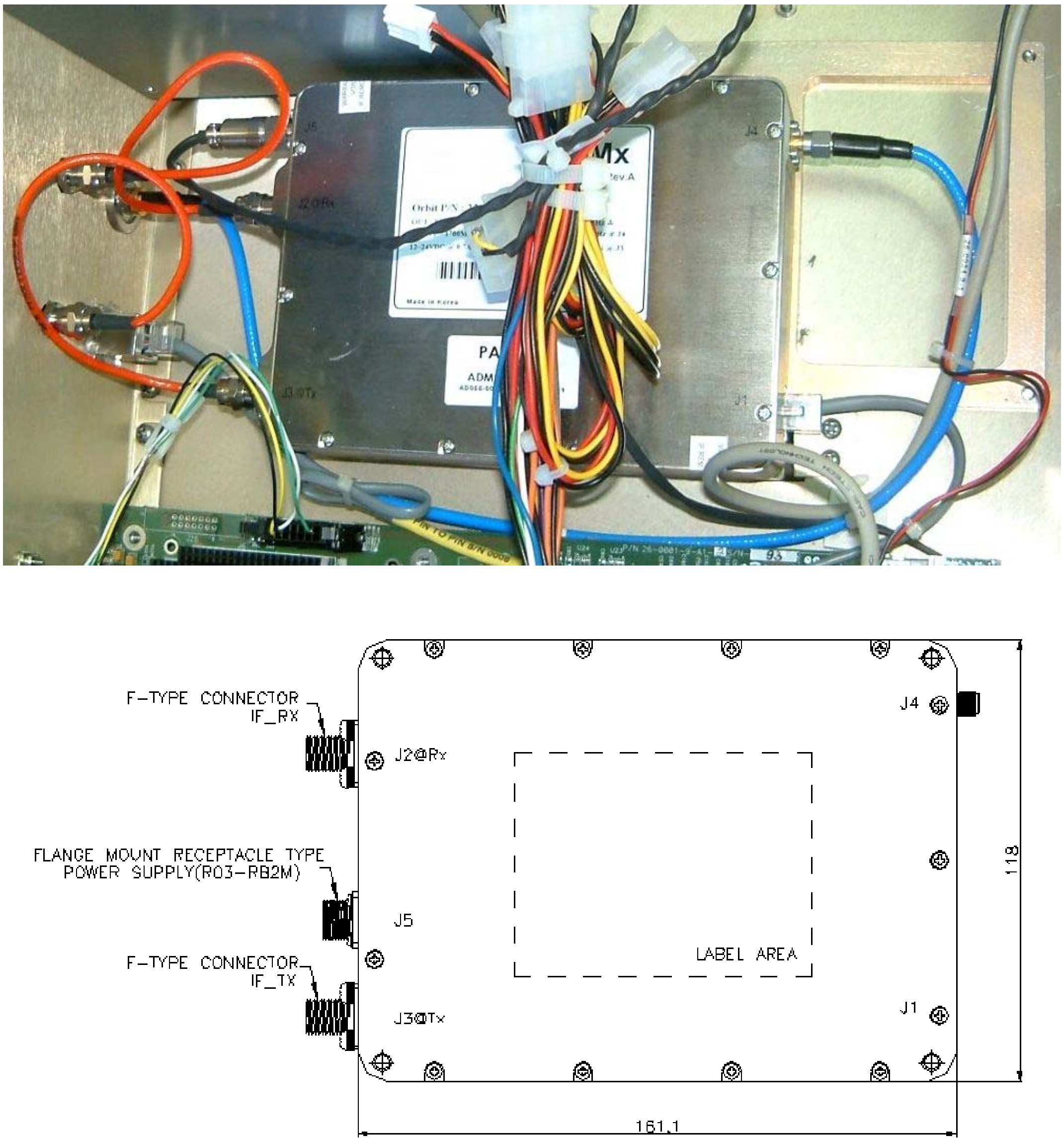


Figure 2-31:BDMx Assembly (Inside the CCU)

Modem and Distribution Array

The modem provides all the functionality required to transmit /receive data in L-band, and can connect to a HUB, Router or Switch (depending on the Modem type).

The modem and distribution array items are supplied and installed by a third-party, therefore, they are not described in this manual.

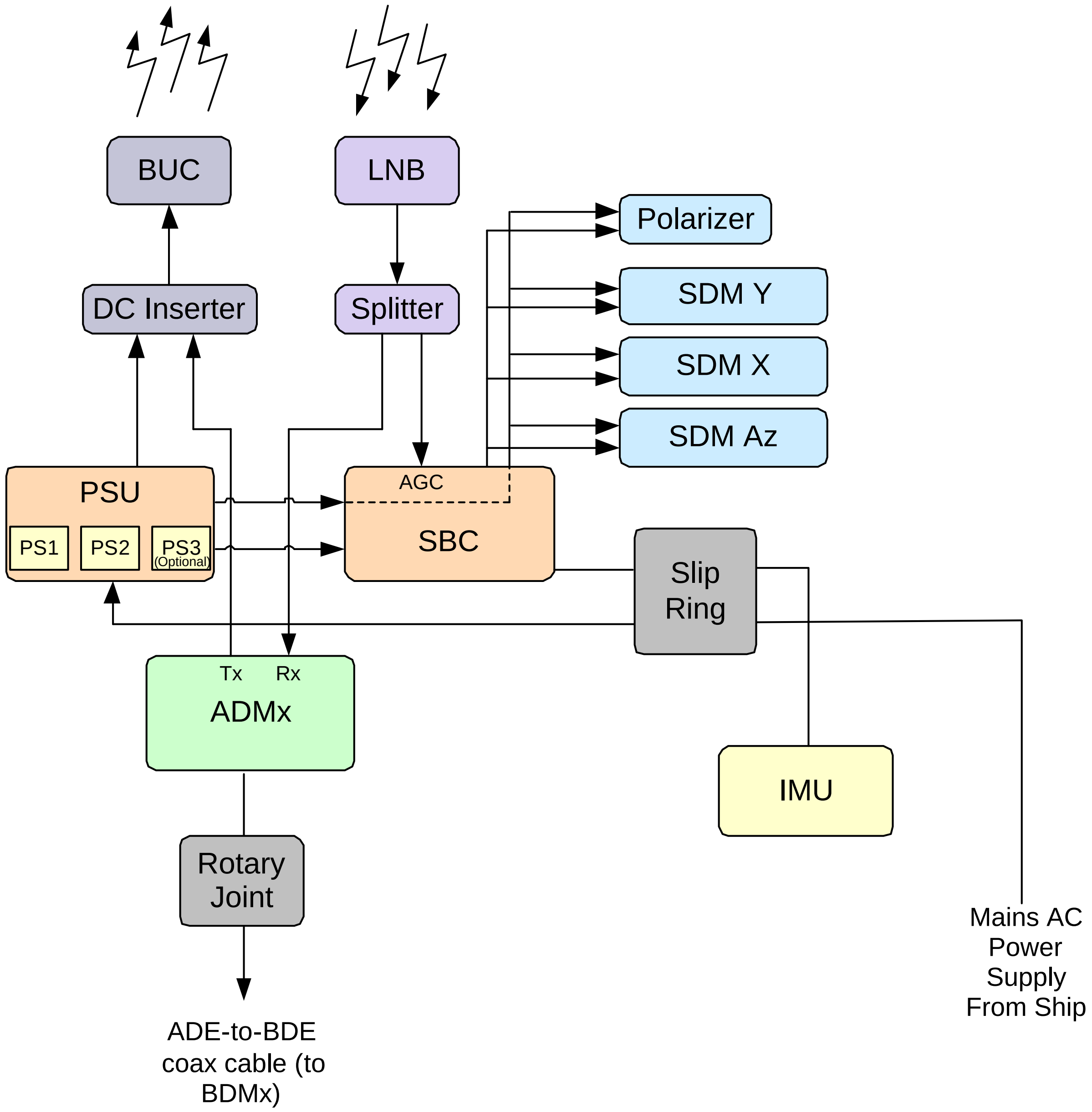
2.2 Block Diagram Description

2.2.1 Overall System Description

The System is divided to the Above Deck Equipment (ADE) contained inside a Radome, and the Below Deck Equipment (BDE) that includes a Control computer (CCU) that provides a Man Machine Interface to the ADE. The CCU is connected to the compass and the satellite modem (provided by the customer).

The following Figures provide several levels of the system's block diagram:

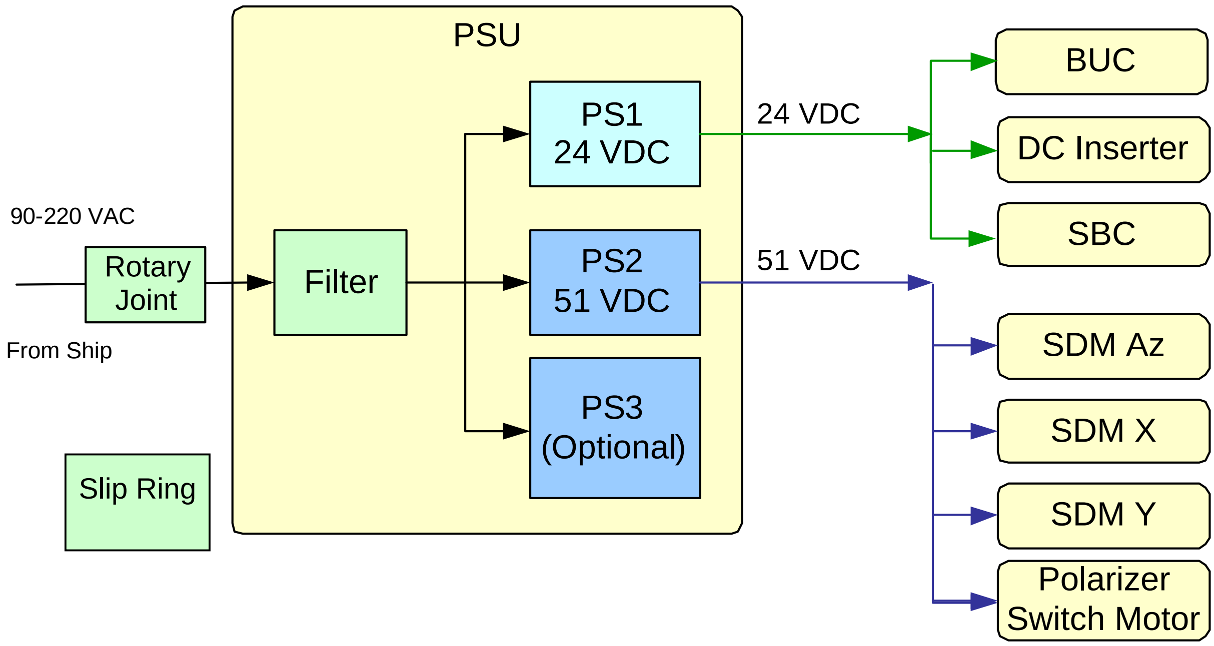
- ADE Overall Block Diagram
- ADE Power Distribution Block Diagram
- ADMx-BDMx Link



When the system is supplied with a BUC that does not require DC supply via the L-Band coax, the DC Inserter is not installed.

Note that there also may be a situation where the DC inserter, although physically present, is actually bypassed and not used. This may occur in case the system was upgraded on-site to include a BUC which does not require DC supply via its L-Band coaxial connector.

Figure 2-32:ADE Overall Block Diagram



Note	When the system is supplied with a BUC that does not require DC supply via the L-Band coax, the DC Inserter is not installed. Note that there also may be a situation where the DC inserter, although physically present, is actually bypassed and not used. This may occur in case the system was upgraded on-site to include a BUC which does not require DC supply via its L-Band coaxial connector.

Figure 2-33:Power Distribution Block Diagram

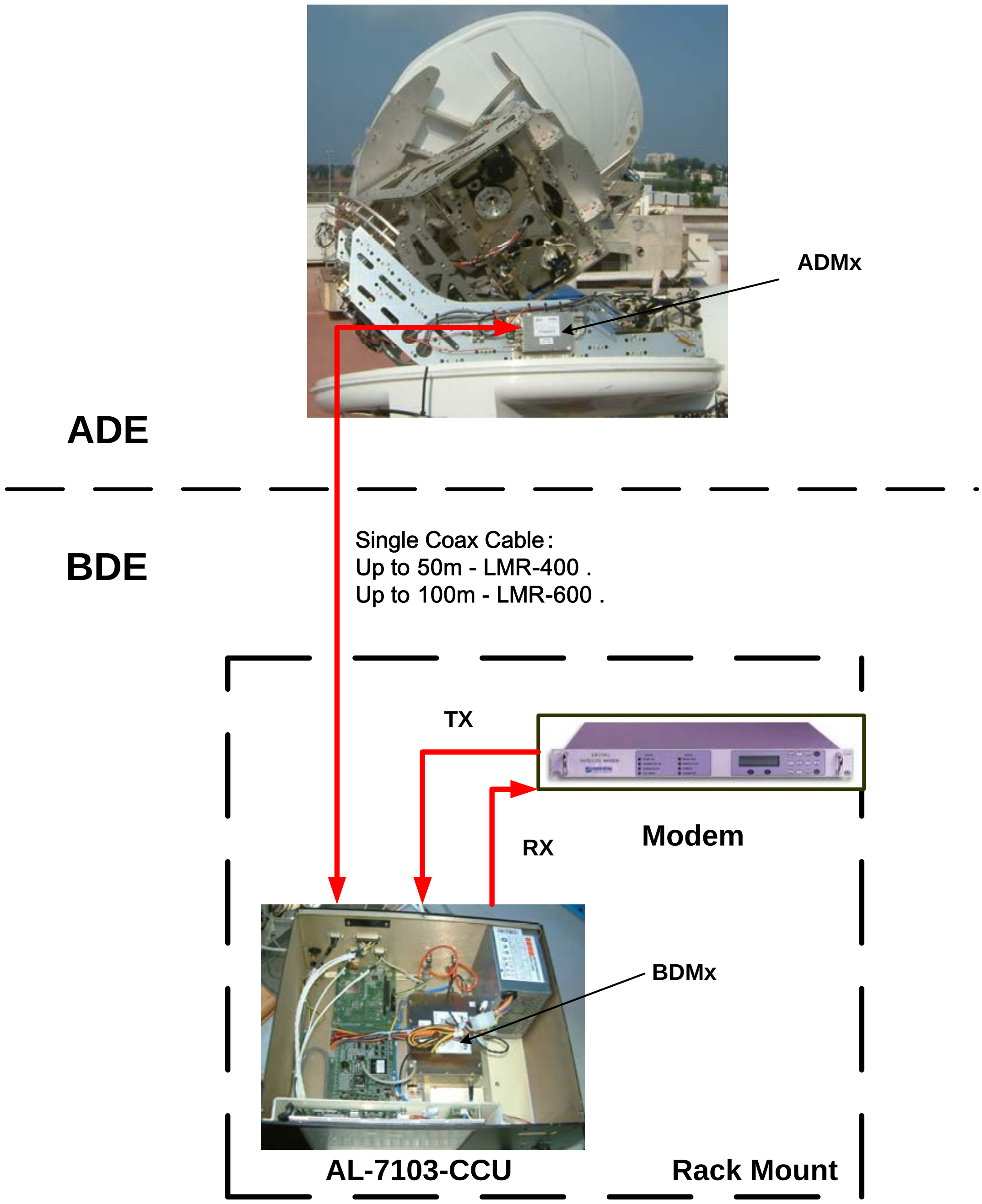


Figure 2-34:ADMx-BDMx Link Block Diagram

2.2.2 ADE-BDE Link (ADMx/BDMx Modules)

The ADMx and the BDMx multiplexer modules are used to establish an ADE-to-BDE link that minimizes the required cabling and uses only a single coax cable (LMR-400 or LMR-600 cable, depending on cable length), carrying the following multiplexed signals:

- Modem L-Band Rx
- Modem L-Band Tx
- Modem 10 MHz Sync to the BUC (and to the LNB, if required)
- CCU to SBC LAN connection for monitoring and control (M&C)

Altogether the single coax holds 10 MHz to 4.7 GHz bandwidth.

Both above decks (ADMx) and below decks (BDMx) multiplexers have integral amplification, making it possible to receive antenna signals on the optimal level on the modem L-Band Rx input, from one hand, while having full control over the BUC power from the other hand.

The ADE-BDE Interconnection is designed for best performance when using a Times LMR-400 type of cable for lengths of up to 50m and LMR-600 type of cable for lengths of up to 100m.

The following Figure depicts the ADMx-BDMx link, including the various signals that are multiplexed and carried between the ADE and BDE.

The Link gain values are as follows:

- Tx Path from modem to BUC – 17 dB, min.
- Rx Path from LNB to Modem – 25 dB, min.

Figure 2-35:ADMx and BDMx Units

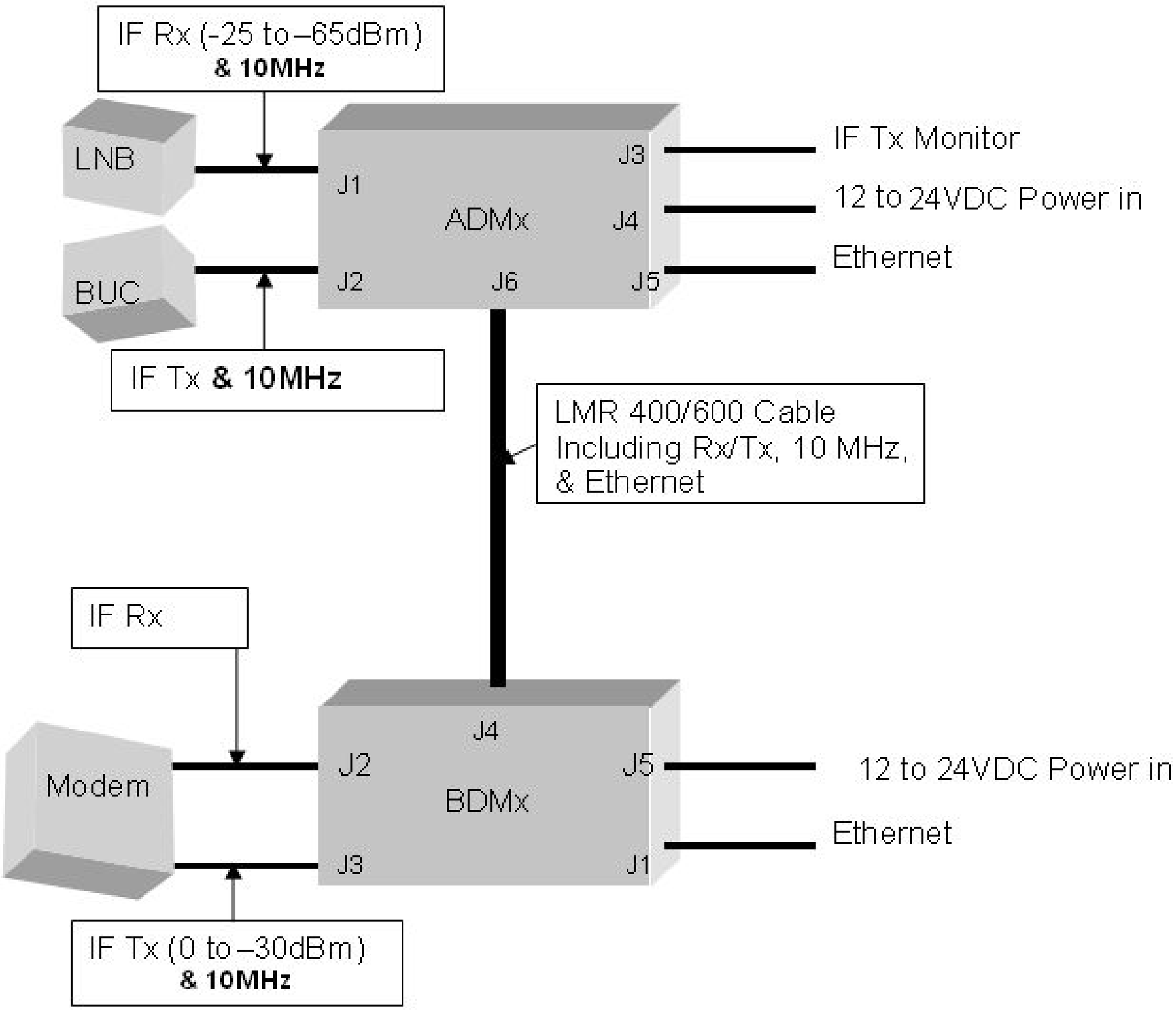


Figure 2-36:ADMx-BDMx Link

2.3 ADE Interconnections and Cables

The AL-7103 ADE wiring is comprised of the following:

- Main Control harness connecting the SBC with all three SDMs
- Rx Coaxial path connecting the LNB to the ADMx and the SBC
- Tx Coaxial path connecting the BUC to the ADMx
- Single Channel Rotary Joint passing on the ADE-BDE connection to the ADMx
- Multiple Slip-ring assembly passing on the AC Mains power to the PSU as well as the IMU power and control signals to the SBC.

When the system is supplied with a BUC that does not require DC supply via the L-Band coax, the DC Inserter is not installed.

Note that there also may be a situation where the DC inserter, although physically present, is actually bypassed and not used. This may occur in case the system was upgraded on-site to include a BUC which does not require DC supply via its L-Band coaxial connector.

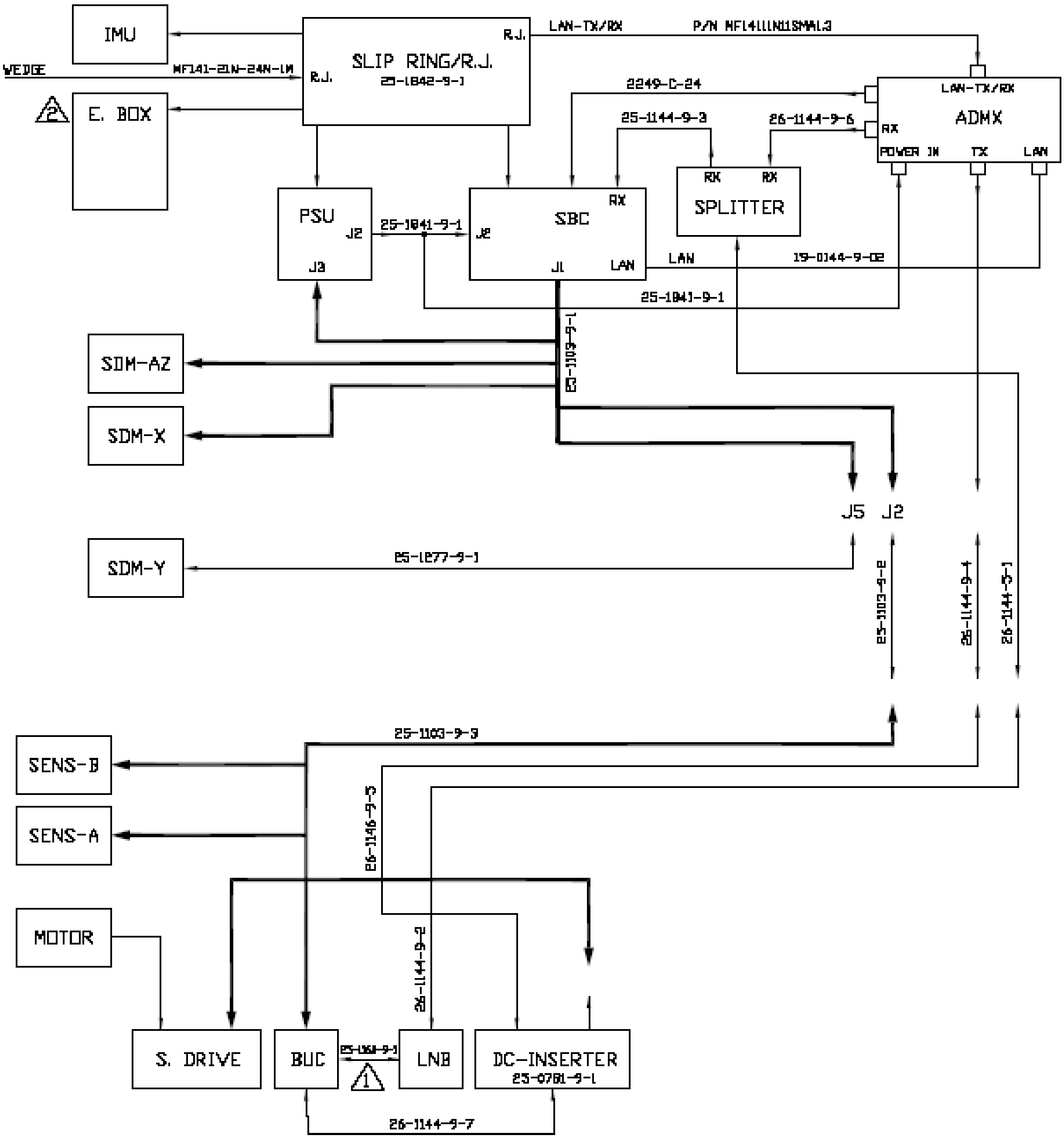


Figure 2-37:OrSat (AL-7103-Ku Mk II) System - ADE Cabling Diagram

CABLE TABLE

No.	CABLE P/N	CABLE DESCRIPTION
1	25-1841-9-1	PSU TO SBC POWER CABLE
2	25-1103-9-1	MAINE HARNESS AL-7103-SYSTEM
3	25-1103-9-2	SPIN THRU WEDGE CABLE
4	25-1103-9-3	POL-DISH CABLE
5	26-1144-9-1	RF CABLE 1.2M RX-WEDGE/RX SPLITER
6	26-1144-9-2	RF CABLE 1.3M RX-WEDGE/RX-LNB
7	26-1144-9-3	RF CABLE 0.65M RX-SPLITER/RX-ADMX
8	26-1144-9-4	RF CABLE 1.22M SPIN TO WEDGE
9	26-1144-9-5	RF CABLE 1.3M WEDGE TO DC INS.
10	26-1144-9-6	RF CABLE LNBR/SBC F-MALE 0.25M
11	26-1144-9-7	RF CABLE BUC/SBC N-MALE 0.5M
13	25-1277-9-1	SDM-Y SPIN THRU X AXIS (J5-SDM)
14	25-1160-9-1	BUC RF CABLE TO FEED 8W
15	25-1842-9-1	SLIP RING WIRING
16	MF14111N11SMA1.3	LAN-TX/RX INPUT CABLE R.J./ADMX
17	2249-C-24	ADMX TO SBC CABLE
19	MF141-21N-24N-1M	LAN-TX/RX INPUT WEDGE TO R.J.
20	19-0144-9-02	LAN CABLE SBC TO ADMX

Figure 2-38:OrSat (AL-7103-Ku Mk II) System - ADE Cables

2.4 System Technical Specifications

2.4.1 Weight

- 270Kg (595lb)

2.4.2 Packaging

- Weight: 400Kg (880lb)
- Dimensions
  - L= 1600 mm (63")
  - W= 1600mm (63")
  - H = 1825mm (71.8").

2.4.3 Radome

♦ Dome Diameter:	1.28m (50”)
♦ Base Diameter:	1.415m (55.7”)
♦ Radome Height:	1.610m (63.4”)

2.4.4 CCU Interfaces

♦ Modem Lock (IRD)	Yes
♦ VGA Out:	Yes
♦ LAN:	Yes
♦ USB (for SW update):	Yes
♦ Ship Gyro Interface	NEMA 0183 Synchro Step-by-Step

2.4.5 CCU Power Requirements

115VAC/220VAC 50Hz/60Hz (Switch), 150W

2.4.6 Antenna System

♦ Antenna Type:	Gregorian Dual offset
♦ Antenna diameter:	45” (1.15m)

2.4.7 Frequency Operation

♦ Tx:	13.75-14.5 GHz
♦ Rx:	10.95-12.75 GHz
♦ Antenna Polarity:	Linear H/V

2.4.8 Gain

♦ Tx:	42.5dBi @14.25 GHz
♦ Rx:	41dBi @11.70 GHz
♦ Cross-Pol. Discrimination:	35dB
♦ System G/T	19 [dB/K°], @ 11.7 GHz, 20° el.
♦ Sidelobe levels	29-25log(θ) dBi for 1.25° <θ<7°
	+8 dBi for 7° <θ<9.2°
	32-25log (θ) dBi for 9.2° <θ<48°
	-10 dBi for 48° <θ<180°
♦ Radome Loss:	0.3dB Typical

2.4.9 LNBs

- 1 of 3 Bands, available on request

♦ Frequency	10.95-11.70 GHz, 11.70-12.2GHz, 12.25-12.75GHz.
♦ N/F:	0.7 dB
♦ LO Stability:	±10 KHz (max.)
♦ GPS	Built-In
♦ Satellite Narrow-Band Tracking Receiver (**NBR**):	Built-In
♦ Radio Package:	4W or 8W BUC

2.4.10 Range of Motion

- Full hemispherical coverage, down to satellite elevation view angle as low as 0° at all sea conditions.
- With no mechanical “points of singularity” (No “Keyholes” at Zenith & Horizon).

♦ Azimuth:	Continuous
♦ Elevation:	0° to 90° (view angle including ship motion))
♦ Polarization:	V/H
♦ Pointing Accuracy:	0.1° RMS.

2.4.11 Ship Motion

♦ Roll:	±30° @ 8 sec.
♦ Pitch:	±15°@ 6 sec.
♦ Yaw:	±8° @ 15 sec.
♦ Turning Rate:	12°/sec

2.4.12 Electrical Interfaces

Power Requirements:

♦ AC (ADE)	AUTO RANGE, 90 to 250 VAC, 50/60 Hz, 350W, (with 4W BUC)

L-band:

♦ RX:	950 – 1950 MHz
♦ TX:	950 – 1450 MHz (STD) 950 – 1700 MHz (EXT)

GPS out:

♦ Update rate:	1 per second
♦ Availability:	Continuously

NBR Bandwidth:

- ♦ 0 – 70KHz (50KHz)

Or

- ♦ 70 – 180KHz (150KHz)

Or

- ♦ 180 –400KHz (300KHz)

♦ Beacon Signal (for the NBR):	Min. C/N 10dB per relevant B/W

2.4.13 Environmental Conditions for Above Deck Equipment (ADE)

♦ EMI/RFI:	EN60945: 2002 (Maritime Radio System Testing) & ETSI EN 302 340 Sec. 4.2.1
♦ Shock:	MIL-STD 810E Method 516.5 Pro. I
♦ Vibration:	MIL-STD-167-1 (Mast Mounted)
♦ Temperature:	-20°C to +60°C
♦ Humidity:	Up to 100% @ 40°C
♦ Wind Speed:	100 Knots

3 Principles of Operation

3.1 Acquisition and Tracking Algorithm

Maintaining a constant look angle towards the satellite is achieved by combination of following the feedback of the IMU ("Stabilization") and periodically slight off-bore-site movement of the antenna so as to peak it to the point of maximal reception ("Step-track").

Stabilization and Step-tracking of the antenna so as to maintain constant view angle towards the satellite is considered in this manual as "Tracking".

The OrSat (AL-7103-Ku Mk II) system is designed to acquire and track a pre-selected satellite. For the system, the satellite is an entity defined by the following three parameters:

- Satellite location on the Geo-stationary arch: positive for East and negative for West longitudes, for example: -4.0 for Amos 4.0 deg West.
- Tracking ("Hunt") frequency, given in L-Band MHz, for example 1200.0 MHz
- Rx Polarization selection: Vertical ("Pol-A") or Horizontal ("Pol-B")

On the reception of the Acquisition command, the OrSat (AL-7103-Ku Mk II) system will engage in a series of automatic actions designed to acquire and track the pre-selected satellite defined by the above three parameters, as depicted in the following diagram:

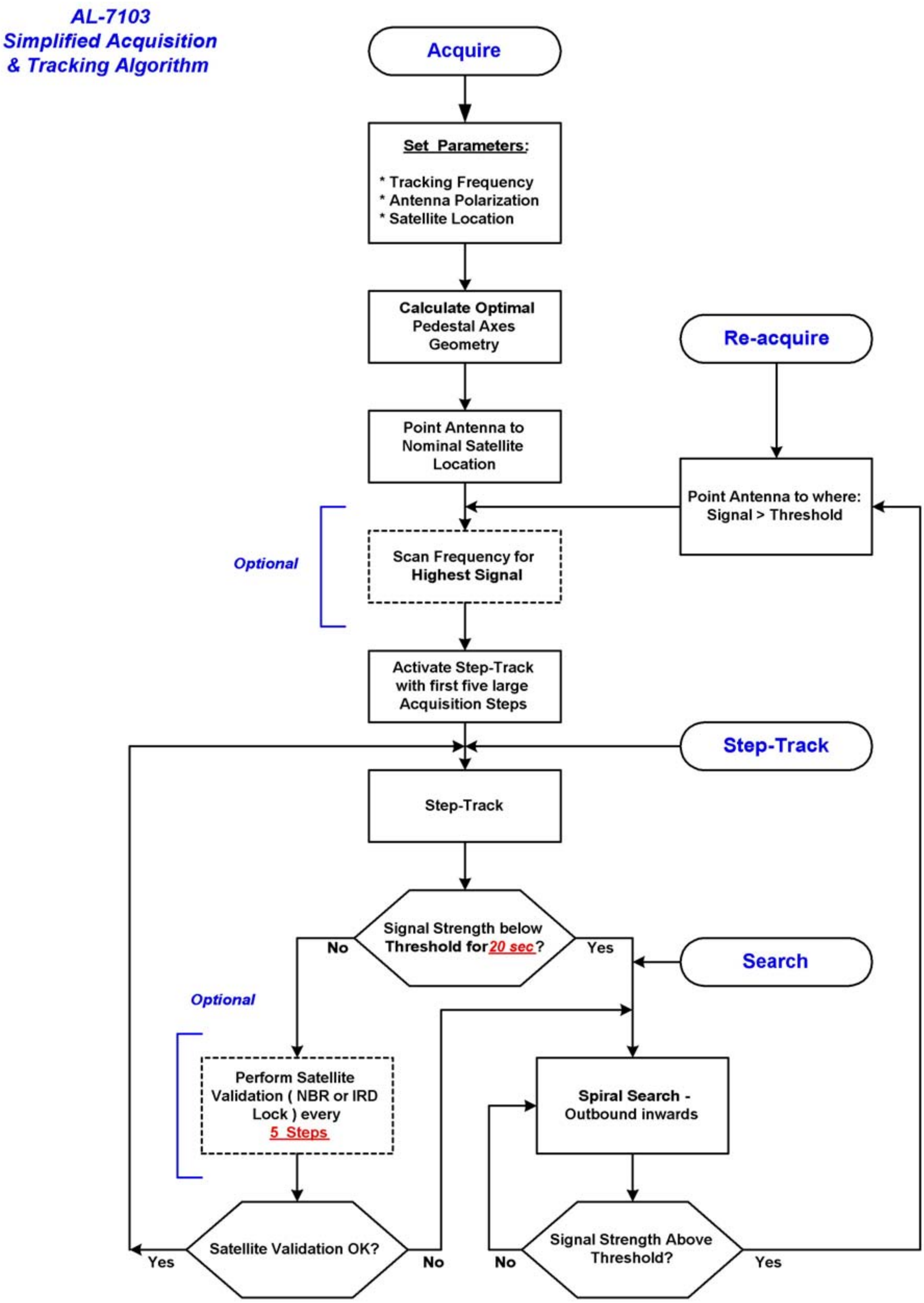


Figure 3-39:AL-7103-Ku Mk II System – Simplified Acquisition and Tracking Algorithm

3.2 Modes of Operation

In principal, after proper installation, set-up and alignment, the OrSat (AL-7103-Ku Mk II) system will function in a completely automatic manner, i.e., after power-up the system will automatically acquire and track the last selected satellite without any intervention from an external operator.

The AL-7103-Ku Mk II system utilizes a number of lower level modes of operation, all to achieve this: Satellite Acquisition, Tracking, Validation, Searching and Re-acquisition

The advanced AL-7103-Ku Mk II system Man-machine interface (CCU screen and keyboard) allows activation of each and every of the lower-level modes, independently. Moreover – quite a number of modes are introduced to allow system installation, set-up, alignment and check-out. Among those are:

- Satellite Manual Pointing and Maintenance
- Mechanical Axes Manual Pointing and Maintenance
- Graphical Logger screen
- Spectrum Analyzer screen
- BUC Monitoring screen.

The utilization of some of the most frequently used functions is described in the Frequently Used Functions (FUF) manual.

3.3 Tracking Receiver Feedback

A good quality signal strength indication is needed for the Step-track part of antenna tracking. "Good quality" is considered an indication having as much of Signal to Noise ratio as possible.

The tracking signal coming from the satellite may be one of the following:

- Satellite Beacon: normally un-modulated CW
- Customer Data Channel: normally occupying few hundred KHz to few MHz of bandwidth, with digital modulation (QPSK or BPSK)
- Unique tracking channel, put up by the customer especially for tracking
- Wide-band TV transponder, digital or analog.

The AL-7103-Ku Mk II system set-up may be adjusted to accommodate each of the above using either the Wide-band or Narrow-band tracking receiver selection.

To achieve optimal performance, following selections are recommended:

- Satellite Beacon: Narrow-band receiver with 50KHz filter
- Customer Data Channel: Narrow-band receiver with either 50, 150 or 300 KHz filter as per the Data Channel occupied bandwidth

- Special tracking channel – Normally this is a 16 Kbps or 32 Kbps QPSK modulated signal: Narrow-band receiver with 50 KHz filter
- Wide-band (TV) transponder, digital – Wide-band receiver or Narrow-band receiver
- Wide-band TV transponder, analog – Wide-band receiver.

Another important aspect to be considered is the fact that the selected tracking is unique to the selected satellite and does not exist, or at least is received on a considerable lower level, from adjacent satellites.

If this is not the case, the AL-7103-Ku Mk II system might lock onto an adjacent satellite.

In general, the priority for selection of tracking signal from this perspective will be as follows:

- Special tracking channel – uniquely defined within the group of adjacent satellites
- Satellite beacon –uniquely defined for the same type of satellites, still must make sure that two adjacent satellites do not have the same beacon!
- Customer Data Channel
- Wide band (TV) transponder, digital or analog.

3.4 Satellite Validation

3.4.1 Introduction

During tracking, a situation may develop where the antenna will lock onto an incorrect target, such as:

- Adjacent satellite producing signals in the same exact frequency range as the AL-7103 tracking feedback
- Terrestrial source of electromagnetic interference in the above mentioned spectrum range
- Strong reflections from obstructing structures, producing wide-band noise, covering the relevant part of the spectrum.

The AL-7103-Ku Mk II system tracking may be set-up to periodically check if it is locked on the right satellite.

This is possible only if additional information regarding the satellite validity may be obtained.

Two options may be utilized:

- Satellite Modem Lock indication (“IRD Lock”)
- Narrow Band Receiver Lock indication (“NBR Lock”).

3.4.2 IRD Lock

The AL-7103-Ku Mk II system is able (per appropriate set-up) to periodically check the status of a Go/No-go indication coming from the modem, signaling that the modem has (and is) successfully locked on the data stream received from the satellite.

Taking into account that the data stream is defined by quite a few parameters (such as Frequency, Modulation, Data-rate, Coding, Rate of Forward Error Correction) one can see that the chance for an exact same signal to be present on another satellite will be quite low.

This fact turns it into a powerful tool to make sure that the antenna is indeed not locked on some noise and is tracking the right satellite.

3.4.3 NBR Lock

Introduction

The AL-7103-Ku Mk II system includes a Narrow-Band Receiver (NBR), contained within the SBC. The primary function of the NBR is to validate that the AL-7103-Ku Mk II system is not locking onto noise or clutter after temporary blockage, obstruction, interference or clutter.

The Narrow band receiver will give a “Lock” status if for the following situation:

- Receiver Bandwidth is set to “50KHz” when the signal is CW-70KHz range
- Receiver Bandwidth is set to “150KHz” when the signal is 70-200KHz range
- Receiver Bandwidth is set to “300KHz” when the signal is 200-400 KHz range.

The minimal signal S/N is 52 dB.

The following procedures detail how to activate the NBR function, and how to select the desired IF bandwidth.

L-Band Power Detector

The NBR L-Band Power Detector, depicted in the following Figure, is a part of the antenna positioning control loop of the satellite communication system. It receives the full satellite 1st IF band of 920-2150 MHz and eventually filters out a specific narrow band PILOT signal of a specific satellite. The Pilot signal is received by a dual-conversion scheme and all surrounding signals filtered out by a switched narrow band BPF bank (50 KHz, 100 KHz, 300 KHz), to be detected by a very precise power detectors scheme with 0.1 dB changes in pilot power detection capability.

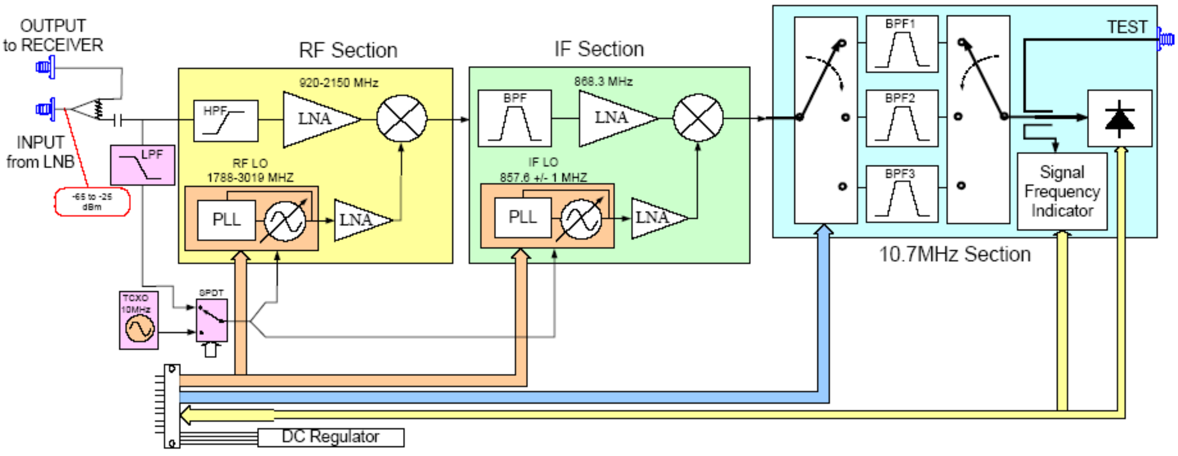


Figure 3-40:NBR L-Band Detector

4 Getting Started - Basic System Operation

4.1 System Start-Up

➢ **To Power Up the System:**

- Turn the ADE and the CCU's POWER switch ON.

  Operating system messages are displayed, and then the Banner/Self-Test screen appears for a period of 10 seconds, during which a 10-to-0 countdown is displayed.

The system can be operated from Basic Operation screen or Operation screen, which provides additional operating capabilities.

Under normal conditions the ship's **operator** will use the **Basic Operation screen**. To enter Basic Operation screen, wait for the 10-to-0 countdown to end.

- If you need to enter the Operation screen, press <C> key during the 10-to-0 countdown, or <O> in the Basic Operation screen.

  The ENTER PASSWORD window is displayed. Type your password and press ENTER.

The power-up sequence is fully automatic, provided that the system is configured to Auto-Start (default setting). At the end of power-up, the system is locked on the satellite that was last selected and saved prior to system shutdown.

4.2 Basic Operation Screen

The Basic Operation screen is the main system screen for the operator, which provides basic needed operation capabilities.

Figure 4-4 illustrates Operation screen main sections.

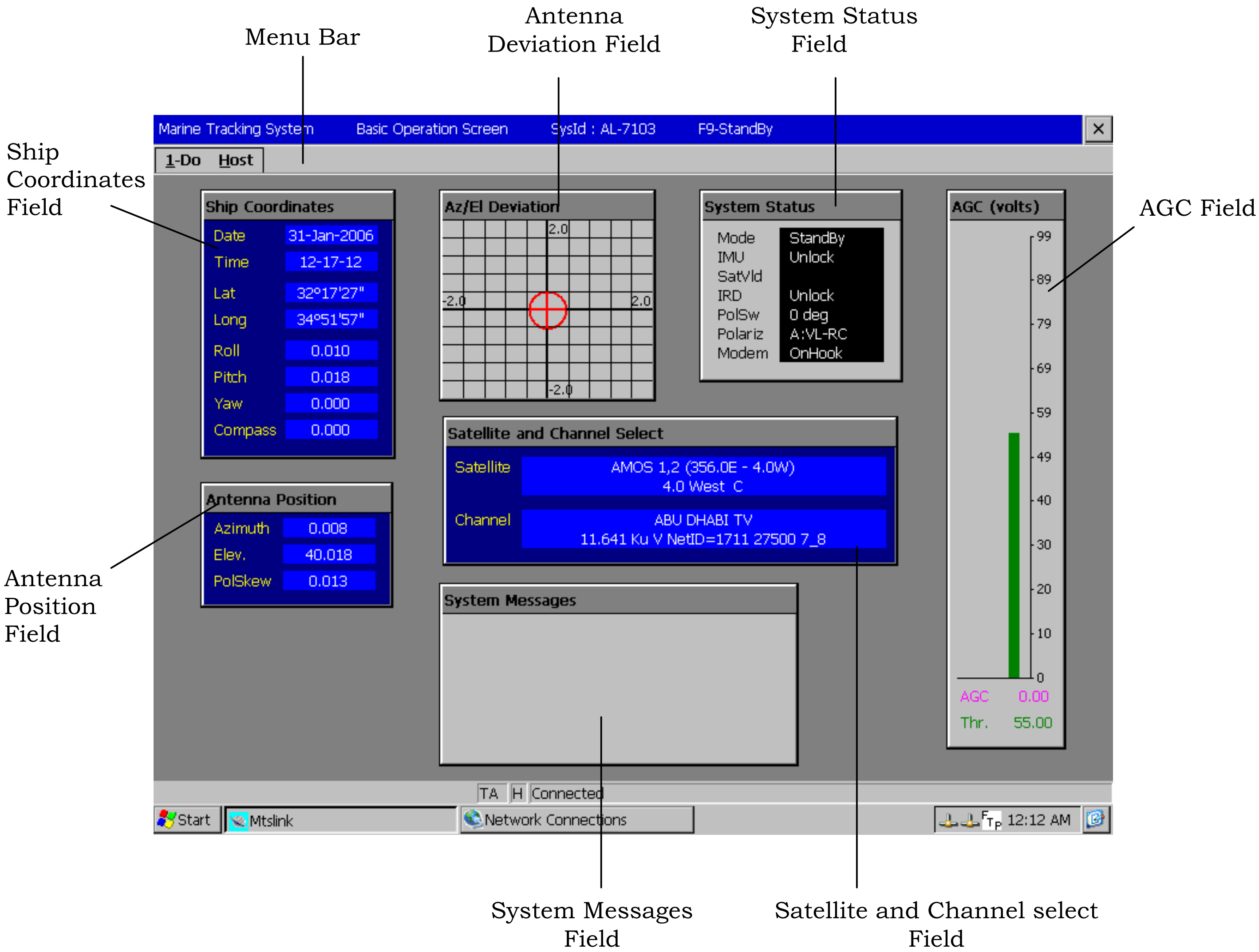


Figure 4-41:Basic Operation Screen

Selecting the Do option from the menu bar will open the operation menu that allows basic functions to be activated. These operations will be explained later in this manual.

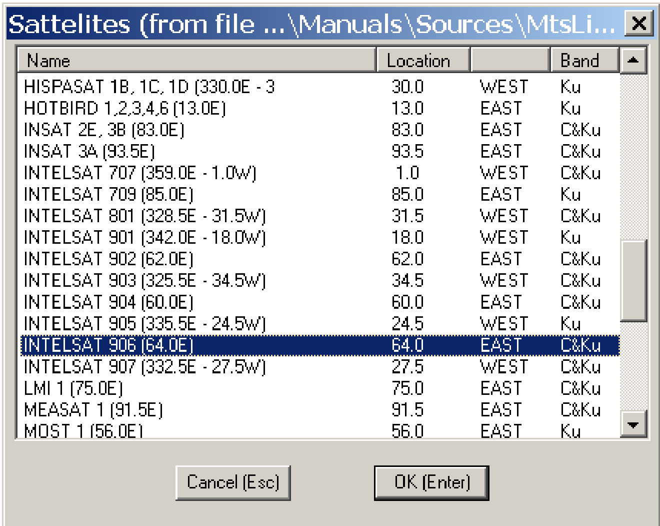
4.3 Selecting a Satellite and Channel (Narrow Band Receiver Activated)

When power-up is completed, the system is automatically locked onto the satellite that was last selected and saved prior to system shutdown.

➢ **To select a different Satellite:**

1. Type <1> for the DO MENU bar (or click on DO), Type <S> for SATELLITE (or click SATELLITE).

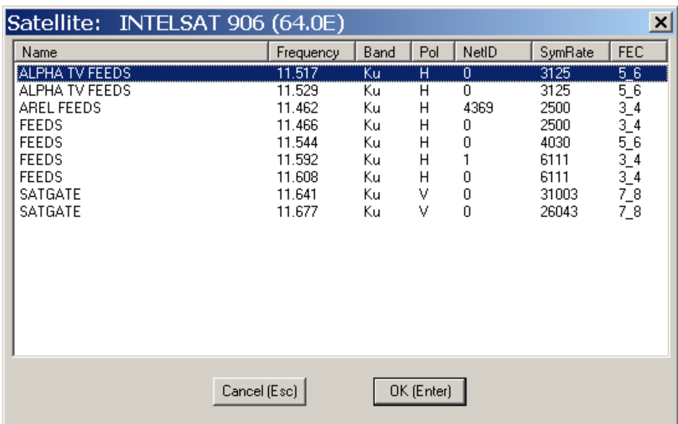
   The SATELLITE window appears.



Name	Location		Band
HISPASAT 1B, 1C, 1D (330.0E - 3	30.0	WEST	Ku
HOTBIRD 1,2,3,4,6 (13.0E)	13.0	EAST	Ku
INSAT 2E, 3B (83.0E)	83.0	EAST	C&Ku
INSAT 3A (93.5E)	93.5	EAST	C&Ku
INTELSAT 707 (359.0E - 1.0W)	1.0	WEST	C&Ku
INTELSAT 709 (85.0E)	85.0	EAST	Ku
INTELSAT 801 (328.5E - 31.5W)	31.5	WEST	C&Ku
INTELSAT 901 (342.0E - 18.0W)	18.0	WEST	Ku
INTELSAT 902 (62.0E)	62.0	EAST	C&Ku
INTELSAT 903 (325.5E - 34.5W)	34.5	WEST	C&Ku
INTELSAT 904 (60.0E)	60.0	EAST	C&Ku
INTELSAT 905 (335.5E - 24.5W)	24.5	WEST	Ku
INTELSAT 906 (64.0E)	64.0	EAST	C&Ku
INTELSAT 907 (332.5E - 27.5W)	27.5	WEST	C&Ku
LMI 1 (75.0E)	75.0	EAST	C&Ku
MEASAT 1 (91.5E)	91.5	EAST	C&Ku
MOST 1 (56.0E)	56.0	EAST	Ku

2. Click on the desired satellite, and select it by pressing ENTER or clicking OK.

   The SATELLITE window appears, listing the available selected-satellite tracking control channels. **Disregard this window-by pressing enter.**

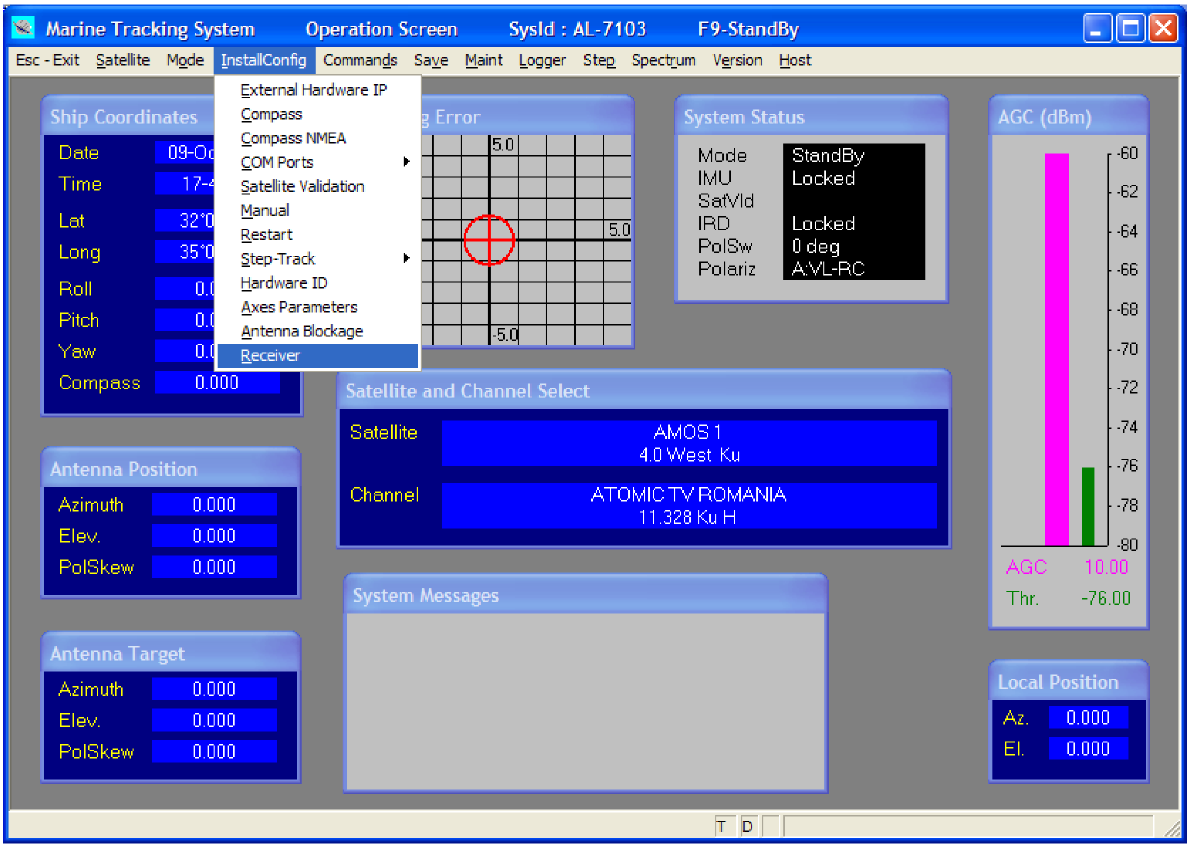


Name	Frequency	Band	Pol	NetID	SymRate	FEC
ALPHA TV FEEDS	11.517	Ku	H	0	3125	5_6
ALPHA TV FEEDS	11.529	Ku	H	0	3125	5_6
AREL FEEDS	11.462	Ku	H	4369	2500	3_4
FEEDS	11.466	Ku	H	0	2500	3_4
FEEDS	11.544	Ku	H	0	4030	5_6
FEEDS	11.592	Ku	H	1	6111	3_4
FEEDS	11.608	Ku	H	0	6111	3_4
SATGATE	11.641	Ku	V	0	31003	7_8
SATGATE	11.677	Ku	V	0	26043	7_8

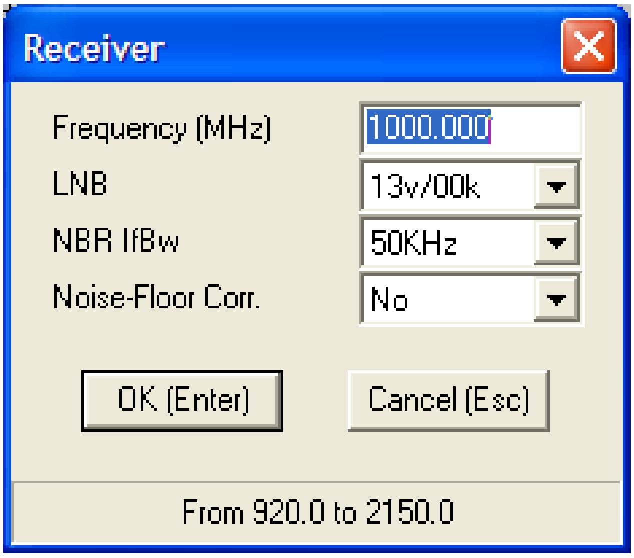
To select the Narrow Band Receiver IF-Bandwidth, perform the following procedure:

Make sure that Narrow Band receiver is activated.

From “Operation Screen” press “I”, then select “Receiver”:



At the Receiver window, select one of the NBR IfBw options: 50 KHz, 150 KHz or 300 KHz.



Save ALL settings to SBC non-volatile memory.

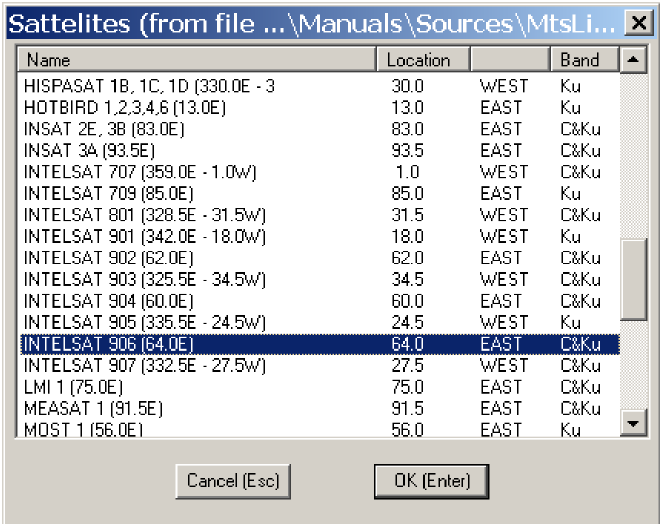
4.4 Selecting a Satellite and Channel (Wide Band Receiver Activated)

When power-up is completed, the system is automatically locked onto the satellite that was last selected and saved prior to system shutdown.

➢ **To select a different Satellite:**

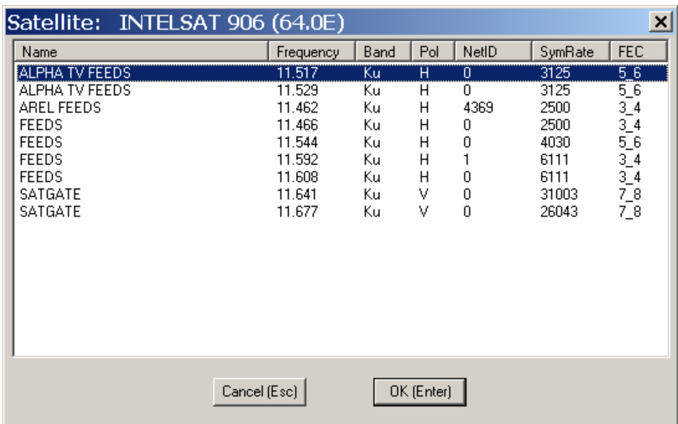
1. Type <1> for the DO MENU bar (or click on DO), Type <S> for SATELLITE (or click SATELLITE).

   The SATELLITE window appears.



2. Click on the desired satellite, and select it by pressing ENTER or clicking OK.

   The SATELLITE window appears, listing the available selected-satellite tracking control channels. **Disregard this window-by pressing enter.**



To select the optimal tracking frequency use the Spectrum Analyzer Screen (SAS) as described below.

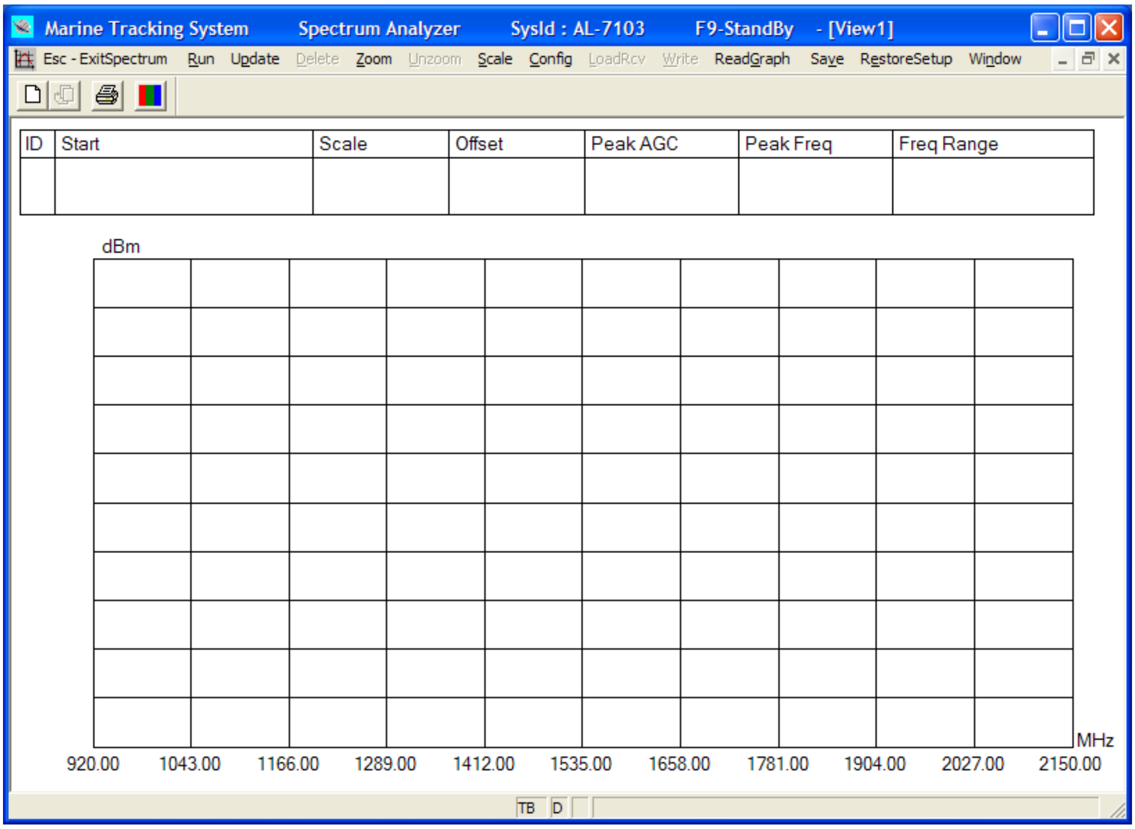
Remember that the receiver incorporated in the AL-7103 SBC is a Wide-band receiver, and looking on signals narrower then a few MHz of bandwidth may be not feasible

When selecting the tracking frequency also take notice that it may be resident also on the adjacent satellite. If such a frequency is selected, the antenna will wonder off to the other satellite. In that case – return the antenna back to it nominal satellite view angle by the “Point-to-Sat” command and use the SAS to pick another frequency.

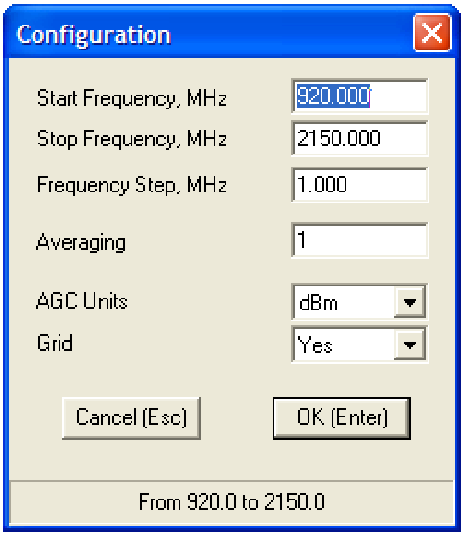
3. Spectrum Analyzer Screen (SAS) for Viewing Wide-Band Satellite Spectrum

The Spectrum Analyzer screen will only work with Wide-band tracking receiver selected.

To access, from “Operation Screen” or “Maintenance Screen” press “R”



To configure the Spectrum Analyzer measurement, press “C”:



Start and Stop frequency values may be used to set up a full or partial range of measurement.

For Ku-Band full range is: 920 to 2150 MHz

For C-Band   full range is: 950 to 1450 MHz

Frequency Step may be set up to as fine as 0.125 MHz, but one mast take into consideration that the measurement time will rise proportionally.

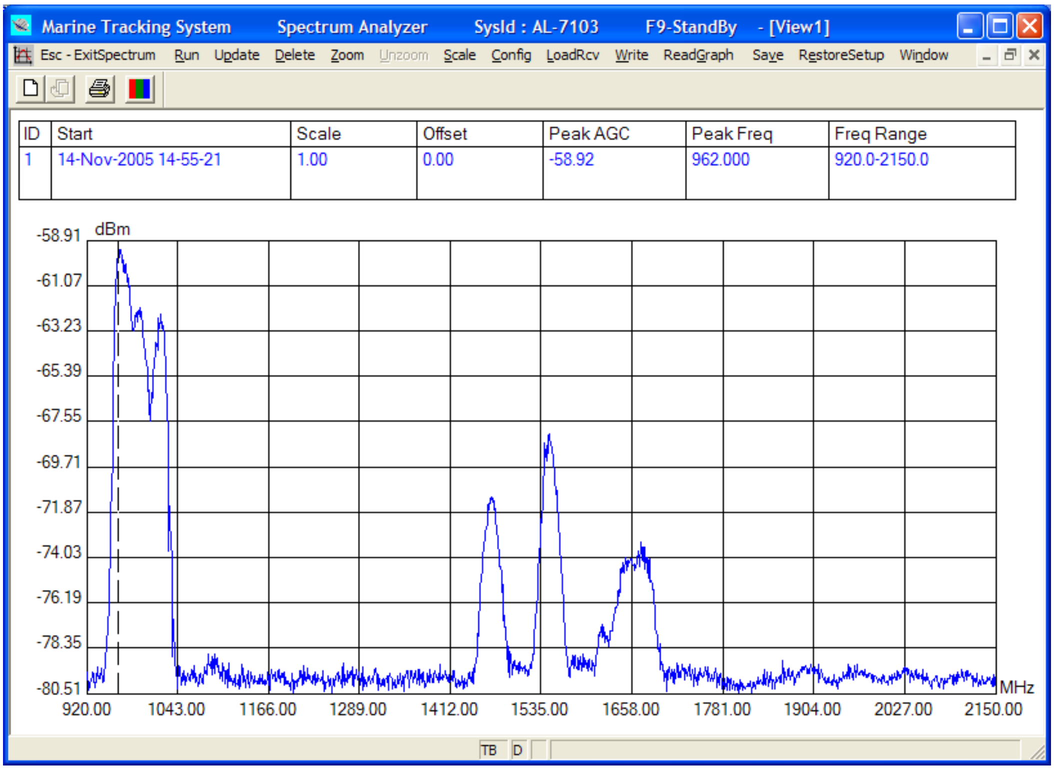
A scan of full Ku-Band range in 1MHz steps without averaging (Averaging set to 1) takes about 3-4 seconds

To make a measurement, one must first make sure that the system is not in “Step-track”. The reason for this is that “Step-track” is using the Tracking receiver resource. If the system is currently in “Step-track” – turn it to “Peak”.

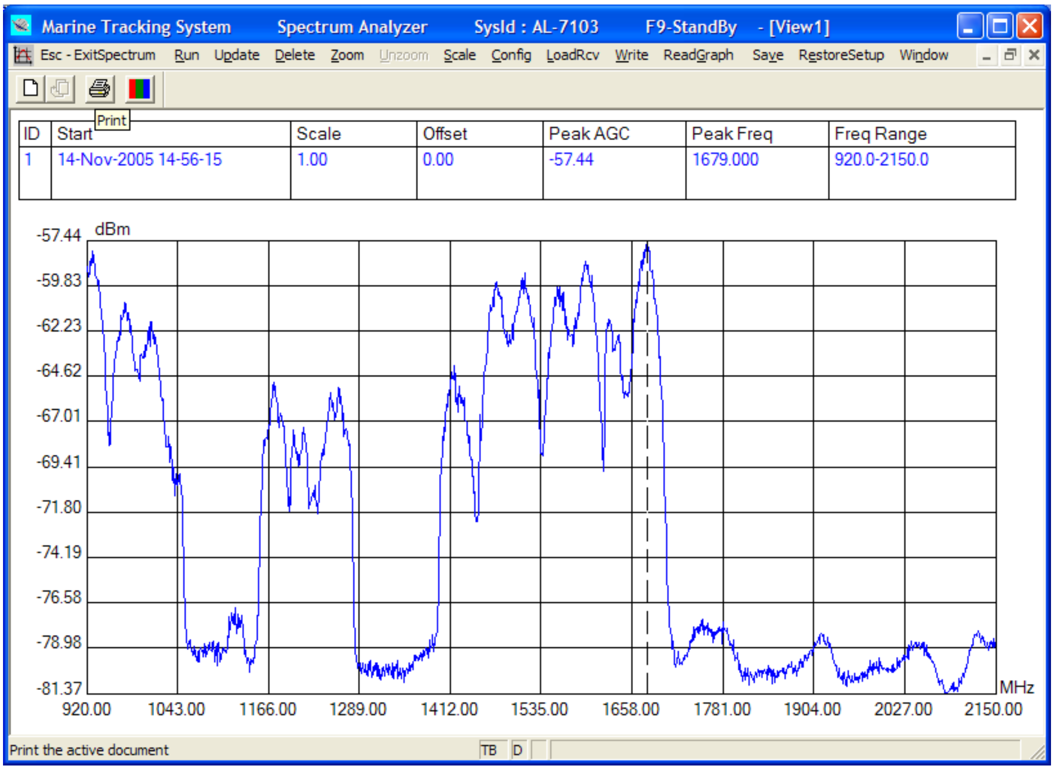
To run the Spectrum Analyzer measurement press “R”.

To Store a recorded Pattern, press “W” then select a filename and save.

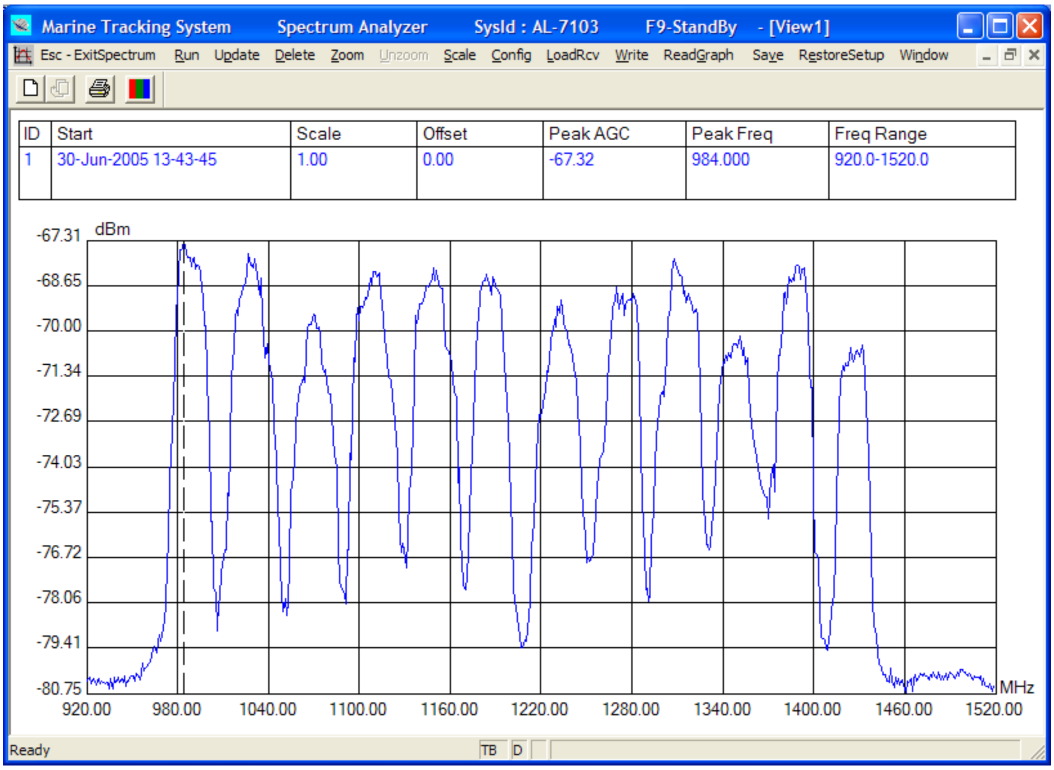
Below find some examples of Satellite Spectrum recordings taken by AL-7103 Ku and C, as viewed from Orbit roof in Natanya:



Satellite: Amos 4.0 West, Horizontal Pol, Ku-Band, LNB LO 10.0 GHz,



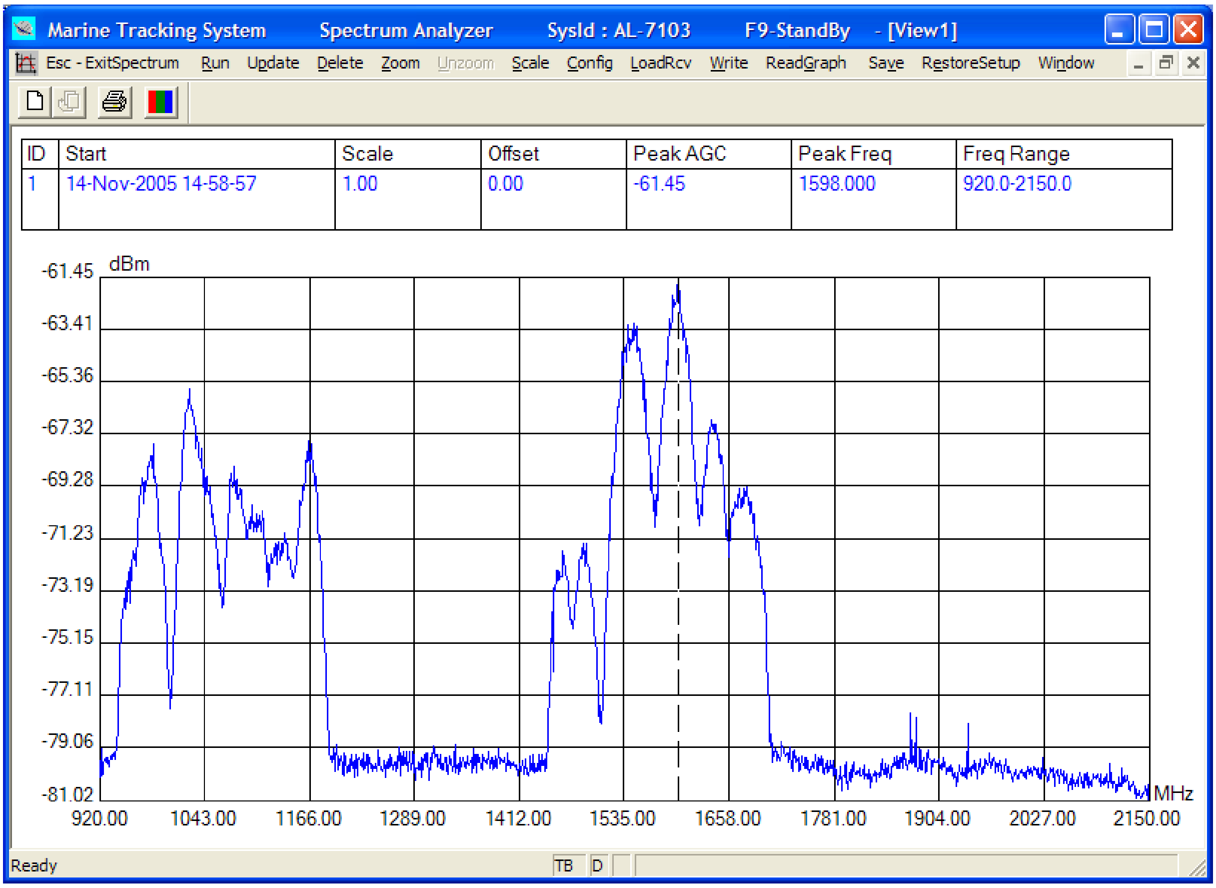
Satellite: Amos 4.0 West, Vertical Pol, Ku-Band, LNB LO 10.0 GHz,



Satellite: Arabsat 26.0 East, C-Band, Linear Pol Satellite as seen with Circular Pol antenna

4. Using SAS to Select Optimal Tracking Frequency for Wide-Band Receiver

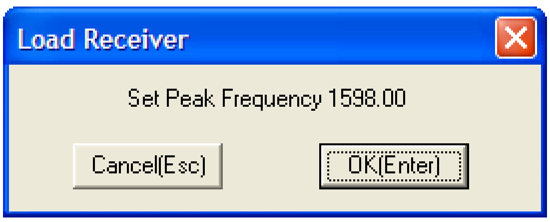
Once a Satellite Spectrum is presented on the Spectrum Analyzer Screen (see paragraph above), a vertical dotted line marks the highest-level frequency:



Satellite: NSS6 95.0 East, Vertical Pol, Ku-Band, LNB LO 10.0 GHz,

This frequency is also stated as “Peak Freq” at the top of the screen: 1598.000 MHz.

If the “LoadRcv” function is activated, this frequency will be loaded into the tracking receiver:

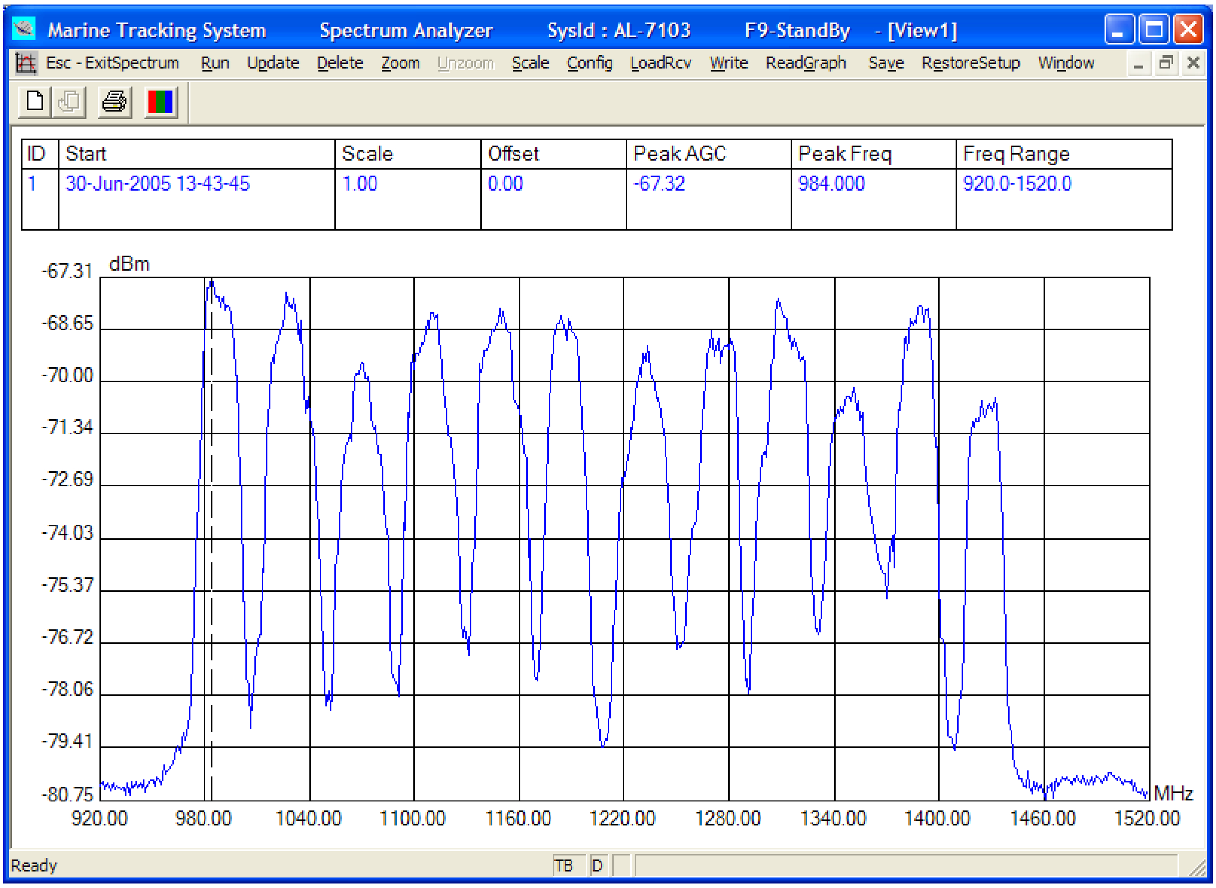


Press Enter to OK, then check by exiting the Spectrum Analyzer screen and viewing the “Receiver” sub-window in Maintenance Screen. Selected “Freq” will be: 1598.000 MHz

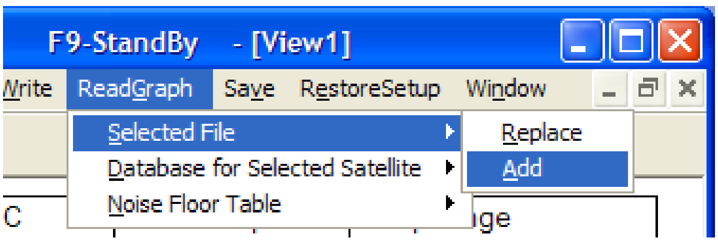
5. Using SAS for Satellite Identification

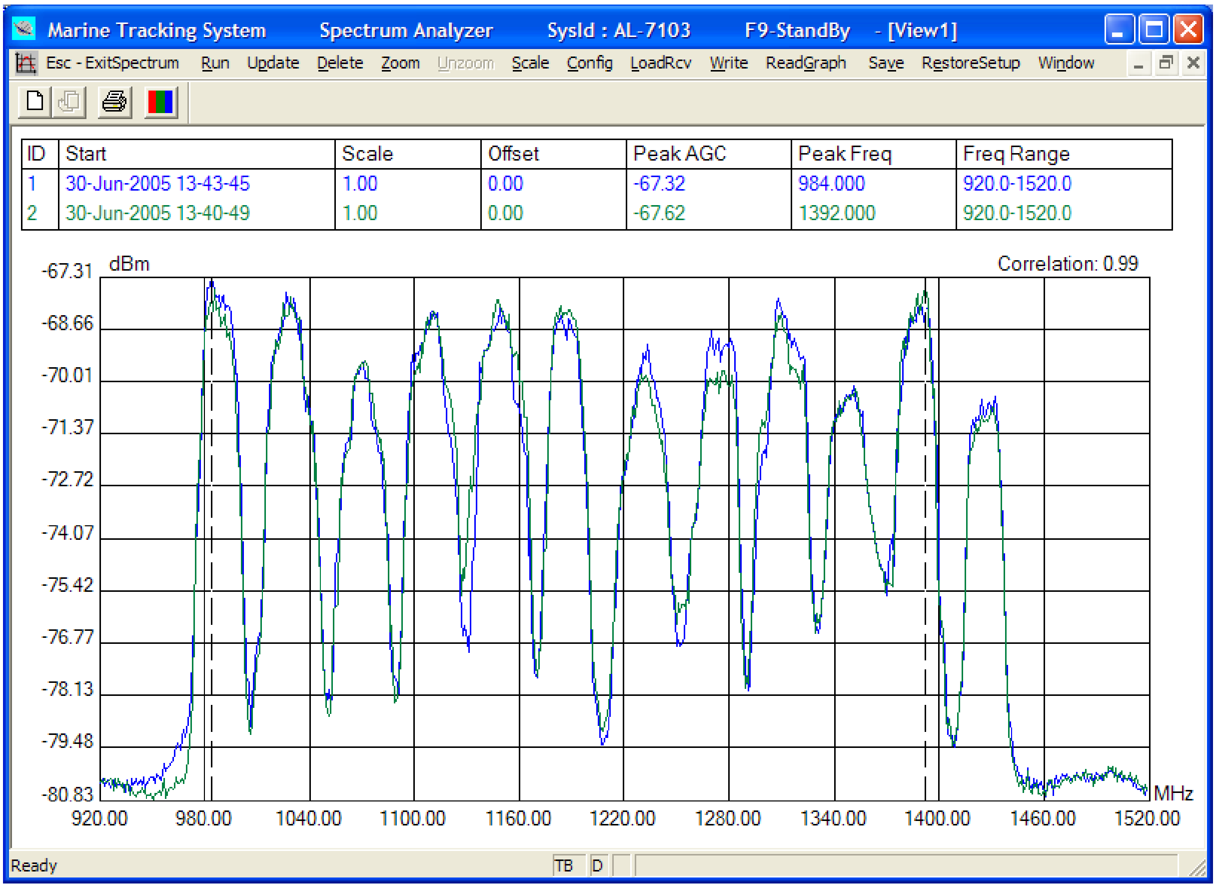
Spectrum Analyzer Screen may also be used to help identify a satellite. This may be done by comparing a measured pattern with a stored reference pattern.

First measure the current satellite pattern:



Press “G” to recall previously saved pattern and add it to the same graph:





In the given example it is pretty obvious that the measured satellite is indeed the same satellite which pattern was saved as a reference.

If the two curves are not so obviously similar, one may use the "Correlation" number, which is calculated and presented on the upper right corner. In the case above the Correlation is 0.99 out of 1.00.

Usually Correlation of over 0.8 means positive satellite identification.

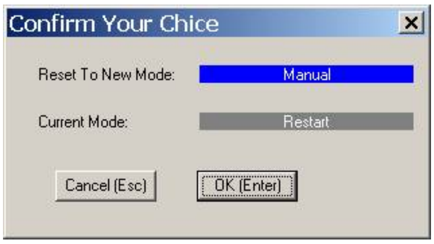
4.5 Moving the Antenna using Manual Mode

The following procedure is used for maintenance and testing purposes, or for finding the satellite when the system does not acquire it automatically.

➢ **To move the Antenna in Manual Mode:**

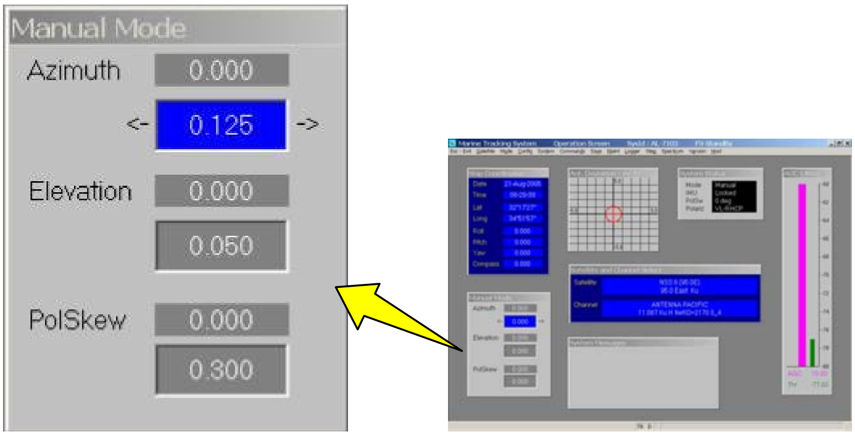
1. From the menu bar, select DO MENU and click MANUAL.

   The CONFIRM YOUR CHOICE window appears.



2. To confirm, press ENTER or click OK.

   MANUAL MODE window appears at the bottom left corner of the OPERATION screen.



3. To move the antenna to any direction, use the up/down arrow keys or the mouse to highlight the pertaining axis bottom-field, and use the right/left arrows or the mouse to increase/decrease the angle in step increments.

   For each axis (Azimuth, Elevation and PolSkew).

   The MANUAL MODE window provides two display fields: the upper field displays the current angle of the axis, and the bottom one displays the new manually changed angle.

4.6 Restarting the System

If the system did not complete the Auto Start sequence, or you want to initialize the system, use the following steps:

➢ **To restart the system:**

1. From the menu bar, select DO MENU and click RESTART.

   The CONFIRM YOUR CHOICE window appears.

2. To confirm your command, press ENTER or click OK.

- The system will initialize the Pedestal X, Y and Z encoders and initialize the IMU for 6 minutes.
- While the Restart is in progress you can not operate the system, a message will appear on the System Messages window: 'Auto Restart in Progress', The IMU will countdown for 6 minutes. After the IMU countdown will finish, the system will lock on the last saved satellite.

4.7 Manual Setting of Heading

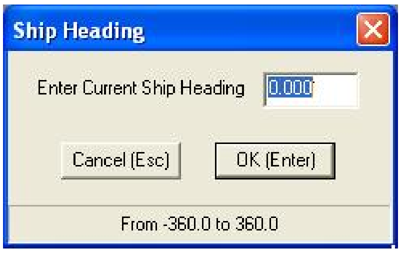
Manual setting of heading is needed if:

- Ship's compass is either inactive or not yet connected (ex: in midst of system installation)

➢ **To Set the Heading:**

1. From the menu bar, select DO MENU and click SETCOMPASS.

   The SHIP HEADING window appears.



2. To confirm, press ENTER or click OK.

   The system will update the Ships Heading.

Note: For incremental compass types (Step-by-Step, Synchro 36:1, Synchro 360:1), a start value of the compass may be set.

- For absolute type, (NMEA-0183, Synchro 1:1), a default compass value may be set. This value will prevail until a valid compass update is received.
- When entering a Compass value, it might affect the accuracy of the IMU X Y Z sensors. It is then recommended to run the System Restart process again.

4.8 Activating Step-Track Mode

The Step-Track mode is automatically activated under normal working conditions. However, if you need to manually activate it for maintenance and testing purposes, perform the following steps.

Make sure you are on the correct satellite with the correct tracking channel.

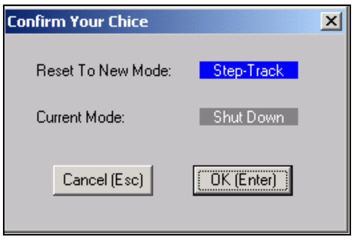
Make sure the AGC level is above the noise floor (-80 dBm).

Make sure the AGC is above the Threshold. If the AGC is below the Threshold the system will go automatic to Search mode after 60 second of Step track.

➢ **To activate the Step-Track Mode:**

1. From the menu bar, select DO MENU and click STEP TRACK.

   The CONFIRM YOUR CHOICE window appears.



2. To confirm, press ENTER or click OK.

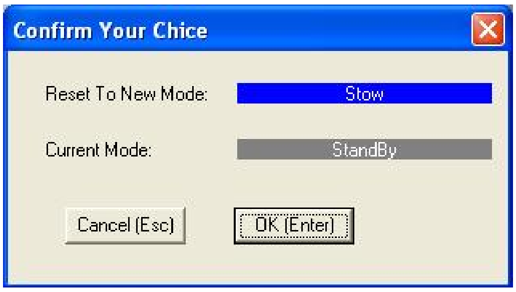
   The system will switch to STEP TRACK mode.

4.9 Stow the System

➢ **To Stow the system:**

1. From the menu bar, select DO MENU and click STOW.

   The STOW window appears.



2. To confirm, press ENTER or click OK.

   The system will switch to STOW mode.

The Stow mode is used to move the system into a certain position, to allow an easy accessibility for maintenance on the ADE.

4.10 Manual Setting of GPS Lat/Long Location

If for some reason there are no GPS position updates, or the GPS is Malfunctioning/Disconnected you can enter the ship's position manually.

➢ **To enter the GPS position manually:**

1. From the menu bar, select DO MENU and click SETGPS.

   The CONFIRM YOUR CHOICE window appears.

2. To confirm, press ENTER or click OK.

   The GPS position will update.

The Latitude and Longitude angles are entered in their decimal form, meaning that +32.5125 degree Latitude are actually 32 deg 30 minutes 45 seconds of arch North to Equator, while –128.7523 degrees Longitude are actually 128 degrees 45 minutes and 8 seconds of arch West of Greenwich.

To make those calculations you must remember that 1 degree of arch is divided into 60 minutes, while each minute of arch in turn contains 60 seconds, so that each degree of arch actually contains 3600 seconds.

32.5125 degrees of Latitude are 32 degrees and 0.5125*3600 = 1845 seconds.

1845 seconds are 1845/60 = 30 minutes and 0.75 * 60 = 45 seconds. The fact that 32.5125 Latitude is a positive number means that it's given North of the Equator. 32.5125 degrees of Latitude are therefore 32 degrees 30 minutes and 45 seconds North of Equator.

Similarly it may be shown that –128.7523 degrees translate to 128 degrees 45 minutes and 8 seconds of arch. The fact that it is a negative number means that it is given West of the Greenwich line.

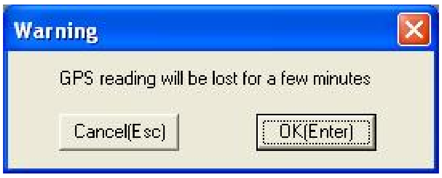
4.11 Clear GPS

The above command is used to initialize GPS data when A GPS-related error message is displayed

➢ **To Clear the GPS:**

1. From the menu bar, select DO MENU and click CLEARGPS.

   The CONFIRM YOUR CHOICE window appears.



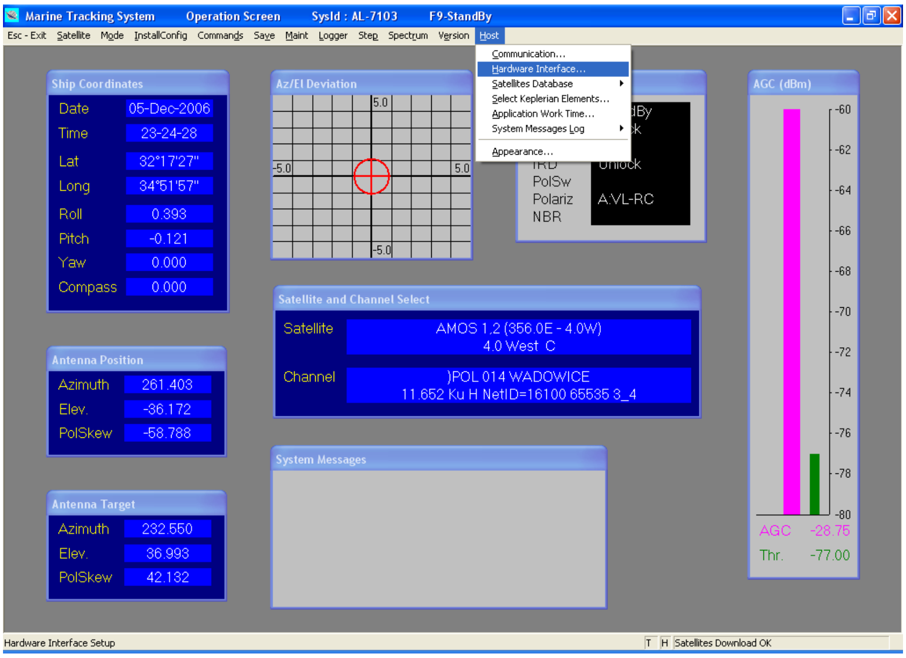
2. To confirm, press ENTER or click OK.

   The GPS receiver is reset. All GPS readings will be lost for a few minutes, until the GPS is relocated.

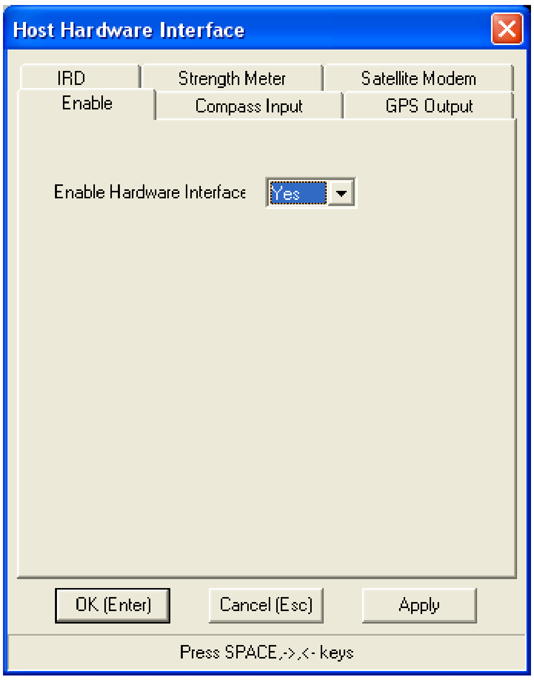
4.12 Setting Up GPS Output

➢ **To set up the GPS Output:**

1. From “Operation Screen”, press “H”, then select “Hardware Interface…” for opening the “Host Hardware Interface” window.

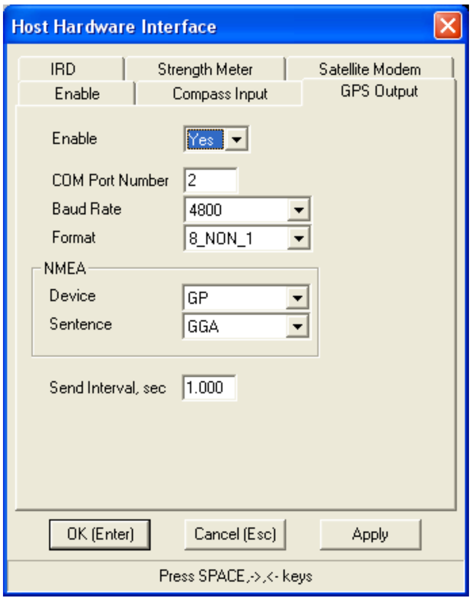


2. Verify that “Enable Hardware Interface” on “Enable” tab is set to “Yes”, and press “Apply”.



3. Select “GPS Output” tab and set parameters as following:

   - Set “Enable” to “Yes”.
   - Set “COM Port Number” to “2”
   - Set “Baud Rate” to “4800”
   - Set “Format” to “8_NON_1”
   - Set “Device” to “GP”
   - Set “Sentence” to “GLL”
   - Set “Send Interval” to “1” Second.



4. Press “OK” when complete.

4.13 Setting AGC Threshold

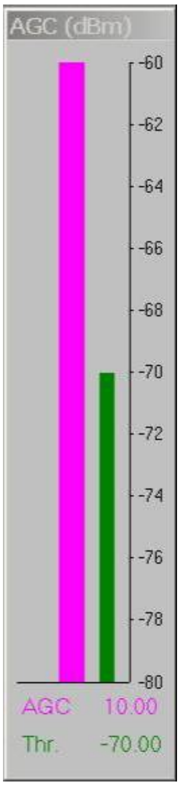
➢ **To set the AGC Threshold:**

1. From the menu bar, select DO MENU and click SET THRESHOLD.

   The SET THRESHOLD LEVEL window appears.

2. Type in a new value (in dbm) into the window, and to confirm, press ENTER or click OK.

The THRESHOLD LEVEL is updated.



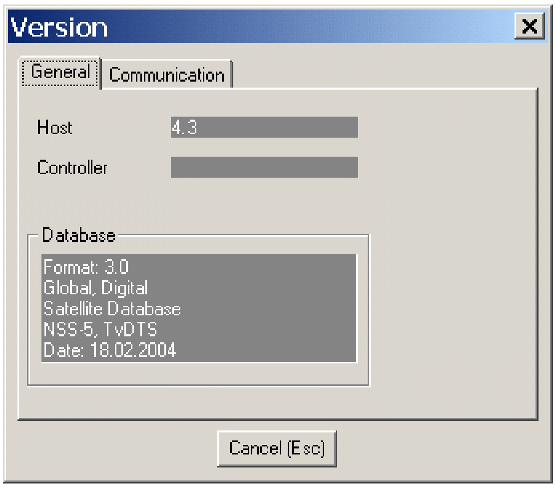
Note: The THRESHOLD LEVEL should be approx 5 dB below the maximum AGC level

4.14 Viewing Software Version Details

➢ **To view the software version details:**

From the menu bar, select DO MENU and click SHOW VERSION.

The VERSION window appears, listing version numbers and dates of the PROGRAM and COMMUNICATION software modules.



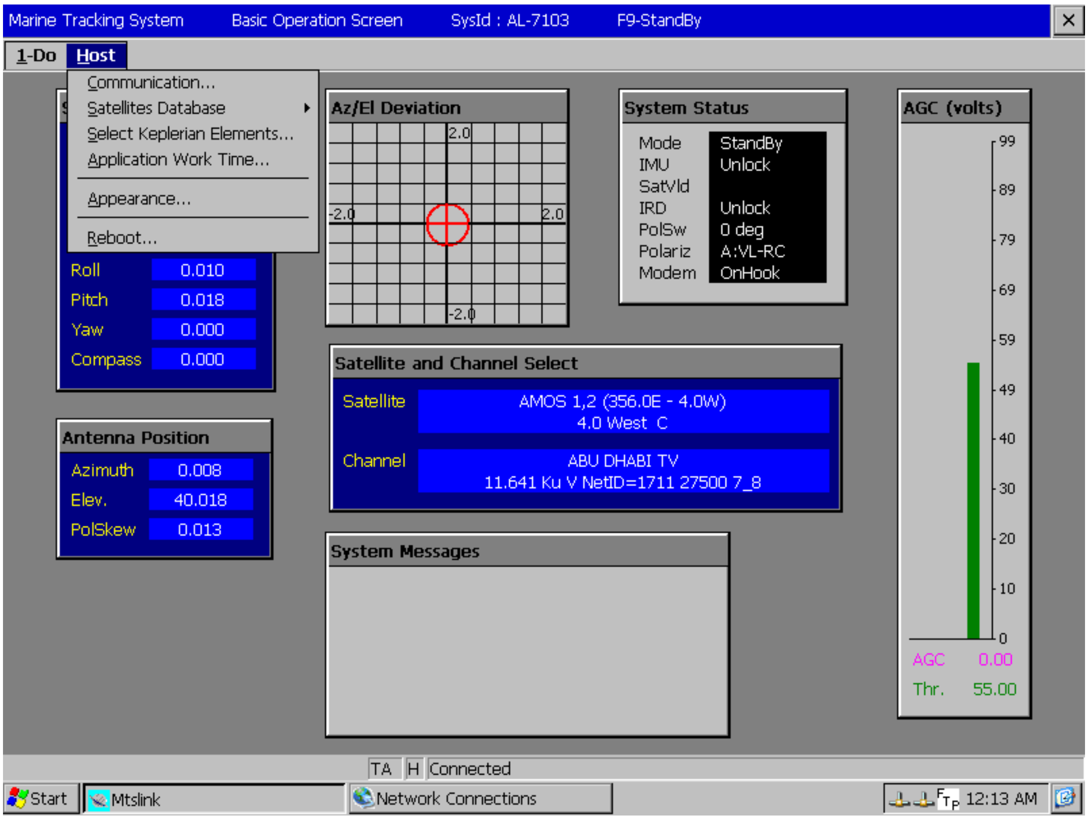
For proper CCU- Controller (SBC) communication, the Program and Communication versions installed on both units should be the same, respectively.

4.15 Using Host Menu

➢ **To use the Host menu:**

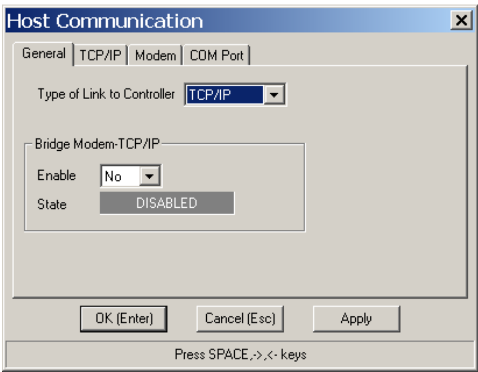
Type <H> or from the menu bar, click HOST.

The HOST sub-menu appears.



1. To use the **COMMUNICATION** functions, click the COMMUNICATION.

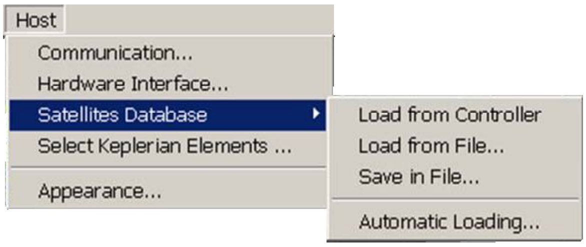
   The HOST COMMUNICATION screen appears.



In order to update the SBC IP address, click on the TCP/IP tab and update.

The SBC IP address by default is always: 192.9.200.10.

2. To use the **SATELLITE DATABASE** functions, click the SATELLITES DATABASE option. The SATELLITES DATABASE sub-menu appears.



The Satellite data base is loading automatically from the controller (SBC) when the communication between the CCU and SBC is initiated.

4.16 Replacing the LNB

➢ **To replace the LNB:**

1. On the CCU, select the STOW mode.
2. Open the radome hatch.
3. Disconnect the coaxial cable from the LNB connector.
4. Remove four screws securing the LNB to the filter.
5. Unpack the new LNB.
6. Install the 0-ring gasket on the LNB.
7. Place the LNB on the filter and fasten four screws securing it.
8. Connect the coaxial cable to the LNB connector.

Note: If the LNB type is changed, set the tracking frequency to match the new LNB. Refer to Chapter 5 in the FUF Manual.

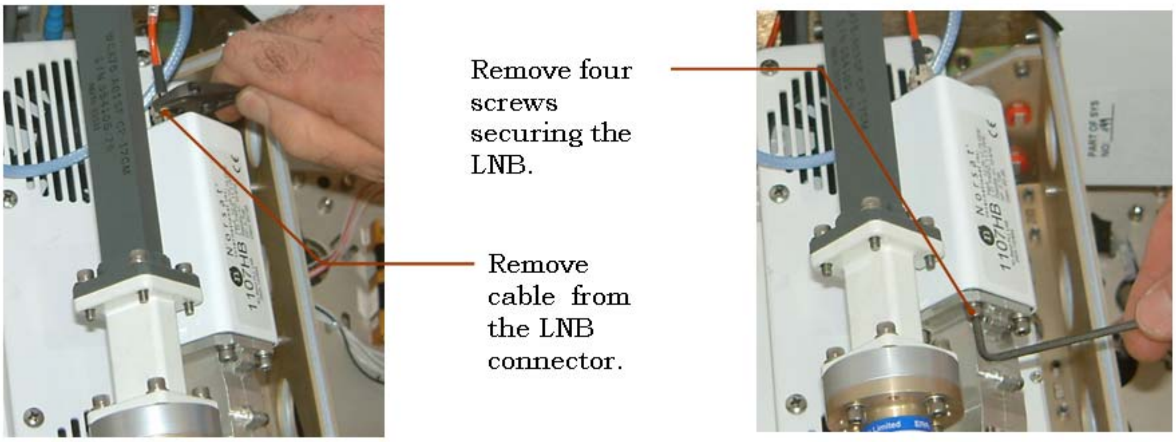


Figure 4-42:Ku-Band LNB Replacement

5 Error Messages & Troubleshooting

5.1 Error Messages

In case of a malfunction, the CCU displays a Message, Warning or an Error, depending on the malfunction classification.

The messages are classified into three categories, each identified by a different color:

- Message - green (e.g. System Shut-Down, Pedestal Y Axis Jammed)
- Warning – blue (e.g. Compass Communication Failed)
- Error –red (e.g. Pedestal X Axis Encoder Fault).

The following Table lists all the messages.

Table 5-1. CCU Messages

Message	***Possible Cause***
Error Messages	
"Error: SDU/IMU Power out of tolerance"	IMU +5VDC, or the Servo Drive power indications exceeded the predefined tolerance limits
"Error: Restart timed out"	The system was not able to complete the restart routine in the predefined time (normally set to 10 minutes)
"Error: Pedestal X Axis Jammed"	No movement is recorded from Pedestal X-axis encoder, while the controller produces a steering command
"Error: Pedestal Y Axis Jammed"	No movement is recorded from Pedestal Y-axis encoder, while the controller produces a steering command
"Error: No Maintenance Configuration File"	The SBC couldn't find the Maintenance Configuration file in its Flash memory (disk C:\), on power-up.
"Error: No Operational Configuration File"	The SBC couldn't find the Operational modes Configuration file in its Flash memory (disk C:\), on power-up.
"Error: No Satellite Database File"	The SBC couldn't find the Satellite Database file in its Flash memory (disk C:\), on power-up.
"Error: No System Configuration File"	The SBC couldn't find the System Parameters Configuration file in its Flash memory (disk C:\), on power-up.
"Error: No Valid IMU Calibration File"	The SBC couldn't find the IMU Calibration file in its Flash memory (disk C:\), on power-up.

Table 5-1. CCU Messages	
Message	***Possible Cause***
"Error: Satellite File Read Error"	The SBC couldn't read the Satellite database file from its Flash memory (disk C:\), during operation.
"Pedestal X NE2 Encoder Fault"	The BiSS digital communication protocol with axis-X NE2 encoder has more then 10% failure rate.
"Pedestal Y NE2 Encoder Fault"	The BiSS digital communication protocol with axis-Y NE2 encoder has more then 10% failure rate.
"Pedestal Z NE2 Encoder Fault"	The BiSS digital communication protocol with axis-Z NE2 encoder has more then 10% failure rate.
"Pedestal X NE2 Enc Init Fault"	The axis-X NE2 encoder initialization has failed.
"Pedestal Y NE2 Enc Init Fault"	The axis-Y NE2 encoder initialization has failed.
"Pedestal Z NE2 Enc Init Fault"	The axis-Z NE2 encoder initialization has failed.
"Error: Pedestal Z Axis Jammed"	No movement is recorded from Pedestal Z-axis encoder, while the controller produces a steering command
"Error: SBC Pwr/Tmpr out of tolerance"	One of the SBC power indications (+5v,+/-12v,+2.5v etc.) exceeded the predefined tolerance limits. This error will also appear if the SBC internal temperature exceeded its tolerance limits.
"Error: SDM-X Servo Power Loss"	The SDM-X Power is down or it is disconnected.
"Error: SDM-Y Servo Power Loss"	The SDM-Y Power is down or it is disconnected.
"Error: SDM-Z Servo Power Loss"	The SDM-Z Power is down or it is disconnected.
"Error: SDM-X Stepper Driver Fault"	The SDM-X Stepper Driver Fault indicator is on (red). Relevant only with IM805 Stepper drivers
"Error: SDM-Y Stepper Driver Fault"	The SDM-Y Stepper Driver Fault indicator is on (red). Relevant only with IM805 Stepper drivers
"Error: SDM-Z Stepper Driver Fault"	The SDM-Z Stepper Driver Fault indicator is on (red). Relevant only with IM805 Stepper drivers

Table 5-1. CCU Messages	
Message	***Possible Cause***
"Error: I/O Bus Fault"	Starting with SBC software Ver4.22 in conjunction with Altera version 0xCDXX, the SBC can recognize a fault in I/O PC Bus by writing to Altera and reading the value back. If the value is not the same – an appropriate message is produced.
Warning Messages	
"Warning: LNB Power Over-Current"	The controller 13/18VDC power supply, feeding the LNB is overloaded
"Warning: Compass Communication Failed"	No valid communication frames were received on the NMEA-0183 compass Com port for over 1.5 seconds.
"Warning: GPS Communication Failed"	No valid communication frames were received on the GPS Com port for over 5 seconds.
"Warning: No GPS Position Updates"	No GPS position-fix frames were received on the GPS Com port for over 30 seconds.
"Warning: System not initialized"	The AL-7103 didn't undergo the process of initialization which includes all axes Encoder init as well as IMU init.
"Warning: LNB voltage out of tolerance"	The controller 13/18VDC power supply, feeding the LNB, is exceeding its predefined tolerance levels
"Warning: Antenna view blocked"	The Antenna has moved into one of the predefined blockage areas
"Warning: No communications with host"	The communications with the host computer, identified by a predefined IP address, has timed-out (10 seconds).
"Warning: Signal below threshold"	The controller signal strength indication (AGC) on the selected frequency is lower then the predefined threshold level.
"Warning: IMU-ACU Communication Fault"	The communications between IMU and the controller has timed-out.
"Warning: Receiver Cal Table not Found"	The SBC couldn't find the internal wide-band receiver linearization calibration file in its Flash memory (disk C:\), on power-up.
"Warning: BUC L-Band Cal Table not Found"	The SBC couldn't find the ADMx (BUC Input) analogue detector linearization calibration file in its Flash memory (disk C:\), on power-up. This Warning will be issued only if the BUC L-Band Power indicator is enabled.

Table 5-1. CCU Messages	
Message	***Possible Cause***
"Warning: BUC L-Band Cal Table not Found"	The SBC couldn't find the BUC output analogue detector linearization calibration file in its Flash memory (disk C:\), on power-up. This Warning will be issued only if the BUC Rf-Power indicator is enabled.
"Warning: PolSwitch not connected"	The SBC recognized a situation in which both Forward and Reverse limit sensors of the PolSwitch are ON. This is interpreted as a not connected PolSwitch.
"Warning: BUC L-Band Cal Table not Found"	The SBC couldn't find the BUC analogue detector linearization calibration file in its Flash memory (disk C:\), on power-up. This Warning will be issued only if the BUC L-Band Power indicator is enabled.
"Warning: X-Axis Forward Limit"	The position encoder readout of the X-axis exceeded its Forward Limit configuration definition.
"Warning: X-Axis Reverse Limit"	The position encoder readout of the X-axis exceeded its Reverse Limit configuration definition.
"Warning: Y-Axis Forward Limit"	The position encoder readout of the Y-axis exceeded its Forward Limit configuration definition.
"Warning: Y-Axis Reverse Limit"	The position encoder readout of the Y-axis exceeded its Reverse Limit configuration definition.
"Warning: iNBR Interface not recognized"	iNBR warning.
"Warning: iNBR High LO Unlocked"	iNBR warning.
"Warning: iNBR Low LO Unlocked"	iNBR warning.
"Warning: Tracking Error Exceeds Limit"	Tracking Error Exceeds Limit.
"Warning: Octans-IMU: Alignment in process"	N/A for this system.
"Warning: Octans-IMU: Anomaly"	N/A for this system.
"Warning: Octans-IMU: Data not ready"	N/A for this system.
"Warning: BUC Tx Stopped"	BUC Transmission stopped by the Controller.
Messages (Information)	
"Auto-Restart in progress"	System is going thru initialization stage including – IMU init, Encoder init and optionally, Satellite acquisition
"Acquiring a Satellite"	System is currently acquiring a satellite
"System no initialized"	Encoder and IMU were not yet initialized.

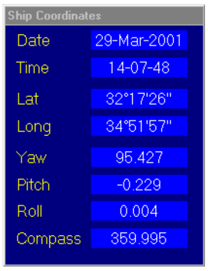
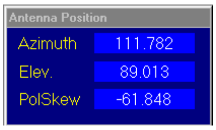
Table 5-1. CCU Messages

Message	***Possible Cause***
"System Shutdown"	System was shut down
"System Shutdown, Ped-X Jammed"	System was shut down due to "Pedestal-X Jammed" fault (No. 36)
"System Shutdown, Ped-Y Jammed"	System was shut down due to "Pedestal-Y Jammed" fault (No. 37)
"PolSkew Disabled, Polarizer Jammed"	System was shut down due to the fact that no movement was recorded from Pedestal Z-axis encoder, while the controller produced a steering command
"System Shutdown, Ped-X Encoder"	System was shut down due to "Pedestal-X Encoder Fault" (No. 8), or "Pedestal-X NE2 Encoder Fault" (No. 104), or "Pedestal-X NE2 Enc Init Fault" (No. 111)
"System Shutdown, Ped-Y Encoder"	System was shut down due to "Pedestal-Y Encoder Fault" (No. 9), or "Pedestal-Y NE2 Encoder Fault" (No. 105) or "Pedestal-Y NE2 Enc Init Fault" (No. 112)
"System Shutdown, Power Loss"	System was shut down due to "SDU/IMU power lout of tolerance" (No. 15)
"System Shutdown, Restart Time"	System was shut down due to "Restart time-out" (No. 17)
"IRD Validation in process"	IRD is being re-validated during Step-track operation. Note that this message is presented for a very short time and is barely visible on the controller screen.
"System Shutdown, Ped-Z Jammed"	System was shut down due to "Pedestal-Z Jammed" fault (No. 119)
"System Shutdown, SBC Power/Tempr"	System was shut down due to "SBC Pwr/Tmpr lout of tolerance" (No. 121)
"System Shutdown, Ped-Z Encoder"	System was shut down due to "Pedestal-Z NE2 Encoder Fault" (No. 106) or "Pedestal-Z NE2 Enc Init Fault" (No. 113)
"System Shutdown, SDM-X Power"	System was shut down due to "SDM-X Servo Power Loss" fault (No. 126)
"System Shutdown, SDM-Y Power"	System was shut down due to "SDM-Y Servo Power Loss" fault (No. 127)
"System Shutdown, SDM-Z Power"	System was shut down due to "SDM-Z Servo Power Loss" fault (No. 128)
"System Shutdown, SDM-X Drv Flt"	System was shut down due to "SDM-X Stepper Driver Fault" fault (No. 129)
"System Shutdown, SDM-Y Drv Flt"	System was shut down due to "SDM-Y Stepper Driver Fault" fault (No. 130)

Table 5-1. CCU Messages	
Message	***Possible Cause***
"System Shutdown, SDM-Z Drv Flt"	System was shut down due to "SDM-Z Stepper Driver Fault" fault (No. 131)
"System Halted, Axes Jammed"	System has experienced multiple jammed-axis faults. More than 6 occurred in two minutes – the system is therefore halted.
"Ax-X Ne2 Enc Reg Read Failed"	While initialization of Axis-X Ne2 encoder, one of the registers was not read correctly (CRC check failed). If not accompanied by other Warning or Error, this is just FYI, as the register is automatically re-read.
"Ax-Y Ne2 Enc Reg Read Failed"	While initialization of Axis-Y Ne2 encoder, one of the registers was not read correctly (CRC check failed). If not accompanied by other Warning or Error, this is just FYI, as the register is automatically re-read.
"Ax-Z Ne2 Enc Reg Read Failed"	While initialization of Axis-Z Ne2 encoder, one of the registers was not read correctly (CRC check failed). If not accompanied by other Warning or Error, this is just FYI, as the register is automatically re-read.
"Ax-X Ne2 Enc Reg Write Failed"	While initialization of Axis-X Ne2 encoder, writing to one of its registers write failed (read-back failed). If not accompanied by other Warning or Error, this is just FYI, as the register is automatically re-written.
"Ax-Y Ne2 Enc Reg Write Failed"	While initialization of Axis-Y Ne2 encoder, writing to one of its registers write failed (read-back failed). If not accompanied by other Warning or Error, this is just FYI, as the register is automatically re-written.
"Ax-Z Ne2 Enc Reg Write Failed"	While initialization of Axis-Z Ne2 encoder, writing to one of its registers write failed (read-back failed). If not accompanied by other Warning or Error, this is just FYI, as the register is automatically re-written.
"iNBR Validation in process"	NBR is being re-validated during Step-track operation. Note that this message is presented for a very short time and is barely visible on the controller screen.

5.2 Basic Troubleshooting

- If you experience persistent problems while acquiring a satellite, and ***no error messages appear***, check that all the system parameters are correctly set.
- Check the parameters on the BASIC OPERATION screen in accordance with the following table:

Parameter	**Check**	**Display**	**Corrective Action**
Pitch and Roll	Verify that the readings displayed in the Ship Coordinates fields appear to be abnormal at the dockside (i.e., there is a pitch or roll of 2º and more).		Restart the system.
Latitude and Longitude	Check with Bridge to verify that the parameters displayed in the Ship Coordinates fields are correct.		Carry out a Clear GPS procedure, and check for updates in the Maintenance screen.
Compass heading	Check with Bridge to verify that the parameters displayed in the Ship Coordinates fields are correct.		Check that if necessary, the Compass Offset has been set. For a step-by-step compass, use the Set Compass mode to enter initial values. Otherwise, check that the Compass' wiring is in order.
Visual inspection of antenna	Verify that the antenna appears to be actually pointing in the direction stated in the Antenna Position fields.		Restart the system.

6 Installation Guide

The Installation of the OrSat (AL-7103-Ku Mk II) consists of the following steps:

Step	Subject	Reference
1	Ship Survey & Installation Planning	Paragraph 6.1
2	Preparing the installation site & Unpacking the system	Paragraph 6.2
3	Installation of the ADE	Paragraph 6.3
4	Installation of the BDE	Paragraph 6.4
5	Compass configuration procedure	Paragraph 6.5
6	Modem integration	Paragraph 6.6
7	Selecting the Tracking Receiver Type	Paragraph 6.7
8	Cease Transmission (Tx) Configuration	Paragraph 6.8
9	Polarization Skew Alignment Procedure	Paragraph 6.9

6.1 Ship Survey & Installation Planning

6.1.1 Introduction

The Ship Survey and Installation Planning go hand-in-hand, and comprise the first part of the installation process.

The survey provides the opportunity to familiarize yourself with the site and enables you to ensure that all the pre-installation tasks can and will be carried out properly. It also gives you an excellent opportunity to collect valuable information on the ship's facilities and the parameters that will affect installation planning and decisions.

This visit to the ship is best conducted with an authorized representative of the ship's personnel. The Installation Planning requires your checking that all the necessary considerations are taken into account and dealt with.

6.1.2 Ship Survey

During the visit to the ship, prepare a Site Survey Report, to allow accurate and efficient installation planning.

During the site survey, particular attention should be given to requirements for blockages, and the relation to other interfering equipment. In addition, one should consider available interfaces with the ship's systems, (power, compass, etc.), other cables, intended locations for equipment placement, etc.

The location of both equipment groups associated with the system (ADE and BDE) should be taken into account. It is very important to ensure that the Radome Support (supplied by the shipyard) is properly designed and mounted, on the deck.

6.1.3 Installation Planning

Installation planning is one of the most important stages in the installation. Correct planning will lead to a successful installation with minimum trouble before and throughout system operation.

Before installation, make sure that:

- ♦ You have visited the ship and familiarized yourself with the ship layout, or received a completed Survey Report.
- ♦ You have received existing ship's layout, as may be available:
    - Ship's construction plan
    - Ship's electric mains layout and UPS access (if available)
    - Ship's compass interface type, wiring and availability.
- ♦ You identify the ship's power supply voltage and frequency and compass (standard and voltage).

Using the data you have gathered for the Survey Report, you can now prepare the installation plan, which should include equipment locations, installation details, cable runs, etc.

The two considerations that have now to be taken into account are the

ADE and BDE location.

The following paragraphs describe the planning and selecting of the installation sites for the equipment.

Note: Correct planning will lead to a successful installation with minimum trouble before and throughout system operation.

6.1.4 Above-the-Deck Location and Installation Considerations

Radome Support Design

The RADOME SUPPORT is supplied by the client and has to conform with certain minimum requirements, as follows:

- Location with no (or at most, minimum) vibration and signal obstruction.
- Rigid construction and mounting.
- The SUPPORT has to be bolted to the MOUNTING SURFACE.
- Ease of access to the Radome hatch for maintenance purposes.

The RADOME SUPPORT is the interface between the deck and the System.

The following Figure illustrates a recommended support design.

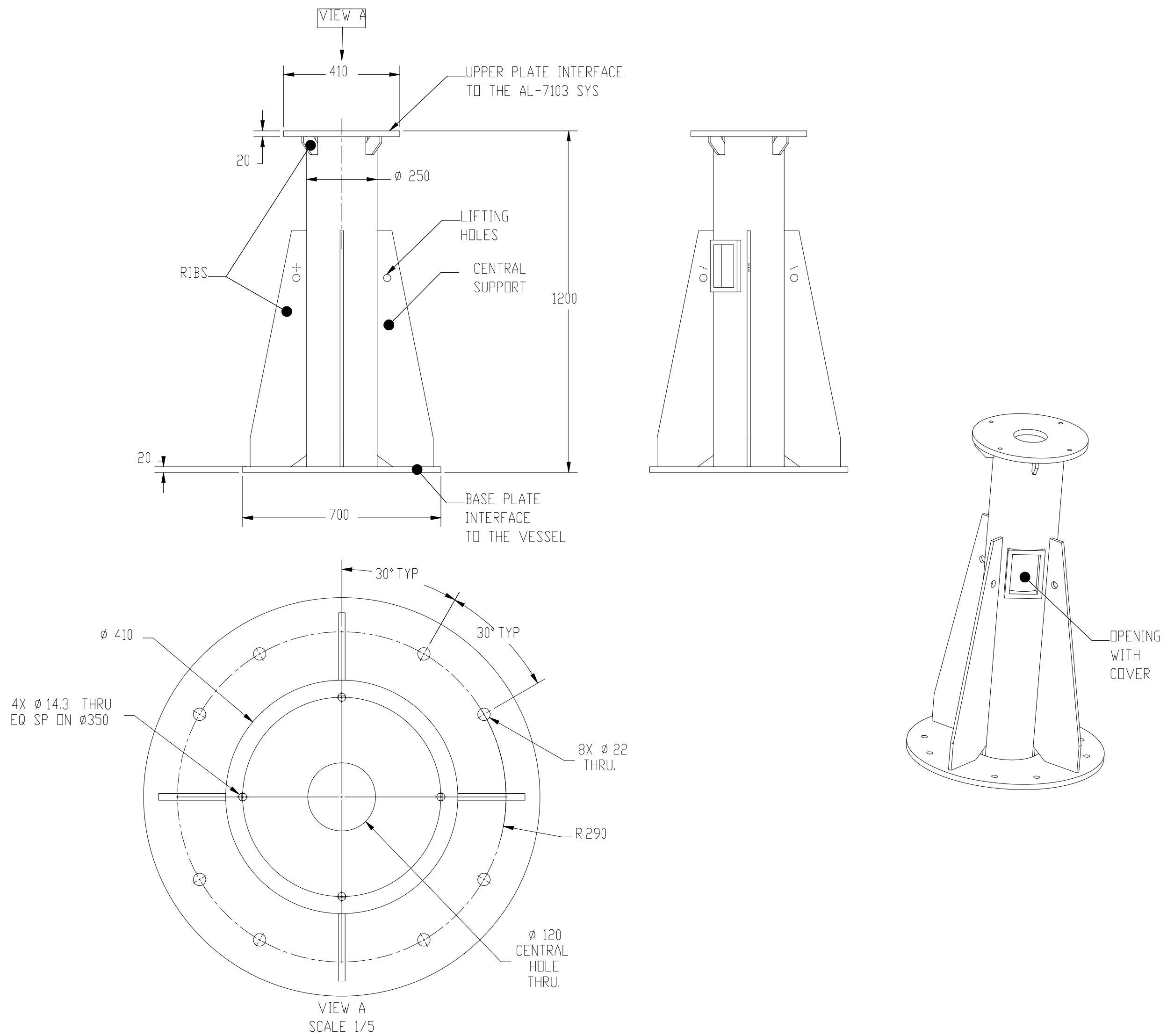


Figure 6-1: Radome Support – Recommended Structure

Figure 6-2: Typical Support Design

It is suggested that the mast shall be welded directly above one of the deck's support beams as shown in the following Figure.

In this configuration, the support is designed to spread the pedestal weight over a wide rectangular area (marked in yellow), mounted over the main construction ribs of the deck over a wide welded area.

To ease the system's maintenance it is recommended to design the support height at 1.2m.

Figure 6-3: Typical Support Mounting

Mechanical Stability

The System's Support structure allows for mechanical stability and supports the Antenna's weight and its dynamics. The mounting surface intended for the ADE has to be rigid, flat, and free of vibration. It also has to be a level and stable surface. The mounting surface should be capable of supporting the total equipment weight.

The support intended for the ADE should be a stable (with natural resonance frequency of above 30 Hz) flat surface, capable of supporting Approx. 400kg (~840lb)

It is recommended to install the Radome above one of the deck's support beams.

Maintenance Access

Consideration should be given to allow unhindered access to the RADOME HATCH on the BASE, thus giving sufficient maintenance access for the technical staff, their tools and spare parts. It is recommended to mount the Radome at a height of 1.2m above the deck to ease maintainability. At minimum, the Radome should be mounted 0.6m above deck to allow opening of the HATCH.

Line Of Sight (LOS)

The LOS is a straight line between the Antenna and the satellite. Obstructions to the LOS will typically be the ship's funnels and masts.

Ideally, the optimum ADE site will have no obstructions to the LOS; i.e., it will have a clear view of the horizon/satellite all around. However, it is normal that a compromise will have to be made between the LOS and other considerations.

Other Location Considerations

The mounting location should be located as far away as possible and on a different plane from high-power radar systems or other radiating devices.

The location selected for installation should have a maximum non-blocked hemispheric view down to 10° visibility.

The distance between the Gyro repeater and the ADE should be considered, when choosing the correct interface type and cable.

Mounting Surface

The following Figure present the mounting surface layout, showing the layout of the mounting surface's holes, required for the bolts securing the ADE to mounting surface. The Bolts attaching the system to the support are supplied by Orbit.

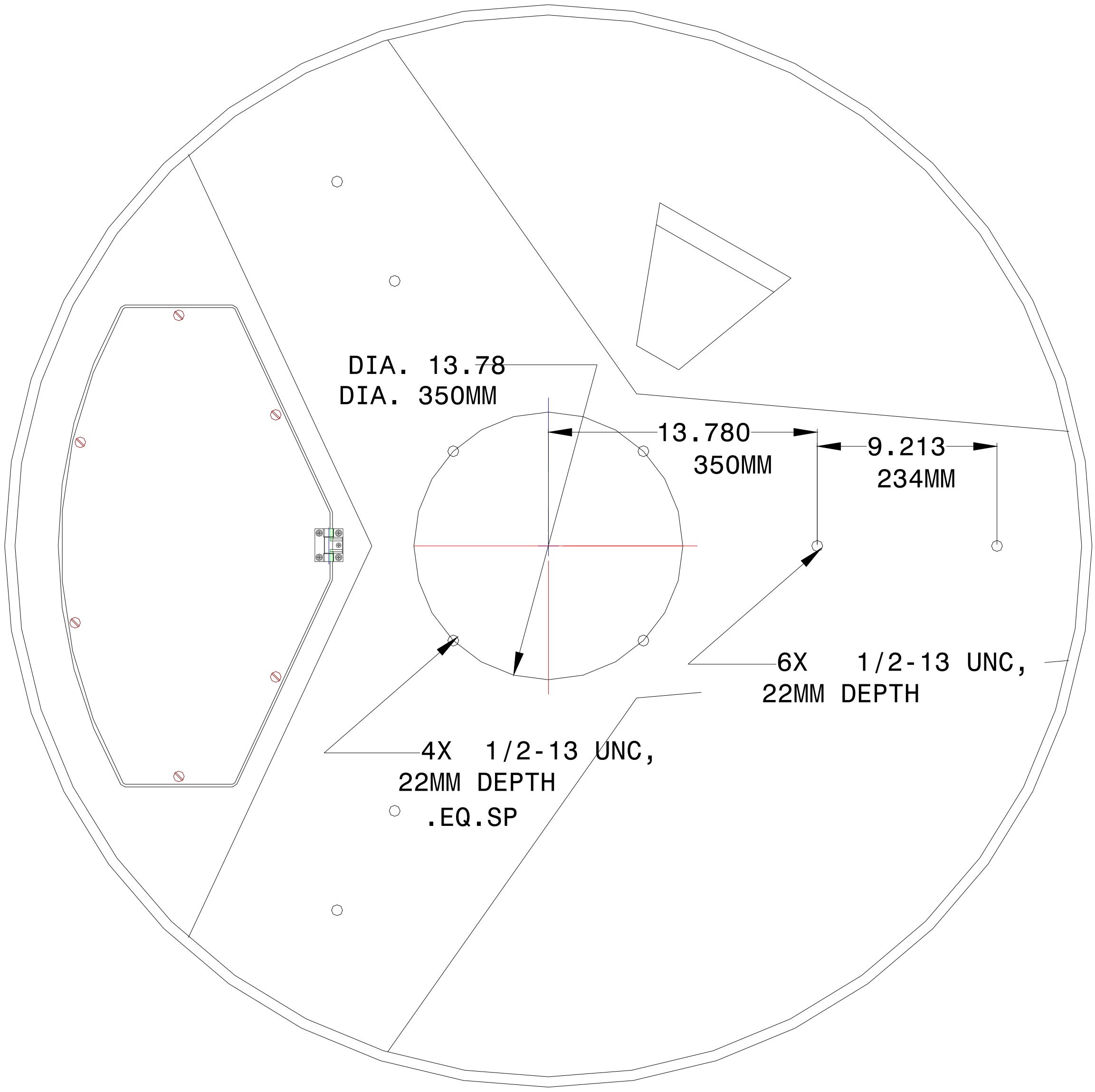


Figure 6-4: Mounting Surface

6.2 Preparing the Installation Site & Unpacking the System

This section describes the site preparation and initial unpacking procedures.

6.2.1 Unpacking the System

The System is packed in a single wooden crate. Crate dimensions are as follows:

- L= 1600 mm (63")
- W= 1600mm (63")
- H = 1825mm (71.8").

Note:

The shipping crate's contents may have shifted during transportation.

As soon as you open the crate, you must check for evidence of damage and immediately report it to the shipper and Orbit Marine.

For unpacking purposes, you will need access both from the front and back of the crate.

6.2.2 Shipping Crate Content

The system is delivered with all ADE installed in the RADOME.

The BDE includes the CCU and external beacon receiver (if applicable).

Note:

- Before you start to open a crate and take out its contents, you must carefully check for any apparent external damage. If Shock and Tilt Watches have been attached to the crate, check that they have not been broken.
- Throughout the unpacking process, you must check all components for shipping damage, and immediately report any such damage to the shippers and support@orbit-ltd.co.il, as units damaged in shipping are not covered under Warranty terms and conditions.
- You should make careful note of all component serial numbers (located on their respective nameplates) as the service and support department will request these numbers when you contact them.
- Any damage or missing items should be reported to support@orbit-ltd.co.il

Figure 6-1: Shipping Crate

Figure 6-2: ADE Arrangement within the Shipping Crate

6.2.3 Unpacking and Visual Inspection

- Place the shipment crate on a rigid, leveled surface.
- Open the crate without damaging the contents.
- The Dome is secured to the Radome Base by a metal ring which is equipped with a locking mechanism. In order to remove the Dome, thus allowing internal inspection, perform the following procedure:

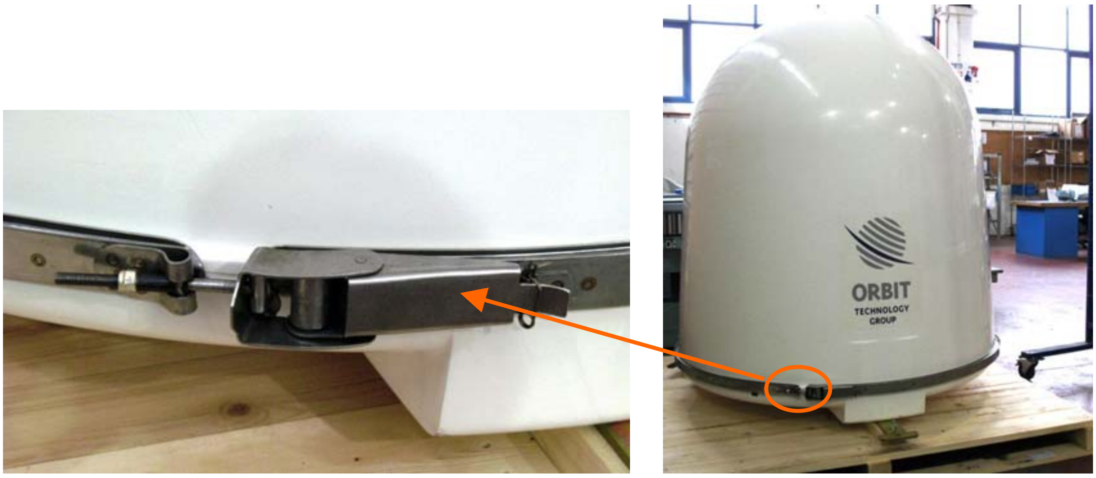


Figure 6-3: Securing Ring and Locking Mechanism – Original Configuration

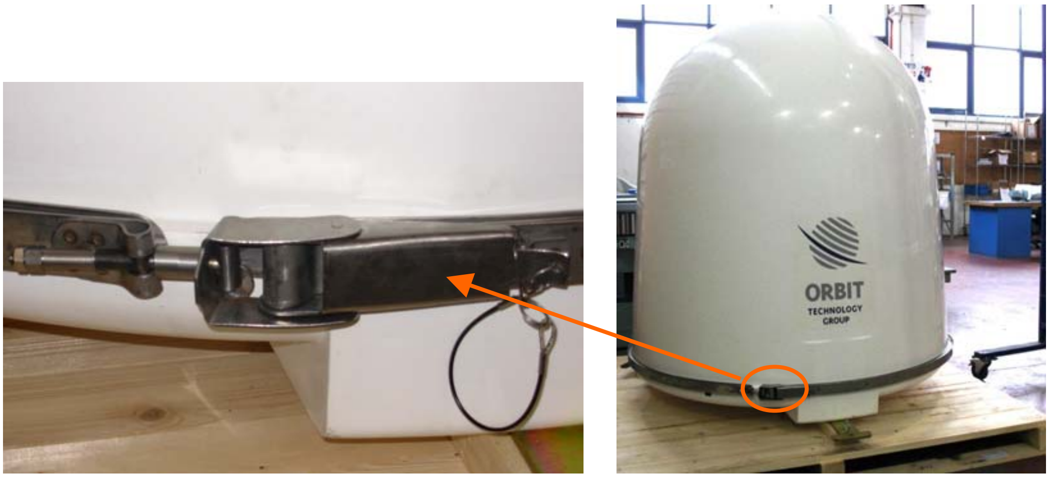


Figure 6-4: Securing Ring and Locking Mechanism – Modified Configuration

- Remove the safety pin from the locking mechanism.

Figure 6-5: Removing the Securing Ring Safety Pin

After removing the safety pin, make sure you put it aside it in a safe place, as you will need it for the radome installation procedure.

In the most recent versions of the system, the safety pin is attached to the locking mechanism with a cable, preventing misplacement of the pin.

- Open the locking mechanism lever.

Figure 6-6: Removing the Securing Ring Safety Pin

- Remove the ring.

When removing the radome-securing ring, pay attention not to scrape the dome.

- Remove the dome.

♦ Unwrap the nylons that cover the system.

- Cut the marked tie-wraps that secure the system's moving parts.
- Remove the CCU package.

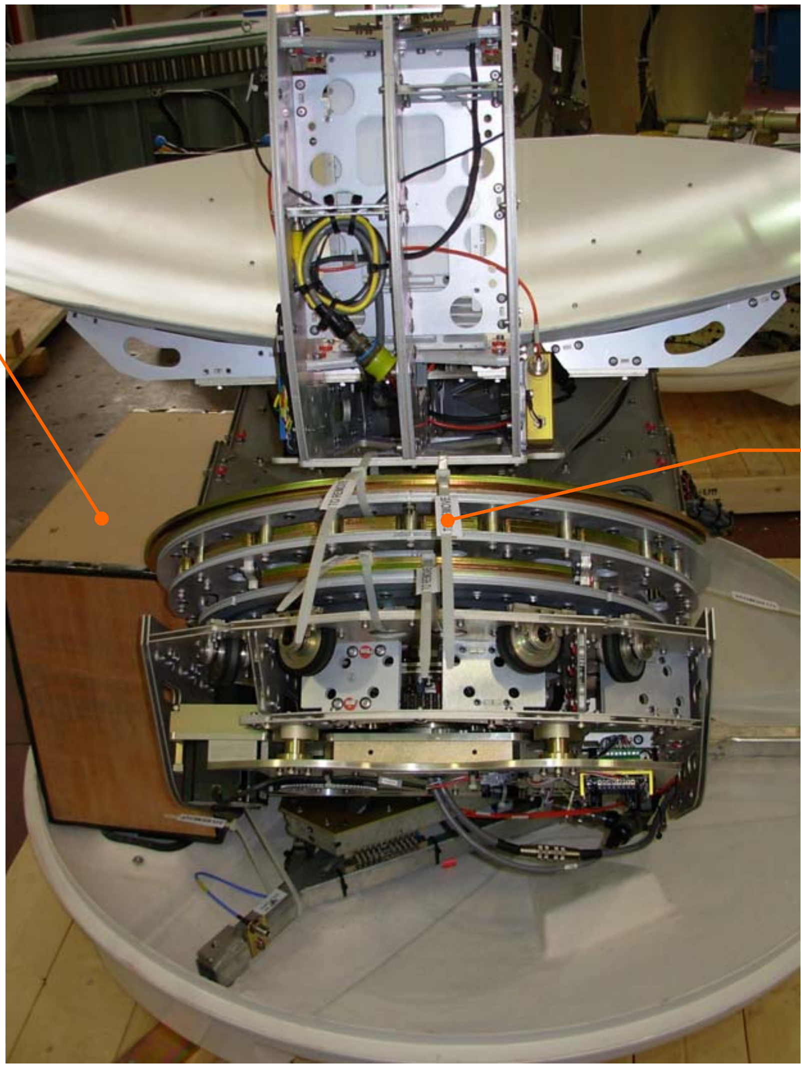


Figure 6-7: Removing Tie-Wraps

- Visually inspect the exterior of the equipment for evidence of any physical damage that might have occurred in shipment/storage.
- Mark all the S/N of the system and its units (PSU, SBC, IMU, BUC, SDM's, CCU, etc.).
- Re-install the dome. Refer to paragraph 6.2.5.

6.3 Installing the ADE

6.3.1 Introduction

Once the unpacking is completed, the OrSat (AL-7103-Ku Mk II) system ADE can be hoisted onto the Radome Support on the ship and secured to it.

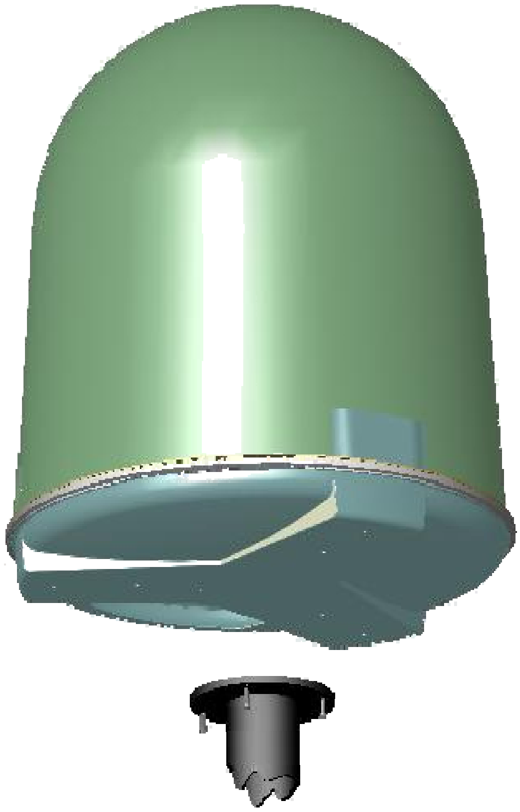


Figure 6-8: ADE Installation on the Radome Support

6.3.2 Lifting and Mounting Procedure

The aim of the following procedure is to provide the main steps that are required to securely lift the AL-7103 system ADE.

To lift the ADE, use the Sling Assembly depicted in the following Figure, or an equivalent one (for 2 Tons lifting weight).

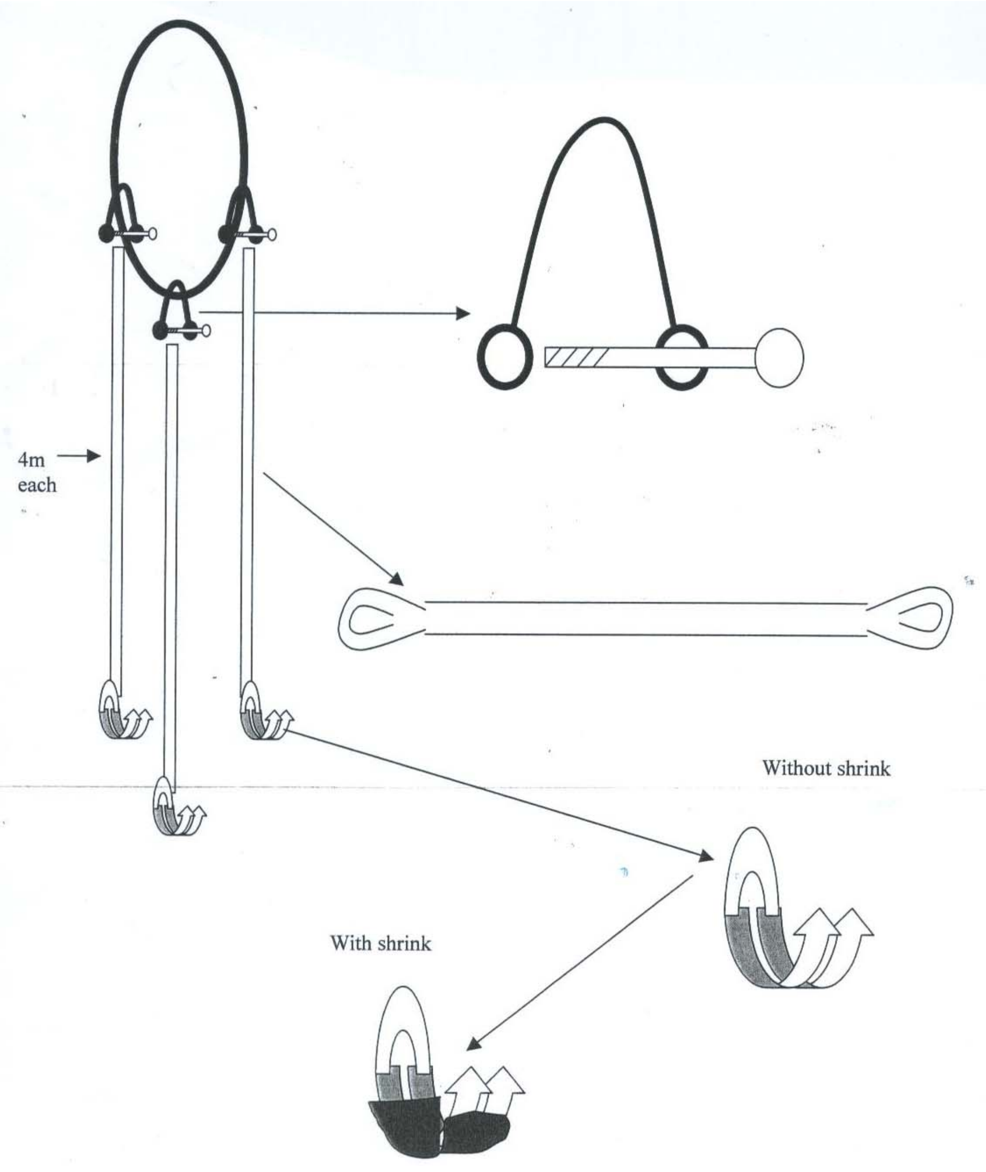


Figure 6-9: Recommended Sling Assembly

♦ Attach the master link with suitable lifting slings to the crane safety hook.

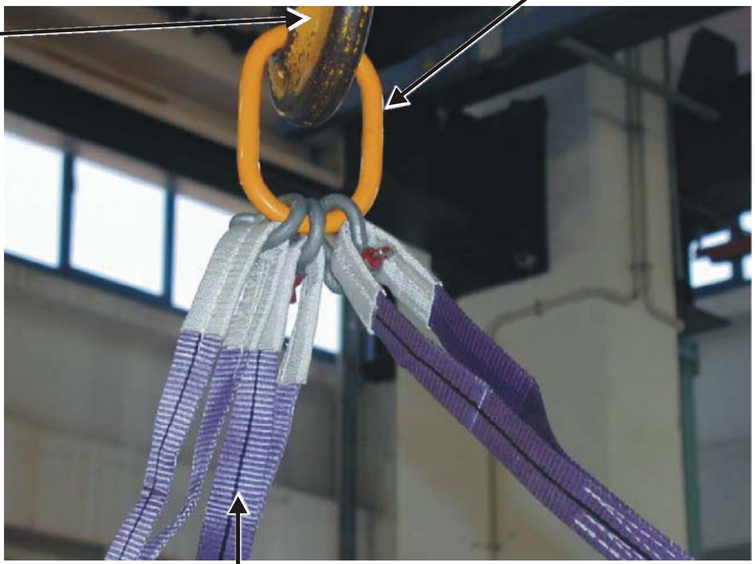


Figure 6-10: Master Link

♦ Attach the lifting slings to the Radome base three lifting arms.

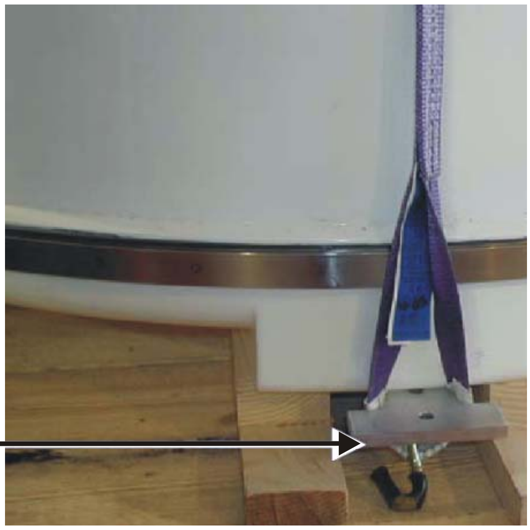


Figure 6-11. Lifting Arms

♦ Wrap the Dome with the red belt.

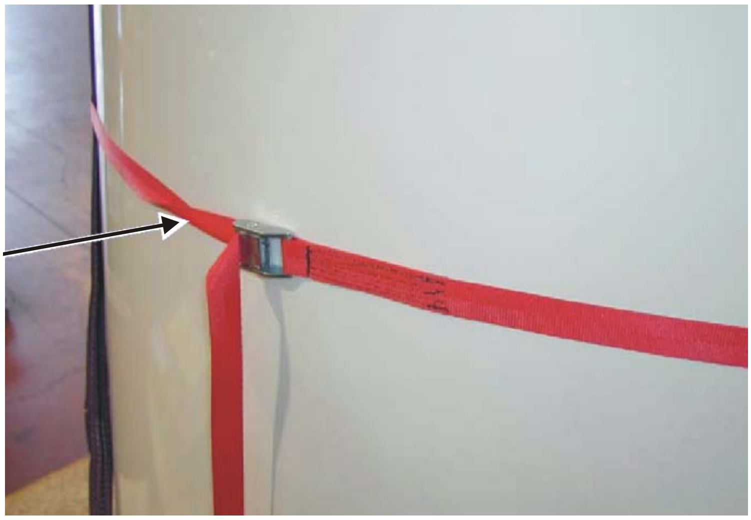


Figure 6-12. Red Belt

♦ Release the three screws securing the lifting arms to the plate's wooden lugs.

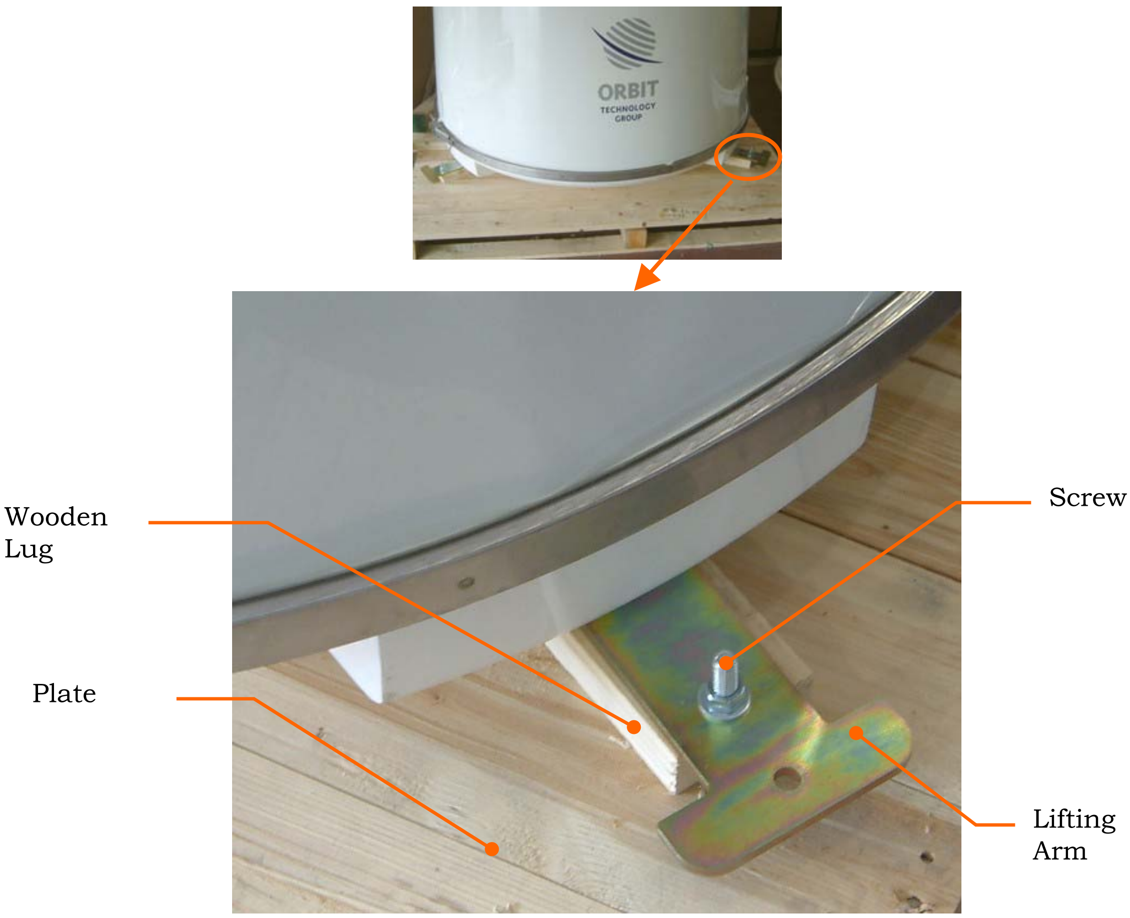


Figure 6-13: Holding Screws

♦ Lift and mount the ADE using slings and the radome lifting arms. Install and fasten the bolts securing the radome base to the support.

Figure 6-14:ADE Lifting Concept

Figure 6-15:Installation on a Vessel

Figure 6-16: Support Mounting Screws

6.3.3 Removing the Radome Lifting Arms

The Radome base is equipped with three lifting arms. Each arm is secured to the Pedestal structure with two screws that protrude the Radome base.

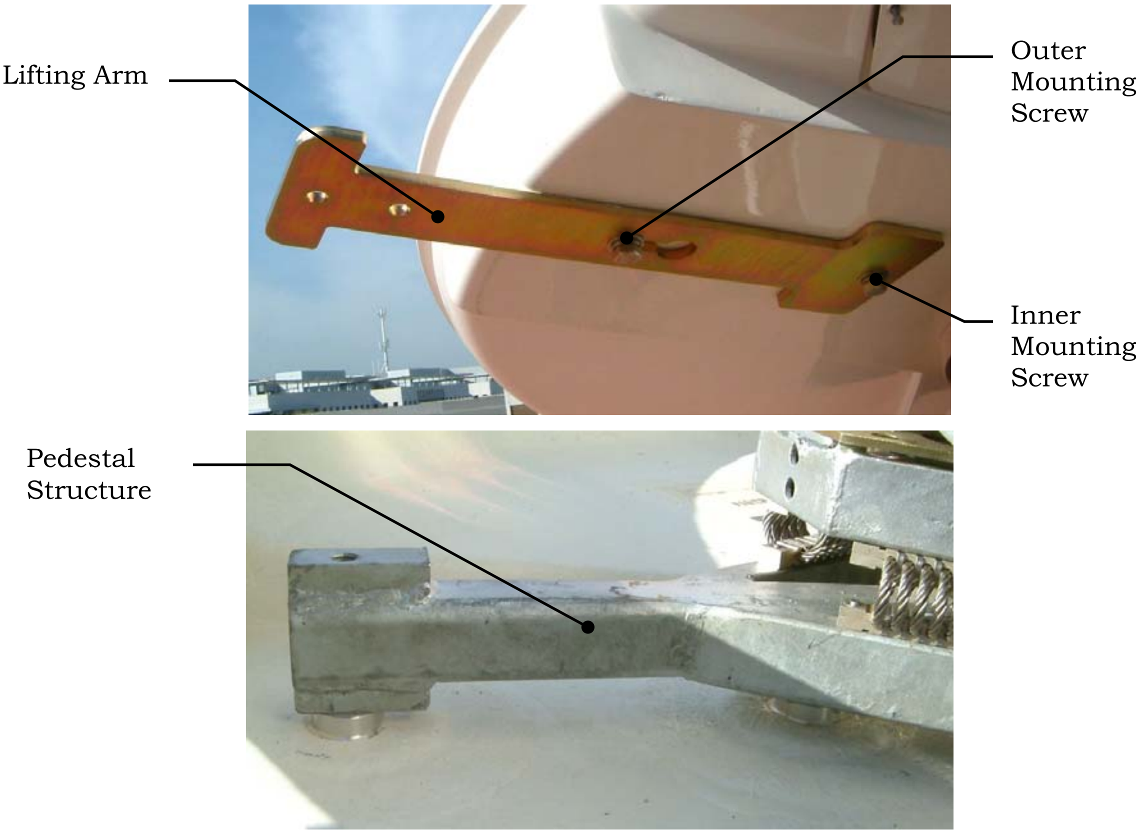
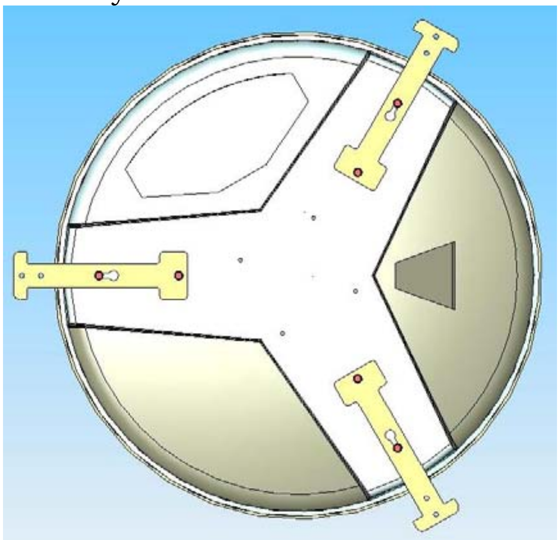
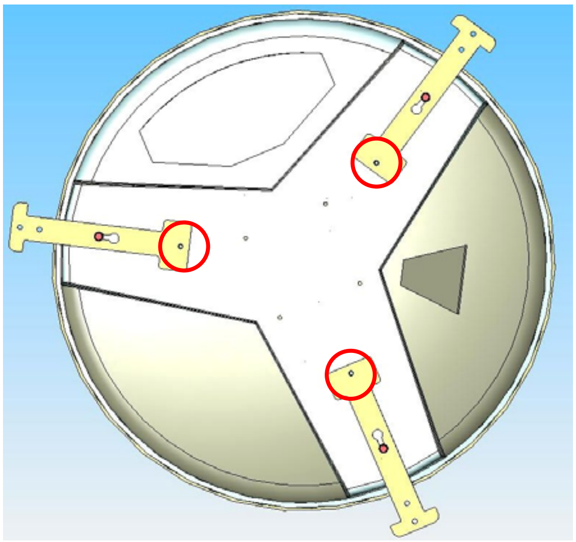
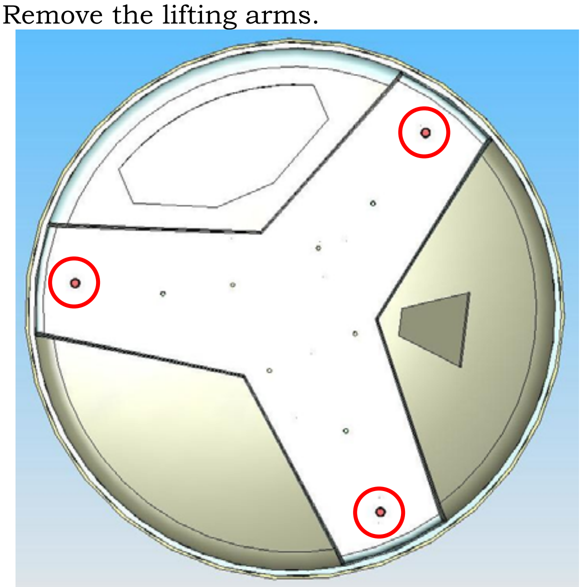
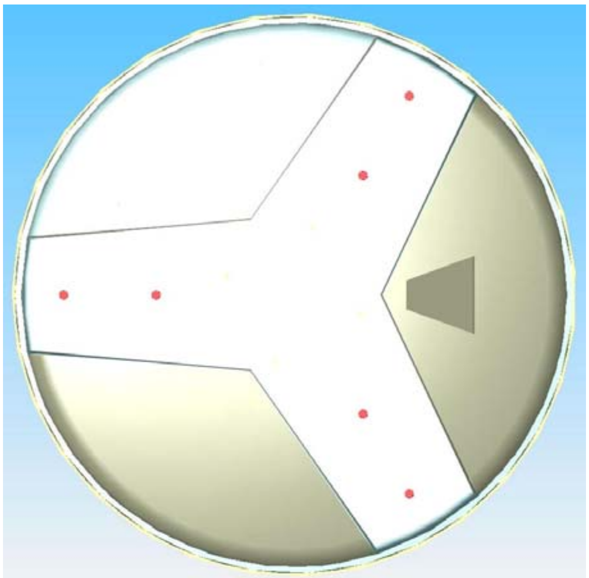


Figure 6-17: Lifting Arms Mounting Screws

After ADE installation, these arms can be removed using the following procedure:

❶ Gain access to the three lifting arms mounted on the Radome base. Each arm is secured by two ½” screws. 	❷ Remove the inner screw of each of the three lifting arms. 
❸ Loosen the outer screw of each of the three lifting arms. Slide the lifting arms slightly outwards until they are free of the screws. Remove the lifting arms. 	❹ Re-install the three inner screws, and fasten all six screws with a torque of 60 Nm ±5%. 

As the lifting arms screws are also used to secure the Pedestal structure to the Radome base, the screws must be re-installed and fastened after the lifting arms are removed.

6.3.4 ADE Cables Connections

Introduction

The following cables are to be connected to the ADE:

- Mains Power Supply cable
- BDE-ADE Link coaxial cable.

The above cables inserted go into the ADE via a pass-thru gland that is installed in an opening rilled in the radome base.

Figure 6-18:ADE Cables Connections

Preparing the Radome Pass-Thru Opening

The preparation procedure includes the following steps:

1. Drilling a 40 mm hole in the Radome Base.

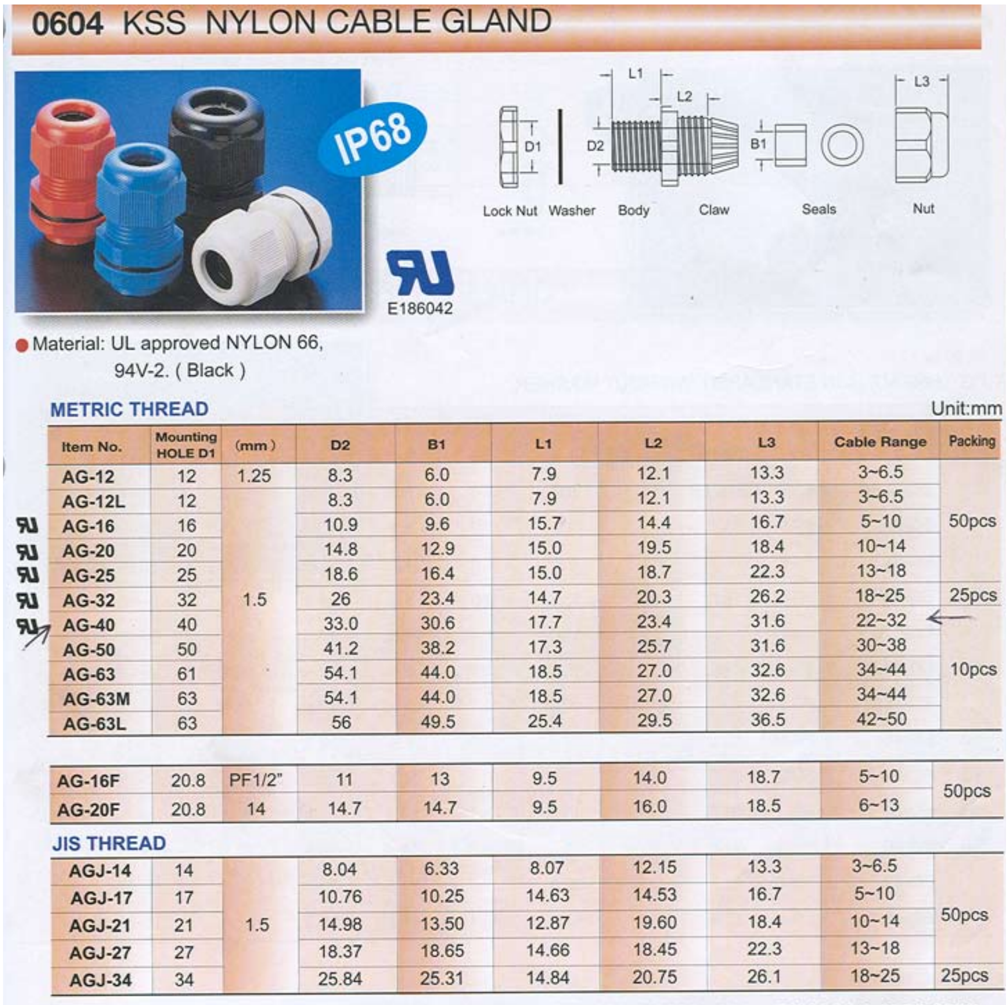
Note: The AG-40 gland was selected to be large enough to allow pass-thru of the ADE-BDE coax cable with its N-type connector installed, and of the AC mains cable. Therefore, the ADE-BDE coax cable may be pre-terminated off the ship, prior to on-board installation.

2. Installing an AG-40 Gland, or equivalent.
3. Inserting the cables and tightening the gland.

It is very important to verify, after the gland is tightened, that it secures both cables and doesn't allow any cable movement inside the gland. If the cables are loose inside the gland (this may be depending on the type of cables and gland used), wrap 7-10cm length area of the cables running thru the gland using a Self-amalgamating Tape (Scapa PIB or equivalent).

4. Sealing the gland thread using RTV Sealing Compound.

Make sure that the gland is tightened over the cables. Note that due to the fact that there are two cables thru the gland, the opening is not completely sealed, even though the gland holds the cables tight. To seal the opening completely, apply RTV Sealing Compound.



0604 KSS NYLON CABLE GLAND

● Material: UL approved NYLON 66, 94V-2. (Black)

METRIC THREAD Unit:mm

Item No.	Mounting HOLE D1	(mm)	D2	B1	L1	L2	L3	Cable Range	Packing
AG-12	12	1.25	8.3	6.0	7.9	12.1	13.3	3~6.5	
AG-12L	12		8.3	6.0	7.9	12.1	13.3	3~6.5	
AG-16	16		10.9	9.6	15.7	14.4	16.7	5~10	50pcs
AG-20	20		14.8	12.9	15.0	19.5	18.4	10~14	
AG-25	25		18.6	16.4	15.0	18.7	22.3	13~18	
AG-32	32	1.5	26	23.4	14.7	20.3	26.2	18~25	25pcs
AG-40	40		33.0	30.6	17.7	23.4	31.6	22~32	
AG-50	50		41.2	38.2	17.3	25.7	31.6	30~38	
AG-63	61		54.1	44.0	18.5	27.0	32.6	34~44	10pcs
AG-63M	63		54.1	44.0	18.5	27.0	32.6	34~44	
AG-63L	63		56	49.5	25.4	29.5	36.5	42~50	

AG-16F	20.8	PF1/2"	11	13	9.5	14.0	18.7	5~10	50pcs
AG-20F	20.8	14	14.7	14.7	9.5	16.0	18.5	6~13	

JIS THREAD

AGJ-14	14		8.04	6.33	8.07	12.15	13.3	3~6.5	
AGJ-17	17		10.76	10.25	14.63	14.53	16.7	5~10	
AGJ-21	21	1.5	14.98	13.50	12.87	19.60	18.4	10~14	50pcs
AGJ-27	27		18.37	18.65	14.66	18.45	22.3	13~18	
AGJ-34	34		25.84	25.31	14.84	20.75	26.1	18~25	25pcs

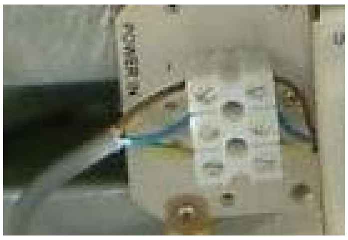
Figure 6-19:ADE Pass-Thru Opening and Gland

ADE Power Cable Connection

To connect mains power supply to the ADE, perform the following:

The ADE is fed by AC power supplied by customer.

1. Remove the protective cover on the POWER IN side.
2. Connect the power cable wires, in the right polarity, to the POWER IN terminals:
    - o Brown wire - Phase (~) terminal
    - o Blue wire - Neutral (0) terminal
    - o Yellow wire - Ground terminal
3. Reinstall the protective cover.



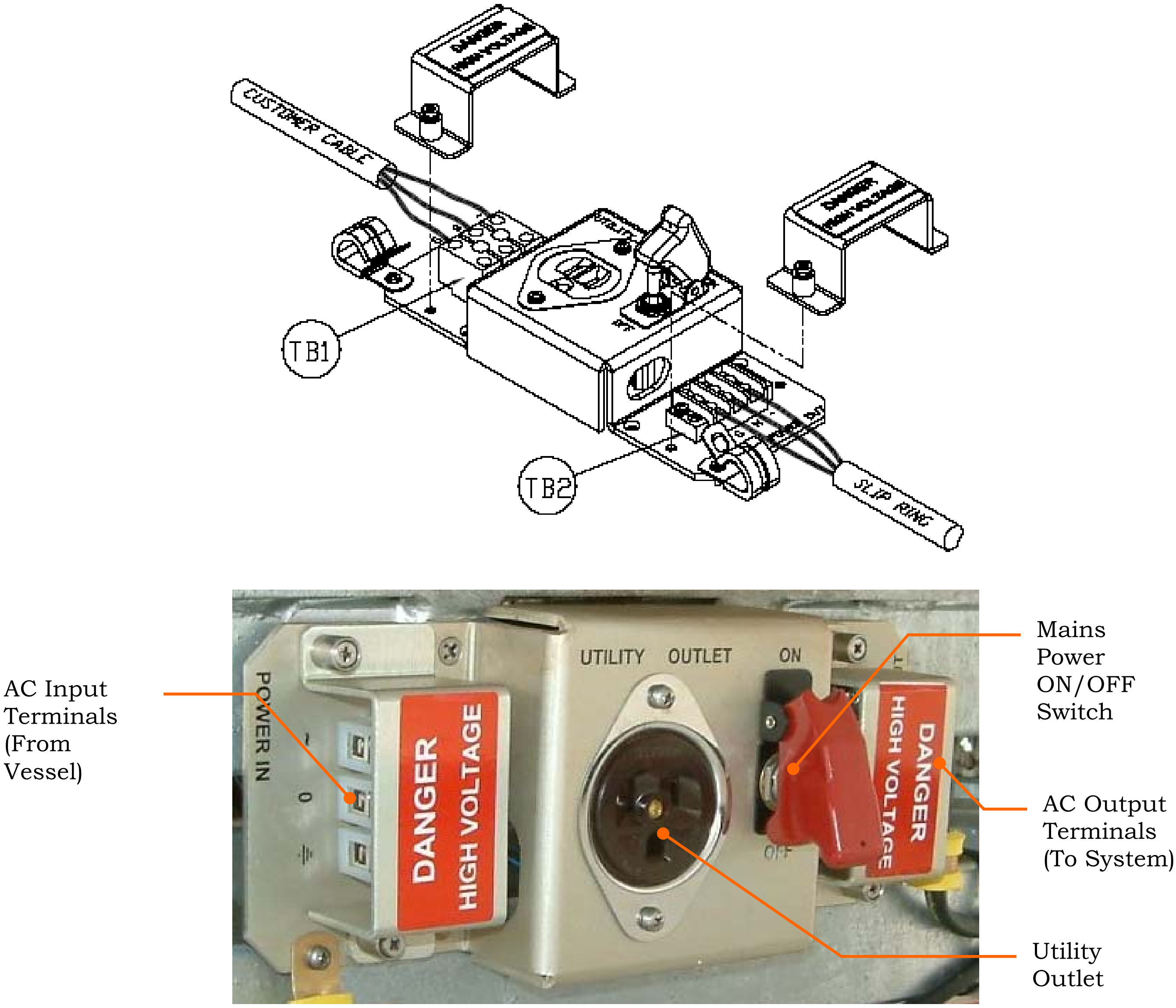


Figure 6-20:ADE Power Connection Box – Original Configuration

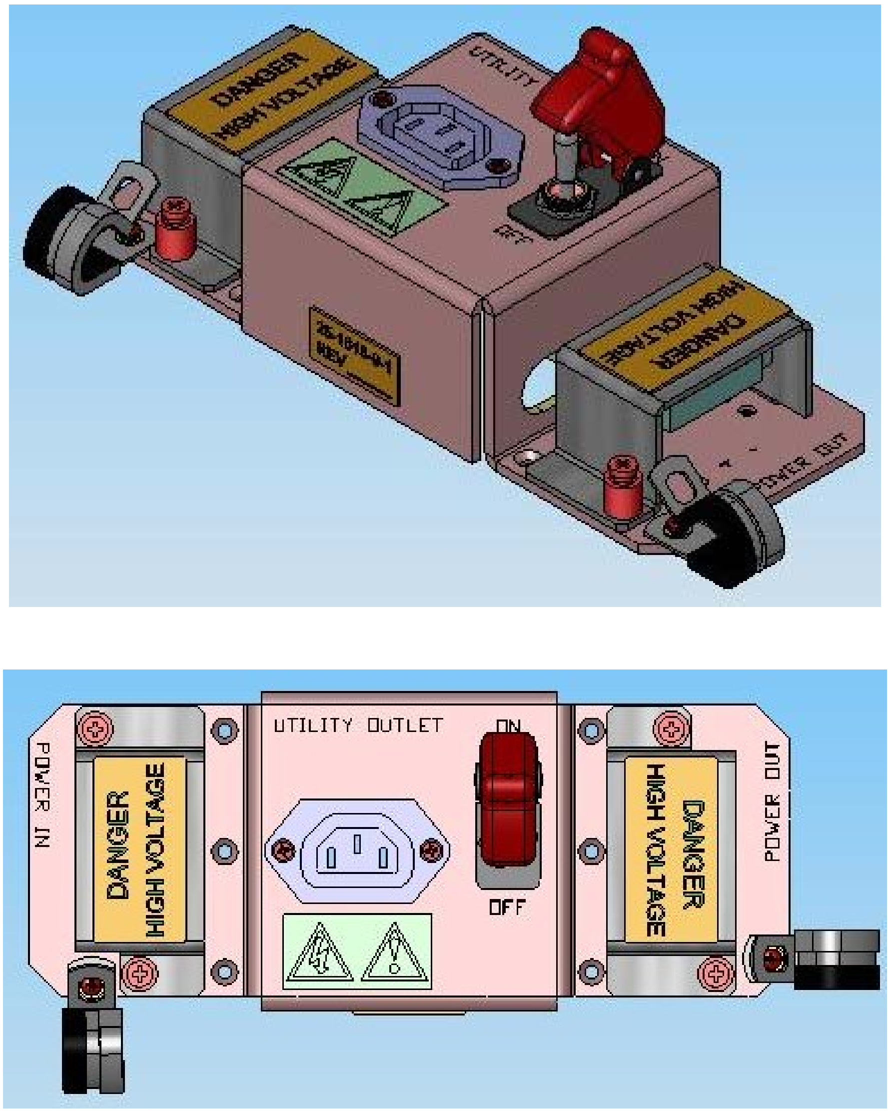


Figure 6-21:ADE Power Connection Box – Modified Configuration

---

WARNING!

The Utility Outlet is connected directly to the vessel's AC voltage input terminals (125 VAC / 250 VAC). Therefore, there still exists live voltage at the Utility Outlet after disconnecting the power supply to the ADE using the Mains Power On/Off Switch.

Note

Only qualified and authorized personnel are allowed to carry out system service / maintenance procedures.

ADE-BDE Cable Connection

The ADE is connected to the BDE by a single LMR-400/600 coax cable. To connect the cable to the BDE, perform the following procedure:

1. Install an EZ-400-NMH Connector on the ADE-Side of the LMR-400/600 cable, as instructed in Appendix A.
2. Connect the cable connector to the ADE's N-Type connector bracket, as shown in the following Figure.

Figure 6-22: ADE-BDE Cable Connection

6.3.5 Installing and Securing the Dome to the Radome Base

Introduction

The Dome is secured to the Radome Base with a securing-ring equipped with a locking mechanism.

The locking mechanism exists in two versions: original and modified.

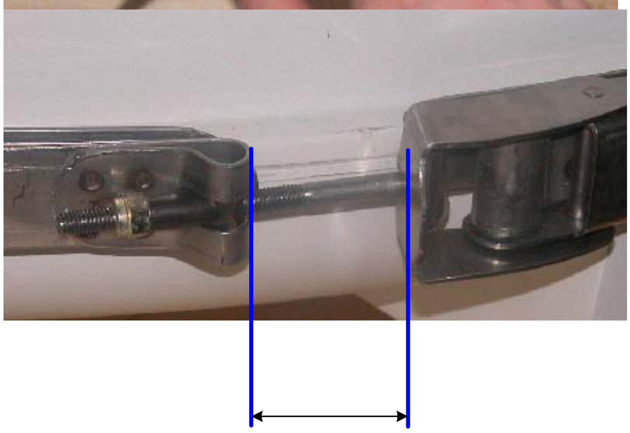
The following procedures describe how to install and secure the Dome to the Radome Base, for the two locking-device configurations.

Installation Procedure – Original Locking Device

The installation procedure should be performed by two personnel.
The procedure should be performed on a leveled, stable, and free-of-obstacles surface.

Step	Description	Details
1.	Verify that the securing ring is unlocked and placed around the Radome Base. Check that the ring is intact.	
2.	Place the Dome on top of the Radome Base. Walk around the system and verify that the Radome and Base are aligned, and that the Radome covers the Base uniformly all along the circumference.	 

Step	Description	Details
3.	Place the ring over the Dome and Radome Base joining circles, so it will overlap and secure the Radome to the Base all along the circumference. Carefully check for full alignment of the ring.	 
4.	Lock the ring latch. Again, verify that the ring is evenly securing the Radome to the Base all along the circumference.	 
5.	Using a mallet, tap the ring all along the circumference, to align the secured Radome and Base.	

Step	Description	Details
6.	Using a no. 13 metric open-end key, fasten the locking mechanism nut, while another technician taps the ring all along the circumference with a mallet, verifying alignment of the secured Dome and Radome Base. Fasten the nut until the locking mechanism inner gap (measured by a caliper) decreases to 30 +1/-0 mm.	   

Step	Description	Details
7.	Install and lock the safety pin on the locking lever.	

Installation Procedure – Modified Locking Device

The installation procedure should be performed by two personnel.
The procedure should be performed on a leveled, stable, and free-of-obstacles surface.

Step	Description	Details
1.	Repeat steps (1.) thru (5.) of the "Installation Procedure – Original Locking Device" paragraph.	
2.	Using a wrench with ½" socket, fasten the locking mechanism nut with a torque of 14 N-m (10 lb-ft), while another technician tapping the ring all along the circumference with a mallet, verifying alignment of the secured Dome and Radome Base.	 

Step	Description	Details
3.	Using a no. 13 metric open-end key, fasten the securing (outer) nut.	 
4.	Install and lock the safety pin on the locking lever.	

6.4 Installing the BDE

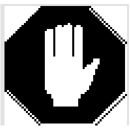
6.4.1 CCU and Modem Installation

The BDE units (CCU and Modem) are typically installed on dedicated 19-inch racks, located in the ship's equipment room(s).

Customer's Modem

CCU

Figure 6-23:Typical BDE Rack Installation



Verify that the CCU is installed at a distance of at least 5 meters from the vessel's Compass.

6.4.2 Connecting CCU Cables

CCU Rear-Panel Connectors Overview

The following Figure shows the CCU rear-panel connectors, and the subsequent Table specifies the type and function of each connector.

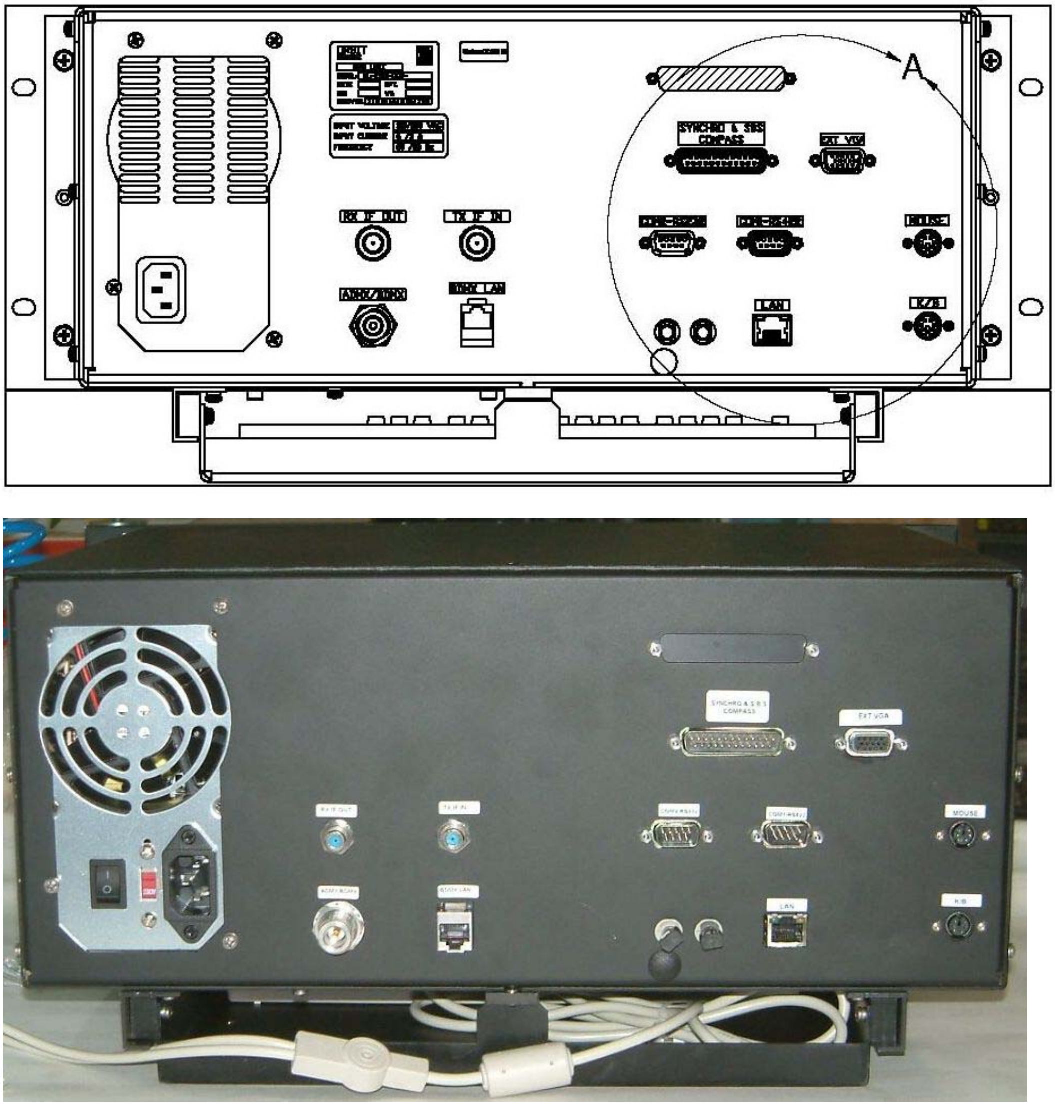


Figure 6-24:AL-7103-KU Mk II CCU Rear Panel Connectors

Table 6-1. AL-7103-KU Mk II CCU Rear Panel Connectors

Connector	Connector Type	Function
Power Supply	Integrated plug	From ship's Mains power source.
LAN	RJ-45	Connects to the ADMx LAN Connector via a jumper cable
K/B	MINI-DIN	Connects CCU to the Keyboard located at CCU drawer.
MOUSE	MINI-DIN	Connects CCU to the mouse located at CCU drawer.
SYNCHRO & SBS COMPASS	DB25 male	Connects CCU to customer's Compass (SYNCHRO & SBS).
COM1-RS422	DB9 male	Connects CCU to customer's Compass (RS-422 port).
COM2-RS232	DB9 male	General-Purpose Serial that can be used for IRD Lock, External AGC, GPS Output, External Beacon Receiver, COMTEC Modem, etc. (RS-232 port).
EXT VGA	DB 15-Pin HD	Connects to an external monitor
RX IF OUT	F-Type	Connects to Modem RX Input
TX IF IN	F-type	Connects to Modem TX Output
ADMx/BDMx	N-Type	Connects to the ADE-BDE cable.
ADMx LAN	RJ-45	Connects to the LAN Connector via a jumper cable

The following paragraphs provide information and instruction pertinent to the available CCU connections.

General-Purpose Connections (Power, LAN Jumper, KB, Mouse)

The following Figure depicts the general-purpose cables that should be connected to the CCU:

- Power cable
- LAN Jumper between the ADMx LAN and the LAN connectors
- Keyboard
- Mouse.

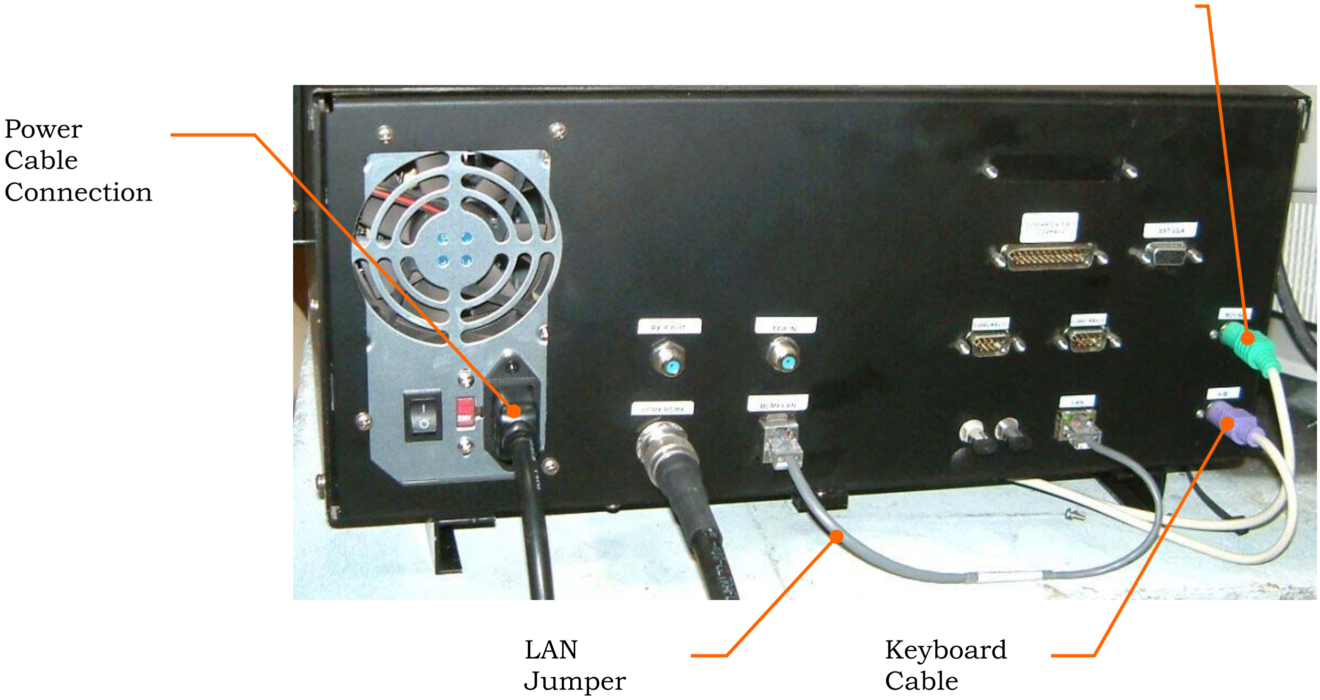


Figure 6-25: CCU Rear Panel – General Purpose Connections

ADE-BDE Cable Connection

The ADE is connected to the BDE by a single LMR-400/600 coax cable. To connect the cable to the CCU, perform the following procedure:

1. Install an EZ-400-NMH Connector on the BDE (CCU)-Side of the LMR-400/600 cable, as instructed in Appendix A.
2. Connect the cable connector to the CCU ADMx/BDMx connector, as shown in the following Figure.

Figure 6-26: CCU Rear Panel – ADMX/BDMX Connector

Serial Communication and Compass Connectors

The CCU rear panel includes three communication connectors:

- Synchro and SBS Compass - Connects CCU to customer's Compass (SYNCHRO & SBS)
- COM1 – RS-422 - Connects CCU to customer's Compass (RS-422 port).
- COM2 – RS-232 - General-Purpose Serial port.

Figure 6-27: CCU Rear Panel – Serial and Compass Connectors

The following Table specifies the communication connector pin-out.

The subsequent paragraphs describe how to use each connector.

Table 6-2. Communication Connectors Pin Out

COM1	RS422
PIN 1	TX +
PIN 2	RX -
PIN 3	TX -
PIN 4	RX +
PIN 5	GND
PIN 6	NC
PIN 7	NC
PIN 8	NC
PIN 9	NC

COM2	RS232
PIN 1	NC
PIN 2	RX
PIN 3	TX
PIN 4	NC
PIN 5	GND
PIN 6	AGC IN
PIN 7	12V
PIN 8	IRD
PIN 9	GND

SYNCHRO & S.B.S. COMPASS	
PIN 1	NC
PIN 2	GND
PIN 3	NMEA -
PIN 4	NMEA +
PIN 5	GND
PIN 6	NC
PIN 7	NC
PIN 8	REF +
PIN 9	NC
PIN 10	REF -
PIN 11	NC
PIN 12	S.B.S. - COM
PIN 13	S.B.S. - A
PIN 14	NC
PIN 15	GND
PIN 16	NC
PIN 17	NC
PIN 18	S1
PIN 19	NC
PIN 20	NC
PIN 21	GND
PIN 22	S2
PIN 23	S3
PIN 24	S.B.S. - C
PIN 25	S.B.S. - B

NMEA-0183 RS-422 Compass Connection

General

The National Marine Electronics Association (NMEA) 0183 standard defines an electrical interface and data protocol for communications between marine instrumentation.

The NMEA-0183 standard is 4800 baud and consists of several different ASCII sentences.

Electrical Interface

This standard allows a single "talker" and several "listeners" on one circuit. The recommended interconnect wiring is a shielded twisted pair, with the shield grounded only at the talker. The standards do not specify the use of any particular connector.

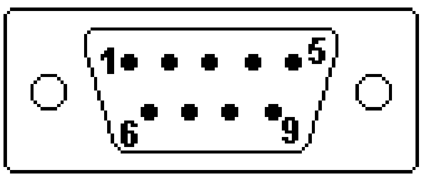
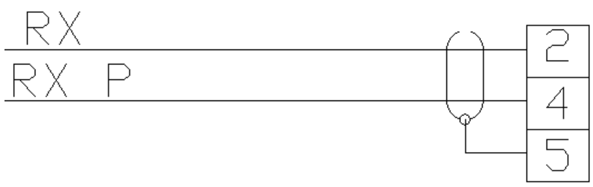
NMEA-0183 recommends that the talker output comply with EIA-422. This is a differential system, having two signal lines, A and B.

The voltages on the "A" line correspond to those on the older TTL single wire, while the "B" voltages are reversed (while "A" is at +5, "B" is at ground, and vice versa).

In either case, the recommended receive circuit uses an opto-isolator with suitable protection circuitry. The input should be isolated from the receiver's ground.

In practice, the single wire, or the EIA-422 "A" wire may be directly connected to a computer's RS-232 input.

The following Figure depicts how to connect an RS-422 NMEA-0183 Compass to the CCU's COM1 Connector.

Connecting an RS-422 NMEA-0183 Compass to COM1 Connector:	
CCU Connector	**Mating Connector Wiring Diagram**
 COM1-RS422	

Mating Connector Pin Out	
Pin	**Signal**
2	RXD-
4	RXD+
5	GND

Figure 6-28: RS-422 NMEA-0183 Compass - Connection Scheme

Compass Configuration Procedures:

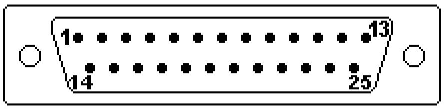
To find and enter the system's Offset to Ships Compass, refer to "Finding and Setting of Heading (Compass) Offset".

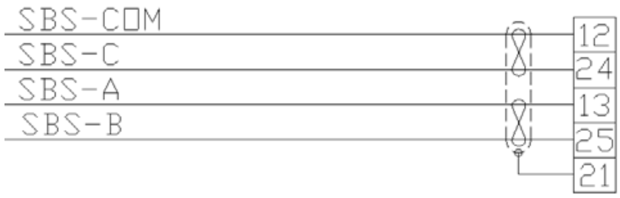
To set the compass interface, refer to " Setting of Interface to Ship's Compass".

To change the default NMEA-0183 sentence, "Changing the Default NMEA-0183 Compass Sentence".

Step-by-Step Compass connection

The following Figure depicts how to connect a Step-by-Step Compass to the CCU's SYNCHRO & SBS Connector.

<table>
<tr><th colspan="2">Connecting a Step-by-Step Compass to SYNCHRO & SBS Connector:</th></tr>
<tr><td><u>CCU Connector</u>


SYNCHRO & SBS</td><td><u>Mating Connector Wiring Diagram</u>

</td></tr>
</table>

Mating Connector Pin Out	
Pin	**Signal**
12	COMMON
13	A
25	B
24	C

Notes:

Supports +20 VDC to +70 VDC.

Supports Dual Polarity:

Positive:	A, B, C	–	+VDC or Open
	Common	–	GND
Negative:	A, B, C	–	GND or Open
	Common	–	+VDC

Figure 6-29: Step-by-Step Compass - Connection Scheme

Compass Configuration Procedures:

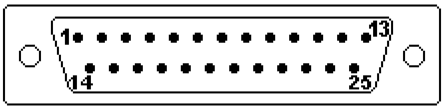
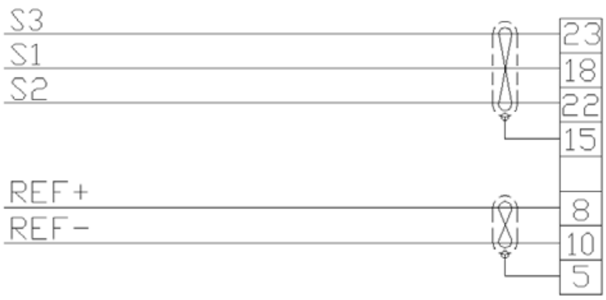
To find and enter the system's Offset to Ships Compass, refer to "Finding and Setting of Heading (Compass) Offset".

To set the compass interface, refer to "Setting of Interface to Ship's Compass".

Synchro Compass connection

The following Figure depicts how to connect a Synchro Compass to the CCU's SYNCHRO & SBS Connector.

Connecting a Synchro Compass to SYNCHRO & SBS Connector:

CCU Connector	**Mating Connector Wiring Diagram**
 **SYNCHRO & SBS**	

Mating Connector Pin Out	
Pin	**Signal**
8	REF+
10	REF-
5	GND
18	S1
22	S2
23	S3
15	GND

Note:

Supports 115 VAC Reference. 60 VAC Reference is Optional.

Figure 6-30: Synchro Compass - Connection Scheme

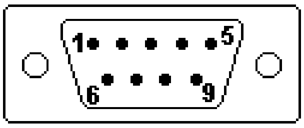
Compass Configuration Procedures:

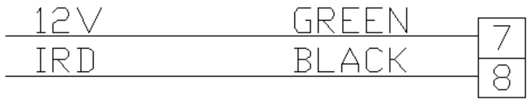
To find and enter the system's Offset to Ships Compass, refer to "Finding and Setting of Heading (Compass) Offset".

To set the compass interface, refer to " Setting of Interface to Ship's Compass".

IRD LOCK Connection

The following Figure depicts how to connect IRD LOCK modem signal to the CCU’s COM2 Connector.

<table>
<tr><th colspan="2">Connecting IRD LOCK to COM2 Connector:</th></tr>
<tr><td><u>CCU Connector</u>


COM2-RS232</td><td><u>Mating Connector Wiring Diagram</u>

</td></tr>
</table>

Mating Connector Pin Out	
Pin	**Signal**
7	12VDC OUTPUT
8	IRD INDICATOR

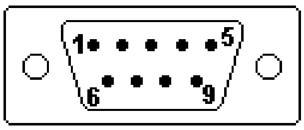
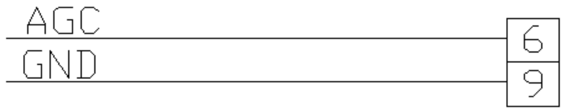
Note:

Connect Pin 7 & Pin 8 via “dry-contact” relay.

Figure 6-31: IRD LOCK - Connection Scheme

External AGC Connection

The following Figure depicts how to connect External AGC to the CCU's COM2 Connector.

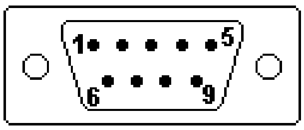
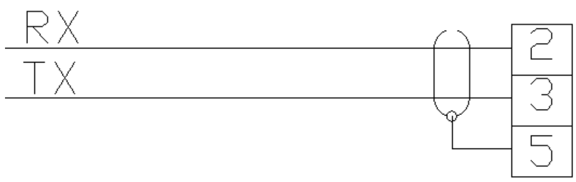
Connecting External AGC to COM2 Connector:	
CCU Connector	**Mating Connector Wiring Diagram**
 **COM2-RS232**	

Mating Connector Pin Out	
Pin	**Signal**
6	AGC IN
9	GND

Figure 6-32: External AGC - Connection Scheme

RS-232 Channel Connection

The following Figure depicts how to connect RS-232 Channel to the CCU's COM2 Connector.

Connecting RS-232 Channel to COM2 Connector:	
CCU Connector	**Mating Connector Wiring Diagram**
 **COM2-RS232**	

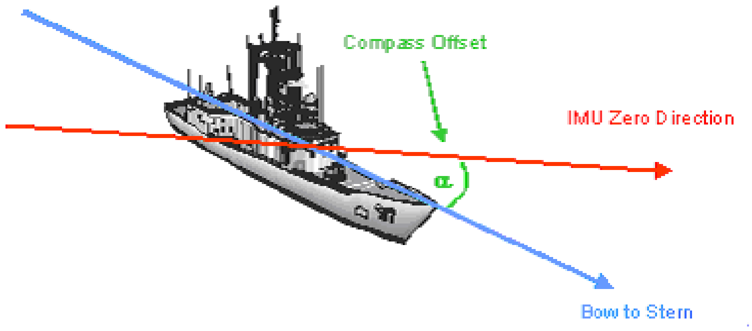
Mating Connector Pin Out	
Pin	**Signal**
2	RXD
3	TXD
5	GND

Figure 6-33: RS-232 Channel - Connection Scheme

6.5 Compass Configuration Procedures

6.5.1 Finding and Setting of Heading (Compass) Offset

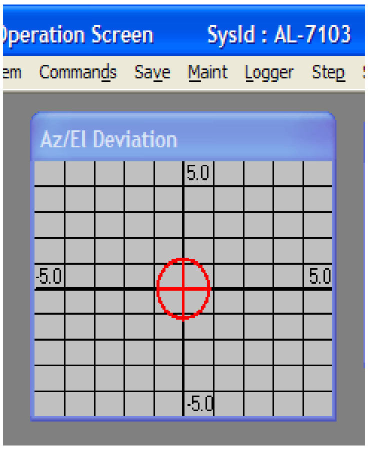
When the system is installed onto a vessel you will find that it is not aligned with the bow of the ship. This means that you will need to set the compass offset so that the system is aligned with the vessel's gyro compass:



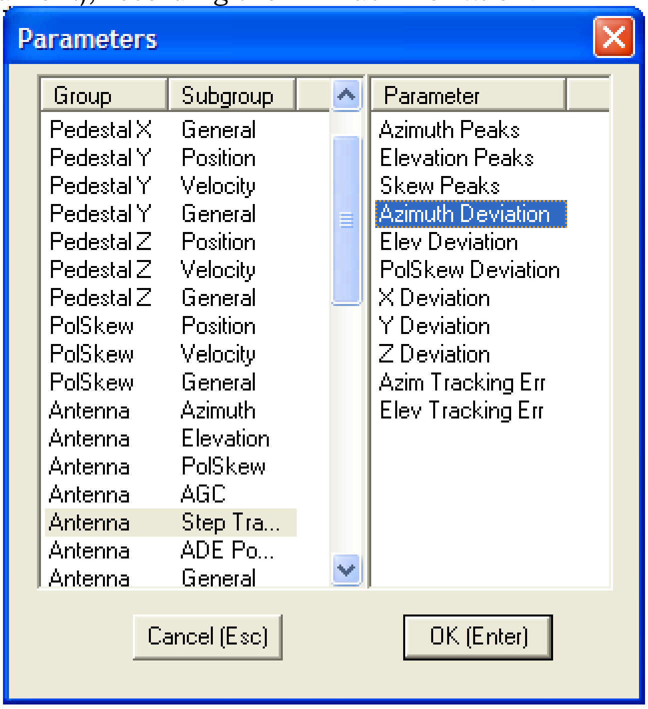
As marked in the drawing above, Compass offset is the angle between the ship's Compass direction, represented by the Bow-to-Stern line and the IMU direction, represented by a black arrow marking on the exterior of the AL-7204 radome.

To establish the exact offset angle the following steps should be taken:

1. Make a "naked-eye" rough estimate for the offset angle. Looking on the drawing above that would be something like -30 degrees (negative because the offset in the example is counter-clockwise from ship's bow).
2. Make a "naked-eye" rough estimate for the offset angle. Looking on the drawing above that would be something like -30 degrees (negative because the offset in the example is counter-clockwise from ship's bow).
3. Set the "naked-eye" estimate into the controller (as shown below).
4. Point antenna to satellite. Record the antenna Azimuth at this point as "Nominal Azimuth".
5. Use Manual mode (see appropriate paragraph in this document) to move the antenna Azimuth orientation to point it onto the satellite. The amount of expected movement depends on how accurate was your initial estimate. Most people can tell direction within +/-10 degrees...
6. Once the satellite is acquired (Beacon receiver locked or, SatModem has locked on the Downstream data channel or, Spectrum analyzer screen shows a recognizable signal pattern or any other way of validating that's the right satellite) put the antenna to Step-track.
7. Find "Azimuth Deviation", which is how far away is the actual antenna Azimuth from the expected one.
8. To do so you may use the graphical cross hair display, which is calibrated in degrees, showing a total of +/- 5 degrees:



9. Or you can use the Graphical logger (see appropriate paragraph in this document), recording the Azimuth Deviation:



10. Or you may put the antenna to "Peak" mode and find the "Azimuth Deviation" by calculating the difference between the current antenna Azimuth and the "Nominal Azimuth" as noted above.

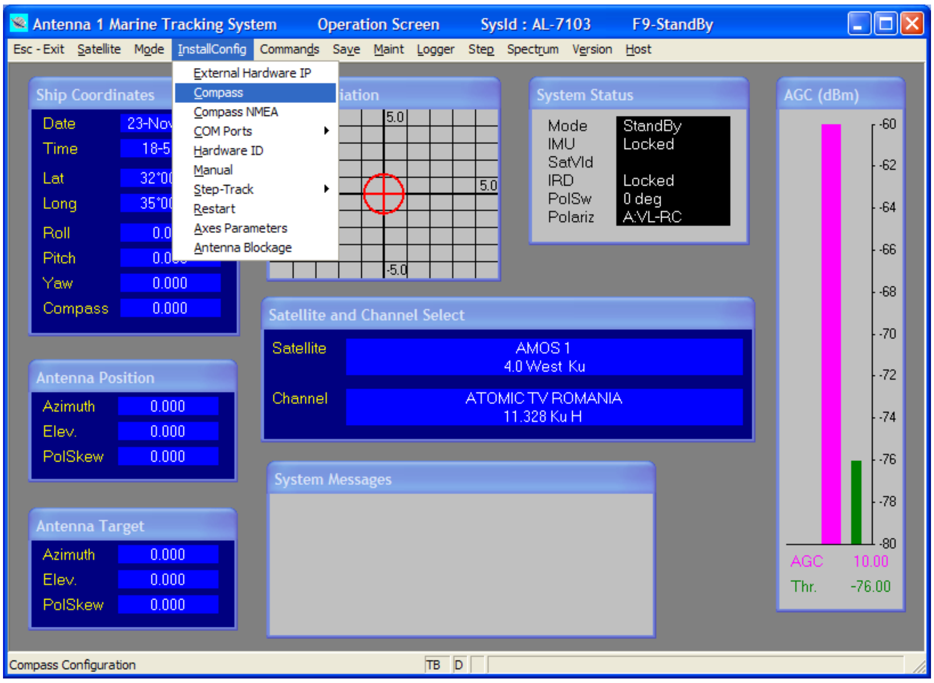
11. The "Azimuth Deviation" obtained in one of the methods shown above will be used to refine the "naked-eye" offset estimate. This will be given by:

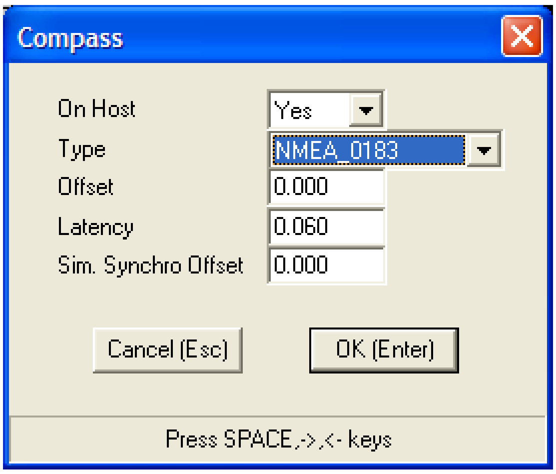
12. Compass Offset Correction = Azimuth Deviation / Cosine (Antenna Elevation)

13. For example, we found the satellite with the cross-hair mark three notches right of center (+3 degrees), while the antenna Elevation is 41.4 degrees.

14. That means that our initial "naked-eye" estimate of –30 degrees must be corrected by:

15. 3/Cos (41.4) = 4.0 degrees, resulting in overall Compass Offset of –26.0 degrees
16. How to set the Offset to the controller-
17. From “Operation Screen” press “I” then select “Compass”:

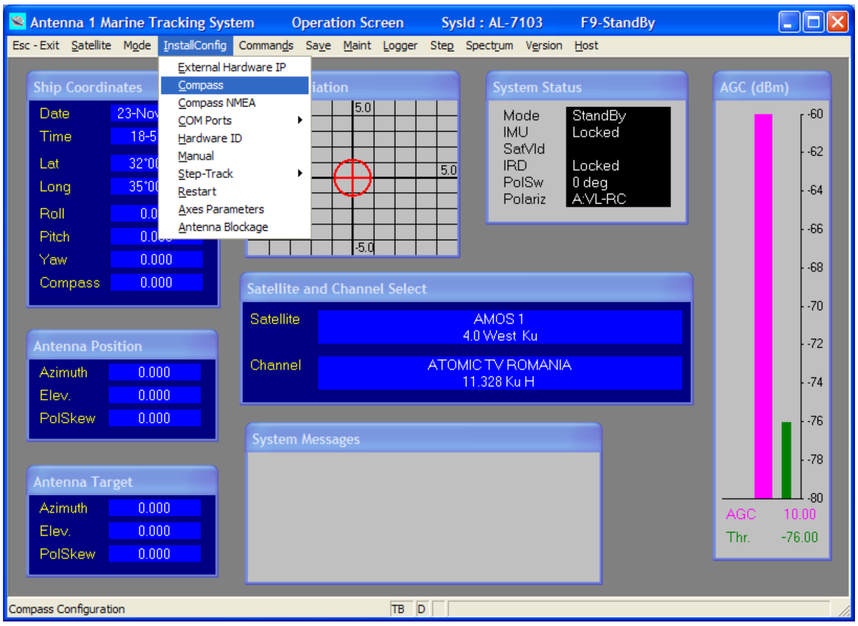


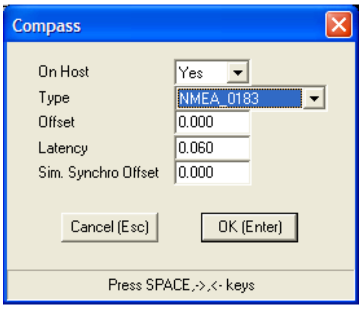


18. Enter the Offset (third line from the top), OK and save into ACU non-volatile memory.

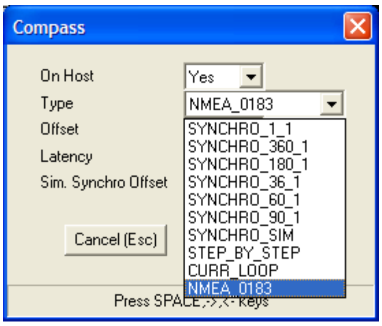
6.5.2 Setting of Interface to Ship's Compass

From "Operation Screen" press "I" then select "Compass":





Select the pertaining compass type:



Supported interface types:

Synchro, Step-by-Step and NMEA-0183.

("Current-loop" – is not supported, although listed.)

The default setting is NMEA-0183

For Synchro or Step-by-Step – please contact factory.

Synchro hardware set-up: 115VAC 50-400 Hz Reference, 90VAC S1, S2, S3 Phases

Synchro 1 to 1:

1 degree of ship rotation corresponds to 1-degree displacement of Compass readout

Synchro 360 to 1:

1 degree of ship rotation corresponds to 360 degrees displacement of Compass readout

Synchro 180 to 1:

1 degree of ship rotation corresponds to 180 degrees displacement of Compass readout

Synchro 90 to 1:

1 degree of ship rotation corresponds to 90 degrees displacement of Compass readout

Synchro 60 to 1:

1 degree of ship rotation corresponds to 60 degrees displacement of Compass readout

Synchro 36 to 1:

1 degree of ship rotation corresponds to 36 degrees displacement of Compass readout

Step-by-Step hardware setup: three Lines – A, B, C and Common

Both types of Step-by-Step are supported: Common GND, and Common Hot

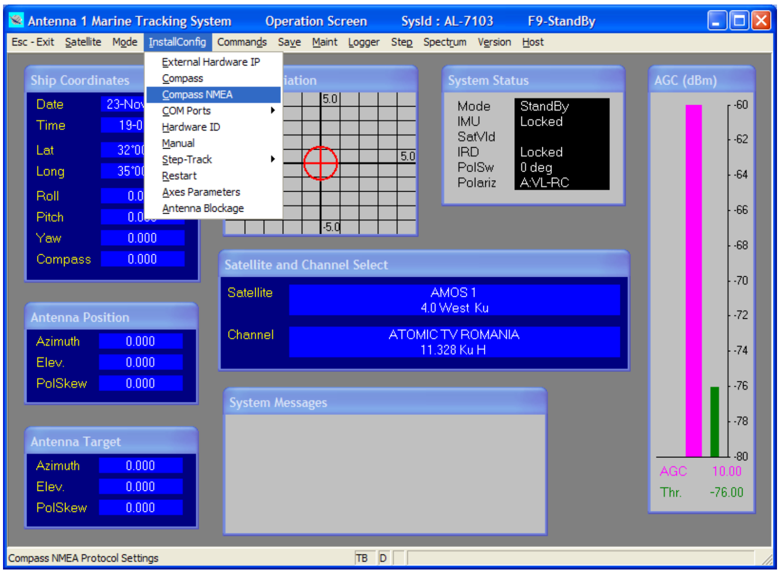
Maximal voltage level allowed for active Line in case of Common GND: 20 to 70VDC

Maximal voltage level allowed for Common Hot: 20 to 70VDC.

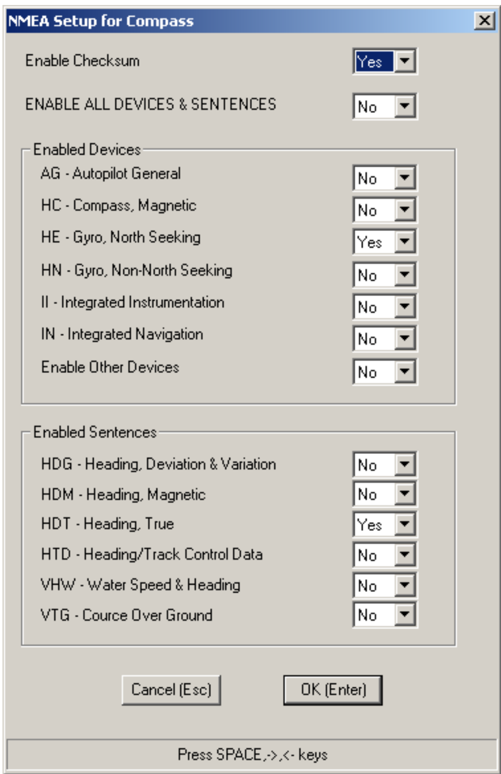
6.5.3 Changing the Default NMEA-0183 Compass Sentence

When connecting an NMEA-0183 compass, perform the following to change the default sentence:

From “Operation Screen”, press “I”, and then select “Compass NMEA”:



At the NMEA Setup screen, select the relevant NMEA sentence, and then select OK to save into the ACU non-volatile memory.



6.6 Modem Integration

6.6.1 Introduction (Rx & Tx Path Gain Calculation)

Following completion of the AL-7103 Mk II System installation, the Modem (which is not part or Orbit's deliverables) should be installed, connected and configured.

When installing the modem, verify the following:

- Rx signal, into the Modem, is within the modem dynamic range.
- Tx signal, from the modem, is set so that the BUC is not saturated, and on the other end strong enough for quality transmission.(1dB Compression point).

The following paragraphs provide calculation examples, for a 50 m ADE-BDE cable, showing how to calculate the gain budget along the system's Rx and Tx paths.

For any other cable type or cable length, perform the pertaining calculations.

6.6.2 Rx Chain Gain Budget (from LNB to Rx Modem Input)

#	Parameter	Value
1	Total Rx chain Gain (ADMx & BDMx)	25dB, typical
2	Typical loss of LMR-400 cable	9dB @ L-BAND for 50m
3	Typical loss of cables, splitter & rotary joint within the pedestal	8dB
4	Total loss (# 2+3)	17dB
5	Total Rx system Gain (# 1–4)	8dB
6	Typical LNB output	– 55dBm
7	**Rx Input level to the modem (# 6+5)**	**-47dBm**

Conclusion: The calculated Rx Input level to the modem (-47dBm) is typically within the dynamic range of the modems, (depends on types of modem, modulation schemes & data rates).

6.6.3 Tx Chain Gain Budget (from the modem to the BUC input)

Coarse Adjustment

#	Parameter	Value
1	Total Tx chain Gain (ADMx & BDMx)	17dB, typical
2	Typical loss of LMR-400 cable	15dB @ 4.7GHz for 50m
3	Typical loss of cables, DC Inserter & rotary joint within the pedestal	6dB
4	Total loss (# 2+3)	21dB
5	Total Tx system Gain (# 1–4)	-4 dB
6	Typical BUC input level for 1dB Compression	4W BUC: – 16dB 8W BUC: – 24dB
7	**Typical coarse value of modem output, for BUC 1dB Compression (# 6-5)**	**4W BUC: – 12dB** **8W BUC: – 20dB**
8	Typical Modem dynamic output range	0 to – 30dB

Conclusion: The calculated coarse value of modem output, for BUC 1dB Compression is well within the typical Modem dynamic output range (0 to – 30dB).

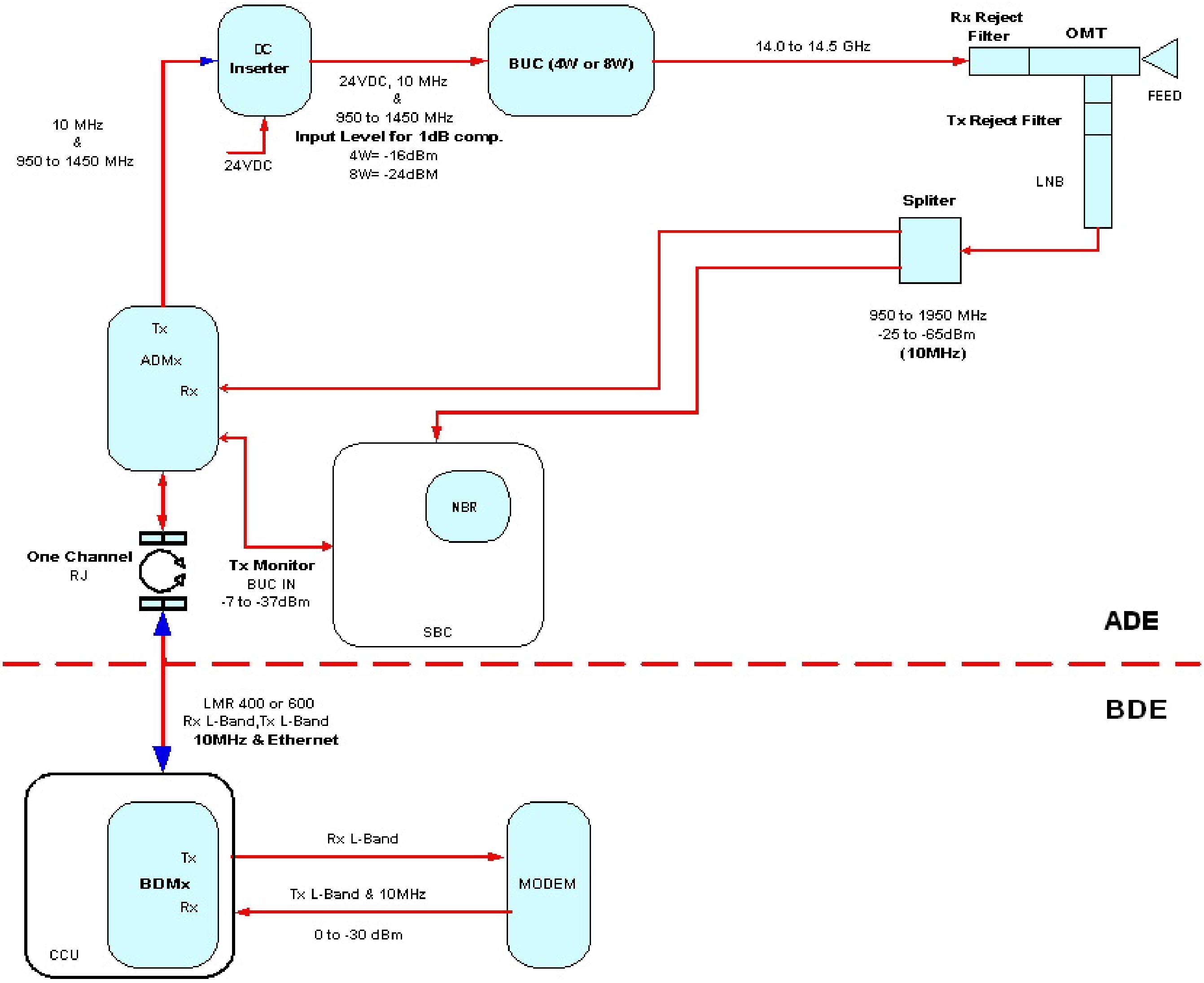
Fine adjustment model output level (using the HUB station)

Setting the Modem power for driving the BUC to 1dB Compression:

1. Activate “Tx on” in the Modem.

   Caution: use the coarse typical calculated values as a starting modem power level (in order to avoid BUC saturation).

2. Raise the Modem power 1 dB at a time while monitoring of the signal at the HUB Spectrum Analyzer (1dB of power giving increase of 1dB of signal).
3. 1dB Compression is reached when 1dB increase of Modem power causes less then 0.5dB of increase in signal level. Do not increase the Modem power beyond this point, as it will drive the BUC into compression.



When the system is supplied with a BUC that does not require DC supply via the L-Band coax, the DC Inserter is not installed.

Note that there also may be a situation where the DC inserter, although physically present, is actually bypassed and not used. This may occur in case the system was upgraded on-site to include a BUC which does not require DC supply via its L-Band coaxial connector.

Figure 6-34:AL 7103-Ku Mk II System - RF Layout

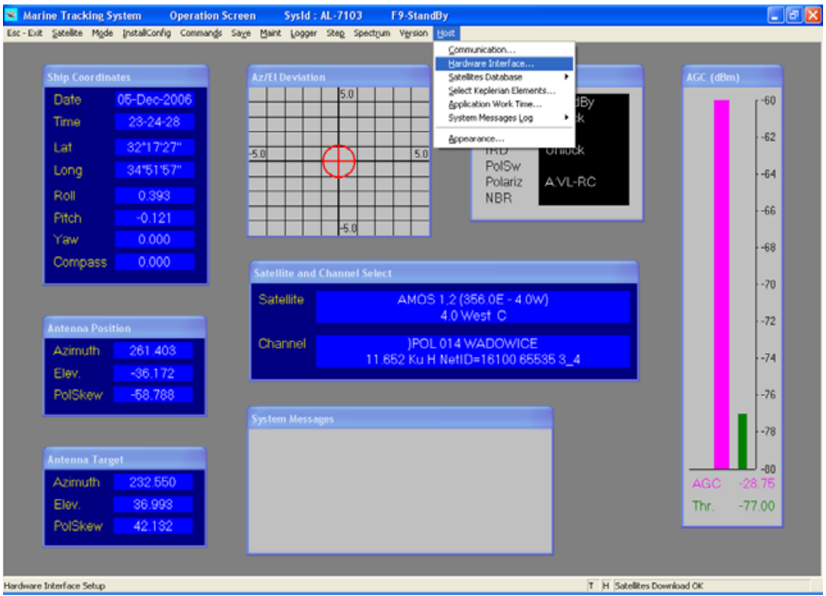
6.6.4 Setting up the GPS output on CCU COM2

The following procedure specifies how to setup the GPS output on port COM2 of the CCU.

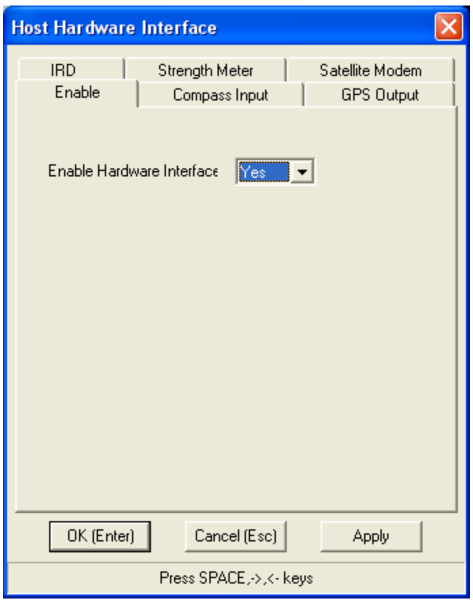
This procedure is needed only if the satellite modem requires GPS updates and can receive the updates in NMEA-0183 format.

➢ **To set up the GPS Output:**

1. From "Operation Screen", press "H", then select "Hardware Interface…" for opening the "Host Hardware Interface" window.

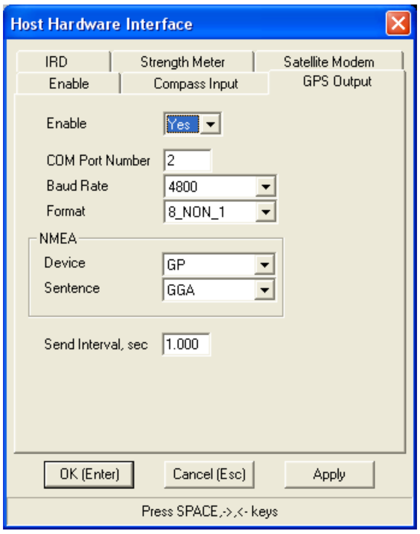


2. Verify that "Enable Hardware Interface" on "Enable" tab is set to "Yes", and press "Apply".



3. Select "GPS Output" tab and set parameters as following:

- Set "Enable" to "Yes"
- Set "COM Port Number" to "2"
- Set "Baud Rate" to "4800"
- Set "Format" to "8_NON_1"
- Set "Device" to "GP"
- Set "Sentence" to "GGA"
- Set "Send Interval" to "1" Second



4. Press "OK" when complete.

6.7 Selecting the Tracking Receiver Type

6.7.1 Introduction

The SBC includes two receiver types:

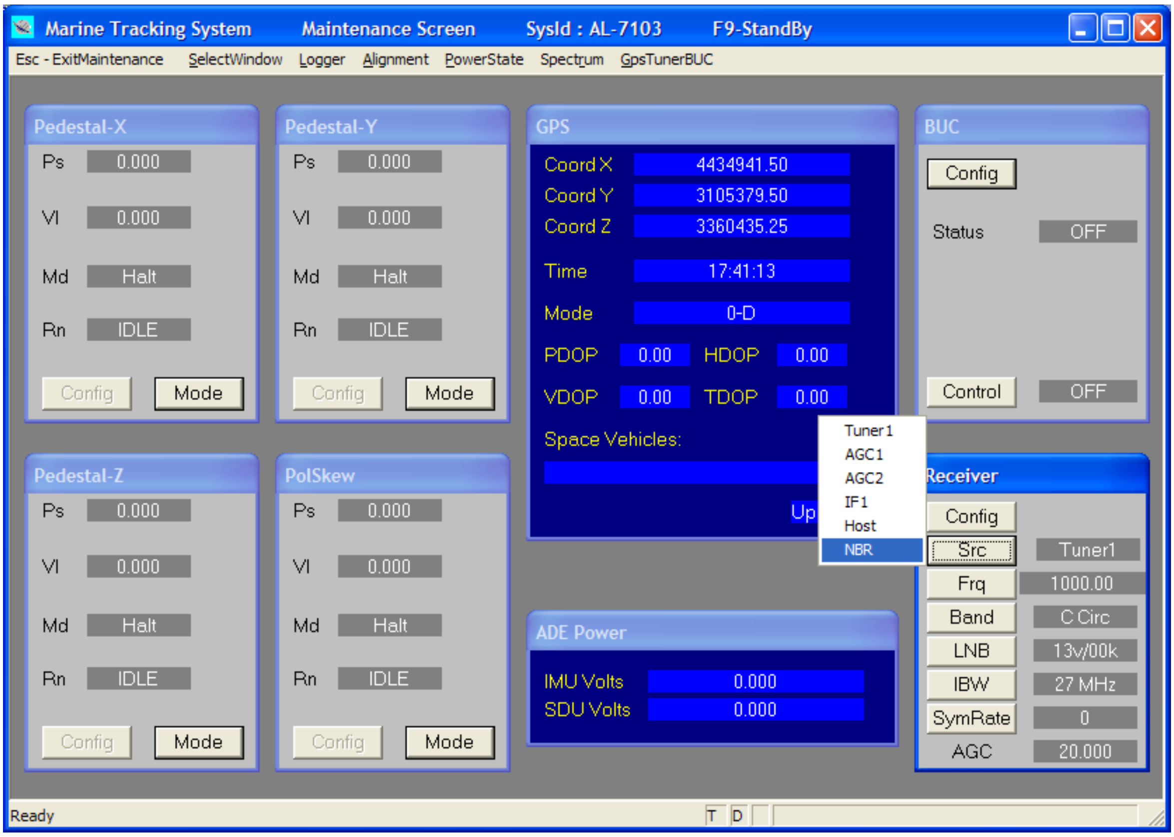
- Narrow Band Receiver (NBR)
- Wide Band Receiver.

This procedure explains how to set the system to work with one of these receivers.

6.7.2 Selecting the Receiver Type

From "Operation Screen" press "M", to go to the "Maintenance" screen.

Press "Src" on the "Receiver" sub-window and select "NBR" to activate the NBR, or "Tuner 1" to activate the Wide Band Receiver:



Save ALL settings to SBC non-volatile memory.

Satellite and Channel Selection operation instructions:

- If the NBR was activated, refer to paragraph 4.3, "Selecting a Satellite and Channel (Narrow Band Receiver Activated)".
- If the Wide Band Receiver was activated, refer to paragraph 4.4, "Selecting a Satellite and Channel (Wide Band Receiver Activated)".

6.8 Cease Transmission (Tx) Configuration

To set and configure the Cease-Transmission (Tx) feature, perform the following procedures.

6.8.1 Setting up Cease-Tx Control

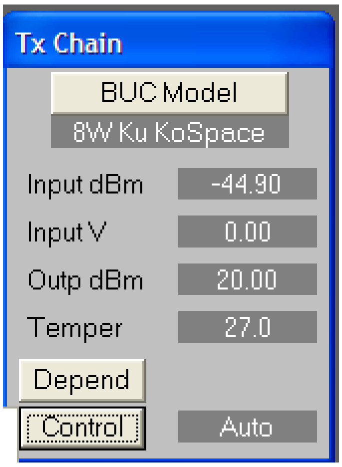
Purpose

The below explains the monitoring and control of the AL-7103 Tx Chain with all BUCs currently defined as valid options.

The Tx-Chain consists of BUC, ADMx, and the logic for automatic control over Tx-enable by the AL-7103 software ("Cease Transmit").

"Tx Chain" Configuration Screen

"Tx Chain" screen contains the following:



BUC Model:

BUC Model selection list:

"Undefined", "4W Ku KoSpace", "8W Ku KoSpace", "8W Ku Agilis", "8W Ku NxGnWv", "8W C Belcom", "10W C Codan", "20W C Codan".

Input (dBm):

L-Band signal power measured on the output of the ADMx in dBm. If ADMx to BUC input losses are taken into consideration, this value has a good correlation of the L-band power injected into the BUC

Input (Volts):

L-Band signal power as measured by the ADMx monitor, in Volts, before the conversion to dBm.

Output (dBm):

BUC output power indication in dBm. This is only presented for BUC's equipped with a output power monitor compatible with the SBC interface: 10w and 20w Codan, 8w KoSpace. If not active, this display will present a blank field.

~~~~~~

Disclaimer Note:

Neither Input(dBm) nor Output(dBm) are designed as precision measurement devices. The presented values have more of an indicative quality, their accuracy strongly dependent on the BUC brand as well as the current environmental conditions.

Regardless, those tools have been proven as extremely effective aids for the in-field integration process.

~~~~~~

<u>Temperature (degC):</u>

BUC temperature indication in degC. This is only presented for BUC's equipped with a temperature monitor compatible with the SBC interface: 10w and 20w Codan, 8w KoSpace. If not active, this display will present a blank field.

<u>Control Button: Tx Control</u>

The button presents a select list with the following options: None/On/Off/Auto.

Default: On (To prevent the need of Configuration change, after software upgrade on a system equipped with KoSpace 4w BUC)

Last selection is saved in non-volatile memory if "Save Maintenance" (or "Save All") is activated.

(Note that in the present version this control has only three states: On/Off/Auto)

<u>Function:</u>

When changed to "On" – The AL-7103 software should send a Tx-On command

When changed to "Off" – The AL-7103 software should send a Tx-Off command

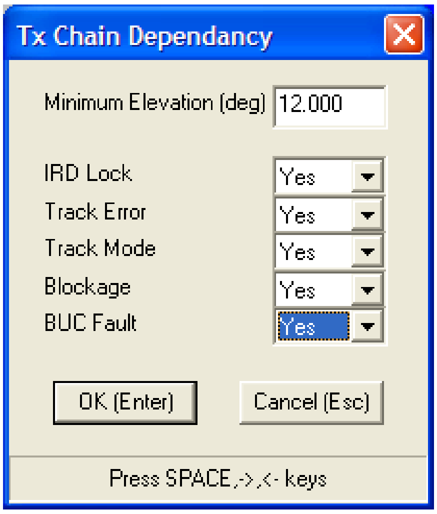
When set to "Auto" – The AL-7103 software will send a Tx-On command if all of the "Tx Dependency"-enabled conditions are true <u>for the duration of minimal time of two consecutive seconds</u>. The AL-7103 software will send a Tx-Off command if one, or more, of the "Tx Dependency"-enabled conditions are false.

When set to "None" – The AL-7103 software will not send any commands.

When "Tx Control" is set to either On,Off, or None the "Tx Dependency" parameters should be disabled (presented in light gray)

Control Button: Tx Dependency

The button opens a configuration sub-screen with the following parameters:



Function:

Min Elevation [deg]: Tx will be stopped if the antenna Elevation angle, relative to the Earth horizon, goes below the dialed value.

IRD Lock: If set to “Yes”, will stop Tx if satellite IRD Lock turns to “Unlock”

Track Error: If set to “Yes”, will stop Tx if the Tracking error produced by the ConScan Step-track, exceeds the Track Error Threshold value, as set in Step-track configuration sub-screen

Track Mode: If set to “Yes”, will stop Tx if the current mode is not Step-track

Blockage: If set to “Yes”, will stop Tx if Antenna view is blocked according to Antenna Blockage Zones settings

BUC Fault: If set to “Yes”, will stop Tx if BUC Fault is identified.

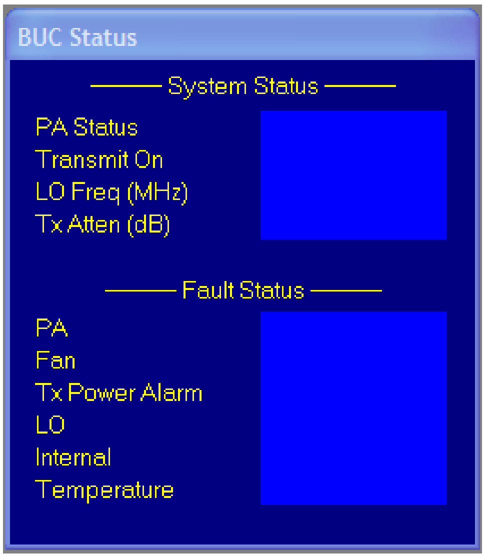
Note that when a Cease-Tx condition is identified, the BUC Tx is stopped immediately (less then 100msec), while when the Cease-Tx condition disappears, the BUC Tx is renewed only after a 2 second delay. This is in compliance with regulatory requirements.

All the above is relevant only if the Control is set to “Auto” and the particular selected BUC has the appropriate interface for Tx Control: 10w and 20w Codan, 4w and 8w KoSpace.

“BUC Status” Screen

BUC Status screen is sequentially accessible thru the “GpsTunerBUC” control label on the Maintenance screen. “BUC Status” screen will present the following status:

For “10W C Codan” and “20W C Codan” Models:



---------- System Status ---------------

PA Status: On/Off

Transmit On: On/Off

LO Freq (MHz): 7300, 7375, 7600, 7675

Tx Atten (dB): 0,4,8,12

------------ Fault Status ----------------

PA: OK/Failed

Fan: OK/Failed

Tx Power Alarm: OK/Failed

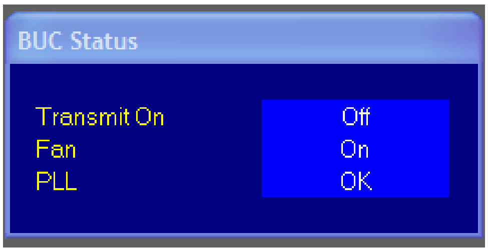
LO: OK/Failed

Internal: OK/Failed

Temperature: OK/Failed

Note that “LO” will indicate “Failed” if there is no 10MHz sync on the BUC input.

For “8W Ku KoSpace”



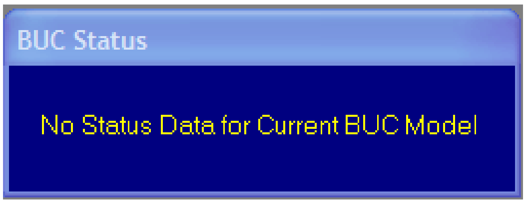
Tx : On/Off

Fan : On/Off

PLL : OK/Failed

Note that “PLL” will indicate “Failed” if there is no 10MHz sync on the BUC input.

All the rest of the BUC selections will show:



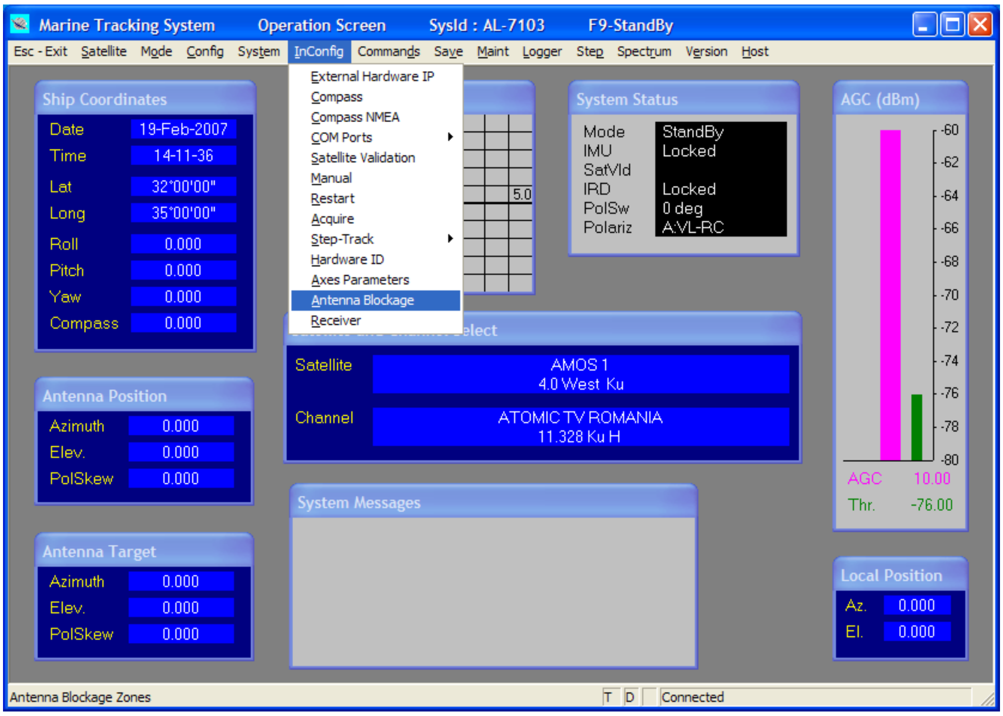
BUC Serial number

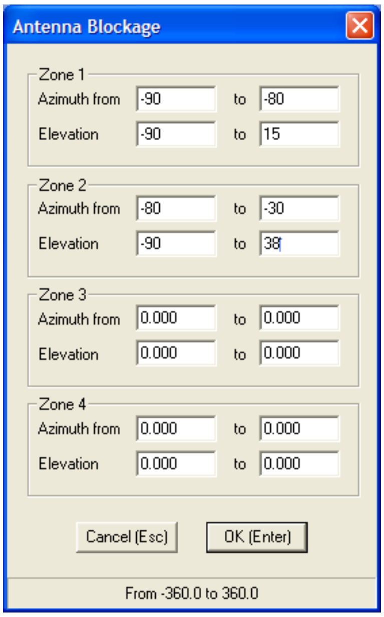
Hardware ID screen presents BUC S/N for BUCs which are able to provide this info.

The list of those BUCs is now extended to: 8W Ku KoSpace, “8W Ku NxGnWv”, 10W C Codan and 20W C Codan.

6.8.2 Enter Blockage Zones Angles

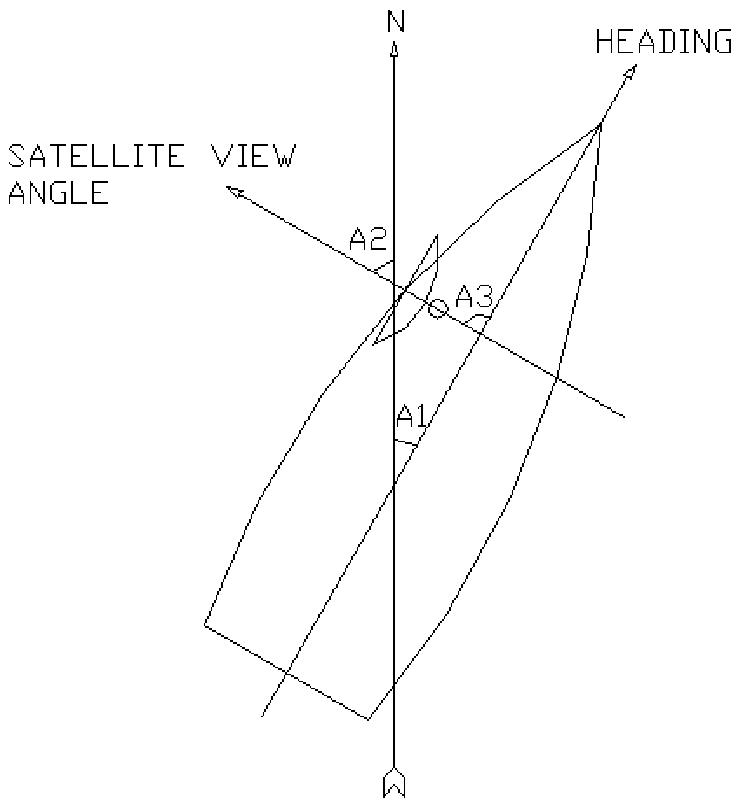
From the “Operation Screen” press “I”, then select “Antenna Blockage”:





Up to four blockage zones may be defined.

Blockage is given in “Local Position” angles (also see paragraph below), which are Azimuth relative to ships Bow, Elevation relative to ships deck: -

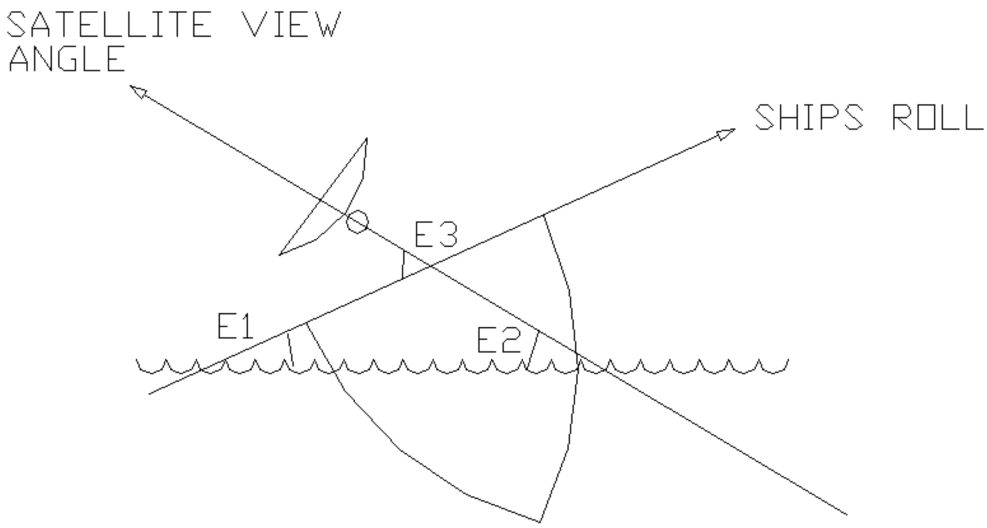


A1 – Ships heading

A2 – Antenna True Azimuth

A3 – Antenna Local Azimuth

Simplified model: Pitch and Roll are zero.



E1 – Ships Roll

E2 – Antenna True Elevation

E3 – Antenna Local Elevation

Simplified model: Pitch and Heading are zero.

One can see that the Local Antenna Azimuth is the Antenna Azimuth with respect to the ships Bow-to-Stern line, rather then the North direction, whereas the Local Antenna Elevation is the Antenna Elevation with respect to the ships deck rather then the horizon level.

The local angles depicted on the diagrams above are only for illustration; the actual mathematical definition of those angles is a bit more complex and takes into consideration ships Pitch, Roll and Heading at all times.

Local angles make the definition of the obstruction zones a whole lot more convenient: survey antenna location and note the corner angles of each obstruction, in Local Azimuth and Elevation.

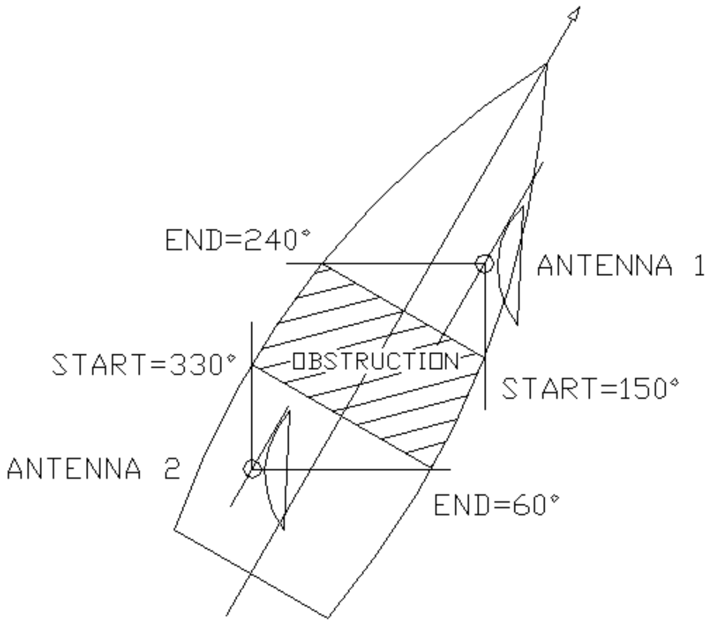
The Obstruction Zone screen allows entering of four angular points defining a single obstruction zone of an antenna: Azimuth Start (from), Azimuth End (to), Elevation Start (from) and Elevation End (to).

Up to four obstruction zones may be entered.

There is no necessity of filling out all the zones, a default setting of a zero value both in “from” and “to” fields will effectively disable the relevant zone.

From the other hand, if a zone is to be defined only in Azimuth, the Elevation angles should be set from –90 to +90 degrees.

An example for a simple obstruction zone setting is presented herein:



In the case above, Antenna 1 is blocked in the range of 90 degrees, starting from 150.0 to 240.0 degrees. Antenna 2 is also blocked in the range of 90 degrees, starting from 330.0 to 60.0 degrees. All of the above, in Local Azimuth terms, of course.

Note that the obstruction zone is defined by a "start" angle, which is always clockwise before an "end" angle.

The obstruction zone setting for both antennas will be as follows:

Antenna 1	Antenna 2
Zone 1	Zone 1
Az from: 150.0 to: 240.0	Az from: 330.0 to 60.0
El from: -90.0 to 90.0	El from: -90 to 90.0
Zone 2	Zone 2
Az from: 0.0 to: 0.0	Az from: 0.0 to 0.0
El from: 0.0 to 0.0	El from: 0.0 to 0.0
Zone 3	Zone 3
Az from: 0.0 to: 0.0	Az from: 0.0 to 0.0
El from: 0.0 to 0.0	El from: 0.0 to 0.0
Zone 4	Zone 4
Az from: 0.0 to: 0.0	Az from: 0.0 to 0.0
El from: 0.0 to 0.0	El from: 0.0 to 0.0

Once set, the CCU will present an "Antenna View Blocked" message when antenna will go in one of the predefined zones. This message may also be read by an external device (such as the iDirect modem in AL-7103-C system), and take action, accordingly

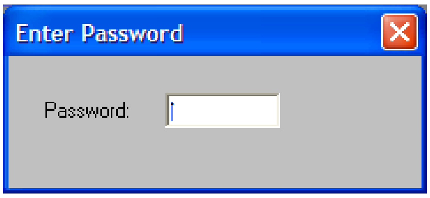
Moreover, when going into antenna blockage zone the controller will automatically revert to “Point-to-Satellite” mode, as it assumes that the Antenna signal is not available for Step-tracking. When going out of a blockage zone, the controller will automatically initiate a re-acquisition sequence.

After setting of the Blockage Zones, one must save them in the SBC non-volatile memory.

6.8.3 Set-up Local Position Antenna Angles Display

Setting-up Local Position display is protected by a High-level password. Please contact Orbit Tech service to get the password. The password will remain valid for a limited amount of time.

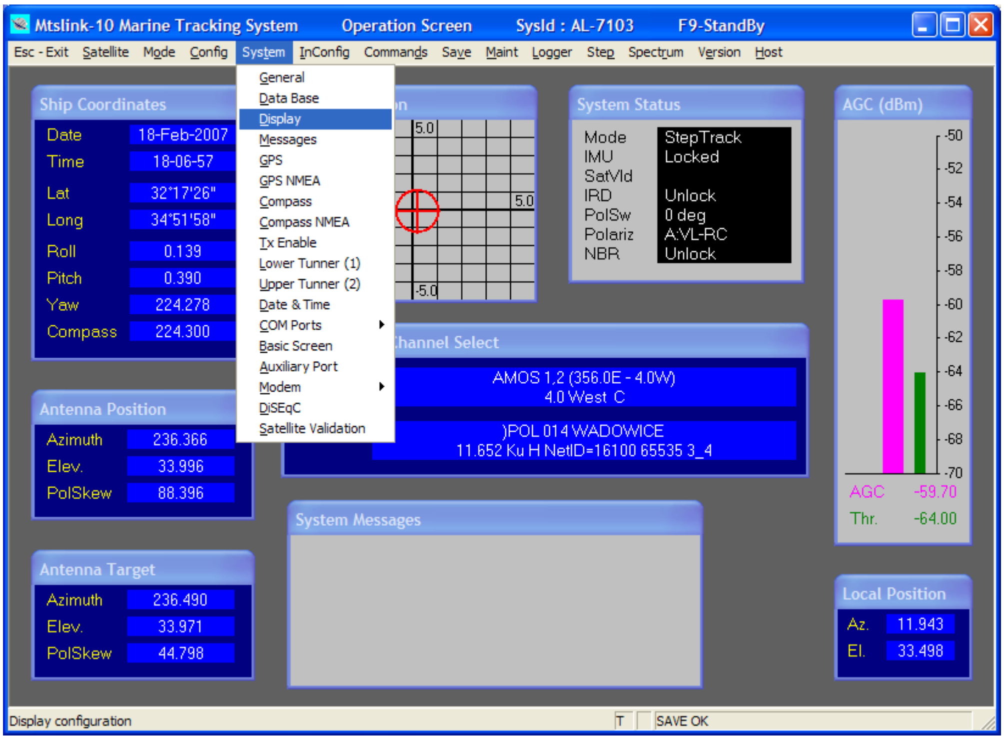
From "Operation Screen" press "U", the following will appear:

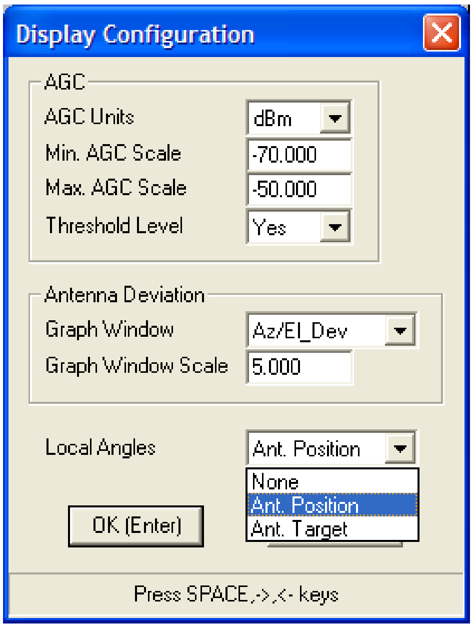


Then type in the valid password

The screen will change to allow access to high-level parameter settings.

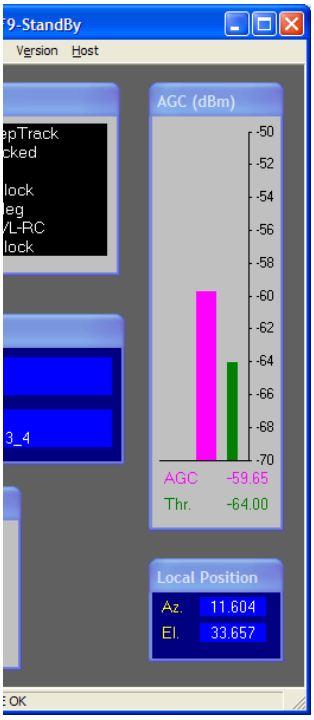
Press "T", for System configuration, then "D", for Display menu:





Select “Ant Position” for Local Angles, then “Ok”

This will add a small display window just below the AGC bar:



Save parameters to SBC non-volatile memory.

6.9 Polarization Skew Alignment Procedure

If required, perform the following procedure to align the Polarization Skew.

1. Access InConfig->Axes Parameters and set Alignment Offsets PolSkew to zero.
2. Activate “Acquire”.
3. Wait till the AL-7103 goes thru all the acquisition stages and reaches Step-track.
4. Turn AL-7103 to Peak.
5. Make sure Tracking Signal has at least 8 dB/Hz on the AL-7103 Spectrum Analyzer screen.
6. Change Polarization Switch to the opposite Polarization.
7. Make sure there is no signal on the opposite Polarization – just the noise level.
8. Change Step-Track setup to: “Step-track Axes: Sk”.
9. Make sure that the following parameters are set correctly: “PolSkew Step-type: ON_MIN”, “Axis 3 Sector: 10.0” and “Axis 3 Velocity: 20.0” (in the newly supplied models these are part of the default settings).
10. Set Signal threshold to –80 dBm (write down the original setting!).
11. Activate Step-track.
12. Log “Step-track, PolSkew Deviation” for 2 minutes.
13. Read mean value of the deviation.
14. Insert the mean value into the PolSkew Offset with an opposite sign (if the logged deviation was +2.0 deg, have to enter –2.0 into PolSkew Offset). Note that the offset value should not exceed 5 degrees in either direction. That’s unless the satellite has a known Polarization Skew anomaly (Ex: most of the Eutelsat satellites have 3.5 degree offset from nominal).
15. Turn AL-7103 to Peak.
16. Return the Polarization Switch back to it original position.
17. Return the Step-Track setup back to “Step-track Axes: ConScan”.
18. Return the Signal threshold to its original setting.
19. Activate “Acquire”.
20. To validate that the Polarization Skew is correct, repeat steps 3-13. Make sure that now the recorded PolSkew Deviation mean value is within +/- 0.5 degree. Then repeat steps 15-19.
21. Save settings in non-volatile memory.

7 Appendix A – Installation Addendum

7.1 Preparing the ADE-BDE Cable

7.1.1 EZ-400-NMH Connector Installation Procedure on LMR-400

The following Figures depict how to install the connectors on both sides of the LMR cable.

1. Flush cut the cable squarely.

2. Slide the heat shrink boot and crimp ring onto the cable. Strip the cable end using the ST-400-EZ prep/strip tool by inserting the cable into End 1 and rotating the tool. Remove any residual plastic from the center conductor.

3. Insert the cable into End 2 of the ST-400-EZ prep/strip tool and rotate the tool to remove the plastic jacket.

4. Debur the center conductor using the DBT-01 deburring tool.

Figure 7-1: EZ-400-NMH Connector Installation Procedure on LMR-400 (sheet 1 of 2)

5. Flare the braid slightly and push the connector body onto the cable until the connector snaps into place, then slide the crimp ring forward creasing the braid.

6. Temporarily slide the crimp ring back, and remove the connector body from the cable to trim the excess braid at the crease line, then remount the connector and slide the crimp ring forward until it butts up against the connector body.

7. Position either the heavy duty HX-4 crimp tool with the appropriate dies (.429" hex) or the CT-400/300 crimp tool directly behind and adjacent to the connector body, and crimp the connector. The HX-4 crimp tool automatically releases when the crimp is complete.

8. Position the heat shrink boot as far forward on the connector body as possible, without interfering with the coupling nut and use a heat gun to form a weather tight seal.

Figure 7-2: EZ-400-NMH Connector Installation Procedure on LMR-400 (sheet 2 of 2)

Prep tool for LMR-400 crimp style connectors (Refer to step 2 & 3 in the Installation Procedure)

Part No.: ST-400EZ Stock No.: 3190-401.

Debarring tool (Refer to step 4 in the Installation Procedure).

Part No.: DBT-01 Stock No.: 3190-406.

Crimp tool for LMR-400 (Refer to step 7 in the Installation Procedure)

Part No.: CT-400/300 Stock No.: 3190-666 -.

Or alternatively use:

Crimp Tool

Part No.: HX-4 Stock No.: 3190-200

0.429" hex dies for EZ-400 crimp connectors

Part No.: Y1719 Stock No.: 3190-202

Figure 7-3: EZ-400-NMH Connector Installation Procedure on LMR-400 – Tools