AL-7103 MKII

1.15m (45”) Ku-Band/X-Band Antenna
Maritime Stabilized VSAT System

Installation and Operation Manual

Document: MAN26-1327, Revision E

Orbit Communication Ltd. P.O.B. 42504, Israel, Tel: +(972) 9 892 2777, Fax: +(972) 9 885 5944 www.orbit-cs.com

Certifications

Orbit Communication Ltd. is an ISO 9001 registered company. Registration License No. 27870, issued May 1st, 2005.

Orbit Communication Ltd. is an Aerospace quality management system AS9001 certified company (Starting as early 2006).

ORBIT AL-7103 Stabilized Maritime Satellite Communication System is in conformity with the appropriate standards: ISO 12100-2:2003, EN 60204-1:1997, EN 614-1:1995, IEC 60945:2002, ETSI EN 302340.
Declaration of Conformity for this equipment is contained in this manual.

The AL-7103 System is granted EUTELSAT Type Approval as standard earth station. Type Approval Certificate Registration Number: EA-A033.

The AL-7103 MKII OrSat™ System is granted INTELSAT Type Approval, as GVF earth station. Type Approval Certificate Registration Number: GVF/IA 200FLT, standards K2 & G.

The AL-7103 MKII OrSat™ System is granted ANATEL Certificate of Homologation No. 2012-08-4778.

Declaration of Conformity

We,

Orbit Technology Group Ltd.
8c Hatzoran St. P.O.B 8657
Netanya 42504, Israel

Declare under our sole responsibility that our product

ORBIT AL-7103 Stabilized Marine Satellite Communication System (ESV),

To which this declaration relates is in conformity with the appropriate standards:

ISO 12100-2:2003
EN 60204-1:1997
EN 614-1:1995
IEC 60945:2002
ETSI EN 302340

Following the provisions of R&TTE Directive **1999/5/EC – Article 3.1a**, **Article 3.1b** and **Article 3.2** with essential requirements covering Low Voltage Directive **2006/95/EC** (replaces **73/23/EEC** as Amended) and Safety of Machinery Directive **98/37/EC** as Amended by **93/68/EEC** and **93/465/EEC**, EMC Directive **2004/108/EC** (replaces **89/336/EEC** as Amended), **ESV Satellite Regulations** regarding all needed functions and **The Allowed EIRP per Bandwidth** (limited spectral density toward adjacent satellites).

Netanya, Israel, January 2008.

Erez Shabirow.

Erez Shabirow
Senior Vice President R&D and Engineering

Revision History and Control

Revision History

Rev #	Date	Comments
Rev: -	October 2006	Initial version
Rev: A	December 2006	Updated version
Rev: B	March 2007	Updated version
Rev: C	January 2010	Updated version
Rev: D	June 2011	Updated version

List of Effective Pages

Total number of pages in this publication is 341, consisting of the following:

Page No.	Content	Change No.
i	Title	
ii	Copyright	
v	Revision History and Control	
xxi	About this Manual	
xxiii	System Technical Specifications	
xxviii-xxix	Safety Precautions	
xxx-xxxiii	Table of Contents	
xxxiv-xl	List of Figures	
1-5	Overview	

6-30	Main System Components	
31-200	System Installation	
86-127	Commissioning the System	
128 - 162	System Operation	
163 - 171	Status Messages	
172 - 183	Appendix A: MIB for the Antenna Control Unit	
184 - 187	Appendix B: Preparing the ADE-BDE Cable	
188 - 202	**1 Appendix C: Central Control Unit – 5U Height** The CENTRAL CONTROL UNIT (CCU) is the interface between the system and the ship's equipment. The CCU provides the following functions: • Modem interface • Conversion of compass inputs • IRD Lock Indicator interface • Adjustable Tx/Rx channel amplification • De-muxing and muxing of Ethernet and RF channels • Ethernet Hub (for dual CCU option) • Running platform for the MTSLINK user interface • Transmission of on-line GPS data to the satellite modem The CCU is installed on a 19" rack-mounted 5U industrial PC (including a	

1U keyboard-and-mouse drawer), which is usually located in the ship's radio room.

The front panel includes a TFT screen which, together with an external keyboard, constitutes the system's human-machine interface (HMI). Manual monitoring and control is performed using provided software applications running on a Windows Embedded CE 5.0 operating system (see **Commissioning the System** on page 86 and **System Operation** on page128).

The rear panel includes several connectors, which connect to the ADE, the modem and the ship's gyrocompass (NMEA-0183, Synchro or Step-By-Step). Two ATTENUATOR SWITCHES allow adaptation to various ADE-BDE cable lengths.

The CCU contains the BDMX module that connects to the ADMX via a single coaxial cable through the rotary joint/multiple slip-ring assembly in the AZIMUTH AXIS. Like the ADMX, the BDMX also provides integral amplification of the Rx and Tx paths.

System operation is fully controlled from the CCU. Using the HMI, the operator can select the desired satellite and channel from the CCU's Global Satellite Coverage database. The system automatically extracts the required data and deploys the SBC to acquire and track the selected satellite, while compensating for the platform's pitch, roll and yaw movements.

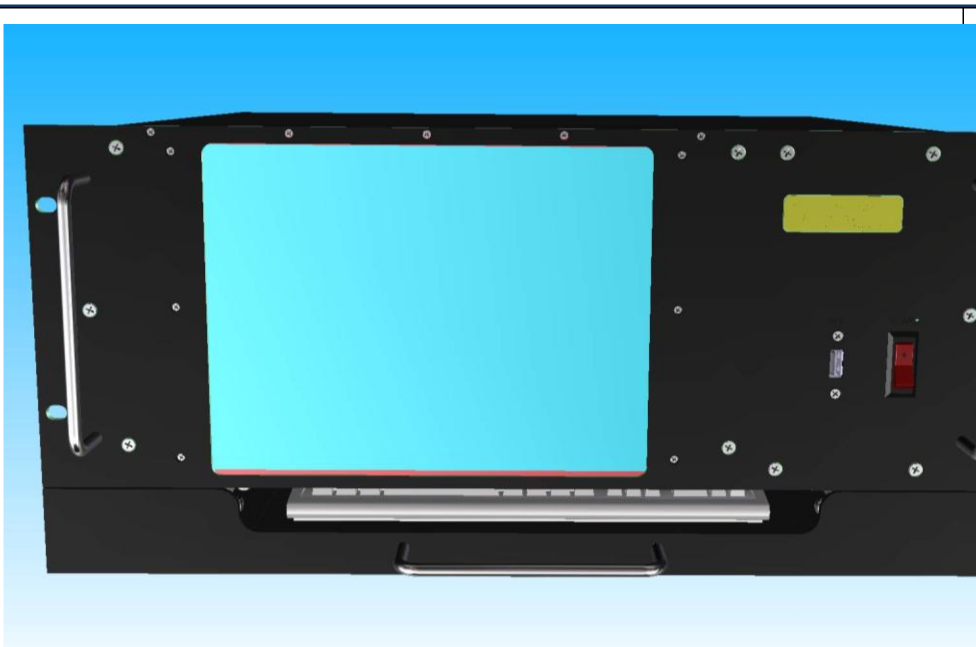


Figure 10-1: CCU Front Panel

Figure 10-2: CCU Rear Panel

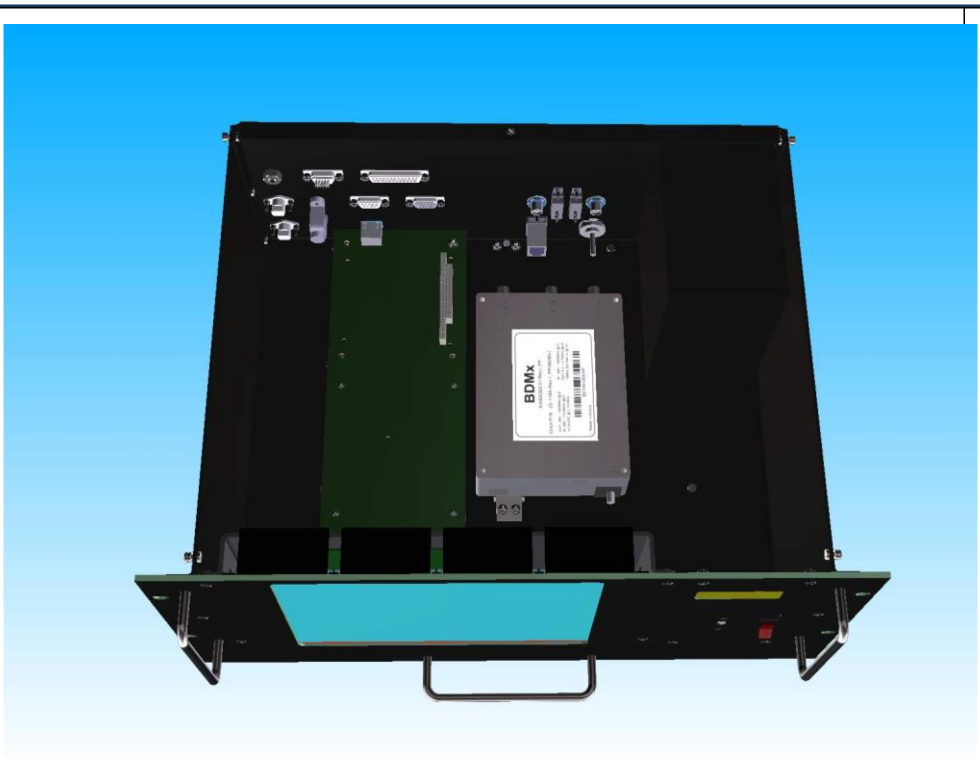


Figure 10-3: CCU Internal View (BDMx)

Installing the BDE (For CCU 5U Height)

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

Figure 10-4: Typical BDE rack installation

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

The front panel includes a 10.4" TFT screen, keyboard and USB connector (for software maintenance). You can also connect the CCU to an external computer or VGA screen.

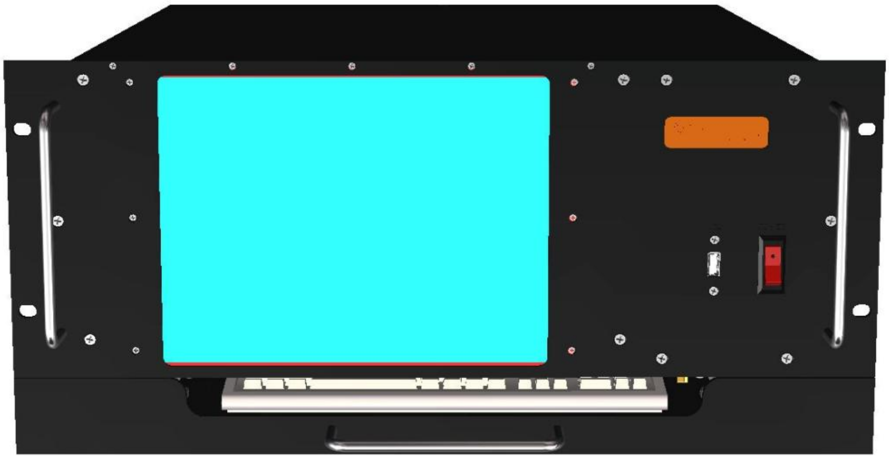


Figure 10-5: CCU Front Panel

Connecting the CCU Cables

Once the CCU is installed, you need to connect it to the various instruments with which it interacts: the ANTENNA terminals, the modems, the ship's compass and the LAN line.

The following table specifies the type and function of each connector.

Table 0-1. AL-7103 CCU Rear Panel Connectors

Connector	Connector Type	Function
Power supply	Integrated plug	From ship's mains power sourc
LAN	RJ-45	Connects to the ADMx LAN co cable
K/B	MINI-DIN	Connects the CCU to the keyb CCU drawer.

MOUSE	MINI-DIN	Connects the CCU to the mouse located in the CCU drawer.
SYNCHRO & SBS COMPASS	DB25 male	Connects the CCU to the ship's compass (Synchro or SBS).
COM1-RS422	DB9 male	Connects the CCU to the ship'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
IF OUT RX	F-Type	Connects to modem RX input
IF OUT TX	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
ATTEN RX	Selector	Selects the Rx attenuator ("I" position - 0dB, "0" position - 8dB)
ATTEN TX	Selector	Selects Tx attenuator ("I" position - 0dB, "0" position - 15dB)

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

The following figure depicts the general-purpose cables that connect to the CCU:

- Power cable
- LAN jumper between the BDMx LAN and LAN connectors
- Keyboard
- Mouse
- Ground Cable

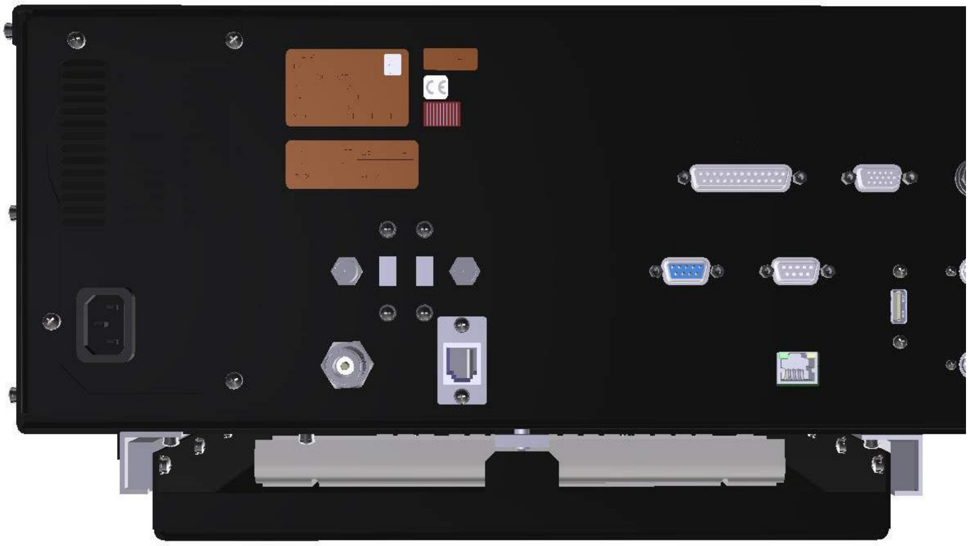


Figure 10-6: CCU rear panel – general-purpose connections

ADE-BDE Cable Connection

The ADE is connected to the BDE via a single LMR-200/400/600 coaxial cable.

➢ **To connect the cable to the CCU:**

1. Install an EZ-400-NMH connector on the BDE side of the LMR-200/400/600 cable (see **Appendix B**: Preparing the ADE-BDE Cable on page 184).

2. Connect the cable connector to the CCU ADMx/BDMx connector, as displayed in the following figure.

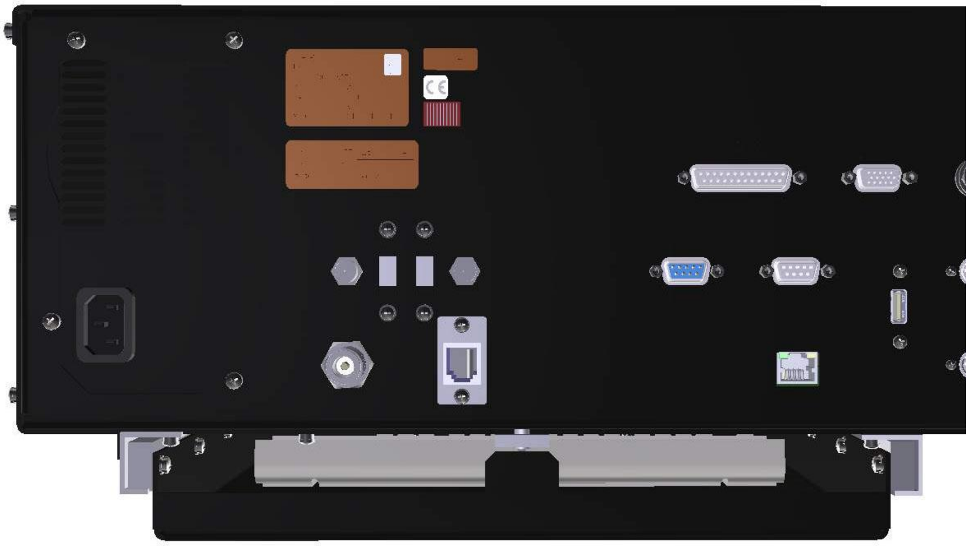


Figure 10-7: CCU rear panel – ADMx/BDMx connector

Serial Communication and Compass Connectors

The CCU rear panel includes three communication connectors:

- **Synchro and SBS Compass** – Connects the CCU to the ship's compass (Synchro or SBS)
- **COM1 - RS-422** – Connects the CCU to the ship's compass (RS-422 port)
- **COM2 - RS-232** – General-purpose serial port

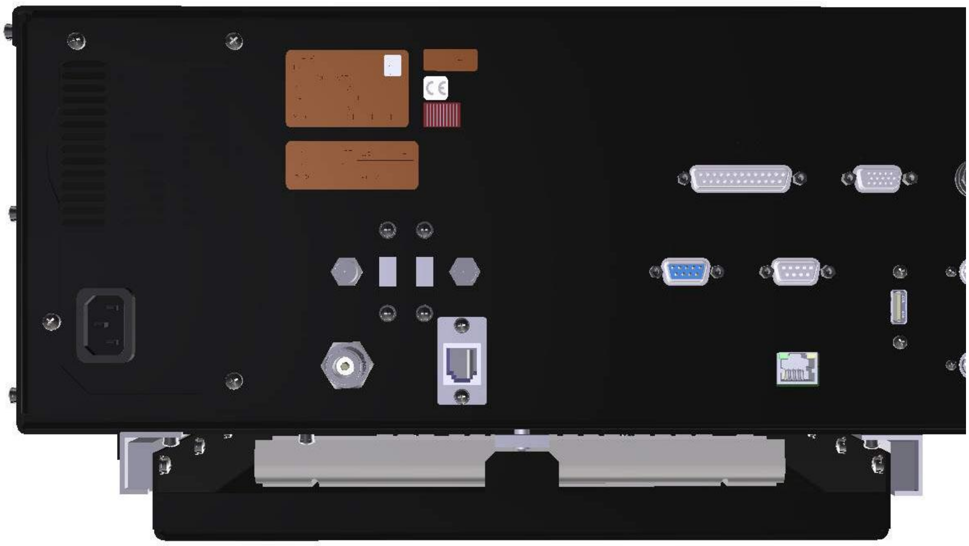


Figure 10-8: CCU rear panel – serial and compass connectors

The system supports the NMEA-0183 gyro compass interface as a default. If a Synchro interface is required, the system should be ordered as such.

The following table specifies the communication connector pin-out.

The subsequent sections describe how to use each connector.

Table 10-1: 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	AGN IN
PIN 7	12V
PIN 8	IRD
PIN 9	GND

Synchro & SBS 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	SBS – COM
PIN 13	SBS – 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	SBS – C
PIN 25	SBS - 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 maritime instrumentation. The NMEA-0183 standard is 4800 baud and consists of several different ASCII sentences.

Electrical Interface

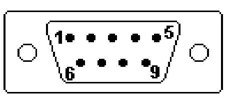
This standard allows a single ‘talker’ and several ‘listeners’ on one circuit. The recommended interconnecting wiring is a shielded twisted pair, with the shield grounded only at the talker. These standards do not specify the use of any particular connector.

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 (i.e. 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 shows how to connect an RS-422 NMEA-0183 compass to the CCU’s COM1 connector.

<table>
<tr><th colspan="2">Connecting an RS-422 NMEA-0183 Compass to COM1 Connector:</th></tr>
<tr><td>CCU Connector


COM1-RS422</td><td>Mating Connector Wiring Diagra

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

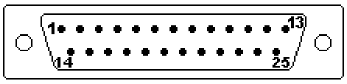
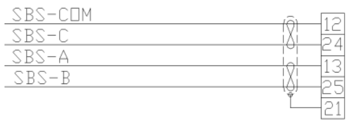
Mating Connector Pin Out	
Pin	**Signal**
2	RXD-
4	RXD+
5	GND

Figure 10-9: NMEA-0183 compass connection scheme

Step-by-Step Compass connection

The following figure shows how to connect a Step-by-Step compass to the CCU's Synchro & SBS connector.

Connecting a Step-by-Step Compass to SYNCHRO & SBS Connector:

CCU Connector	Mating Connector Wiring Diagram
 Synchro & SBS	

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

Figure 10-10: Step-by-Step compass connection scheme

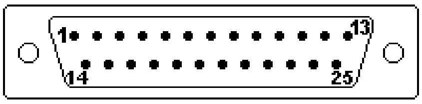
- Supports +20 VDC to +70 VDC
- Supports dual polarity:
  - **Positive –** A, B, C: +VDC or Open; Common: GND
  - **Negative –** A, B, C: GND or Open; Common: +VDC

Synchro compass connection

The following figure shows how to connect a Synchro compass to the `CCU`'s Synchro & SBS connector.

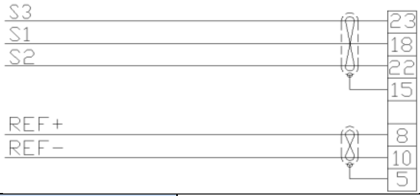
Connecting a Synchro Compass to SYNCHRO & SBS Connector:

CCU Connector



SYNCHRO & SBS

Mating Connector Wiring Diagram



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

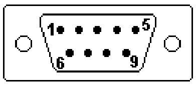
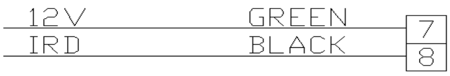
Figure 10-11: Synchro compass connection scheme

Note: Supports 115 VAC reference – 60 VAC reference is optional.

IRD Lock Connection

The following figure shows how to connect the IRD lock modem signal to the `CCU`'s COM2 connector. Pins 7 & 8 should be connected via a 'dry-contact' relay.

Connecting IRD LOCK to COM2 Connector:

CCU Connector	Mating Connector Wiring Diagram
 COM2-RS232	

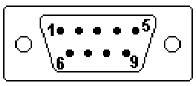
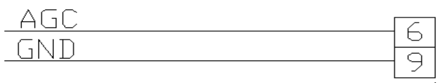
Mating Connector Pin Out	
Pin	**Signal**
7	12VDC OUTPUT
8	IRD INDICATOR

Figure 10-12: IRD lock connection scheme

External AGC Connection

The following figure shows 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	

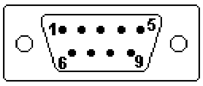
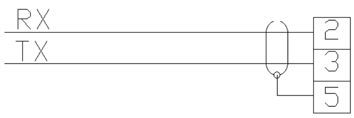
Mating Connector Pin Out	
Pin	**Signal**
6	AGC IN
9	GND

Figure 10-13: External AGC connection scheme

RS-232 Communication Channel

The RS-232 port is usually used for GPS output. The following figure illustrates how to connect the 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 10-14: RS-232 connection scheme

About this Manual

This manual is designed to guide you through the installation and operating procedures for the OrSat™ (AL-7103 MKII) Maritime Satellite Communication System. It is recommended that you familiarize yourself with the information and procedures contained in this manual to facilitate smooth implementation of the system.

Text Conventions

Style	Indicates	Example
Text	Normal descriptive text	Contents
`Text/Text`	Words or figures that appear on the screen or that should be typed. The name of a file or directory	`System Status`
`<Text>`	A key to be pressed	`<ESC>`
TEXT	The name of a hardware component	ANTENNA
Text	The name of a GUI element	**Operation Screen**
➢	The description of a procedure	➢ **To configure…**

Notations

	Indicates important information that should be noted
	Indicates a potential hazard
	Indicates the safest method of installation or an operation that *must be adhered to.*

Acronyms & Abbreviations

ABS	Automatic Beam Switching
ACU	Antenna Control Unit
ADE	Above Deck Equipment
ADMx	Above Deck MUX
AGC	Automatic Gain Control
BDE	Below Deck Equipment
BDMx	Below Deck MUX
BUC	Block Up Converter
B/W	Band Width
CCU	Central Control Unit
CW	Clockwise
CCW	Counter-clockwise
CFE	Customer-furnished Equipment
HMI	Human-Machine Interface
IMU	Inertial Measurement Unit
KB	Keyboard
LNA	Low Noise Amplifier
LNB	Low Noise Block
M&C	Monitor & Control
MK	Mark
MUX	Multiplexer
NMS	Network Management System
PSU	Power Supply Unit
RJ	Rotary Joint
SBC	Single Board Controller
SDM	Servo Drive Module
SNMP	Simple Network Management Protocol
SR	Slip Ring

System Technical Specifications

Parameter	Specification
Antenna Type	Gregorian dual-offset
Antenna diameter	45” (1.15m)
Radome	
Dome Diameter	1.28m (50”)
Base Diameter	1.415m (55.7”)
RADOME Height	1.610m (63.4”)
Frequency Operation	
Tx	14.00-14.5 GHz Optional – extended range, 13.75 – 14.5 GHz
Rx	10.95-12.75 GHz
Antenna Polarity	Linear H/V
Gain	
Tx	42.5dBi @14.25 GHz
Rx	41dBi @11.70 GHz
Cross-Pol. Discrimination	35dB
System G/T @ 11.7 GHz	19 [dB/K°] @ 20° elevation 18.6@10.95
Side lobe 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
LNB band	C: 10.95-11.70 GHz A: 11.70-12.2 GHz B: 12.25-12.75 GHz

Parameter	Specification
LO Stability	±10 KHz
GPS	Built-In
Satellite Narrow-Band Tracking Receiver (NBR)	Built-In 950-2150Mhz
Radio Package	4W ,8W or 16W BUC (standard/extended)
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 and horizon).
Antenna view angles	
Azimuth	Continuous
Elevation	0º to 90º (view angle)
Polarization	V/H
Pointing Accuracy	0.1° RMS
Ship Motion	
Roll	30° @ 8 sec.
Pitch	15°@ 6 sec.
Yaw	8° @ 15 sec.
Turning Rate	12°/sec
Electrical Interfaces	
Power Requirements:	AC (ADE) AUTO RANGE
	90 to 250 VAC 50/60 Hz
	350W (with 4W BUC)
	400W (with 8W BUC)
	460W (with 16W BUC)
L-Band	

Parameter	Specification
RX	950 – 1950 MHz
TX	950 – 1450 MHz (STD)
TX	950 – 1700 MHz (EXT)
GPS out	Update rate: 1 per second
Availability	Continuous
NBR Bandwidth	0 – 70KHz (50KHz)
	70 – 180KHz (150KHz)
	Above 180KHz (300KHz)
Beacon Signal (for the NBR)	Min. C/N 10dB per relevant Bandwidth for a given Bandwidth that is not less than 25KHz
Modem Lock (IRD)	Yes
VGA Out	Yes
LAN	Yes
USB (for SW update)	Yes
Ship Gyro Interface	NMEA 0183, Synchro & Step-by-Step optional
Environmental Conditions for Above Deck Equipment (ADE) & System Certifications	
Directive	R&TTE Compliant
CE Compliance	
Safety & Ergonomics	ISO 12100-2:2003
	EN 60204-1:1997
	EN 614-1:1995
	IEC 60945:2002
EMC	
Conducted & Radiated Emission	IEC 60945:2002
Immunity	IEC 61000-4-2:1995

Parameter	Specification
	IEC 61000-4-3:1995
	IEC 61000-4-4:1995
	IEC 61000-4-5:1995
	IEC 61000-4-6:1996
	IEC 61000-4-11:1996
Environmental Conditions	
Wind Speed	100 knots
Shock	MIL-STD 810F Method 516.5 (half sine pulse) In addition, the system was tested successfully in more severe conditions: 10G by 30 times 5G shock with 6ms duration by 30 thousand times with 600ms interval
Vibration	MIL-STD-167-1 (Mast Mounted)
Temperature	IEC 60945:2002-Dry Heat +55°C with RADOME
	IEC 60945:2002-Low Temp Temperature -25°C with RADOME
	Storage Temp. 70°C
Humidity	IEC 60945:2002-Damp Heat Humidity 93%(+/-3%) @ 40°C
Satellite Regulations Compliance	
Eutelsat Earth Station Standard	EESS 502
Intelsat Earth Station Standard	IESS 208 IESS 601
Anatel	ADDENDUM TO RESOLUTION No. 364, APRIL, 29TH 2004
ETSI	ETSI EN 302 340 (Satellite regulations) Compliant
ITU	ITU Resolution COM4-20 WRC-03 April 2008-S Compliant

Parameter	Specification
FCC	FCC- 04-286 compliant
Orbit Type Approvals	
Eutelsat Type Approval	Eutelsat Type Approval EA-A033
Intelsat Type Approval	Intelsat Type Approval GVF/IA 200 FLT
Singtel	ST-1 ChungHWA
Anatel	Certificado de Homologao (Intransfervel) N÷ 2012-08-4778

Safety Precautions

The following general precautions apply to the installation, operation and servicing of the system. Specific warnings appear throughout the manual where they apply, and may not appear in this summary.

- Only qualified and trained personnel should perform installation, operation, and maintenance of this equipment.
- Before entering the RADOME for maintenance purposes, shut off the main power to the system from the ship's electrical panel. Upon entry, switch off the ADE POWER BOX.
- Take extra care when handling the ADE POWER BOX, SLIP RING, and POWER SUPPLY UNIT – which are all connected to 110/220 VAC – and when handling the SERVO DRIVE MODULES – which are connected to 96 VDC.
- The system conducts potentially harmful voltages when connected to the designated power sources. Never remove equipment covers except for maintenance or internal adjustments.
- Keep clear of the moving ANTENNA at all times. The POSITIONER is equipped with high-torque motors that generate considerable force.

- When units are connected to the chassis's ground (to prevent shock and similar hazards), the chassis's ground conductor must not be removed.
- Although the RADOME is not heavy, care should be taken when lifting it as it acts as a sail under 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 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 running.

♦ System interfaces require high-quality connectors and cables.

♦ Use only Orbit-authorized parts for repair.

Radiation Safety

The following figure illustrates the safety distances for an OrSat™ AL-7103 MKII system equipped with an 8W BUC.

For systems equipped with a 16W BUC, safety distances should be multiplied by approximately 1.5.

The values illustrated in this diagram are driven by ACGIH and ICNIRP guidelines for occupational use.

Table of Contents

List of Figures

2 Overview

2.1 Introduction

The OrSat™ (AL-7103 MKII) system is a stabilized maritime communication system carrying a highly efficient dual-offset Gregorian 1.15m (45”) Linear Ku-Band ANTENNA, housed in a low-loss 1.28m (50”) RADOME.

The OrSat™ system is designed to maintain a steady and accurate view angle 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, from +75° to –75° latitude.

The view angle is maintained in three angular dimensions with respect to the satellite: azimuth, elevation and polarization skew.

A continuous bidirectional Tx/Rx satellite communication data link is maintained via an industry-standard satellite digital communication modem, which serves as the interface between the signals produced by the OrSat™ ANTENNA on L-Band frequency and the ship’s user data network.

The satellite modem is not part of the OrSat™ (AL-7103 MKII) system. It is normally provided by the customer or system integrator.

2.2 Global OrSat™ Features

The OrSat™ system is capable of supporting continuous communication on global voyages via automatic beam switching between satellites. This feature supports a wide variety of configurations that cover most Global-Ku requirements and consists of the following components:

- **Global Ready SBC** – An upgraded version of the original SBC (Single Board Controller). The SBC supports automatic and smooth satellite transition, global LNB management for continuous reception, and co-pol/cross-pol feed selection.

- **Global LNB** – Covers the full Ku-Band receive range via selection of one of four LO (local oscillator) ranges.
- **Co-Cross Polarization Feed**

2.3 System Architecture

The OrSat™ (AL-7103 MKII) system consists of equipment mounted above decks (Above Deck Equipment or ADE) and below decks (Below Deck Equipment or BDE).

The ADE includes a three-axis PEDESTAL, ANTENNA, RF PACKAGE, SINGLE-BOARD CONTROLLER (SBC), and POWER SUPPLY UNIT (PSU), installed inside a weather-proof RADOME.

The BDE includes the CENTRAL CONTROL UNIT (CCU), which serves as the interface to the L-Band Tx/Rx modem, the ship's gyrocompass, and the system's human-machine interface (HMI).

The ADE connects to the BDE via a single coaxial cable, multiplexing L-Band Tx/Rx and Ethernet LAN control.

Both the ADE and BDE are fed by AC mains power.

The system's functional layout is illustrated in the following diagram:

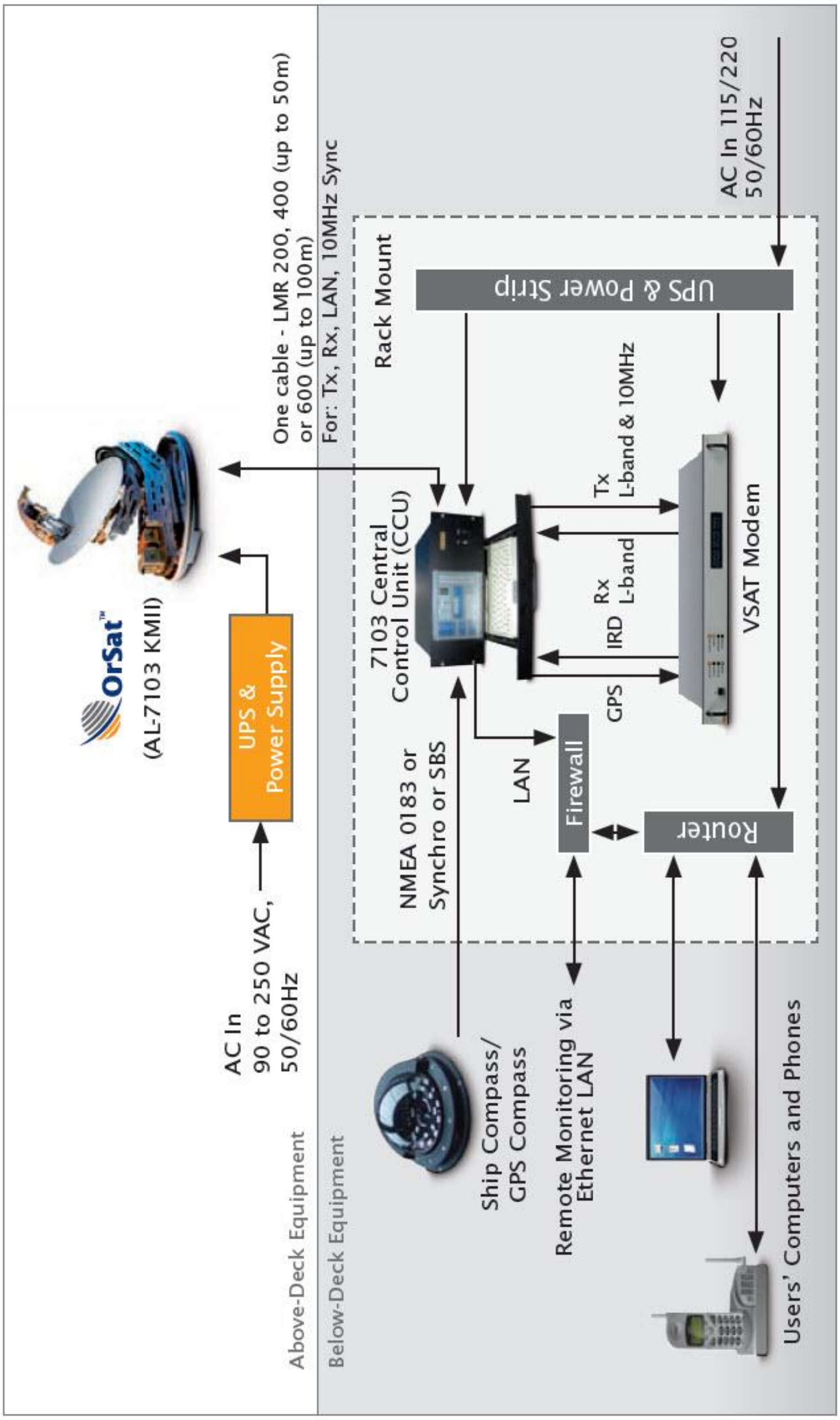


Figure 2-1: OrSat™ (AL-7103 MKII) System Architecture

2.4 Key System Features

The OrSat™ (AL-7103 MKII) system provides the following features:

- Exclusive mechanical design and compact dimensions.
- Advanced automatic tracking capabilities with high dynamic accuracy, based on positioning input from the system's built-in GPS ANTENNA and heading data from the ship's compass (supports NMEA-0183, Step-By-Step and Synchro compass interfaces).
- Extremely high efficient ANTENNA-to-RADOME size ratio.
- Unique polarization-over-X-over-Y-over-azimuth axis configuration, which provides full hemispherical coverage with no 'keyholes' at the horizon and zenith.
- Eutelsat approval for the ANTENNA and RF PACKAGE.
- Built-in NARROW BAND RECEIVER (NBR).
- IRD Interface to the modem.
- Above-deck mux (ADMX) and below-deck mux (BDMX) used to transfer RF and data between the ADE and the BDE via a single coaxial cable.
- Plug & play installation.
- Field-replaceable modular components for easy maintenance.
- Built-in satellite database, maintenance-logging and data-logging features.
- Remote control and monitoring via Ethernet LAN.
- Remote backdoor access, allowing system M&C via a LAN or Internet connection, using an alternative narrow-band link (for example: Iridium, Inmarsat).
- Support for industry standard protocols: SNMP for network management and OpenAMIP for antenna-router integration.

2.5 OpenAMIP Protocol

OpenAMIP protocol is an industry-wide open-source standard for antenna-router integration. IP based, OpenAMIP facilitates the exchange of information between an Antenna Controller Unit (ACU) and a satellite router. It allows the router to command the ANTENNA and enables the use of Automatic Beam Switching (ABS), which transfers connectivity from one satellite beam to the next as a vessel passes through multiple footprints. In addition, OpenAMIP and

ABS enable service providers and their customers to meet government regulations by commanding the ANTENNA to mute the signal in no transmit zones.

The OpenAMIP is supported in OrSat™ AL-7103 software version VL4.82 or higher in order to enable standardization of the interface to the customer's routers.

2.6 SNMP Protocol

Simple Network Management Protocol (SNMP) is an 'Internet-standard' protocol for managing systems based on IP networks. It is used to monitor network-attached components for conditions that warrant administrative attention. For example, the customer's Network Management System (NMS), supporting SNMP, translates the information into data management and presents it in a way that allows command & control of the system's performance.

SNMP was added to the OrSat™ AL-7103 software version VL4.82 or higher to enable standardization of the interface to the customer's NMS. The following parameters can be monitored and set via the SNMP protocol:

- Tracking frequency – MHz Units up to 1 KHz resolution (950.000 to 2150.000 MHz)
- LNB Setting – 13v00KHz, 13v22KHz, 17v00KHz, 17v22KHz, Co13v00KHz, Co13v22KHz, Co17v00KHz, Co17v22KHz
- Set Satellite Preset – Up to 0.1° resolution (-180.0° to 180.0° Geostationary Arch Longitude)
- Polarization Skew Offsets (C,X and Ku) – Up to 0.1° resolution (-180.0° to 180.0°)
- NBR Bandwidth – 50, 150 or 300 KHz
- Compass Offset – Up to 0.1° resolution (-180.0° to 180.0°)
- Obstruction Zones – Up to 0.1° resolution (Z1 Start, Z1 End, Z2 Start, Z2 End, Z3 Start, Z3 End, Z4 Start, Z4 End)

3 Main System Components

The OrSat™ (AL-7103 MKII) system components are divided into two groups:

- ABOVE-DECK EQUIPMENT (ADE)
- BELOW-DECK EQUIPMENT (BDE)

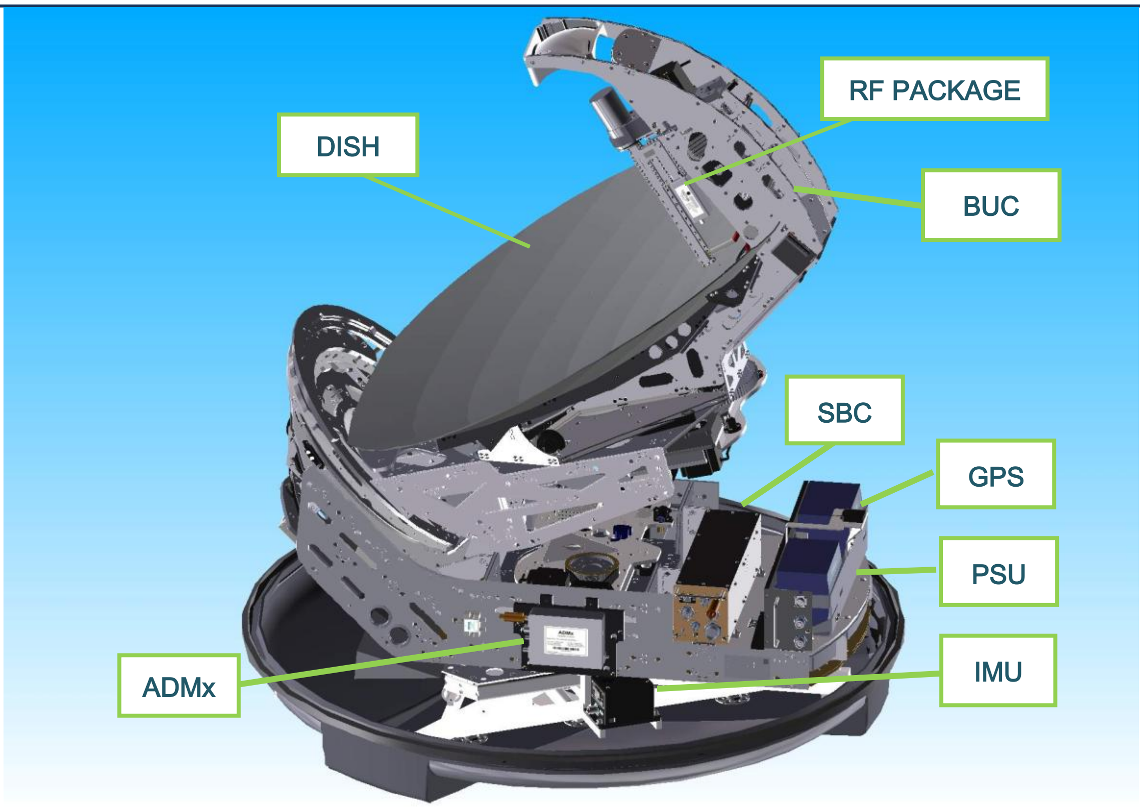
3.1 Above Deck Equipment

The ADE includes the following main assemblies and units:

- 1.28 (50") RADOME and RADOME BASE.
- PEDESTAL supports the three-axis POSITIONER and ANTENNA.
- 1.15m (45") composite-material linear-polarization Ku-Band Tx/Rx ANTENNA.
- SERVO DRIVE MODULES (SDM) – one per axis.
- INERTIAL MEASUREMENT UNIT (IMU) which serves to stabilize the ANTENNA from pitch, roll, and short-term yaw.
- GPS OMNI ANTENNA.
- Tracking SINGLE BOARD CONTROLLER (SBC) including a built-in NARROW BAND RECEIVER (NBR) and GPS RECEIVER.
- RF PACKAGE which includes a 4W, 8W, or 16W BLOCK UP-CONVERTER (BUC) and the RF FRONT END, consisting of an ORTHOMODE TRANSDUCER (OMT), RF filters and LOW NOISE BLOCK converter (LNB).
- ADMX (the above-deck component of the ADMX/BDMX LINK subsystem).
- POWER SUPPLY UNIT (PSU).

The entire ADE assembly, with the exception of the IMU and CONNECTORS PANEL, rotate freely on the PEDESTAL's AZIMUTH AXIS. The coaxial cable connecting the ADE with the BDE is protected from looping during rotation of the ANTENNA by the ROTARY-JOINT/SLIP-RING ASSEMBLY in the AZIMUTH AXIS.

The following figures display the location of the various ADE components. The subsequent sections provide a brief technical description of each component.



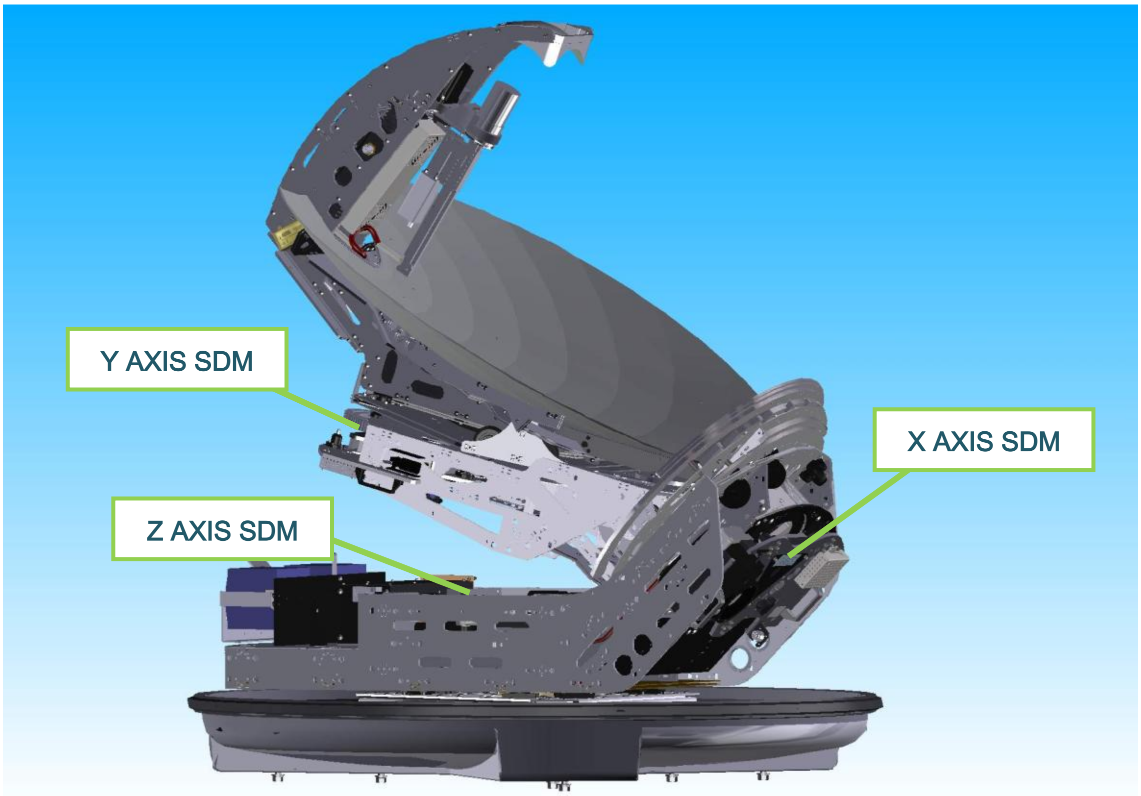


Figure 3-1: Above Deck Equipment (ADE)

3.1.1 Radome and Radome Base

All ADE components are enclosed within a 1.28m (50") RADOME mounted on a BASE RING and BASE PLATE.

The RADOME covers and protects the complete ADE. Maintenance access is provided by a service hatch in the RADOME BASE PLATE.

Figure 3-2: Radome – General View

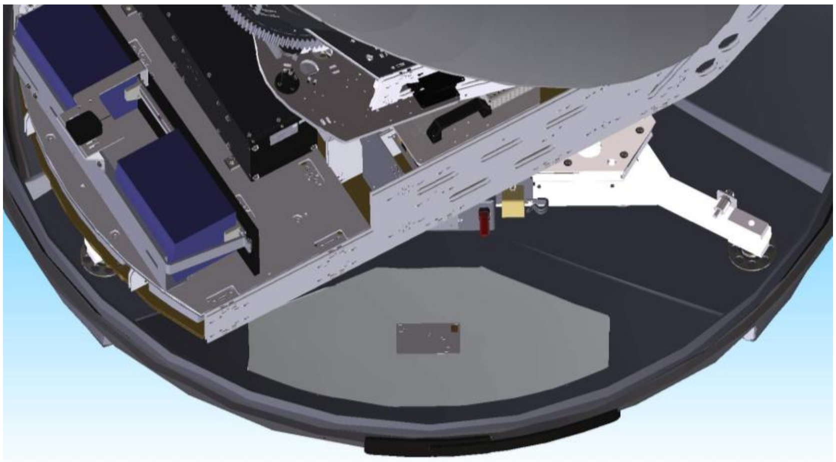


Figure 3-3: Radome Base Service Hatch

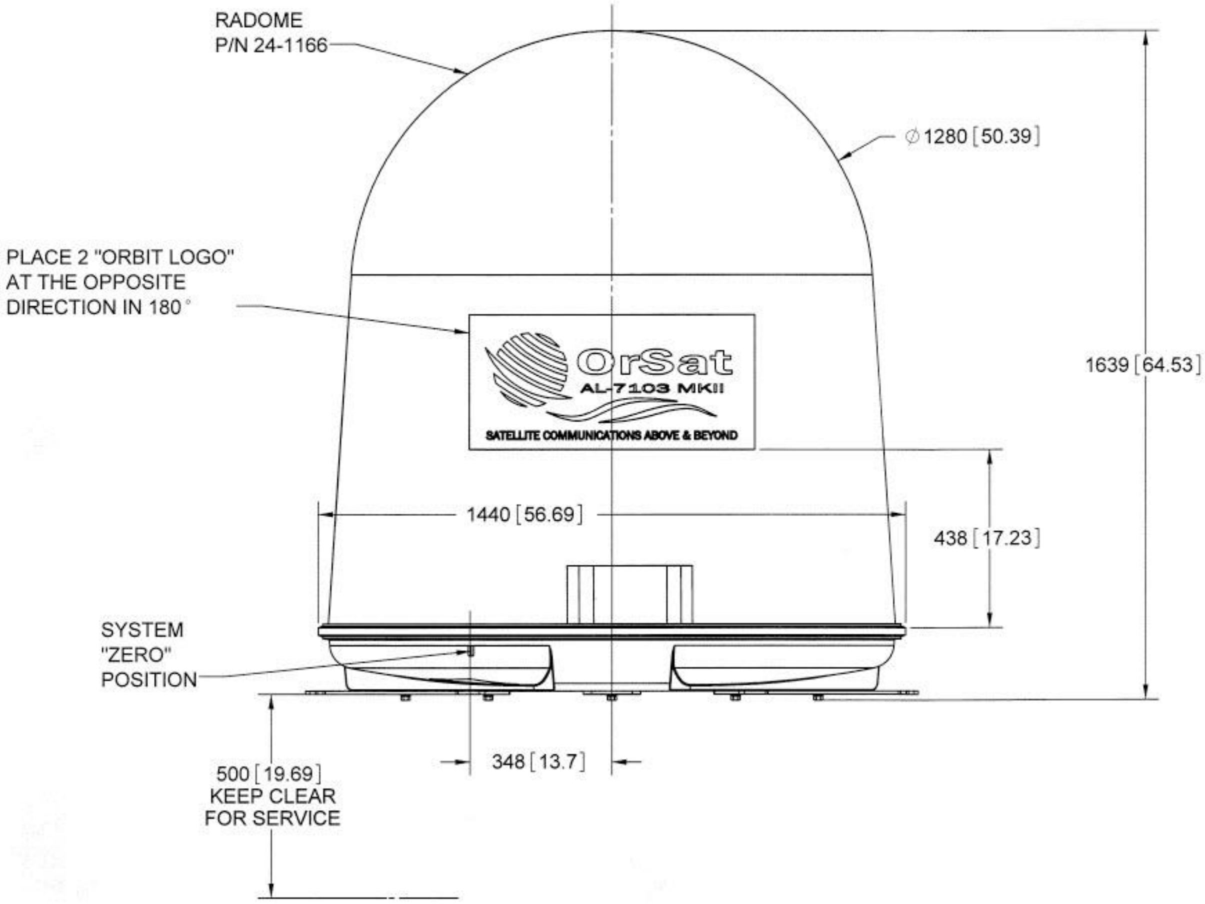


Figure 3-4: Radome Outline Dimensions

3.1.2 Pedestal

The PEDESTAL, with its Y-over-X-over-Azimuth POSITIONER, supports the ANTENNA and keeps it focused on the satellite. It is mounted on the RADOME BASE using shock absorbers. The PEDESTAL AXES are not orthogonal. The relative notation angles between the axes are set to produce the tightest packaging factor possible: the 1.12m × 1.19m ANTENNA is packed within a 1.28m RADOME.

The POSITIONER is composed of the following axes:

- AZIMUTH AXIS – provides continuous, unlimited 360° rotation. The coaxial cable connecting the ADE and BDE runs through this axis protected by a single-channel rotary joint/multiple slip-ring assembly.
- X AXIS – provides 350° of free rotation (-175° to +175°).
- Y AXIS – provides 350° of free rotation (-175° to +175°).

The above axes are driven by identical SERVO DRIVE MODULES (SDMs).

In addition to these axes, a fourth POLARIZATION AXIS situated on the RF FRONT END provides two discrete polarization positions: 0° or 90°.

The three axes and their range of angular movement augmented by the polarization switch allow the ANTENNA to point towards the satellite in multiple combinations of angular axis positions. The SBC selects the best possible combination before each pointing command, so as to allow continuous focus on the satellite under all specified sea conditions without exceeding the system's mechanical limits and without encountering geometrical keyholes.

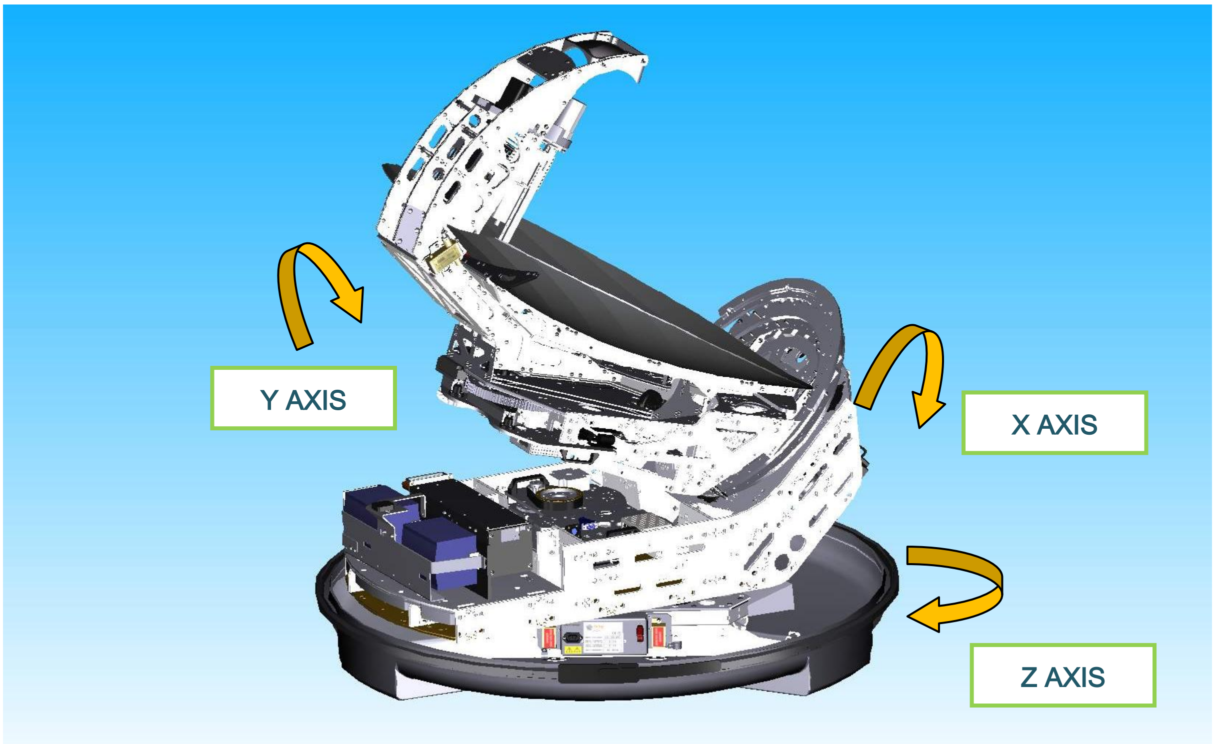


Figure 3-5: Pedestal Axes

3.1.3 Servo Drive Modules

Each one of the Azimuth, X, and Y axes is equipped with an identical SERVO DRIVE MODULE (SDMs), which acts as a full self-contained turntable that rotates the axis.

Each SDM contains the following assemblies:

- Stepper driver with 1:16 micro-step control capability
- Integral stepper motor
- 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

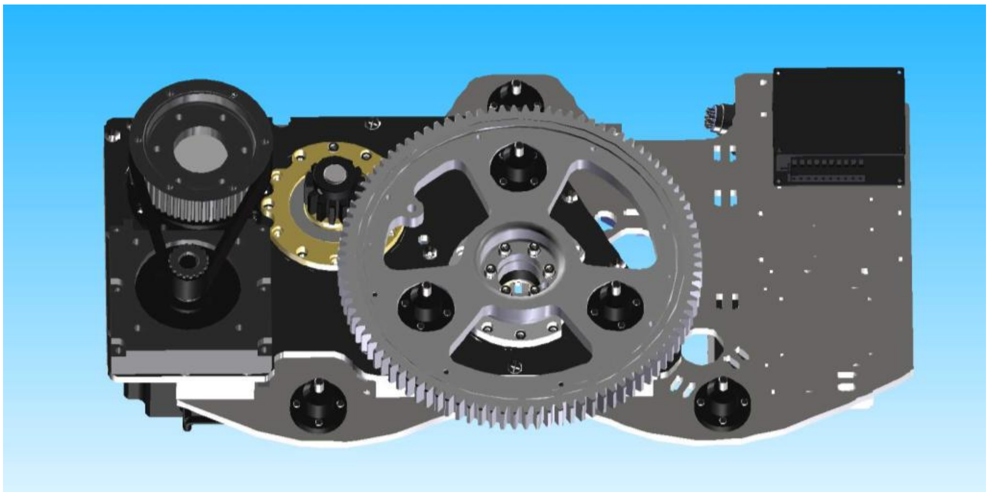


Figure 3-6: Servo Drive Module (SDM)

3.1.4 Single Board Controller

The SINGLE BOARD CONTROLLER (SBC) is a real-time ANTENNA control unit with an industry-standard CPU, on-board Flash and SDRAM memory. This unit controls the positioning of the ANTENNA on the basis of commands received from the CCU.

Figure 3-7: Single Board Controller

The SBC runs a real-time operating system that reads all system sensors, performs 3D mathematical transformations, controls the movement of the POSITIONER AXES and provides on-line communication with the CCU via a standard Ethernet-LAN connection.

The SBC contains a built-in NARROW BAND RECEIVER (NBR) for step-tracking feedback. A 2-WAY SPLITTER divides the output signal of the LOW NOISE BLOCK down-converter (LNB) between the ADMX, which communicates the received data to the BDMX, and the NBR which uses the signal to stabilize the ANTENNA position.

The SBC is powered with +24 VDC from the PSU and incorporates an internal DC-DC power supply that provides +5, +12 and –12 VDC voltage to its internal circuits.

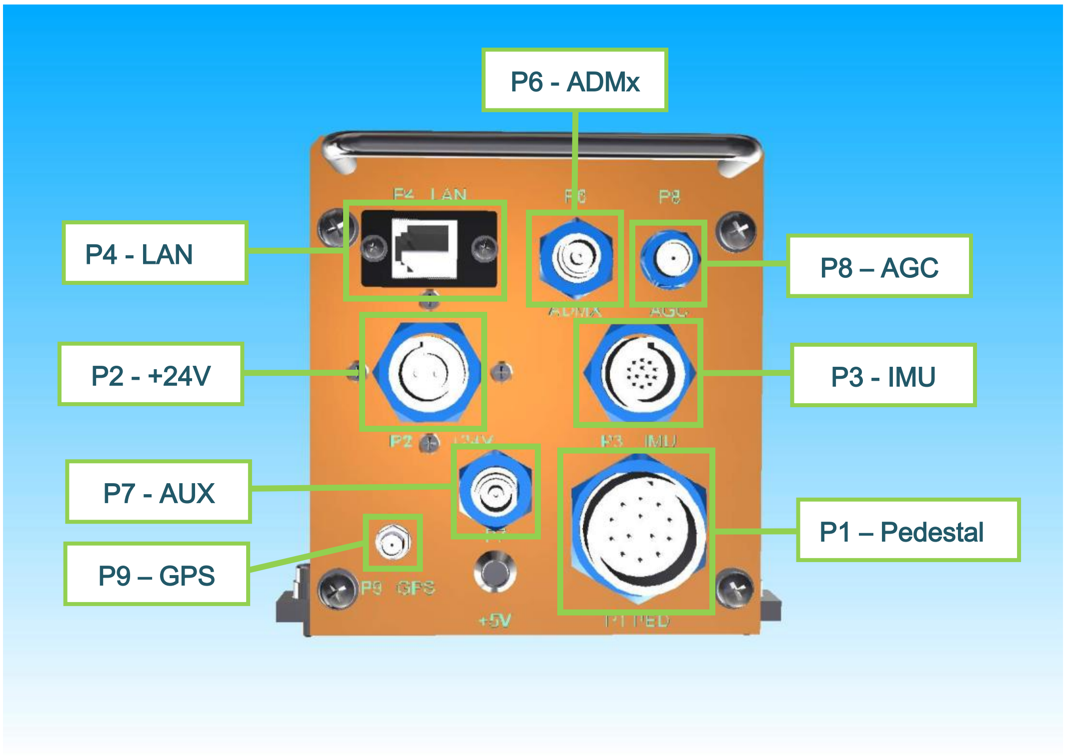


Figure 3-8: SBC Front Panel Connectors

The SBC connects to the other ADE components via its front-panel connectors. The following table describes each connector.

Table 3-1: SBC Front Panel Connectors

Connector	Type	Function
AGC	F-Type	Connects to the LNB via the SPLITTER
Pedestal	D38999/ 24WE35SN	Connects to the pedestal SDMs, polarization skew axis and BUC for M&C communication
GPS	SMA	Connects to the GPS ANTENNA
LAN	RJ-45	Connects to the ADMX

Connector	Type	Function
AUX	BNC	For R&D purposes
ADMx	BNC	To read Input dBm (input RF level)
+24V	MS	Connects to the PSU (input power)
IMU	MS	Connects to the IMU (outputs 12V and 5V power to the IMU)

3.1.5 Power Supply Unit

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.

Figure 3-9: Power Supply Unit (PSU)

AC mains input voltage, connected to the ADE, is fed to the PSU via the AZIMUTH AXIS slip-ring. For systems equipped with a 4W or 8W BUC, the PSU contains two industry-standard 150W modules; one producing 24 VDC and the other 51 VDC. For systems with a 16W BUC a different PSU is installed which contains three industry-standard 150W modules; one producing 24 VDC and two producing 51 VDC.

A DC INSERTER is used to supply 24 VDC to BUCs that require DC supply via the L-Band coaxial cable.

3.1.6 GPS Antenna

The GPS ANTENNA is connected to the SBC which contains a built-in GPS RECEIVER.

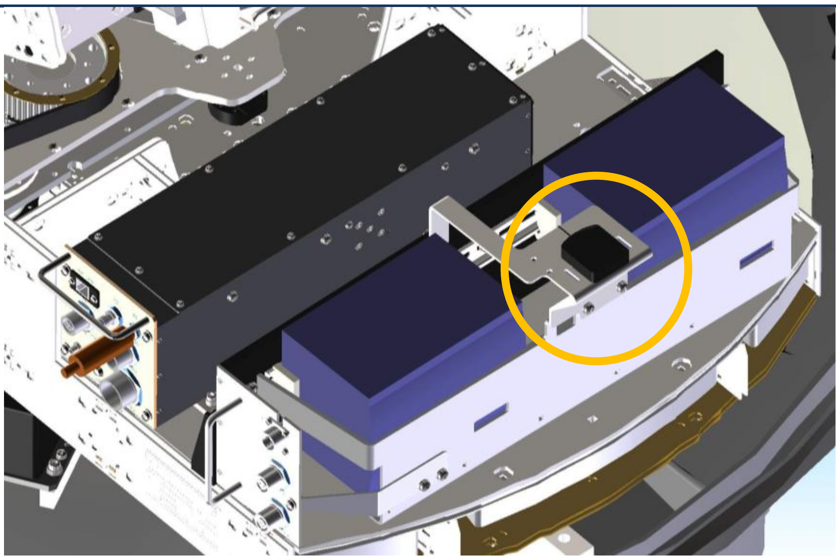


Figure 3-10: GPS Antenna

3.1.7 Inertial Measurement Unit

A strap-down solid-state INERTIAL MEASUREMENT UNIT (IMU) is installed on the PEDESTAL and provides the SBC with extremely accurate dynamic readings of the platform's sea movement. The SBC stabilizes the POSITIONER accordingly in real-time via the SDMs.

Figure 3-11: Inertial Measurement Unit (IMU)

The IMU reports the following data:

* Pitch and roll – Short-term data measured by two RATE-GYRO SENSORS, dynamically integrated by the SBC with long-term data measured by two INCLINOMETERS.
* Yaw variations – Short-term data measured by a RATE-GYRO SENSOR dynamically integrated by the SBC with long-term yaw data received from the ship's gyrocompass.

3.1.8 Antenna

The high efficiency dual-offset Gregorian 1.15m (45") composite material ANTENNA is installed on the Y AXIS and supports the Tx/Rx Ku-Band RF FRONT END with a mechanical linear polarization switch.

There are two types of Tx/Rx Ku-Band RF PACKAGE; Cross-Polarization (X-POL) and Co-Cross Polarization. Both configurations are available with the 4W, 8W, and 16W BUC.

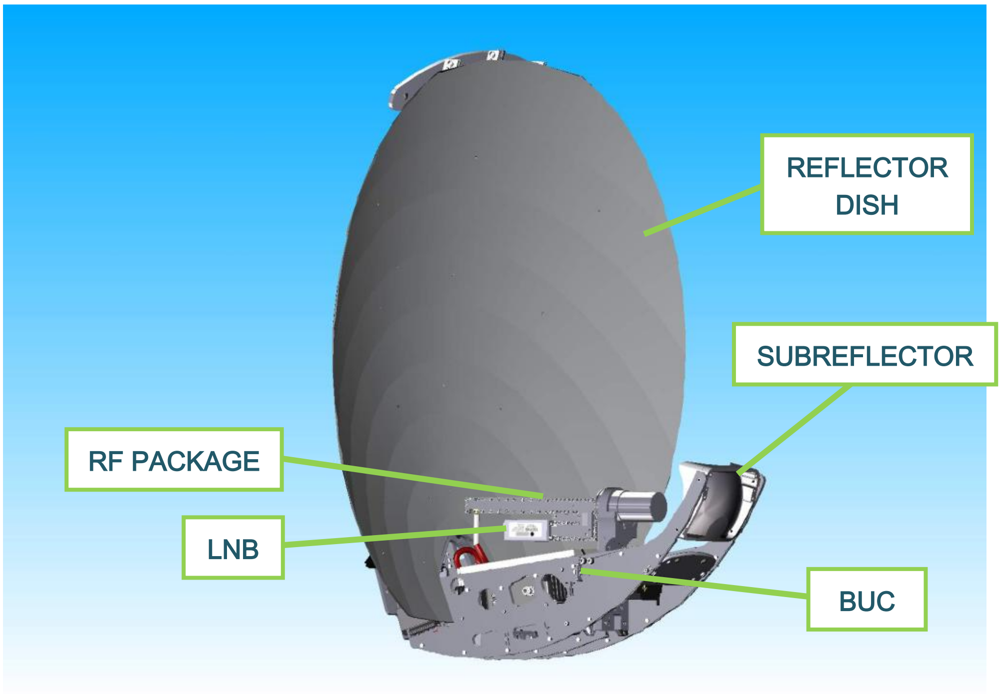


Figure 3-12: Antenna Assembly

3.1.9 Cross Polarization (X-POL) RF Package

The CROSS POLARIZATION RF PACKAGE, mounted on the ANTENNA DISH, includes the following components:

- 4W/8W/16W BUC
- RF FRONT END – composed of a FEED HORN, integrated RF CHAIN, LNB, and 10DB ATTENUATOR
- POLARIZER MOTOR

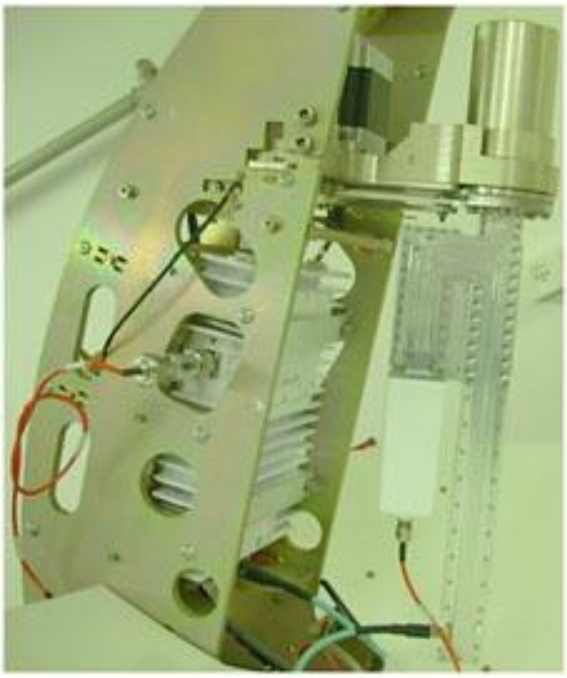


Figure 3-13: Cross-Polarization (X-POL) RF Package (4W/8W BUC Configuration)

Figure 3-14: Cross-Polarization (X-POL) RF Package (16W BUC Configuration)

When the system is supplied with a BUC that requires DC supply via the L-Band coaxial connector, a DC INSERTER is installed. For all other BUCs power is supplied via the M&C cable.

Note that there also may be a situation where the DC INSERTER, although physically present, is actually bypassed and not used. This may occur when the system is upgraded on-site to include a BUC that does not require DC supply via the coaxial connector.

Co-Cross Polarization RF Package (Global Feed)

The CO-CROSS POLARIZATION RF PACKAGE, mounted on the ANTENNA DISH, includes the following components:

- 4W/8W/16W BUC
- RF FRONT END – composed of a FEED HORN, integrated RF CHAIN, Cross-Pol and Co-Pol LNBs, 10DB ATTENUATOR, and RF SWITCH
- POLARIZER MOTOR
- LINE AMPLIFIER (SBC-AGC connector)

The global feed covers the full 10.95-to-12.75 GHz Rx band and supports both cross-pol and co-pol satellites.

Figure 3-15: Co-Cross-Polarization RF Package (8W BUC Configuration)

Figure 3-16: Co-Cross-Polarization RF Package (16W BUC Configuration)

When the system is supplied with a BUC that requires DC supply via the L-Band coaxial connector, a DC INSERTER is installed. For all other BUCs power is supplied via the M&C cable.

Note that there also may be a situation where the DC INSERTER, although physically present, is actually bypassed and not used. This may occur when the system is upgraded on-site to include a BUC that does not require DC supply via the coaxial connector.

Low Noise Block

The cross-pol system is supplied with one of three available Ku-Band PLL LOW NOISE BLOCKS (LNB); 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 easily be replaced to match the required frequency range.

Figure 3-17: Ku-Band LNB (Typical)

Wide-Band (Quad-Band) LNB

The co-cross pol system is supplied with a wide-band (Quad-Band) LNB covering the full Ku-Band receive range.

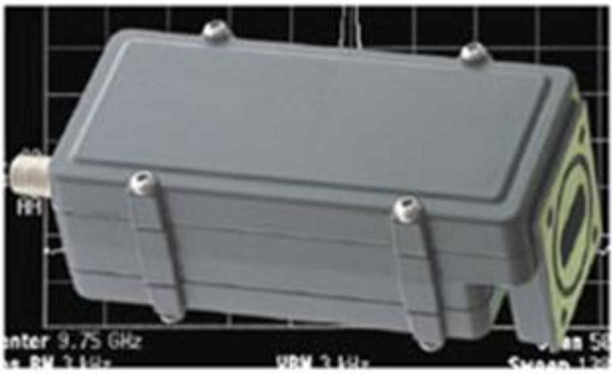


Figure 3-18: Wide-Band Ku-Band LNB (Typical)

3.1.10 Block Up-Converter

The OrSat™ system is supplied with a 4W, 8W, or 16W (Standard or Extended) Ku-Band BLOCK UP-CONVERTER (BUC) which serves as the system's RF transmitter.

The BUC receives the IF signal from the modem in L-Band via the ADMX and then up-converts and amplifies the IF signal to Ku-Band for transmission to the satellite. It is suitable for both data and voice communication operating in different modulation formats (for example: BPSK, QPSK, and QAM).

The BUC is powered by the DC INSERTER unit which receives 24 VDC from the PSU.

The Ku-Band BUC assembly consists of the following components:

- UP-CONVERTER
- SOLID STATE POWER AMPLIFIER
- PHASE LOCKED OSCILLATOR
- DC-DC POWER CONVERTER

The appropriate BUC (4W, 8W, or 16W) is selected on the basis of the following considerations:

- **Required bandwidth:** Greater power is required for higher bandwidth.
- **Geographic location:** Greater power is required at greater distance from the center of the satellite's coverage zone (i.e., its *footprint*), or from the Earth's equator.

- **Power Limitations:** A 4W BUC can hold up to 512 Kbps with relatively efficient signal-to-noise ratio (SNR). Higher bandwidth requires an 8W or 16W BUC.

Figure 3-19: 16W BUC (Typical)

Figure 3-20: 8W BUC (Typical)

Figure 3-21: 4W BUC (Typical)

3.1.11 Above Deck Mux (ADMx)

The ADMX (mounted on the PEDESTAL) and the BDMX (inside the CCU) multiplexer modules form the communications link between the ADE and BDE, minimizing the physical connection to a single coax cable (LMR-200, LMR-400, or LMR-600, depending on the required cable length).

The ADMX also provides integral amplification of the Tx and Rx paths.

Figure 3-22: ADMx

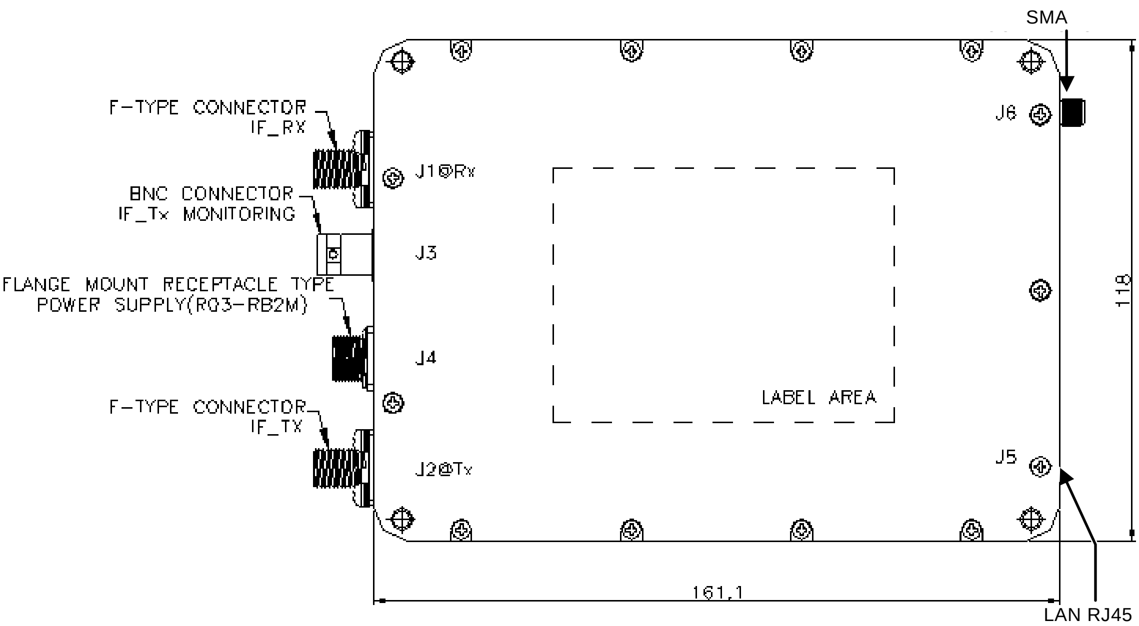


Figure 3-23: ADMx Schematic Diagram

3.1.12 ADE Power Connection Box

The ADE is fed with mains AC power via the POWER CONNECTION BOX.

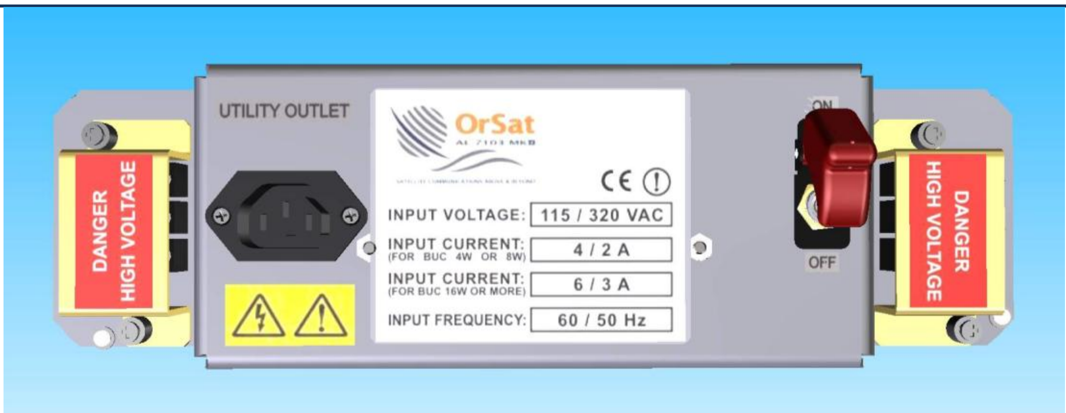


Figure 3-24: ADE Power Connection Box

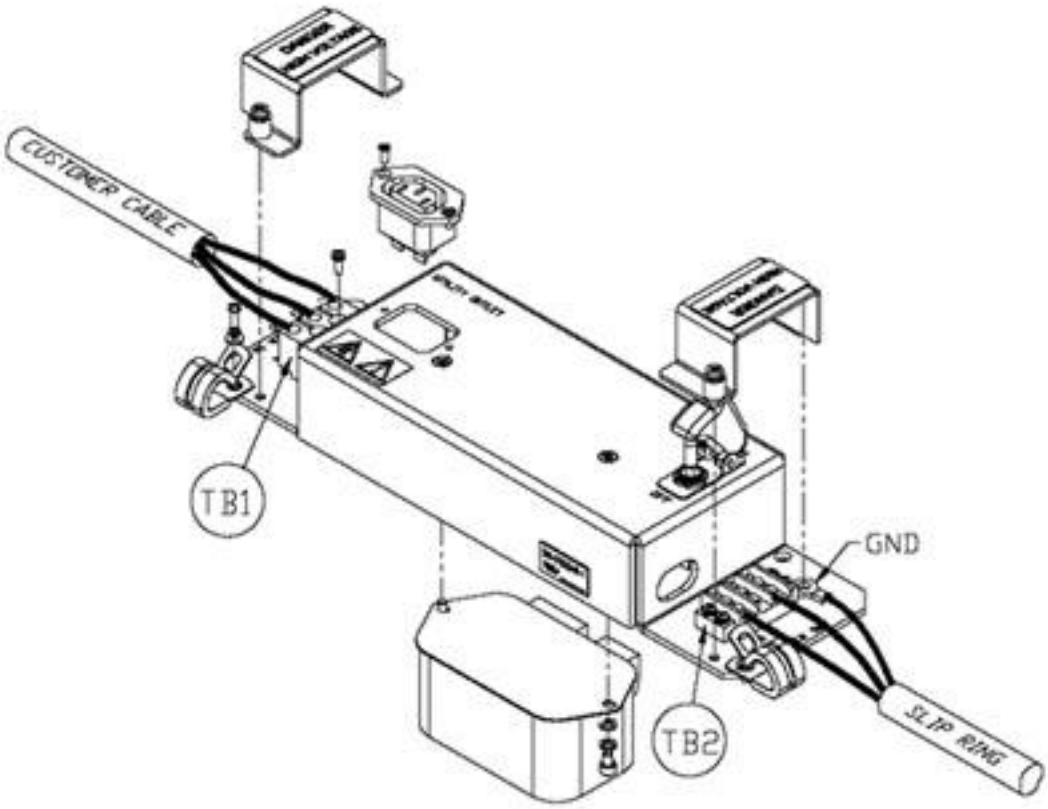


Figure 3-25: ADE Power Connection Box schematic diagram

WARNING!

The Utility Outlet is connected directly to the vessel's AC voltage input terminals (125 VAC / 250 VAC). Therefore, live voltage is always present at the utility outlet even when the power supply to the ADE is discontinued using the mains power ON/OFF switch.

The utility outlet bears the same voltage as the input power. Be careful not to connect a 110 VAC device where the input is 220 VAC.

3.2 Below Deck Equipment (BDE)

3.2.1 Central Control Unit – 1U Height

The CENTRAL CONTROL UNIT (CCU) is the interface between the system, the ship's equipment, and the human operator.

The CCU provides the following functions:

- Modem interface
- Conversion of compass inputs
- IRD Lock Indicator interface
- Adjustable TX channel amplification
- De-muxing and muxing of Ethernet and RF channels
- Ethernet Hub
- Running platform for M&C software applications
- Transmission of on-line GPS data to the satellite modem
- SNMP support for network management

The CCU is 1U high and is typically installed on a dedicated 19-inch rack in the ship's radio room. The front panel includes a USB and LAN jack from which the unit can be connected to a CFE computer for manual control and software maintenance.

The CCU unit can be custom-ordered with an additional dedicated 17" LCD and 1U keyboard drawer.

Manual monitoring and control is performed using provided software applications running on a Windows Embedded CE 6.0 operating system (see **Commissioning the System** on page 86System Operation for details).

The rear panel includes several connectors that connect to the ADE, the modem and the ship's gyrocompass (NMEA-0183, Synchro, or Step-by-Step). An ATTENUATOR SWITCH allows adaptation to various ADE-BDE cable lengths.

The CCU contains the BDMX module that connects to the ADMX via a single coaxial cable through the rotary joint/slip-ring assembly in the AZIMUTH AXIS. Like the ADMX, the BDMX also provides integral amplification of the Rx and Tx paths.

System operation is fully controlled from the CCU. Using the HMI, the operator can select the desired satellite and channel from the CCU's Global Satellite Coverage database. The system automatically extracts the required data and deploys the ACU to acquire and track the selected satellite, while compensating for the platform's pitch, roll and yaw movements.

Figure 3-26: Central Control Unit

3.2.2 Modem and Distribution Array

The CFE 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.

3.3 ADE-BDE Link (ADMx/BDMx Modules)

The ADMX and the BDMX multiplexer modules form the ADE-to-BDE link, which carries the following multiplexed signals:

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

The coaxial cable provides 10MHz to 4.7GHz bandwidth.

The ADE-BDE connection is designed for best performance when using a Times LMR-200 cable for lengths of up to 30m, an LMR-400 cable for lengths of up to 50m, or an LMR-600 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 ADMX-BDMX link gain values are as follows:

- Tx: 21dB (typical)
- Rx: 25dB (typical)

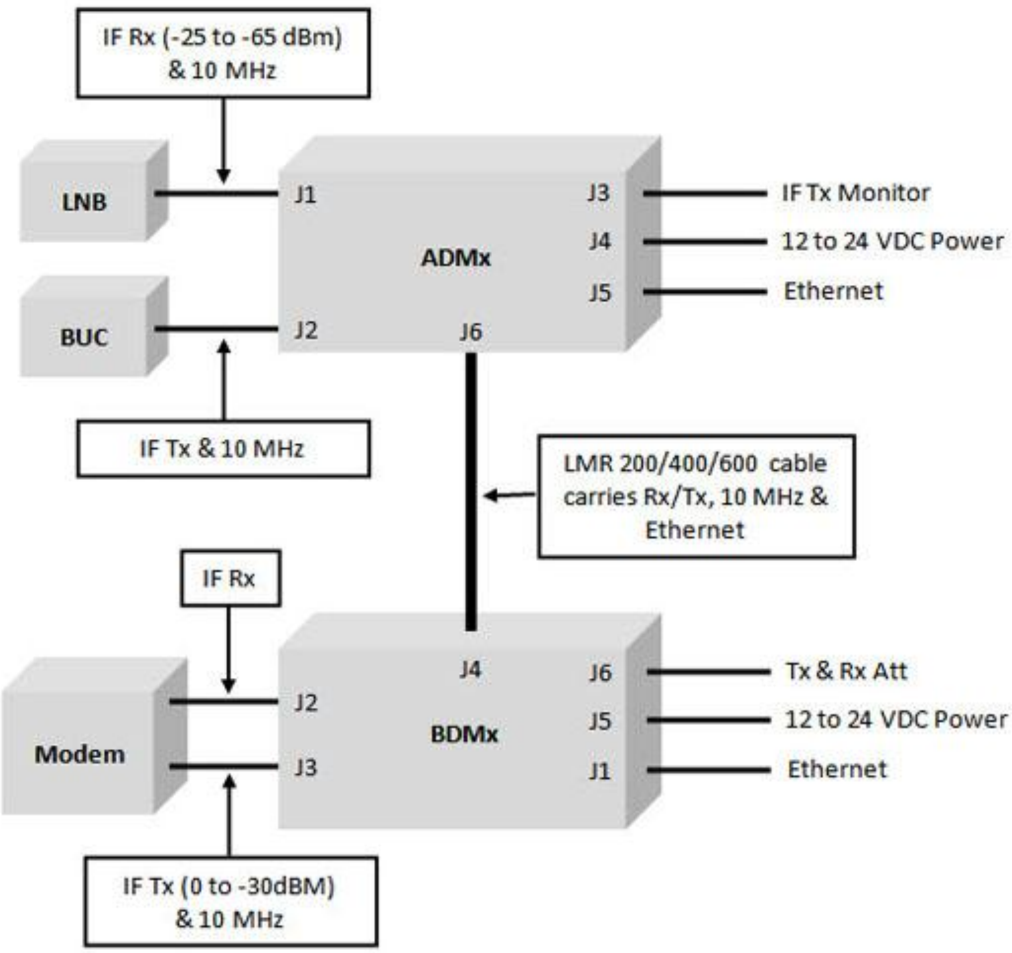


Figure 3-27: ADMx- BDMx Link

3.4 ADE Interconnections and Cables

The AL-7103 MKII ADE wiring system consists 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 via the 2-WAY SPLITTER.
- Tx coaxial path connecting the BUC to the ADMX.
- Single-channel ROTARY JOINT passing the ADE-BDE connection between the ADMX and BDMX.
- Multiple slip-ring assembly passing AC mains power to the PSU as well as IMU power and control signals to the SBC.

Note

For some BUCs, an attenuator is installed on the RF IN connector.

When the system is supplied with a BUC that requires DC supply via the L-Band coaxial connector, a DC INSERTER is installed. For all other BUCs, power is supplied via the M&C cable.

When a global LNB is installed, an amplifier is installed on the SBC's AGC connector.

The following cabling diagrams illustrate two system configurations:

- System containing a BUC with the M&C feature.
- System containing a BUC without the M&C feature (with a DC INSERTER)

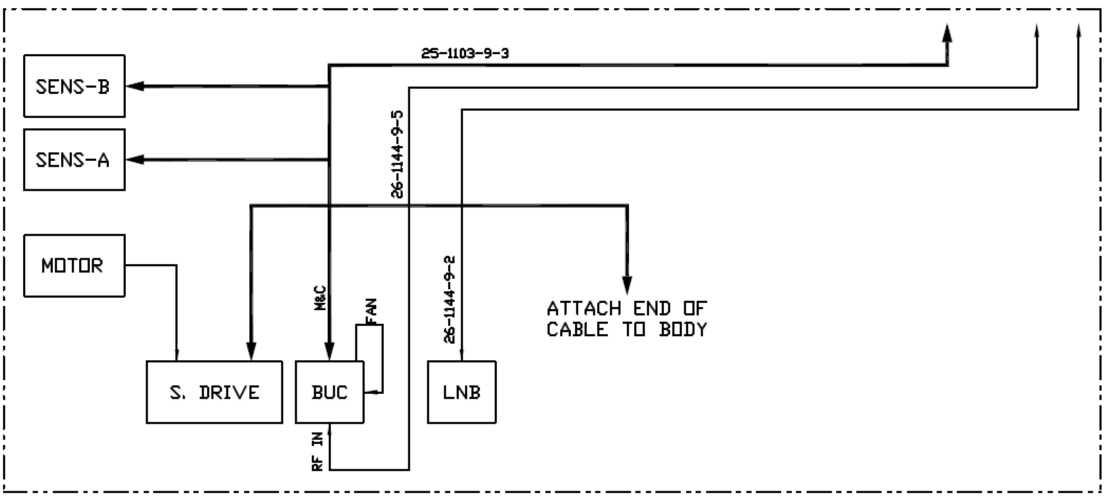


Figure 3-28: OrSat™ System - ADE Cabling Diagram – BUC with M&C

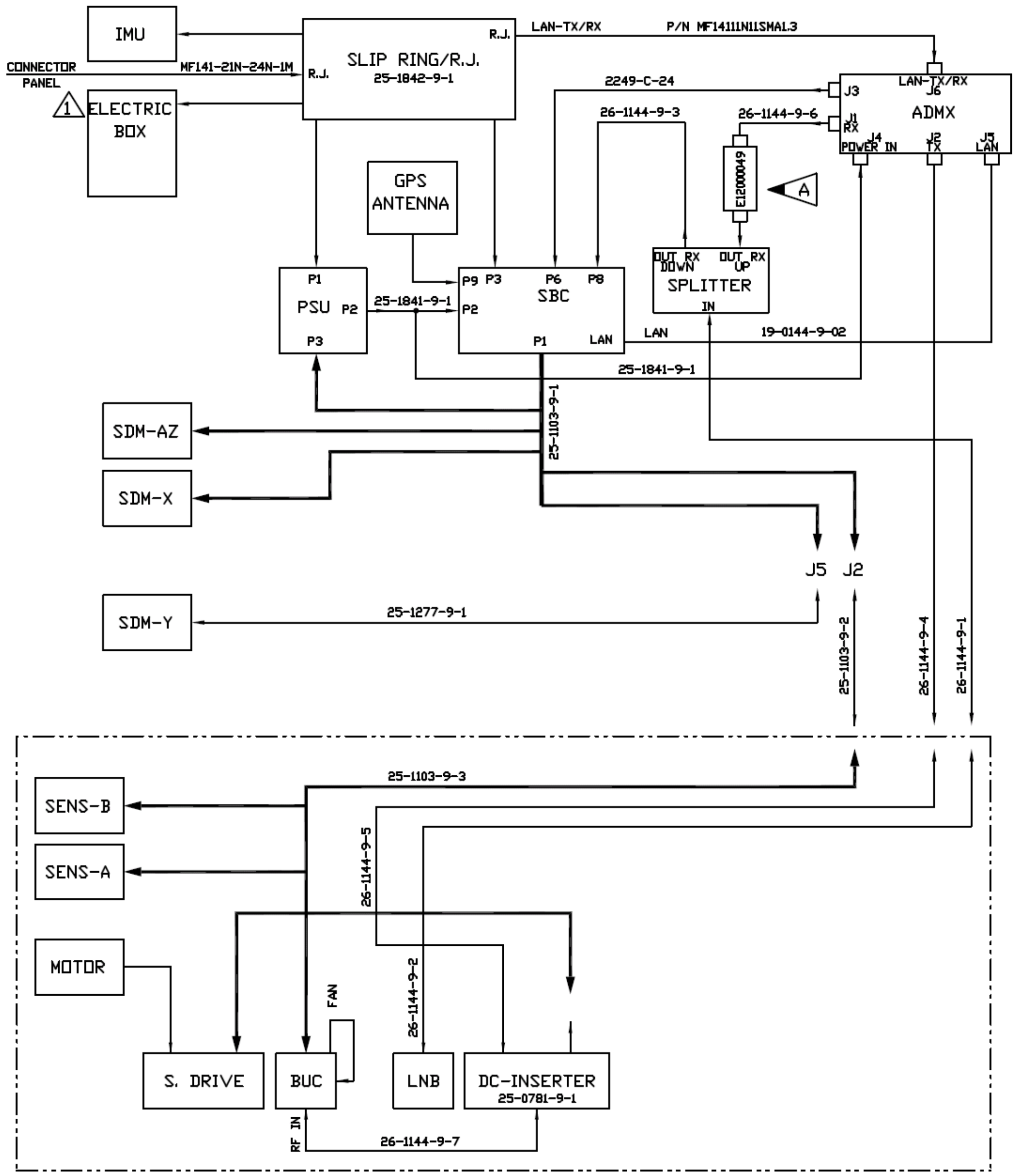


Figure 3-29: OrSat™ System - ADE Cabling Diagram – BUC without M&C

3.5 Block Diagrams

3.5.1 Overall System Architecture

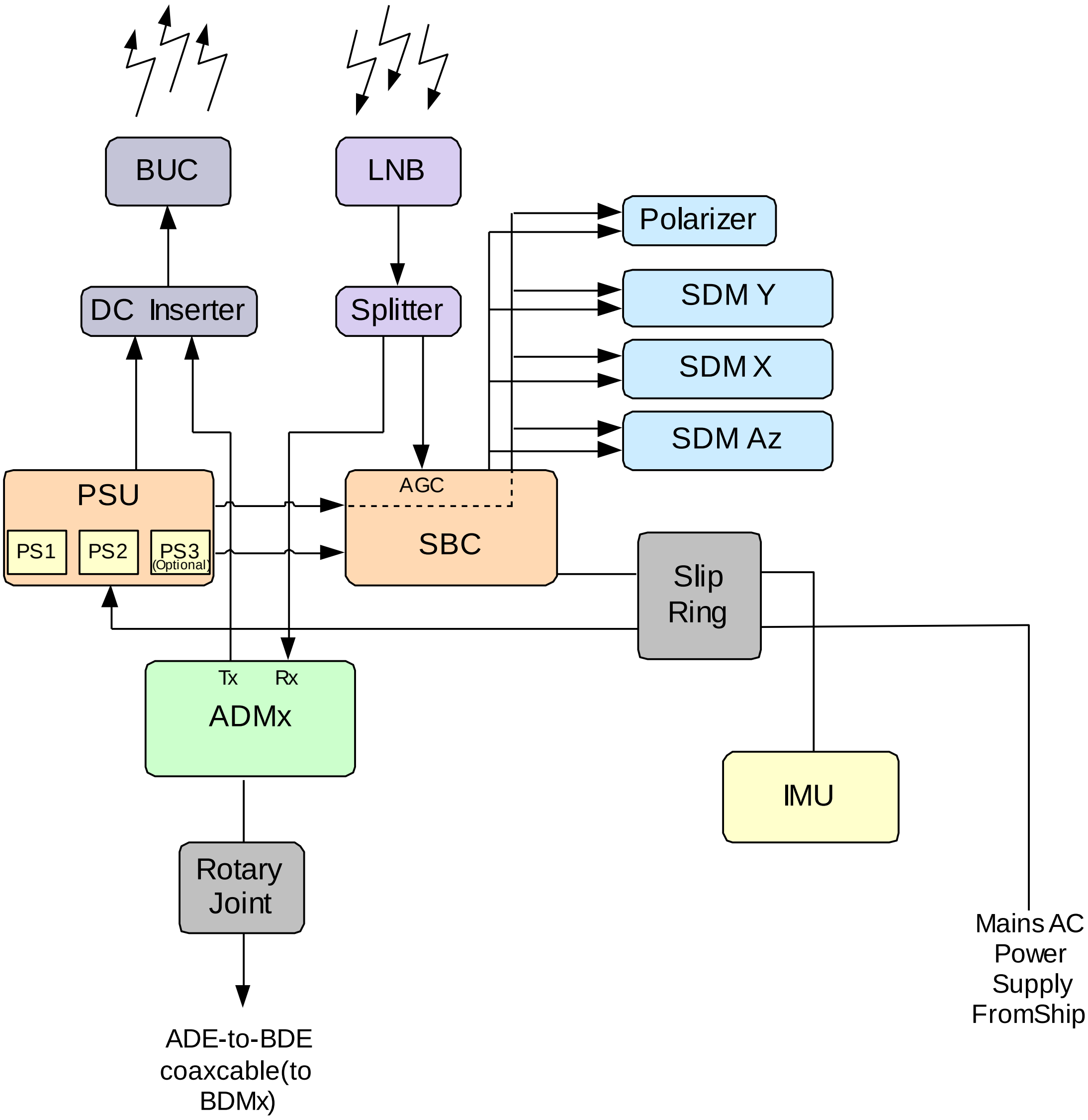


Figure 3-30: ADE Overall Block Diagram

3.5.2 ADE Power Distribution

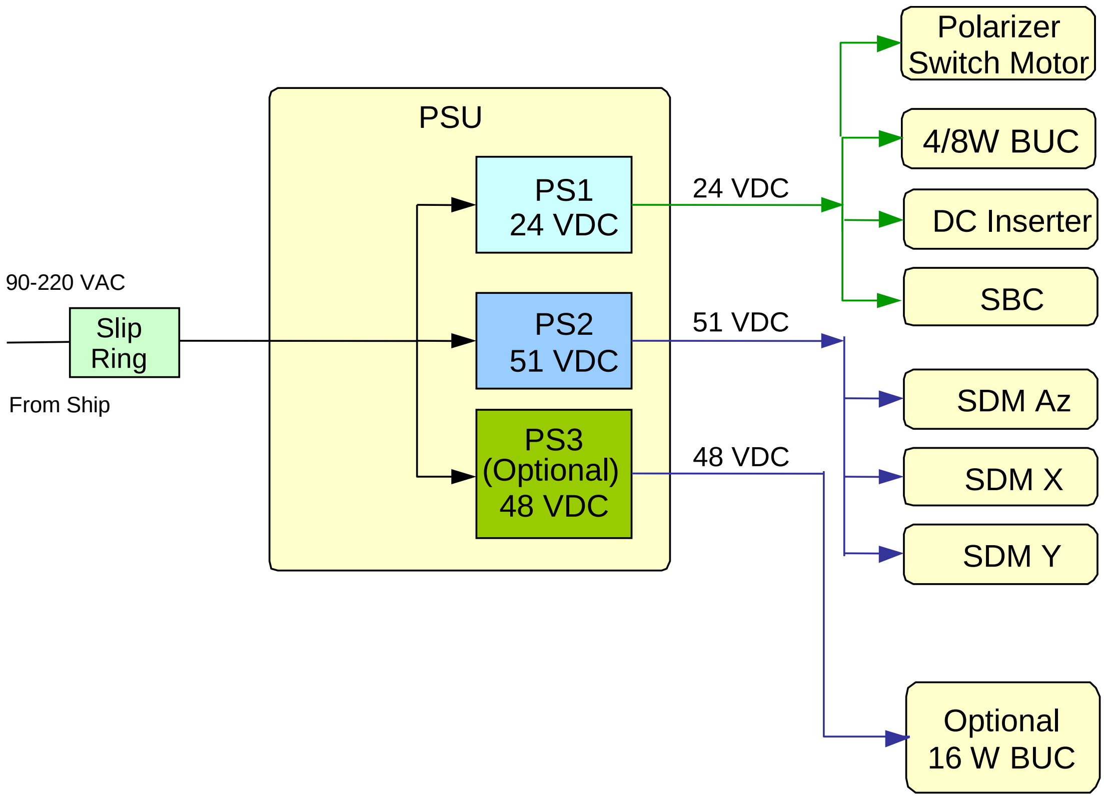


Figure 3-31: ADE Power Distribution Block Diagram (4W / 8W / 16W BUC)

When the system is supplied with a 16W BUC, the system is equipped with a different PSU that contains three industry-standard 150W modules, producing 24, 48, and 51 VDC respectively

When the system is supplied with a BUC that requires DC supply via the L-Band coaxial connector, a DC INSERTER is installed. For all other BUCs, power is supplied via the M&C cable.

Note that there also may be a situation where the DC INSERTER, although physically present, is actually bypassed and not used. This may occur when the system is upgraded on-site to include a BUC that does not require DC supply via the coaxial connector.

3.5.3 ADMx-BDMx Link

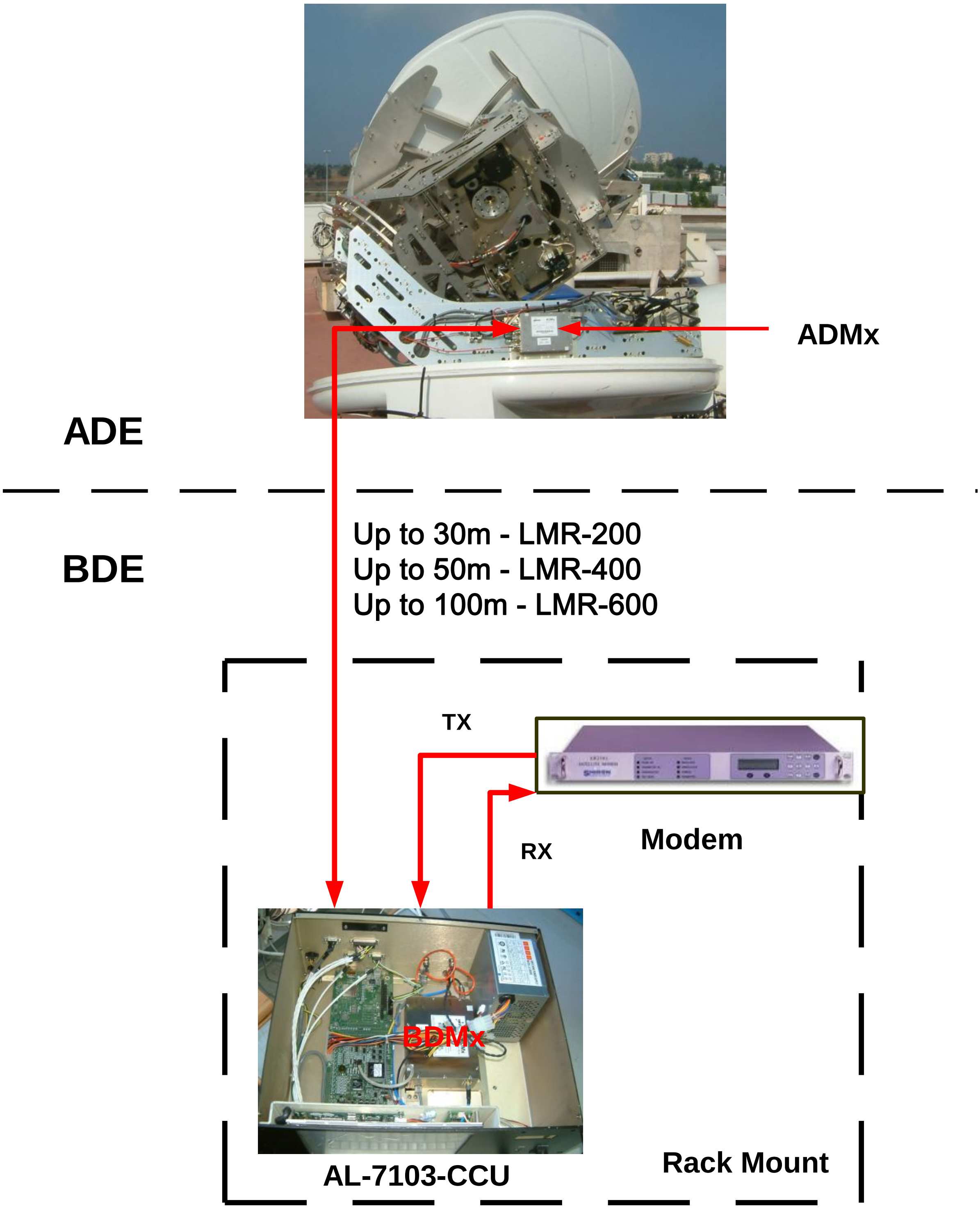


Figure 3-32: ADMx-BDMx Link Block Diagram

4 System Installation

Installation of the AL-7103 MKII system consists of the following steps:

- Ship survey and installation planning
- Unpacking the system
- Installing the ADE
- Installing the BDE

As you perform the installation process, monitor your progress by filling out the Installation Checklist provided in **Appendix E**: Installation Checklist on page 203.

4.1 Ship Survey and Installation Planning

The ship survey and installation planning go hand-in-hand, and comprise the first part of the installation process.

The survey serves to familiarize you with the installation site in order to ensure that all the necessary pre-installation tasks can be carried out properly. It should also provide valuable information on the ship's facilities and the various parameters that affect installation planning. This visit to the ship is best conducted with an authorized representative of the ship's personnel.

4.1.1 Ship Survey

During your visit to the ship, prepare a site survey report, which will allow accurate and efficient installation planning (use the Pre-installation Checklist form provided in **Appendix C**: Central Control Unit – 5U Height

The CENTRAL CONTROL UNIT (CCU) is the interface between the system and the ship's equipment. The CCU provides the following functions:

- Modem interface
- Conversion of compass inputs
- IRD Lock Indicator interface
- Adjustable Tx/Rx channel amplification
- De-muxing and muxing of Ethernet and RF channels
- Ethernet Hub (for dual CCU option)

* Running platform for the MTSLINK user interface
* Transmission of on-line GPS data to the satellite modem

The CCU is installed on a 19” rack-mounted 5U industrial PC (including a 1U keyboard-and-mouse drawer), which is usually located in the ship’s radio room.

The front panel includes a TFT screen which, together with an external keyboard, constitutes the system’s human-machine interface (HMI). Manual monitoring and control is performed using provided software applications running on a Windows Embedded CE 5.0 operating system (see **Commissioning the System** on page 86 and **System Operation** on page128).

The rear panel includes several connectors, which connect to the ADE, the modem and the ship’s gyrocompass (NMEA-0183, Synchro or Step-By-Step). Two ATTENUATOR SWITCHES allow adaptation to various ADE-BDE cable lengths.

The CCU contains the BDMX module that connects to the ADMX via a single coaxial cable through the rotary joint/multiple slip-ring assembly in the AZIMUTH AXIS. Like the ADMX, the BDMX also provides integral amplification of the Rx and Tx paths.

System operation is fully controlled from the CCU. Using the HMI, the operator can select the desired satellite and channel from the CCU’S Global Satellite Coverage database. The system automatically extracts the required data and deploys the SBC to acquire and track the selected satellite, while compensating for the platform’s pitch, roll and yaw movements.

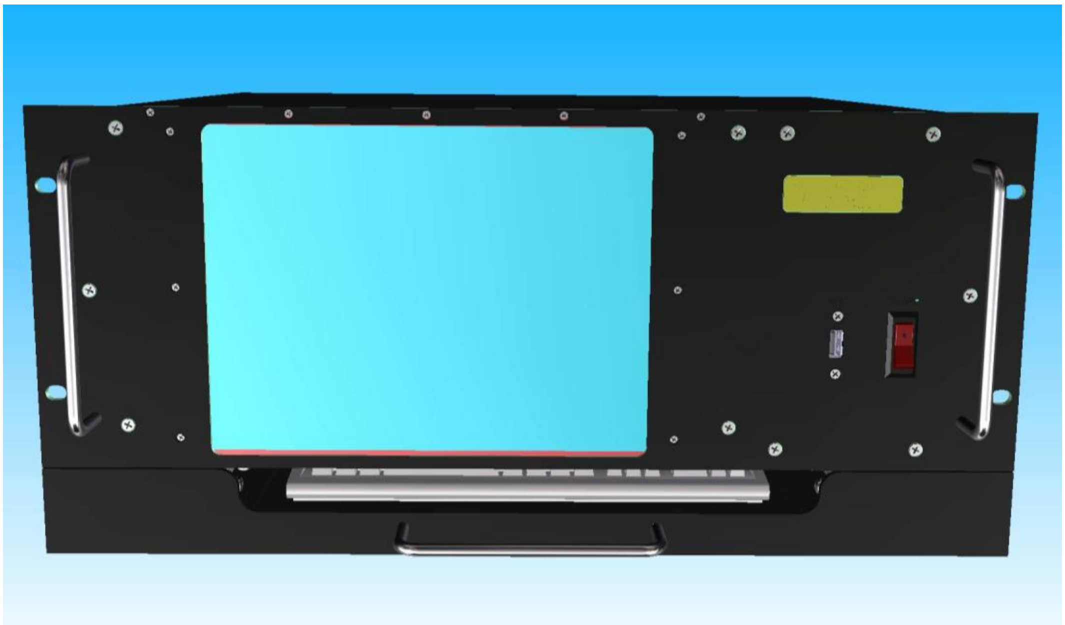


Figure 10-1: CCU Front Panel

Figure 10-2: CCU Rear Panel

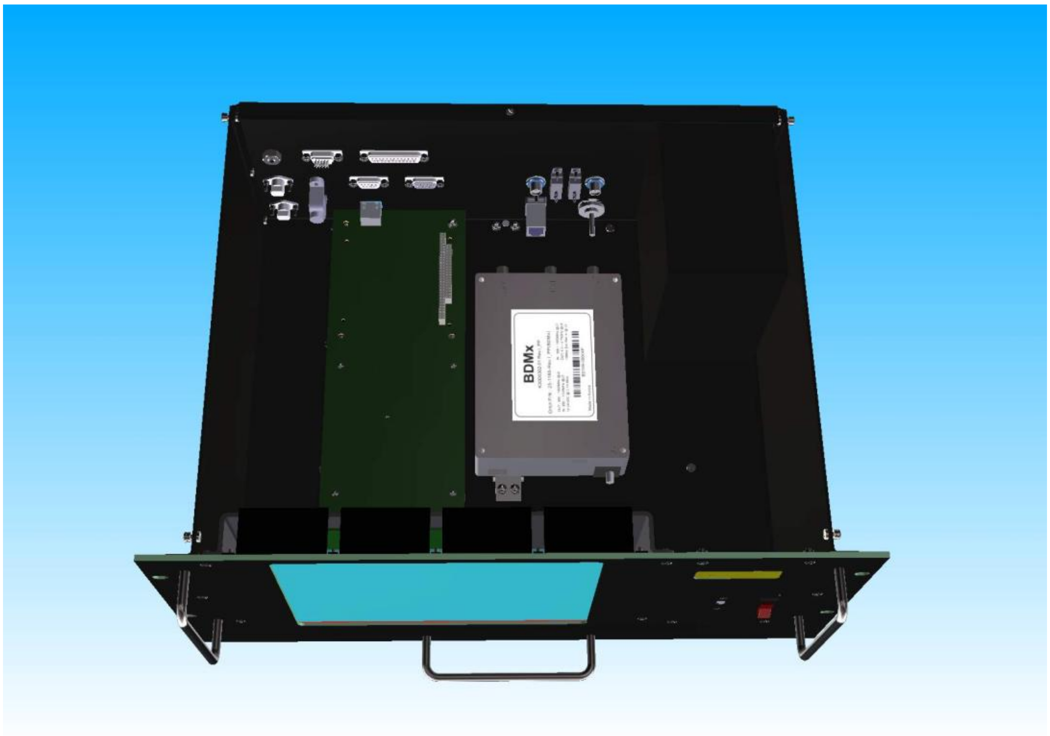


Figure 10-3: CCU Internal View (BDMx)

Installing the BDE (For CCU 5U Height)

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

Figure 10-4: Typical BDE rack installation

Verify that the CCU is installed at a distance of at least 5 meters from the ship’s compass.

The front panel includes a 10.4" TFT screen, keyboard and USB connector (for software maintenance). You can also connect the CCU to an external computer or VGA screen.

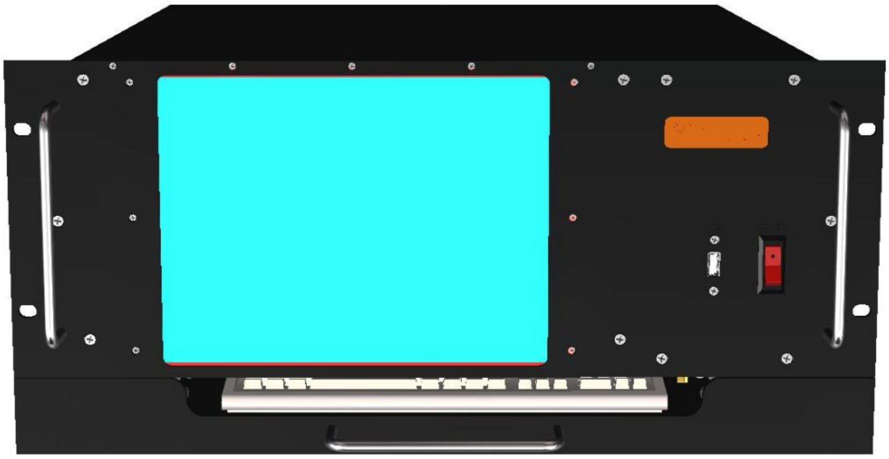


Figure 10-5: CCU Front Panel

Connecting the CCU Cables

Once the CCU is installed, you need to connect it to the various instruments with which it interacts: the ANTENNA terminals, the modems, the ship's compass and the LAN line.

The following table specifies the type and function of each connector.

Table 0-1. AL-7103 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 the CCU to the keyboard located in the CCU drawer.
MOUSE	MINI-DIN	Connects the CCU to the mouse located in the CCU drawer.
SYNCHRO & SBS COMPASS	DB25 male	Connects the CCU to the ship's compass (Synchro or SBS).
COM1-RS422	DB9 male	Connects the CCU to the ship'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
IF OUT RX	F-Type	Connects to modem RX input
IF OUT TX	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
ATTEN RX	Selector	Selects the Rx attenuator ("I" position - 0dB, "0" position - 8dB)
ATTEN TX	Selector	Selects Tx attenuator ("I" position - 0dB, "0" position - 15dB)

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

The following figure depicts the general-purpose cables that connect to the CCU:

- Power cable
- LAN jumper between the BDMx LAN and LAN connectors
- Keyboard
- Mouse
- Ground Cable

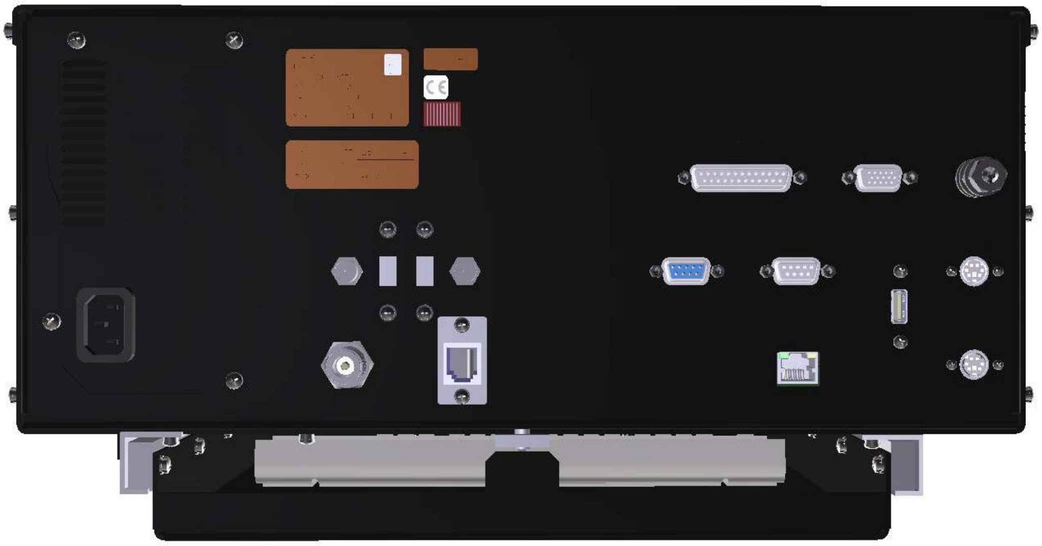


Figure 10-6: CCU rear panel – general-purpose connections

ADE-BDE Cable Connection

The ADE is connected to the BDE via a single LMR-200/400/600 coaxial cable.

➢ **To connect the cable to the CCU:**

1. Install an EZ-400-NMH connector on the BDE side of the LMR-200/400/600 cable (see **Appendix B**: Preparing the ADE-BDE Cable on page 184).

2. Connect the cable connector to the CCU ADMx/BDMx connector, as displayed in the following figure.

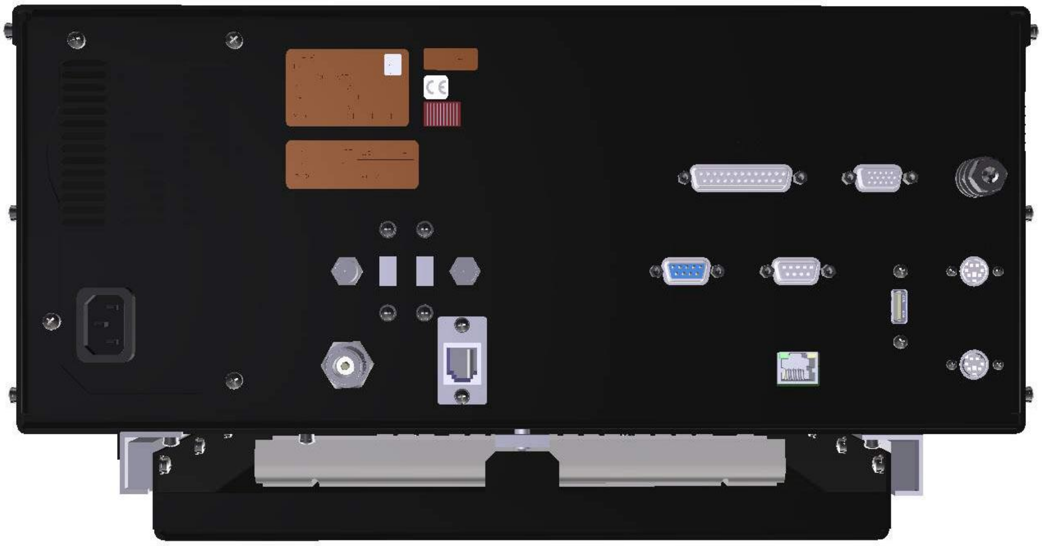


Figure 10-7: CCU rear panel – ADMx/BDMx connector

Serial Communication and Compass Connectors

The CCU rear panel includes three communication connectors:

- **Synchro and SBS Compass** – Connects the CCU to the ship's compass (Synchro or SBS)
- **COM1 - RS-422** – Connects the CCU to the ship's compass (RS-422 port)
- **COM2 - RS-232** – General-purpose serial port

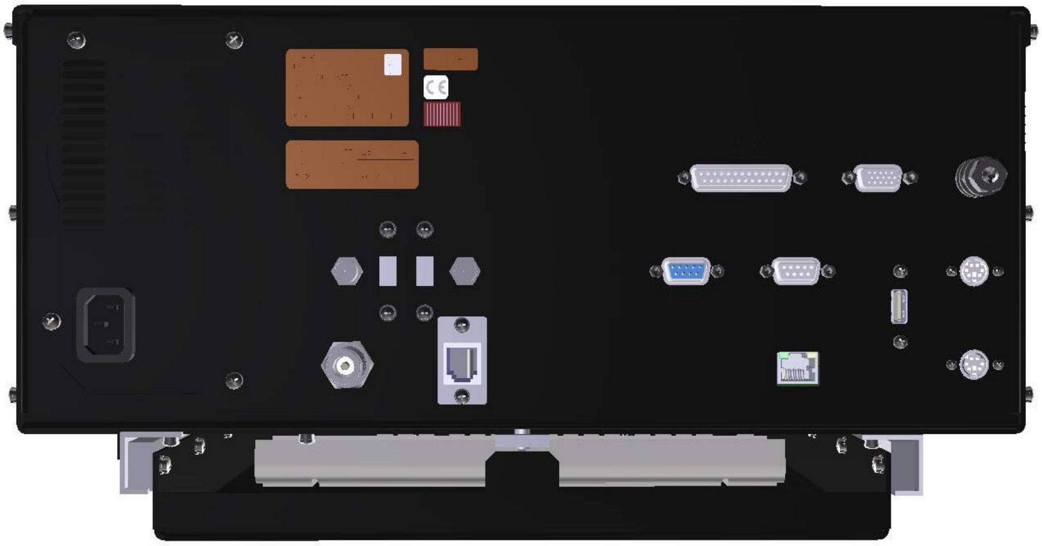


Figure 10-8: CCU rear panel – serial and compass connectors

The system supports the NMEA-0183 gyro compass interface as a default. If a Synchro interface is required, the system should be ordered as such.

The following table specifies the communication connector pin-out. The subsequent sections describe how to use each connector.

Table 10-1: 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	AGN IN
PIN 7	12V
PIN 8	IRD
PIN 9	GND

Synchro & SBS 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	SBS – COM
PIN 13	SBS – 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	SBS – C
PIN 25	SBS - 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 maritime instrumentation. The NMEA-0183 standard is 4800 baud and consists of several different ASCII sentences.

Electrical Interface

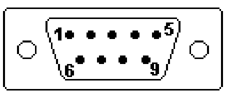
This standard allows a single 'talker' and several 'listeners' on one circuit. The recommended interconnecting wiring is a shielded twisted pair, with the shield grounded only at the talker. These standards do not specify the use of any particular connector.

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 (i.e. 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 shows 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  **COM1-RS422**	**Mating Connector Wiring Diagram** 

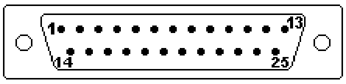
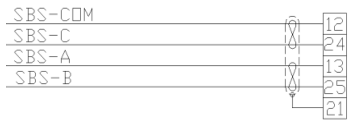
Mating Connector Pin Out	
Pin	**Signal**
2	RXD-
4	RXD+

5	GND

Figure 10-9: NMEA-0183 compass connection scheme

Step-by-Step Compass connection

The following figure shows how to connect a Step-by-Step compass to the CCU'S Synchro & SBS connector.

Connecting a Step-by-Step Compass to SYNCHRO & SBS Connector:	
CCU Connector  **Synchro & SBS**	**Mating Connector Wiring Diagram** 

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

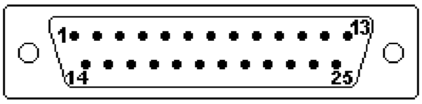
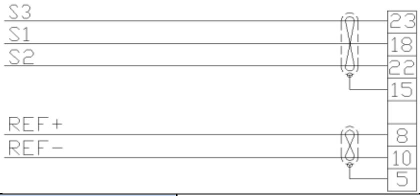
Figure 10-10: Step-by-Step compass connection scheme

- 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

Synchro compass connection

The following figure shows 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	

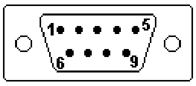
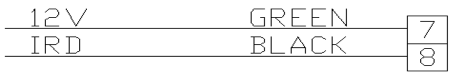
Mating Connector Pin Out	
Pin	**Signal**
8	REF+
10	REF-
5	GND
18	S1
22	S2
23	S3
15	GND

Figure 10-11: Synchro compass connection scheme

Note: Supports 115 VAC reference – 60 VAC reference is optional.

IRD Lock Connection

The following figure shows how to connect the IRD lock modem signal to the CCU'S COM2 connector. Pins 7 & 8 should be connected via a ‘dry-contact’ relay.

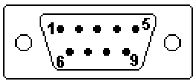
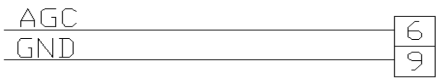
Connecting IRD LOCK to COM2 Connector:	
CCU Connector  **COM2-RS232**	**Mating Connector Wiring Diagram** 

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

Figure 10-12: IRD lock connection scheme

External AGC Connection

The following figure shows how to connect external AGC to the CCU'S COM2 connector.

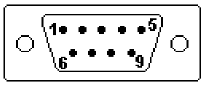
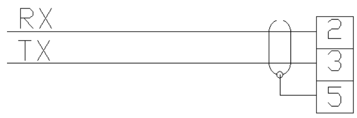
Connecting External AGC to COM2 Connector:	
CCU Connector  **COM2-RS232**	**Mating Connector Wiring Diagram** 

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

Figure 10-13: External AGC connection scheme

RS-232 Communication Channel

The RS-232 port is usually used for GPS output. The following figure illustrates how to connect the RS-232 channel to the CCU'S COM2 connector.

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

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

Figure 10-14: RS-232 connection scheme

Appendix D: Pre-Installation Checklist on page 188). Particular attention should be paid to blockage zones and other interfering equipment, as well as the available interfaces with the ship's systems (for example: power, compass) and cable layout.

Study the intended locations for both the above- and below-deck equipment. Ensure that the RADOME support (supplied by the shipyard) is properly designed and mounted on the deck.

4.1.2 Installation Planning

Installation planning is a crucial stage in the installation process. Correct planning will ensure a successful installation with minimum difficulties prior to and throughout system operation.

Make sure to complete the following tasks:

- Visit the ship and familiarize yourself with the ship's layout, or receive a completed survey report (see **Ship Survey above**).
- Review the following layout data, as may be available:
    - Ship's construction plan
    - Ship's electric mains layout and UPS access (mandatory)
    - Ship's compass interface type, wiring, and availability
- Identify the ship's power supply voltage and frequency
- Identify the ship's compass (standard and voltage)

Use the above information and survey report to prepare an installation plan, which should include the following elements:

- Shore-side assembly site (dock or hanger)
- Crane access, availability, and height
- Location, and orientation of the RADOME SUPPORT
- Orientation of the ADE assembly
- Location of the BDE
- Cable runs

The following sections describe the selection and preparation of installation sites for the above-deck equipment (ADE).

4.1.3 Above-Deck Location and Installation Considerations

Radome Support Design

The RADOME support connects the system with the deck of the ship. Supplied by the customer, it must conform to the following minimum requirements:

- Location with minimal vibration and signal obstruction
- Rigid construction and mounting (the support must be bolted to the mounting surface)
- Ease of access to the RADOME hatch for maintenance purposes

The following figure illustrates a suggested support design.

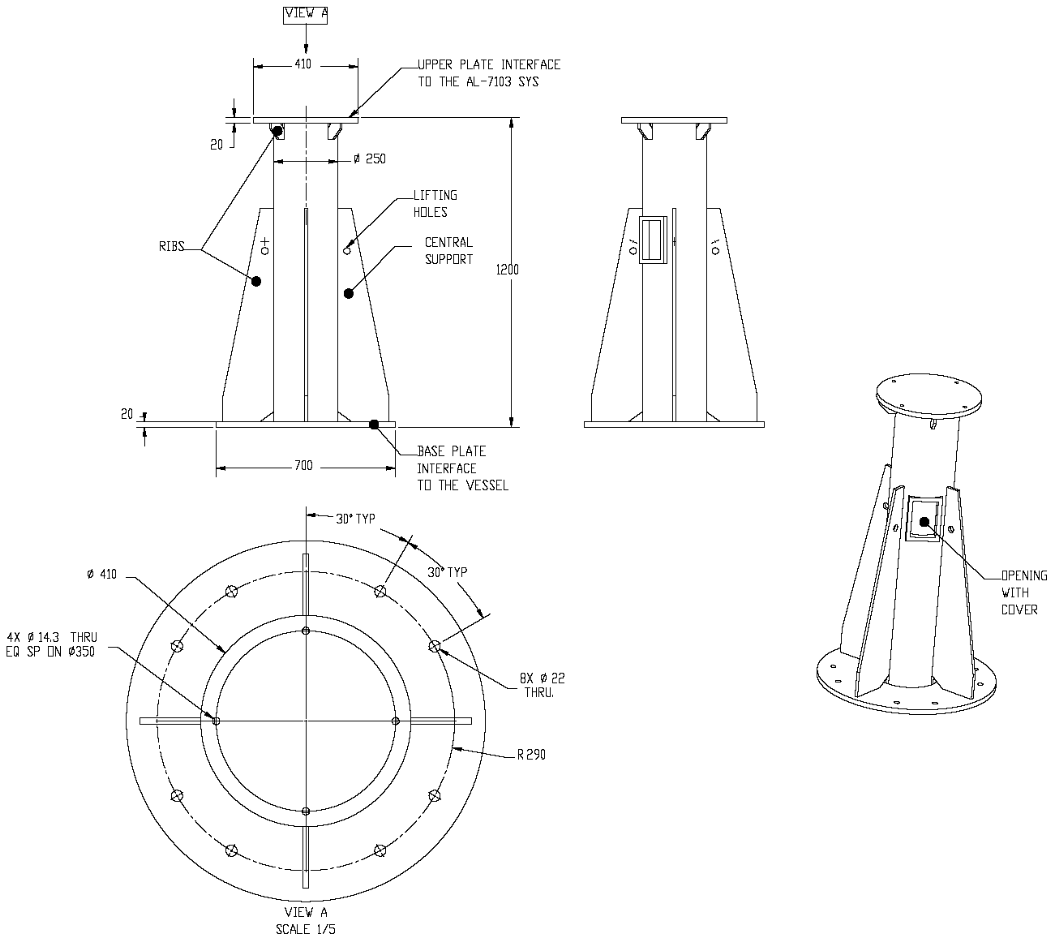


Figure 4-1: Radome support – suggested structure

It is recommended that the mast be welded directly above one of the deck's support beams, as shown in the following figure.

Figure 4-2: Typical support mounting

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.

Figure 4-3: Typical installation locations

In most cases, preparing for the attachment of Orbit's BASE RING to the RADOME support, installing the ADE/BDE cables and wiring, and installing and connecting the modem is the responsibility of the shipyard. The remaining installation process is the responsibility of Orbit's authorized technicians.

Mechanical Stability

The system's support structure must provide mechanical stability and support the ANTENNA's weight (approximately 400 Kg) and dynamics. The mounting surface must be level (within a few degrees), stable and free of vibration, with a natural resonance frequency of above 30 Hz.

Maintenance Access

The hatch on the RADOME BASE must be accessible to the maintenance staff, their tools and spare parts. For this purpose it is recommended to mount the RADOME at a height of 1.2m above the deck. At the minimum, the RADOME should be mounted no lower than 0.6m above the deck to allow the hatch to open.

Line Of Sight (LOS)

The LOS is a straight line between the ANTENNA and the satellite. This line is typically obstructed by the ship's funnels and masts. Ideally, there should be no obstructions to the LOS, with a clear view of the satellite in all directions. However, it is usually necessary to compromise between the LOS and other considerations.

UPS

An On-Line UPS is required, which functions 100% of the time due to battery backup protection. Power is broken down and then reconstructed by an inverter, thereby eliminating incoming surge and line noise, adjusting high or low voltages, and producing perfect sine wave power. Alternatively, a Line Interactive UPS can be used. This UPS has enhanced power protection with Automatic Voltage Regulation (AVR).

The following table contains the recommended UPS specs for the OrSat™ AL-7103 system:

Table 4-1. AL-7103 UPS Specs

	BUC 4W	BUC 8W	BUC 16W
AL-7103	900 VA	1 KVA	1.2 KVA
CCU	350 VA		

Other Location Considerations

- The system should be located as close as possible to the ship's electrical panel, allowing room for the UPS.
- The mounting location should be as far as possible and on a different level from high-power radar systems or other radiating devices.
- The OrSat™ system complies with the IEC 60945 standard. The installation should be planned to prevent any disturbing radiation that exceeds this standard. Where there is difficulty calculating the correct conditions, it is recommended to maintain a distance of 10m and 10° from the main lobe of any radar. Refer to IEC 60945, section 10.4, *Immunity to Radiated Radiofrequencies*.
- The distance between the ADE and the Gyrocompass repeater should be considered when choosing the correct interface type and cable.

- The operation of the rack-mounted CCU is largely automatically, however it is preferable to monitor it periodically. It should therefore be located to facilitate easy access by the operator. Consideration should also be given to empty space around the equipment, so as to allow sufficient maintenance access for technical staff to the rear panel, where the cables are connected. The CCU rear panel should have a clearance of at least 30cm to allow heat dissipation, as well as a sufficiently shallow bend in the coaxial cable when connected to the CCU.

Mounting Surface

The following figure displays the mounting surface layout, including the holes required to bolt the ADE securely to the mounting surface. The bolts attaching the system to the support are supplied by Orbit.

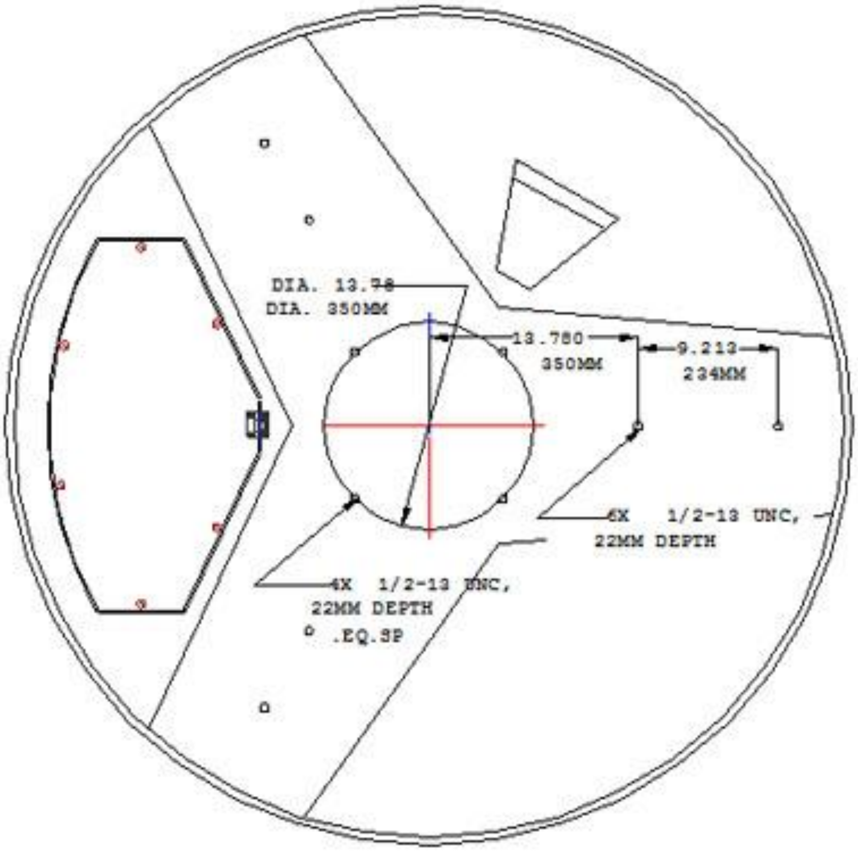


Figure 4-4: Mounting surface layout

4.1.4 Pre-Installation Checklist

Before bringing the installation crew to the site, complete the pre-installation checklist (provided in **Appendix C**: Central Control Unit – 5U Height

The CENTRAL CONTROL UNIT (CCU) is the interface between the system and the ship's equipment. The CCU provides the following functions:

- Modem interface
- Conversion of compass inputs
- IRD Lock Indicator interface
- Adjustable Tx/Rx channel amplification
- De-muxing and muxing of Ethernet and RF channels
- Ethernet Hub (for dual CCU option)
- Running platform for the MTSLINK user interface
- Transmission of on-line GPS data to the satellite modem

The CCU is installed on a 19" rack-mounted 5U industrial PC (including a 1U keyboard-and-mouse drawer), which is usually located in the ship's radio room.

The front panel includes a TFT screen which, together with an external keyboard, constitutes the system's human-machine interface (HMI). Manual monitoring and control is performed using provided software applications running on a Windows Embedded CE 5.0 operating system (see **Commissioning the System** on page 86 and **System Operation** on page128).

The rear panel includes several connectors, which connect to the ADE, the modem and the ship's gyrocompass (NMEA-0183, Synchro or Step-By-Step). Two ATTENUATOR SWITCHES allow adaptation to various ADE-BDE cable lengths.

The CCU contains the BDMX module that connects to the ADMX via a single coaxial cable through the rotary joint/multiple slip-ring assembly in the AZIMUTH AXIS. Like the ADMX, the BDMX also provides integral amplification of the Rx and Tx paths.

System operation is fully controlled from the CCU. Using the HMI, the operator can select the desired satellite and channel from the CCU'S Global Satellite Coverage database. The system automatically extracts the required data and deploys the SBC to acquire and track the selected satellite, while compensating for the platform's pitch, roll and yaw movements.

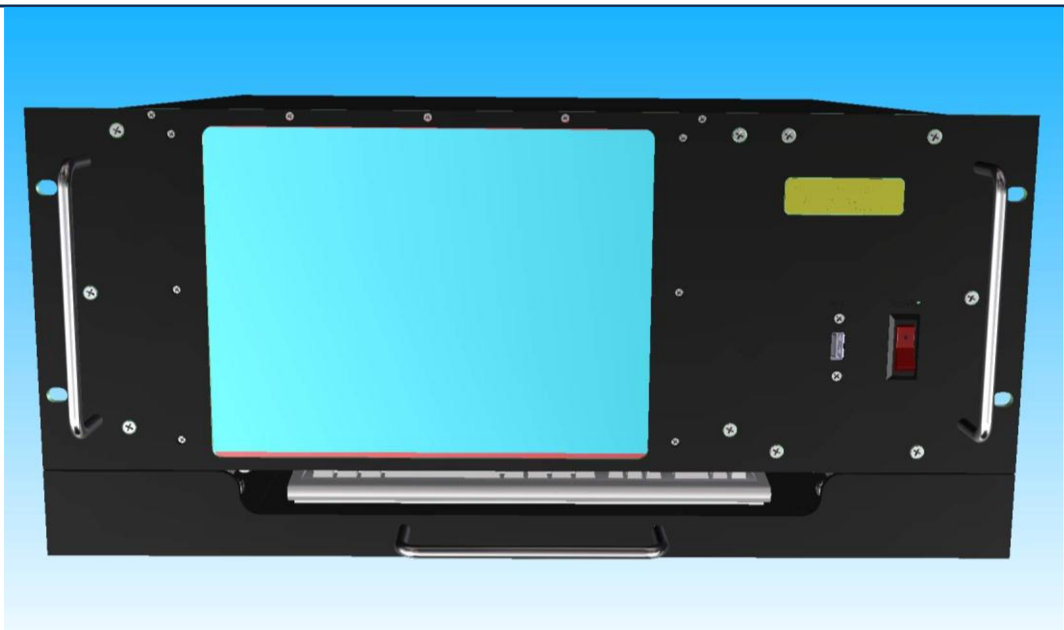


Figure 10-1: CCU Front Panel

Figure 10-2: CCU Rear Panel

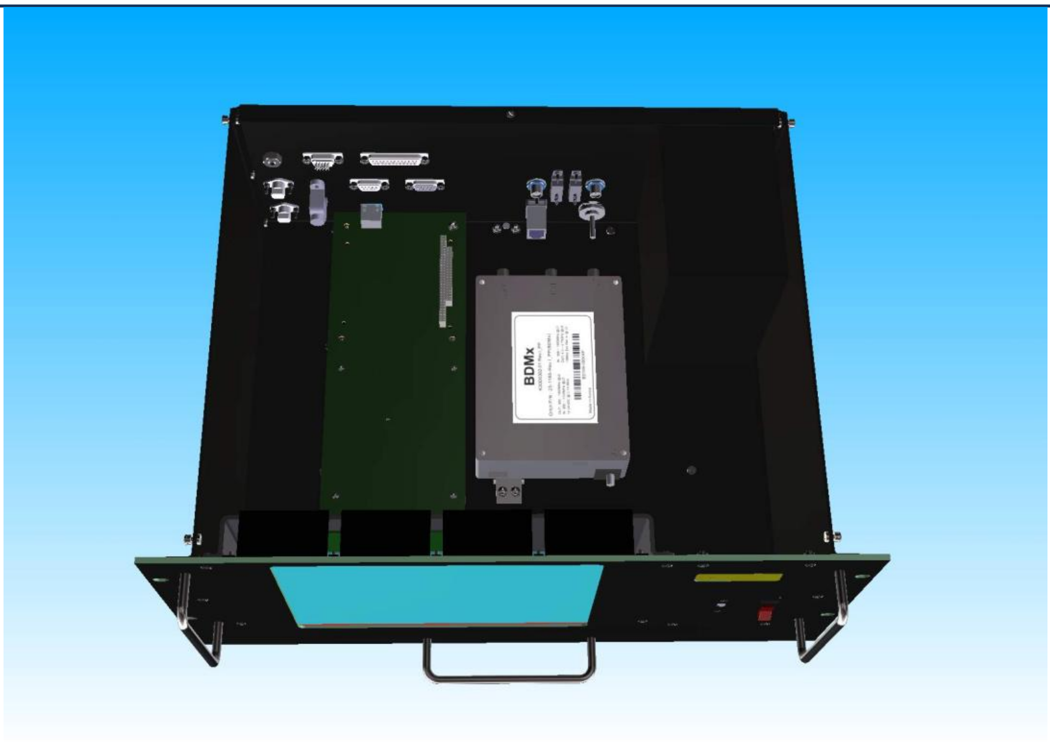


Figure 10-3: CCU Internal View (BDMx)

Installing the BDE (For CCU 5U Height)

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

Figure 10-4: Typical BDE rack installation

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

The front panel includes a 10.4" TFT screen, keyboard and USB connector (for software maintenance). You can also connect the `CCU` to an external computer or VGA screen.

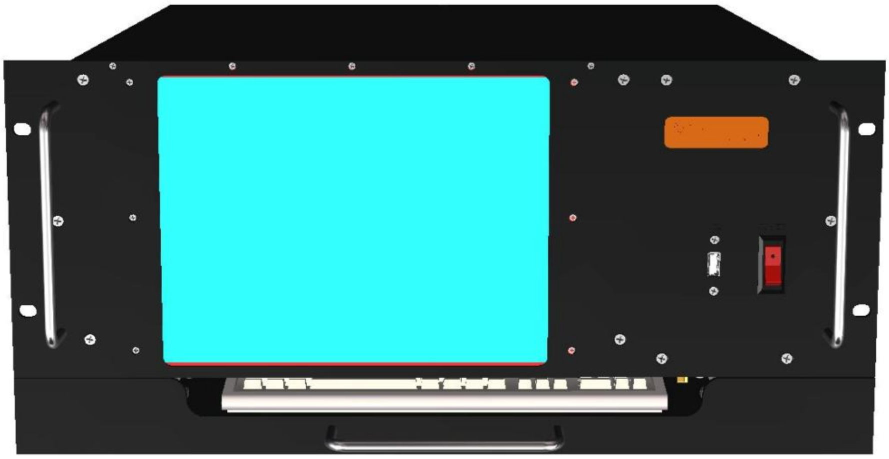


Figure 10-5: CCU Front Panel

Connecting the CCU Cables

Once the `CCU` is installed, you need to connect it to the various instruments with which it interacts: the `ANTENNA` terminals, the modems, the ship's compass and the LAN line.

The following table specifies the type and function of each connector.

Table 0-1. AL-7103 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 the CCU to the keyboard located in the CCU drawer.
MOUSE	MINI-DIN	Connects the CCU to the mouse located in the CCU drawer.

SYNCHRO & SBS COMPASS	DB25 male	Connects the CCU to the ship's compass (Synchro or SBS).
COM1-RS422	DB9 male	Connects the CCU to the ship'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
IF OUT RX	F-Type	Connects to modem RX input
IF OUT TX	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
ATTEN RX	Selector	Selects the Rx attenuator ("I" position - 0dB, "0" position - 8dB)
ATTEN TX	Selector	Selects Tx attenuator ("I" position - 0dB, "0" position - 15dB)

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

The following figure depicts the general-purpose cables that connect to the `CCU`:

- Power cable
- LAN jumper between the BDMx LAN and LAN connectors
- Keyboard
- Mouse
- Ground Cable

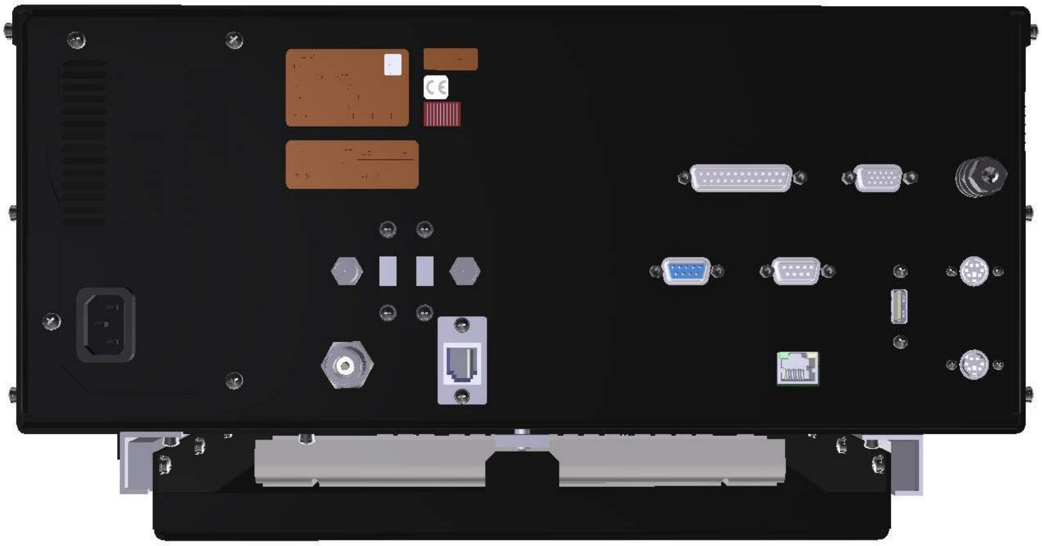


Figure 10-6: CCU rear panel – general-purpose connections

ADE-BDE Cable Connection

The ADE is connected to the BDE via a single LMR-200/400/600 coaxial cable.

➢ **To connect the cable to the CCU:**

1. Install an EZ-400-NMH connector on the BDE side of the LMR-200/400/600 cable (see **Appendix B**: Preparing the ADE-BDE Cable on page 184).

2. Connect the cable connector to the CCU ADMx/BDMx connector, as displayed in the following figure.

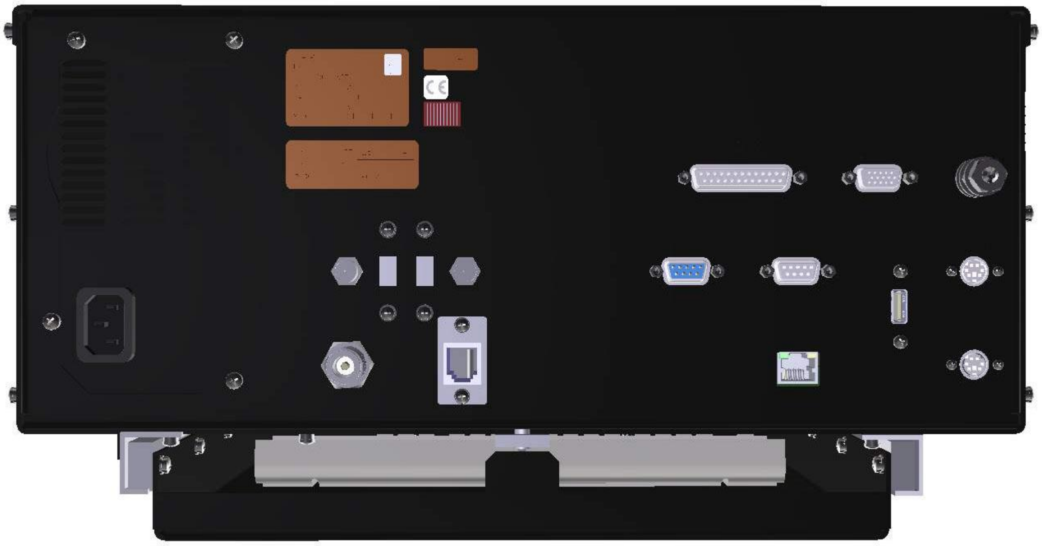


Figure 10-7: CCU rear panel – ADMx/BDMx connector

Serial Communication and Compass Connectors

The `CCU` rear panel includes three communication connectors:

- **Synchro and SBS Compass** – Connects the `CCU` to the ship's compass (Synchro or SBS)
- **COM1 - RS-422** – Connects the `CCU` to the ship's compass (RS-422 port)
- **COM2 - RS-232** – General-purpose serial port

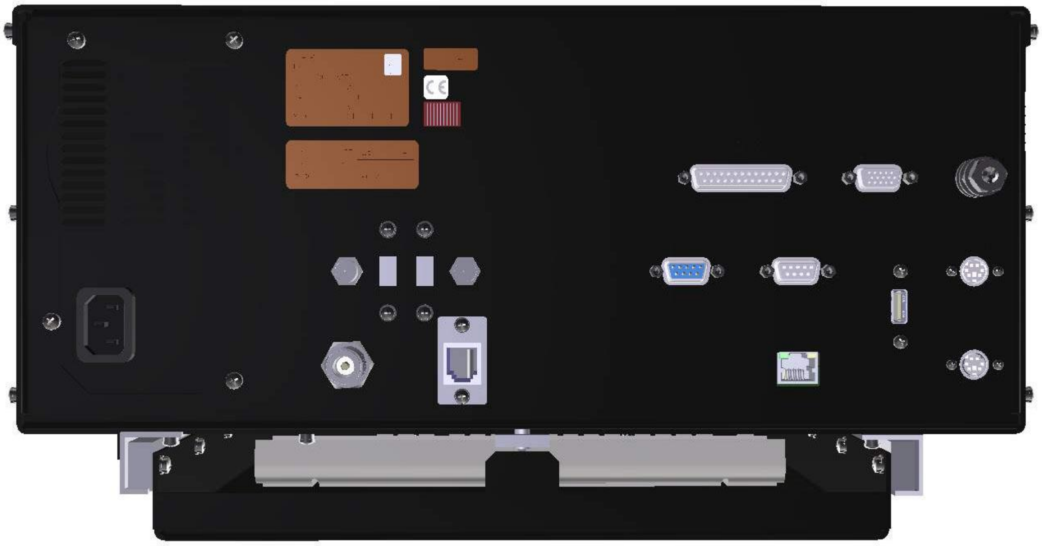


Figure 10-8: CCU rear panel – serial and compass connectors

The system supports the NMEA-0183 gyro compass interface as a default. If a Synchro interface is required, the system should be ordered as such.

The following table specifies the communication connector pin-out. The subsequent sections describe how to use each connector.

Table 10-1: 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	AGN IN
PIN 7	12V
PIN 8	IRD
PIN 9	GND

Synchro & SBS 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	SBS – COM
PIN 13	SBS – 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	SBS – C
PIN 25	SBS - 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 maritime instrumentation. The NMEA-0183 standard is 4800 baud and consists of several different ASCII sentences.

Electrical Interface

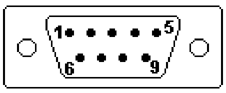
This standard allows a single ‘talker’ and several ‘listeners’ on one circuit. The recommended interconnecting wiring is a shielded twisted pair, with the shield grounded only at the talker. These standards do not specify the use of any particular connector.

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 (i.e. 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 shows 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**	

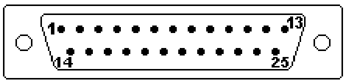
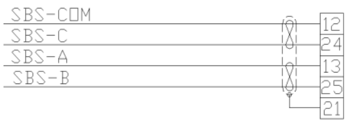
Mating Connector Pin Out	
Pin	**Signal**
2	RXD-
4	RXD+

5	GND

Figure 10-9: NMEA-0183 compass connection scheme

Step-by-Step Compass connection

The following figure shows how to connect a Step-by-Step compass to the CCU's Synchro & SBS connector.

Connecting a Step-by-Step Compass to SYNCHRO & SBS Connector:	
CCU Connector  **Synchro & SBS**	**Mating Connector Wiring Diagram** 

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

Figure 10-10: Step-by-Step compass connection scheme

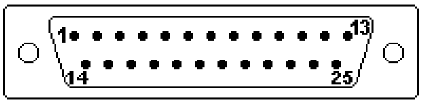
- Supports +20 VDC to +70 VDC
- Supports dual polarity:
  - **Positive –** A, B, C: +VDC or Open; Common: GND
  - **Negative –** A, B, C: GND or Open; Common: +VDC

Synchro compass connection

The following figure shows how to connect a Synchro compass to the CCU's Synchro & SBS connector.

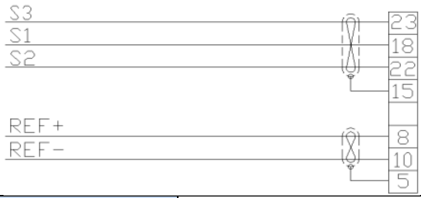
Connecting a Synchro Compass to SYNCHRO & SBS Connector:

CCU Connector



SYNCHRO & SBS

Mating Connector Wiring Diagram



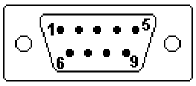
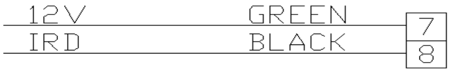
Mating Connector Pin Out	
Pin	**Signal**
8	REF+
10	REF-
5	GND
18	S1
22	S2
23	S3
15	GND

Figure 10-11: Synchro compass connection scheme

Note: Supports 115 VAC reference – 60 VAC reference is optional.

IRD Lock Connection

The following figure shows how to connect the IRD lock modem signal to the CCU's COM2 connector. Pins 7 & 8 should be connected via a 'dry-contact' relay.

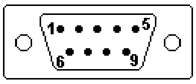
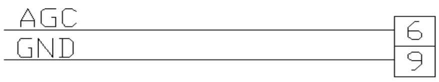
Connecting IRD LOCK to COM2 Connector:	
CCU Connector  **COM2-RS232**	**Mating Connector Wiring Diagram** 

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

Figure 10-12: IRD lock connection scheme

External AGC Connection

The following figure shows how to connect external AGC to the CCU's COM2 connector.

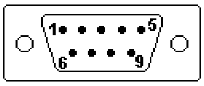
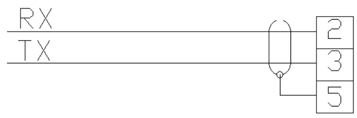
Connecting External AGC to COM2 Connector:	
CCU Connector  **COM2-RS232**	**Mating Connector Wiring Diagram** 

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

Figure 10-13: External AGC connection scheme

RS-232 Communication Channel

The RS-232 port is usually used for GPS output. The following figure illustrates how to connect the RS-232 channel to the CCU's COM2 connector.

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

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

Figure 10-14: RS-232 connection scheme

Appendix D: Pre-Installation Checklist on page 188) to verify that the installation site and customer-supplied equipment are available and ready.

4.2 Unpacking the System

The OrSat™ system is packed in a single wooden crate, with the following dimensions:

- **Length:** 1.6m (63")
- **Width:** 1.6m (63")
- **Height:** 1.825m (71.8")

Figure 4-5: Shipping Crate

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

4.2.1 Crate Contents

The system is delivered with the entire `ADE` assembled within the `RADOME`, in addition the `CCU` and an external beacon receiver (if applicable).

Only use the original packaging when transporting the OrSat™ system from one location to another. Any other packaging may cause damage to the system, and is not covered under the warranty.

Figure 4-6: ADE assembly within the shipping crate

4.2.2 Unpacking and Visual Inspection

The crate contents may have shifted during transport. As soon as you open the crate, you need to check for any evidence of external damage. Each crate is equipped with two shock indicators, which turn color if the crate has been exposed to undue shock or vibration in transport. An additional shock indicator is attached to the `RF ASSEMBLY` inside the crate.

Figure 4-7: Shock Indicator on the Packing Crate

Figure 4-8: Close-up of the Shock Indicator

➢ **To unpack the system for inspection:**

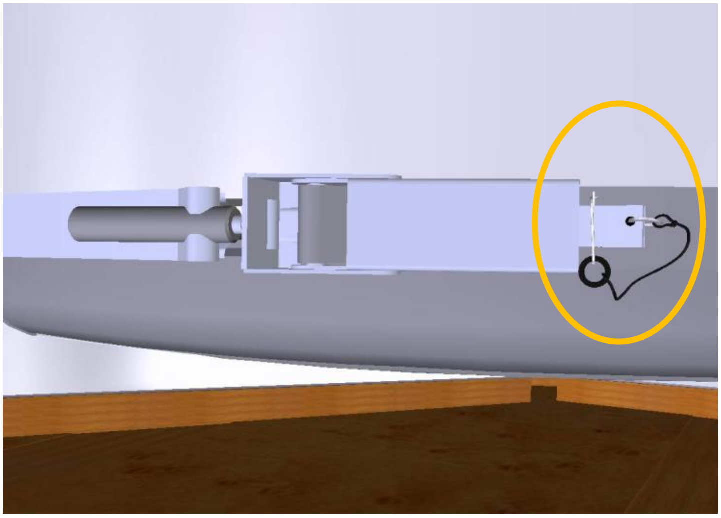
1. Place the crate on a stable, level surface and open it carefully to avoid damaging the contents.
2. Check the shock indicators on the crate. If they have turned red, do not open the crate, and contact Orbit immediately. Otherwise, carefully dismantle the crate and remove its top and side panels from around the system.
3. The `RADOME` is secured to its base by a metal ring equipped with a locking mechanism. Follow the procedure below to remove the `RADOME`.

➲ To remove the radome:

Step 1

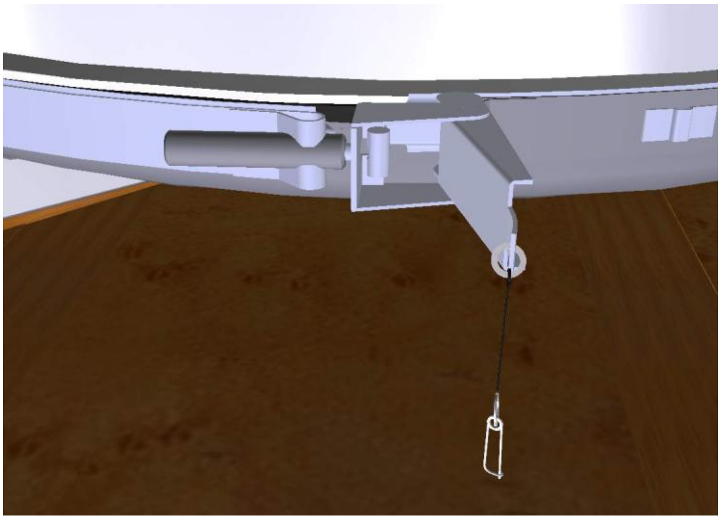
Remove the safety pin from the locking mechanism.

The pin is attached to the locking mechanism with a cable, preventing misplacement of the pin.



Step 2

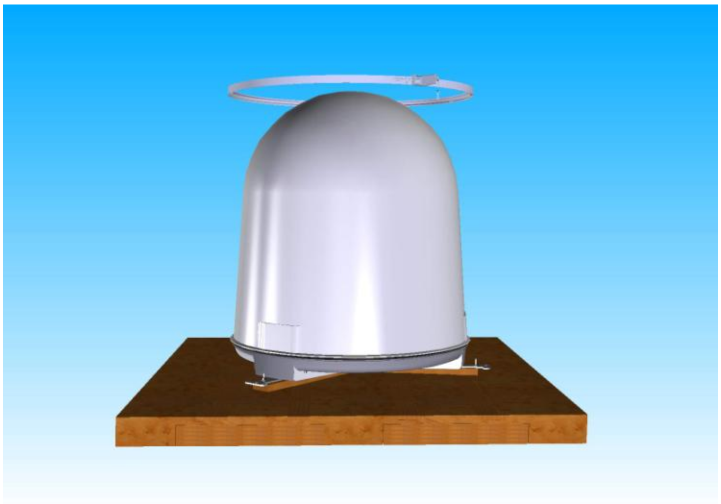
Open the lever of the locking mechanism.



Step 3

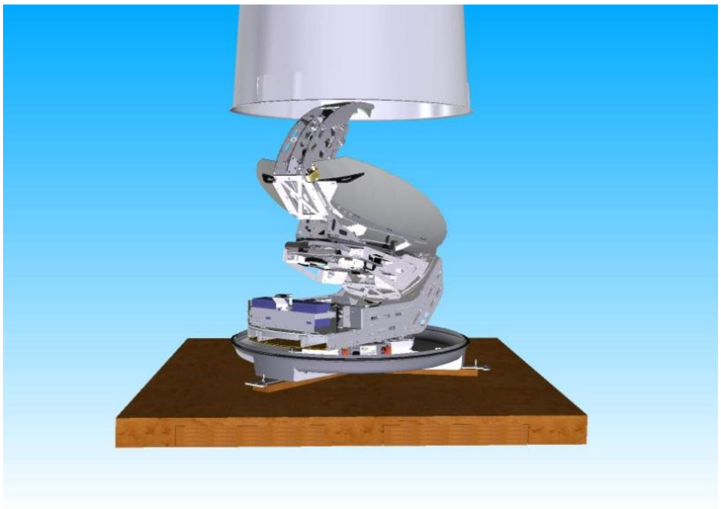
Remove the ring from the RADOME.

Be careful not to scrape the RADOME.



Step 4

Remove the RADOME.



➢ **To inspect the system:**

1. Remove the nylon wrapping covering the system.
2. Check the shock indicator on the RF ASSEMBLY. If it has turned red, contact Orbit immediately. Otherwise, continue to the next step.

Figure 4-9: Shock Indicator on the RF Assembly

3. Cut the tie-wraps marked ‘To Remove’, which secures the system’s moving parts.

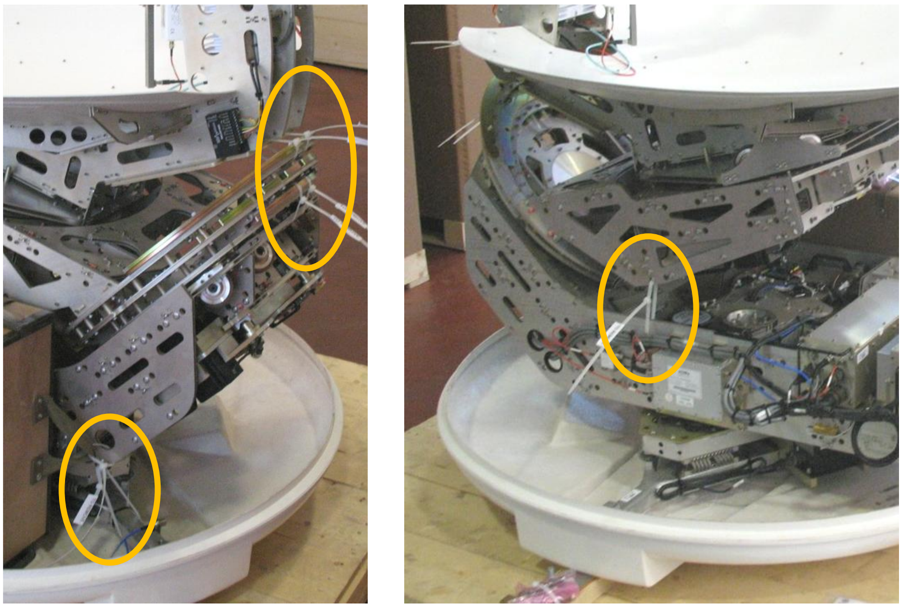


Figure 4-10: Removing the tie-wraps

4. Remove the CCU package.

Figure 4-11: ADE assembly and CCU package

5. Visually inspect the exterior of the equipment for evidence of any physical damage that might have occurred during shipment or storage.

6. Record the serial numbers of the system and each of its units (for example: `PSU`, `SBC`, `IMU`, `BUC`, `SDM`s, `CCU`), located on each unit's nameplates. This information will be useful whenever you contact the Orbit Service and Support Department.

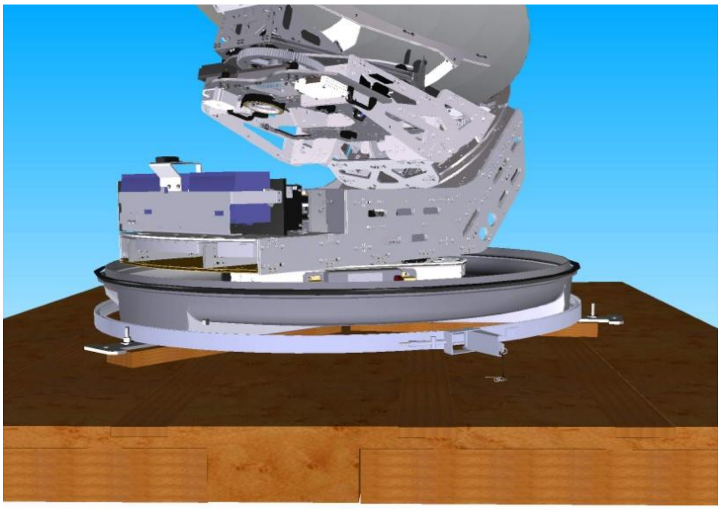
Report any damaged parts to the shippers and to support@orbit-cs.com, as units damaged during shipping are not covered under the warranty terms and conditions.

➲ To re-install the radome:

The following procedure should be performed by two technicians on a level, stable surface.

Step 1

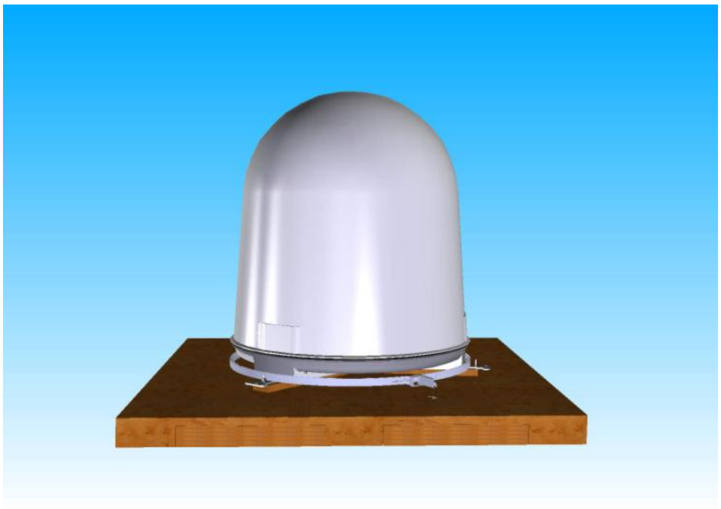
Place the securing ring around the RADOME BASE and verify that it is intact and unlocked.



Step 2

Place the RADOME on top of the RADOME BASE.

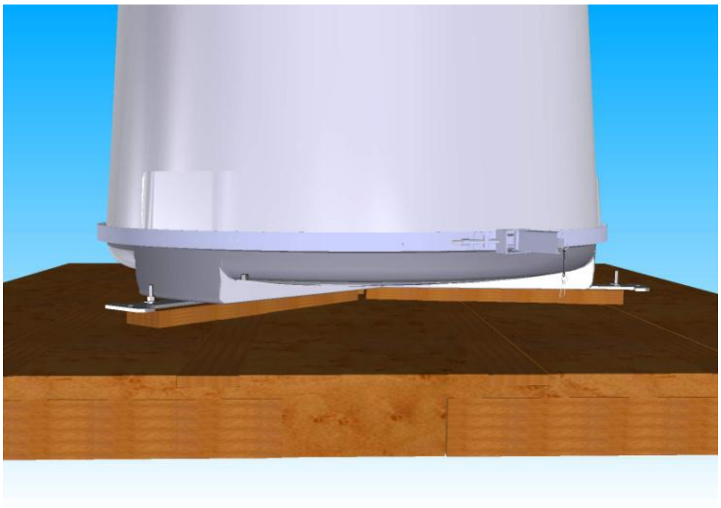
Walk around the RADOME and verify that it is properly aligned with the RADOME BASE and covers the base uniformly along its circumference.



Step 3

Place the ring over the RADOME and RADOME BASE, overlapping both.

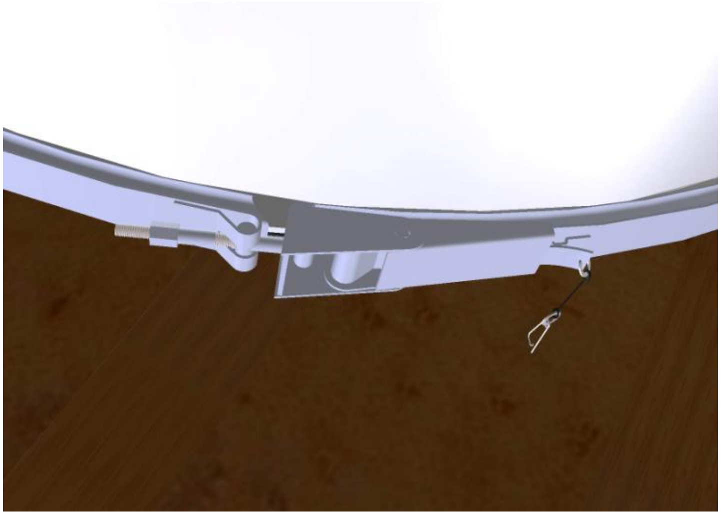
Carefully check that the ring is fully aligned all along its circumference.



Step 4

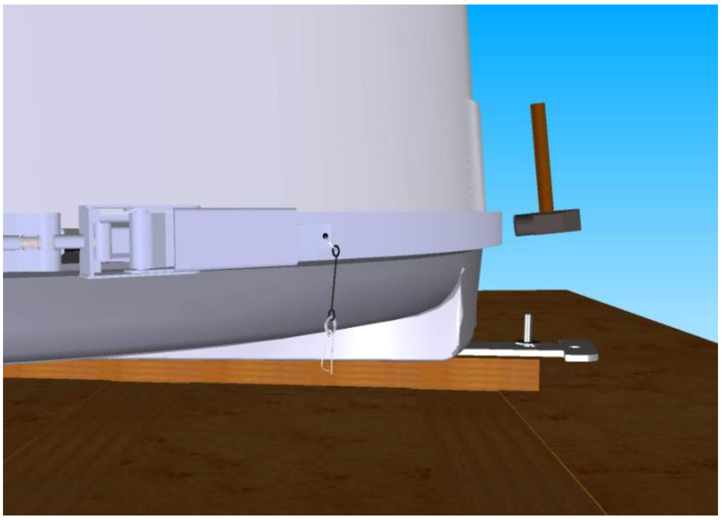
Lock the ring latch.

Verify again that the ring secures the RADOME to the RADOME BASE evenly all along its circumference.



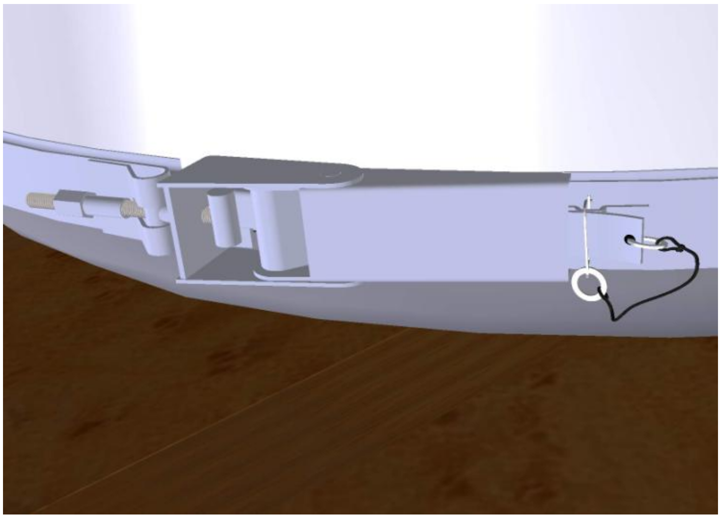
Step 5

Tap the ring with a mallet all along its circumference.



Step 6

Insert and lock the safety pin on the locking lever.



4.3 Installing the ADE

Once the unpacking is completed, the OrSat™ system `ADE` can be hoisted onto the `RADOME SUPPORT` and secured to it.

4.3.1 Lifting and Mounting Procedure

In order to lift the `ADE`, you will need to use a sling assembly such as that illustrated below, capable of lifting at least 1000 Kg.

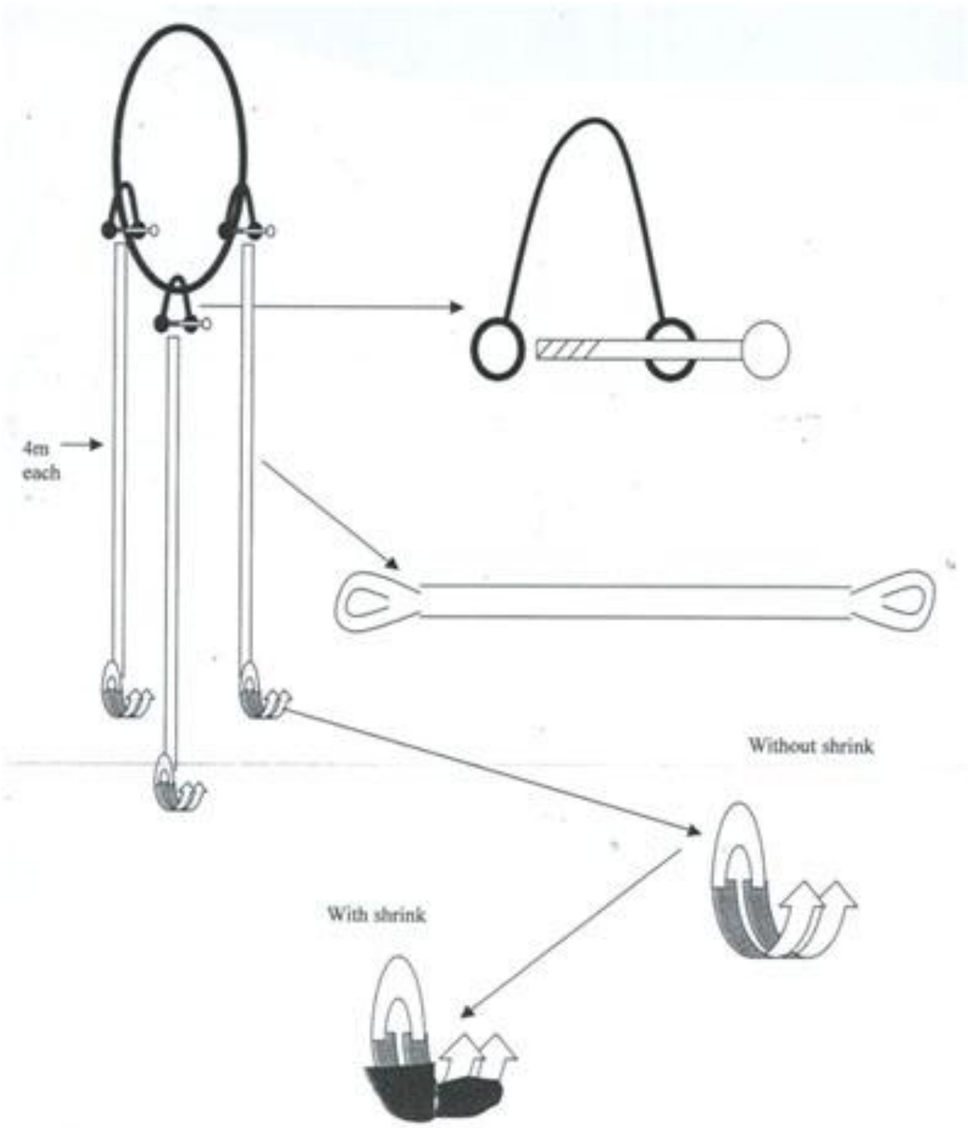


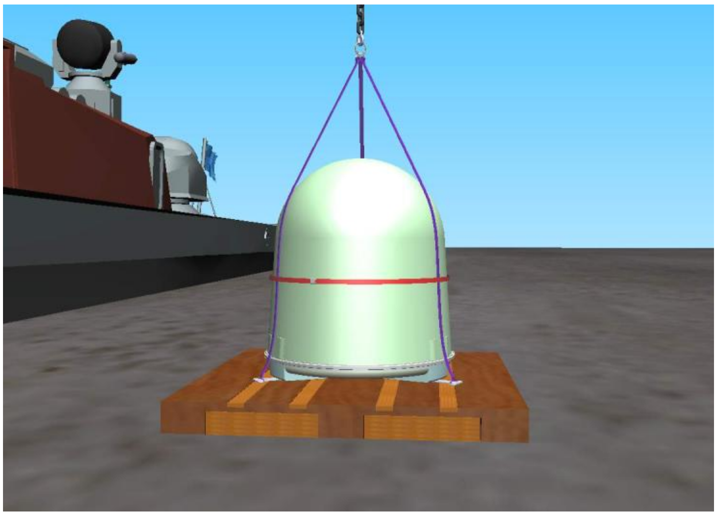
Figure 4-12: Recommended sling assembly

➲ Lifting and Mounting the System onto the Ship

Step 1

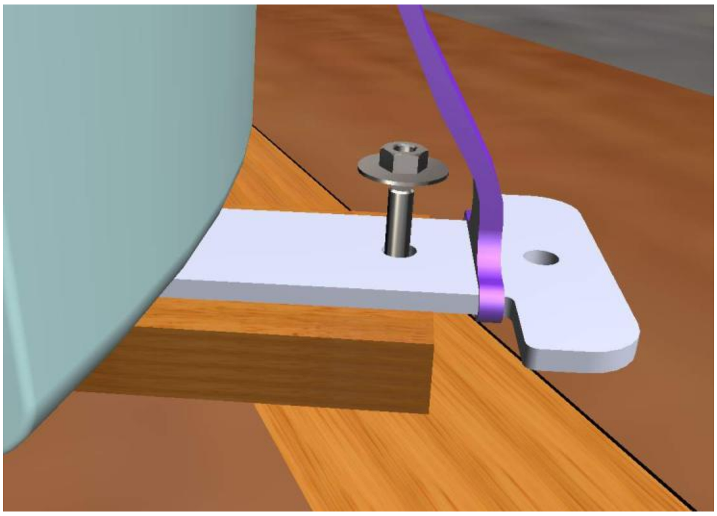
Attach the master link of the lifting harness to the crane's safety hook, and secure the three straps to the lifting arms on the RADOME BASE.

Wrap the red belt around the RADOME.



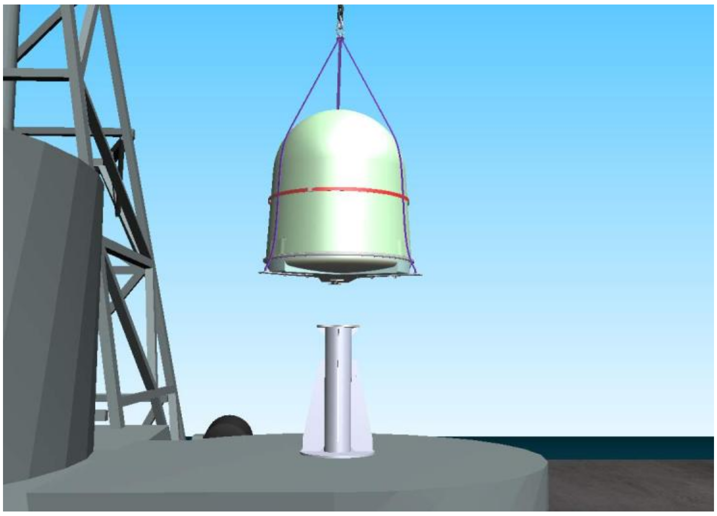
Step 2

Release the three holding screws securing the lifting arms to the wooden shipping palette.



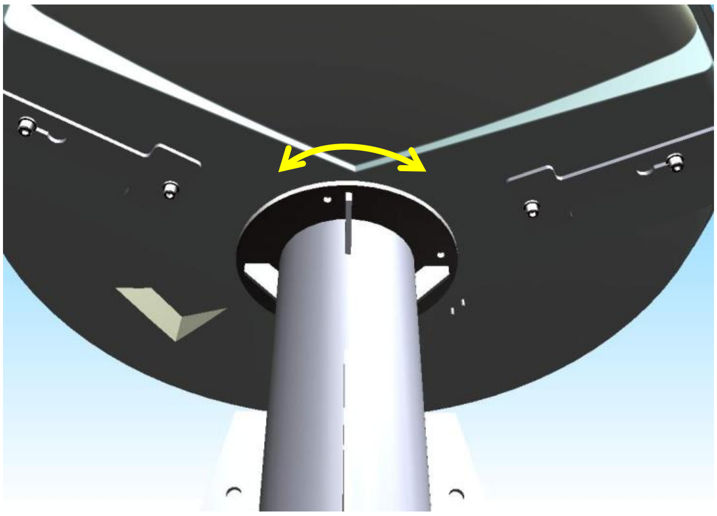
Step 3

Lift and mount the ADE onto the RADOME support, using the slings and lifting arms.



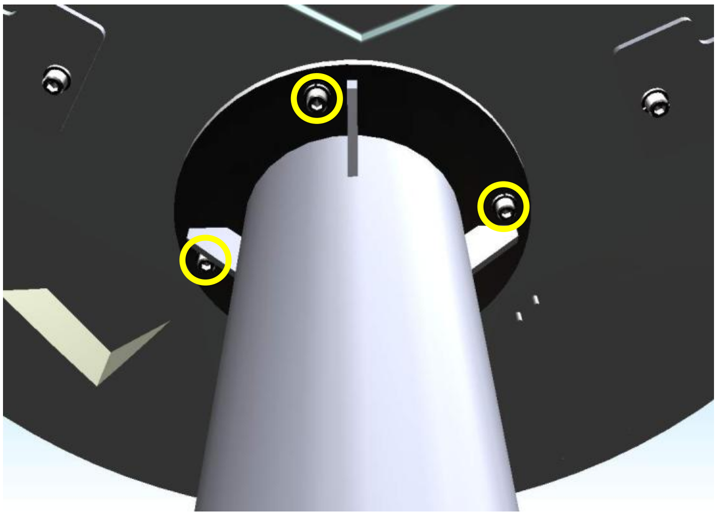
Step 4

Rotate the system until the four holes in the upper plate of the RADOME support are aligned with the four holes in the RADOME BASE.



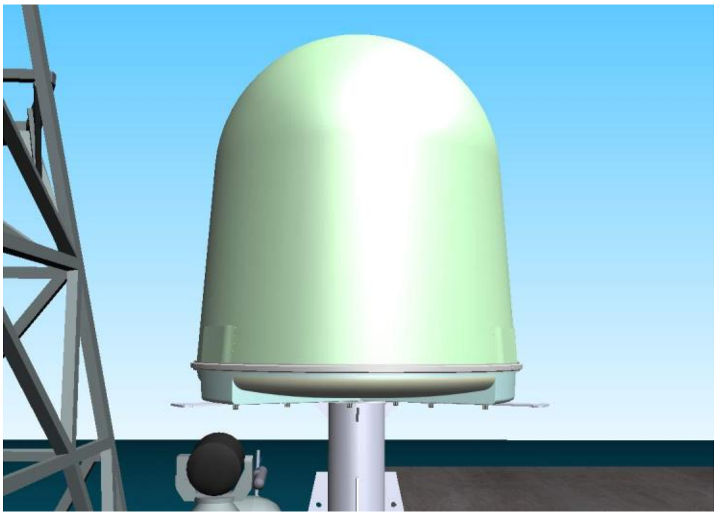
Step 5

Fasten the 4 bolts securing the RADOME BASE to the support.



Step 6

Remove the red belt and lifting harness from the RADOME.



4.3.2 ADE Cables Connections

The following cables must be connected to the ADE:

- Mains power supply cable
- ADE-BDE link coaxial cable (LMR-200/400/600).

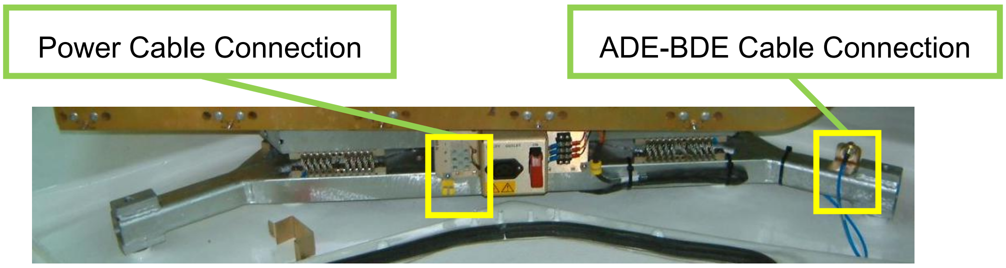


Figure 4-13: ADE cable connections

These cables reach the ADE via a pass-thru gland installed in an opening drilled into the RADOME BASE.

Figure 4-14: ADE pass-thru opening and gland

➢ **To prepare the pass-thru opening**

1. Drill a 40mm hole in the RADOME BASE.
2. Install an AG-40 Gland, or its equivalent.

The AG-40 gland is large enough to accommodate the coaxial cable with its N-type connector together with the AC mains cable. Therefore, the coaxial cable may be pre-terminated off the ship, prior to on-board installation.

---

3. Insert the cables and tighten the gland.
4. Verify that the gland secures both cables and does not allow any cable movement inside the gland. If the cables are loose inside the gland (depending on the type of cables and

gland used), wrap the length of the cables running through the gland (7-10cm) in a self-amalgamating tape (Scapa PIB or equivalent).

5. Apply RTV sealing compound to the gland thread and opening.

➢ **To connect the mains power supply to the ADE:**

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

Figure 4-15: Connecting the mains power cable

3. Reinstall the protective cover.

WARNING!

The utility outlet is connected directly to the vessel's AC voltage input terminals (125/250 VAC). Therefore, live voltage is always present at the utility outlet even when the power supply to the `ADE` is discontinued using the mains power ON/OFF switch.

The utility outlet bears the same voltage as the input power. Be careful not to connect a 110 VAC device where the input is 220 VAC.

➢ **To connect the ADE to the BDE**

1. Install an EZ-400-NMH connector on the `ADE` side of the LMR-200/400/600 cable (see **Appendix B**: Preparing the ADE-BDE Cable on page 184).

2. Attach the cable connector to the ADE's N-Type connector bracket, as shown in the following figures.

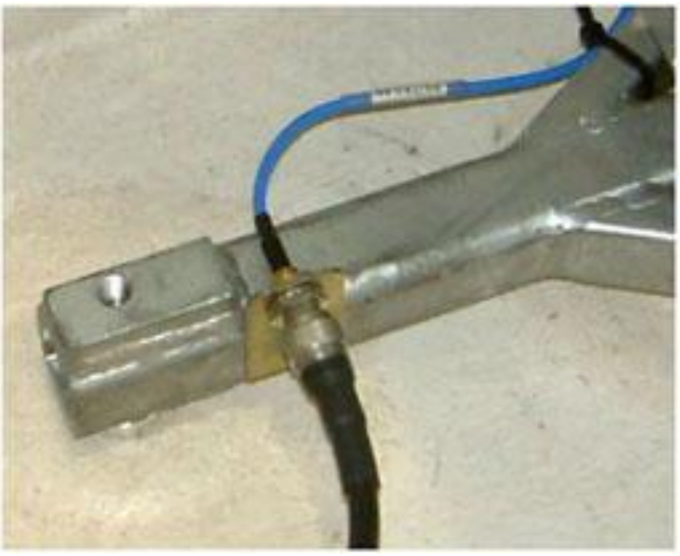


Figure 4-16: ADE-BDE cable connection

4.4 Installing the BDE

4.4.1 Central Control Unit 1U (for Central Control Unit of 5U Height – please refer to Appendix C: Central Control Unit – 5U Height)

The CCU is 1U high and is typically installed on a dedicated 19-inch rack in the ship's radio room.

Make sure that the CCU is installed at a distance of at least 5 meters from the ship's compass.

The front panel includes a USB and LAN jack from which the unit can be connected to a CFE computer for manual control and software maintenance.

Figure 4-17: CCU Front Panel

4.4.2 Connecting the CCU Cables

Once the CCU is installed, you need to connect it to the various instruments with which it interacts: the ANTENNA terminal, the modem, the ship's compass and the LAN line.

The following table specifies the type and function of each connector.

Table 4-2: CCU Rear Panel Connectors

Connector	Type	Function
Power Supply	Integrated Plug	Mains power connection (from the ship's power source)
ATTEN RX	Selector	Rx attenuator ('I' position - 0dB, '0' position - 8dB)
ATTEN TX	Selector	Tx attenuator ('I' position - 0dB, '0' position - 15dB)
SYNCHRO & SBS COMPASS	DB25 male	Connects to the ship's SYNCHRO or Step-by-Step compass

Connector	Type	Function
NMEA COMPASS	DB9 male	Connects to the ship's NMEA-0183 compass
AUX Com	DB15	Optional communication links
VGA	DB 15-Pin HD	Connects to an external VGA monitor
AUX COM	DB9 male	For future use
USB (2)	USB	Connects to an external computer
LAN (2)	RJ-45	Auxiliary LAN connections
Tx	F-Type	Connects to the modem's Tx output
Rx	F-Type	Connects to the modem's Rx input
AUX-IF 1	F-Type	Optional IF link (for example, 10 MHz source)
AUX-IF 2	F-Type	Optional IF link (for example, 10 MHz source)
BDMx to ADMx	N-Type	Connects to the ANTENNA's ADE-BDE coaxial cable

General-Purpose Connections

The following figure depicts the general-purpose cables to be connected to the CCU:

- Power cable
- External VGA
- USB
- LAN

Figure 4-18: CCU Rear Panel – General Purpose Connections

ADE-BDE Cable Connection

The BDMX unit within the CCU communicates with the ADMX unit in the ANTENNA terminal through a single coaxial cable, which connects to the N-Type jack on the CCU back panel.

➢ **To connect the cable to the CCU:**

1. Install an N-Type connector on the BDE side of the LMR cable (see **Appendix B: Preparing** the ADE-BDE Cable on page 184 for instructions).
2. Connect the cable connector to the its respective ADMx/BDMx connector on the CCU, as displayed in the following figure.

Figure 4-19: CCU Rear Panel – BDE-ADE Cables Connectors

CCU-Modem RF Cables Connection

The CCU is connected to the modem via the following connectors:

- Rx – Connects to the modem's Rx input.

* Tx – Connects to the modem's Tx output.
* AUX-IF 1
* AUX-IF 2

Figure 4-20: CCU Rear Panel – CCU-Modem Connectors

Compass Connectors

The CCU rear panel includes the following compass connectors:

* SYNCHRO & SBS COMPASS - Connects to the ship's SYNCHRO or Step-by-Step compass.
* NMEA COMPASS - Connects to the ship's NMEA-0813 Compass.

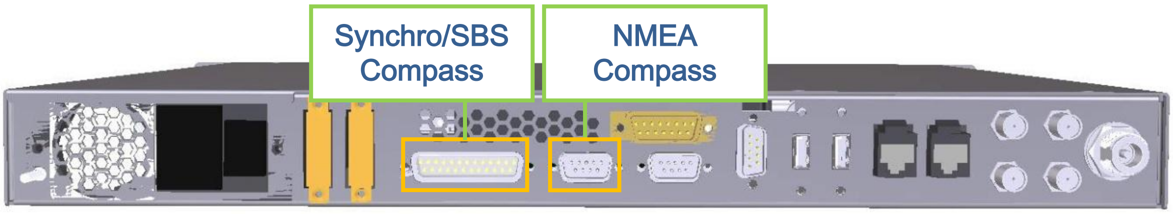


Figure 4-21: CCU Rear Panel – Compass Connectors

The following table specifies the communication connector pin-out. The subsequent sections describe how to use each connector.

Table 4-3: Communication Connectors Pin-out

NMEA	RS-422
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

Modem	RS-232
PIN 1	NC
PIN 2	NC
PIN 3	TX
PIN 4	NC
PIN 5	GND
PIN 6	NC
PIN 7	12V
PIN 8	IRD
PIN 9	NC

Synchro & SBS 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	SBS – COM
PIN 13	SBS – 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	SBS – B
PIN 25	SBS – C

4.4.3 Connecting the NMEA-0183 Compass

General

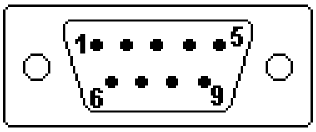
The National Marine Electronics Association (NMEA) 0183 standard defines an electrical interface and data protocol for communications between maritime instrumentation. The NMEA-0183 standard is 4800 baud and consists of several different ASCII sentences.

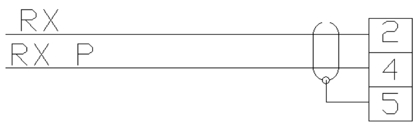
Electrical Interface

This standard allows a single ‘talker’ and several ‘listeners’ on one circuit. The recommended interconnecting wiring is a shielded twisted pair, with the shield grounded only at the talker end. These 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 A line voltages correspond to those on the older TTL single wire, while the B voltages are reversed (i.e. 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.

The following figure shows how to connect an RS-422 NMEA-0183 compass to the CCU.

<table>
<tr><th colspan="2">Connecting an RS-422 NMEA-0183 Compass to COM1 Connector:</th></tr>
<tr><td>CCU Connector


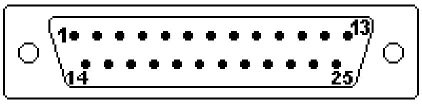
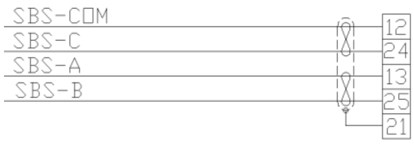
NMEA</td><td>Mating Connector Wiring Diagram

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

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

Figure 4-22: NMEA-0183 Compass Connection Scheme

Step-by-Step Compass Connection

The following figure shows how to connect a Step-by-Step compass to the CCU’s Synchro & SBS connector.

Connecting a Step-by-Step Compass to SYNCHRO & SBS Connector:	
CCU Connector  **Synchro & SBS**	**Mating Connector Wiring Diagram** 

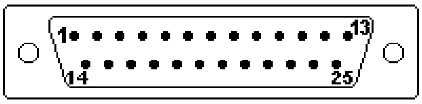
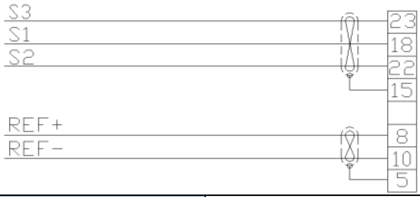
Mating Connector Pin Out	
Pin	**Signal**
12	COMMON
13	A
25	B
24	C

Figure 4-23: Step-by-Step compass connection scheme

- 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

Synchro Compass Connection

The following figure shows how to connect a Synchro compass to the `CCU`’s Synchro & SBS connector.

Connecting a Synchro Compass to SYNCHRO & SBS Connector:	
CCU Connector  **SYNCHRO & SBS**	**Mating Connector Wiring Diagram** 

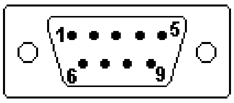
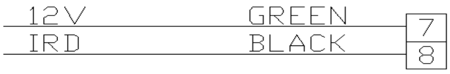
Mating Connector Pin Out	
Pin	**Signal**
8	REF+
10	REF-
5	GND
18	S1
22	S2
23	S3
15	GND

Figure 4-24: Synchro compass connection scheme

Note: Supports 115 VAC reference – 60 VAC reference is optional.

IRD Lock Connection

The following figure shows how to connect the IRD lock modem signal to the CCU's MODEM connector. Pins 7 & 8 should be connected via a 'dry-contact' relay.

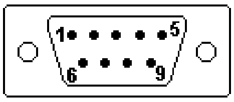
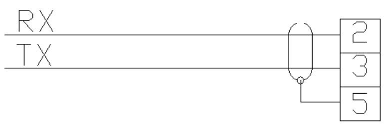
Connecting IRD LOCK to MODEM Connector:	
CCU Connectors	**Mating Connector Wiring Diagram**
 **MODEM**	

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

Figure 4-25: IRD lock connection scheme

Modem Connection

The following figure shows how to connect the modems to the CCU's COM3 connector.

Connecting GPS Output to COM3 Connector	
CCU Connectors	**Mating Connector Wiring Diagram**
 **MODEM (COM3 RS232 Tx)**	

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

Figure 4-26: RS-232 connection scheme

5 Commissioning the System

This section contains instructions for the commissioning procedures that must be performed after installation of the system. The commissioning process includes the following procedures:

- Configuring the Compass
- Integrating the Modem (performed by the customer)
- Configuring the Cease Tx Function (performed by the customer)
- Setting the Restart Mode
- Calibrating the Noise Floor

Warning!

The OrSat™ AL-7103 MKII Maritime Satellite Communication System is pre-configured and tested before it is shipped. Tampering with any of the system settings that are not explicitly mentioned in this manual can impair the functioning of the system.

5.1 System Start-up

1. Turn on the `ADE` and the `CCU`'s power switches. The **Banner/Self-Test** window appears for a 10 second countdown.

Figure 5-1: Startup Screen

If the countdown is not interrupted, the **Basic Operation** screen is displayed. This screen only allows you to monitor general system status and view system messages.

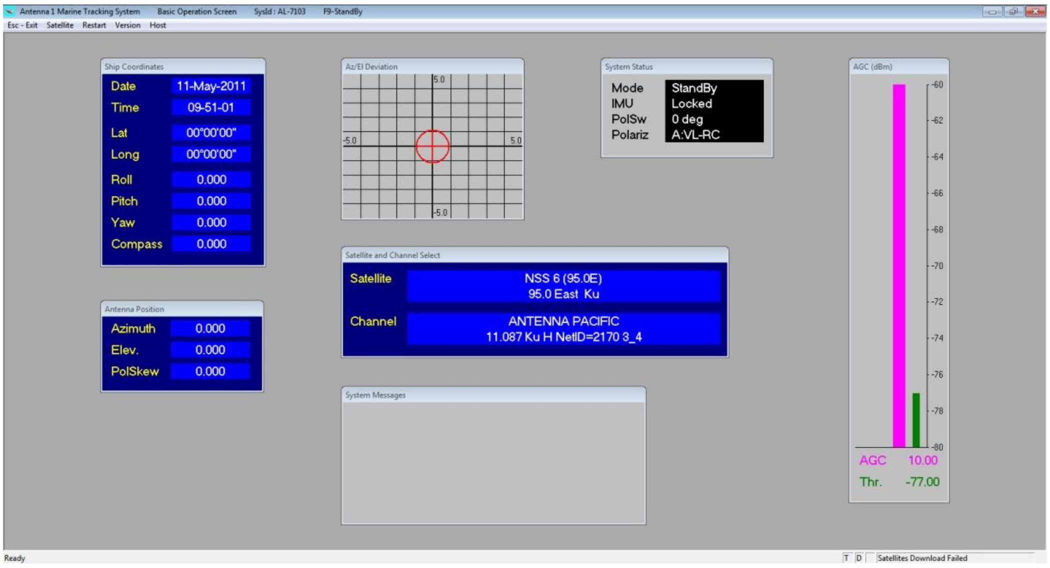


Figure 5-2: Basic Operation Screen

2. To update parameters or perform manual system operations, interrupt the countdown by pressing the <C> key and enter the password: AL-7200.

   If the **Basic Operation** screen has already appeared, you can press the <O> key to enter the password. This opens the **Operation Screen**.

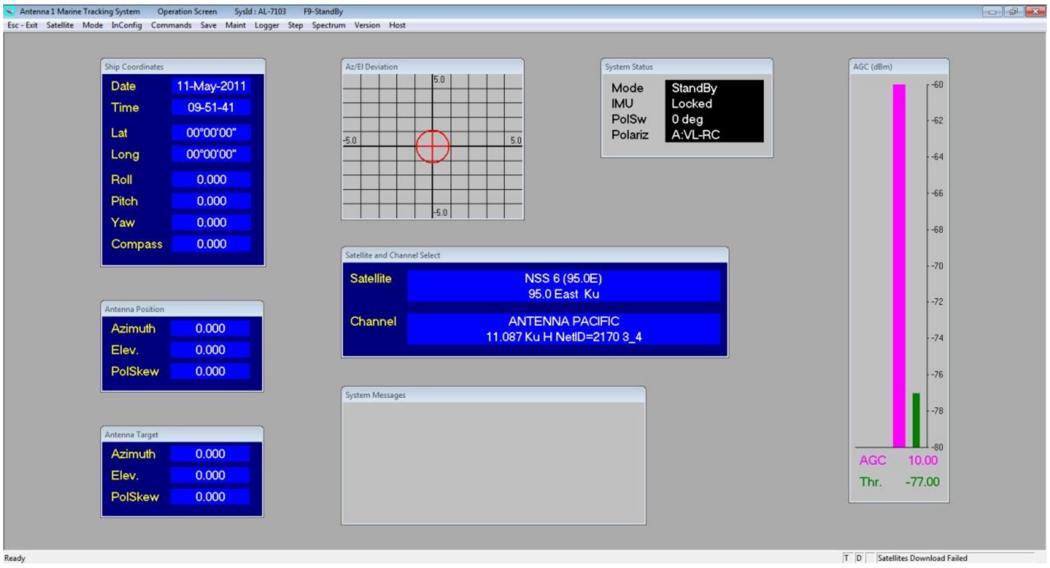


Figure 5-3: Operation Screen

To return to the **Basic Operation Screen**, press the <U> key, followed by the <Enter> key.

5.2 Configuring the Compass

Before you can begin running the AL-7103 OrSat™ system, you need to configure the interface with the ship's compass and align the `POSITIONER` with the ship's gyrocompass.

5.2.1 Setting the Compass Interface

1. Open the **InConfig** menu and select **Compass**. The **Compass** dialog box appears.

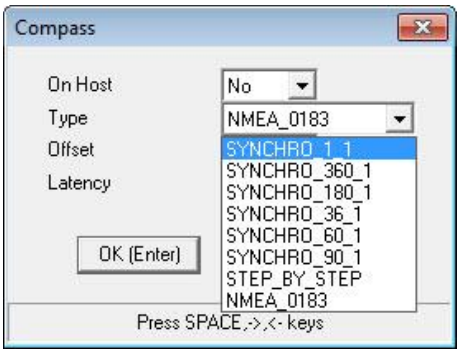


Figure 5-4: Compass dialog box

2. Select the appropriate compass type. The system supports the following interface types:
   - NMEA-0183
   - Synchro
   - Step-by-Step
3. Click **OK (Enter)**.

The system supports the NMEA-0183 gyrocompass interface by default. This should be taken into account when ordering the system for a vessel that uses a Synchro or Step-by-Step compass.

5.2.2 Configuring NMEA-0183 Compass Defaults

1. Open the **InConfig** menu and select **Compass NMEA**. The **NMEA Setup for Compass** dialog box appears.

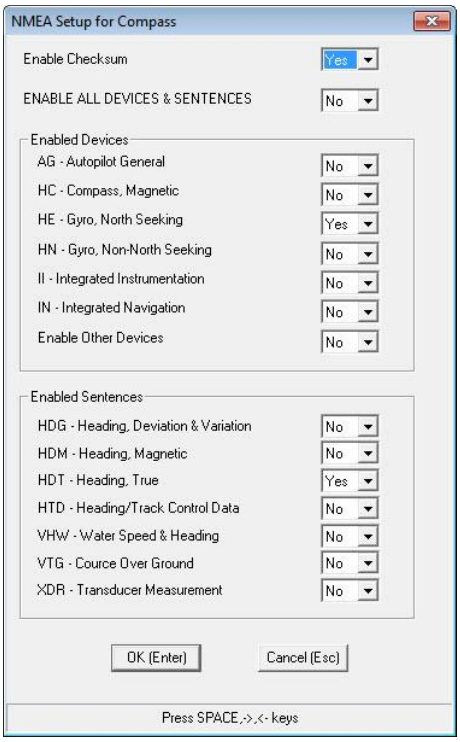


Figure 5-5: NMEA Setup for Compass dialog box

2. Set the **Enable Checksum** field to ‘Yes’.

3. Set the **ENABLE ALL DEVICES & SENTENCES** option to ‘No.’

4. Set **only** the following options to ‘Yes’:

   - Under **Enabled Devices**: **HE – Gyro, North Seeking**
   - Under **Enabled Sentences**: **HDT – Heading, True**

5. Click **OK (Enter)**.

Clicking **OK** only saves your settings to `SBC` non-volatile memory when the Save function is properly configured (see **Saving Parameters in SBC Non-Volatile Memory** on page 159).

5.2.3 Configuring a Synchro Compass

A Synchro compass is fed by 115VAC 50,-400Hz reference; 90VAC S1, S2, S3 phases.

Select one of the following options:

- **Synchro 1 to 1** – 1° of ship rotation corresponds to a 1° displacement of the compass readout.
- **Synchro 360 to 1** – 1° of ship rotation corresponds to a 360° displacement of the compass readout.
- **Synchro 180 to 1** – 1° of ship rotation corresponds to a 180° displacement of the compass readout.
- **Synchro 90 to 1** – 1° of ship rotation corresponds to a 90° displacement of the compass readout.
- **Synchro 60 to 1** – 1° ship rotation corresponds to a 60° displacement of the compass readout.
- **Synchro 36 to 1** – 1° of ship rotation corresponds to a 36° displacement of the compass readout.

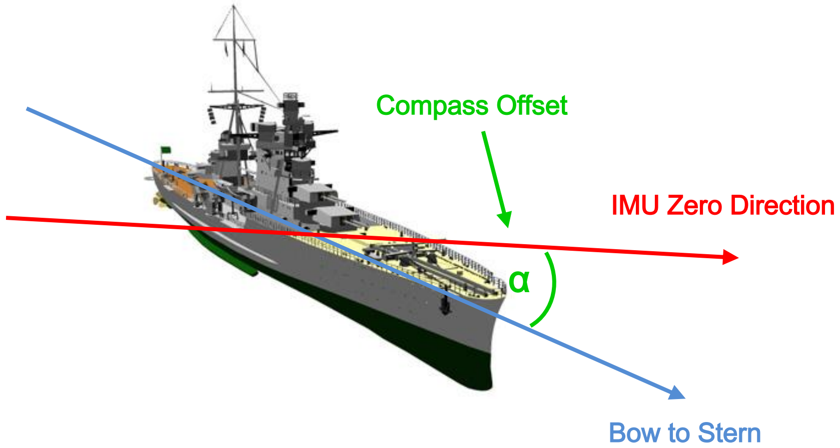
5.2.4 Configuring a Step-by-Step Compass

A Step-by-Step compass uses the following pin-out: Three lines (A, B, C) and common ground. The AL-7103 OrSat™ system supports both types of Step-by-Step compass:

- **Common GND** – Maximum voltage level allowed for an active line is 70VDC.
- **Common Hot** – Maximum voltage level allowed is 70VDC.

5.2.5 Setting the Compass Offset

After the system is installed onto a vessel, it must first be aligned with the bow of the ship. This is accomplished by setting the *compass offset* so that the system is aligned with the vessel's gyrocompass.



As portrayed in the above figure, the compass offset is the angle between the ship's heading – represented by the bow-to-stern line – and the `IMU` zero direction.

➢ **To establish the exact compass offset angle:**

1. Make a 'naked-eye' rough estimate for the offset angle. In the above figure, an appropriate estimate would be -30° (the negative value is due to the counter-clockwise rotation from the ship's bow).

2. From the **Operation Screen**, open the **InConfig** menu and select **Compass**. The **Compass** dialog box appears.

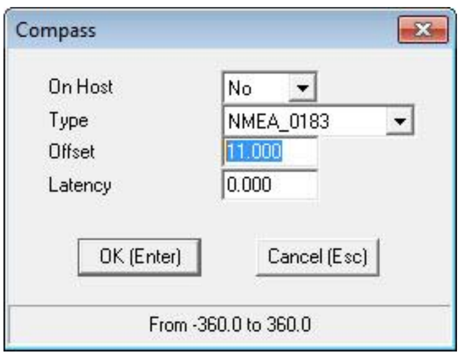


Figure 5-6: Compass dialog box

3. Enter the 'naked-eye' estimate in the **Offset** field and click **OK (Enter)**.

4. Point the `ANTENNA` to the desired satellite (see **Selecting a Satellite** on page 132). Write down the `ANTENNA`'s azimuth as it appears in the **Antenna Target** window of the **Operation Screen**. This will serve as your *nominal azimuth*.

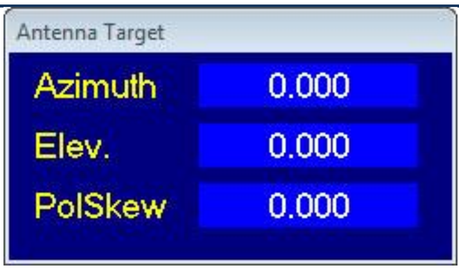


Figure 5-7: Antenna Target window

5. Using Manual Mode (see **Manual Mode** on page 138), increment or decrement the ANTENNA's azimuth orientation until it points to the satellite. The amount of movement required depends on the accuracy of your initial estimate (a typical estimate will fall within +/-10°).

Use the **Spectrum Analyzer Screen** to determine when you are locked onto the satellite (see **Using the Spectrum Analyzer Screen** on page 149).

6. Once the satellite is acquired, set the ANTENNA to Step-Track Mode (see **Step-Track Mode** on page 137).

7. Determine the *azimuth deviation*, which measures the distance between the nominal azimuth and the ANTENNA's actual azimuth. You can use one of the following methods:

   - Observing the graphic **Az/El Deviation** window on the **Operation Screen**, which is calibrated up to +/- 5°.

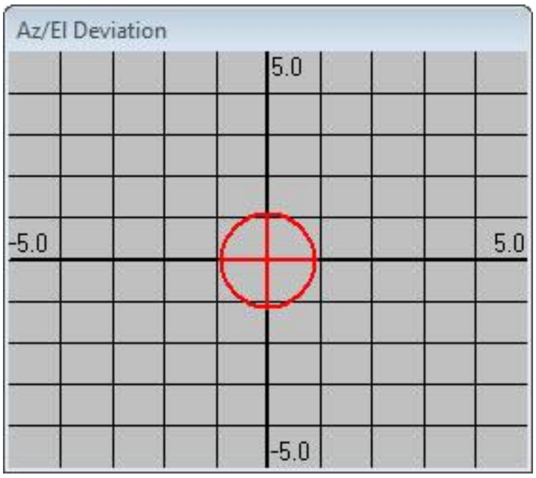


Figure 5-8: Ant. Deviation - Az/El window

- Running the **Graphic Data Logger**, which records azimuth deviation as a parameter of the `ANTENNA` Step Track subgroup (see **Using the Graphic Data Logger** on page 154).

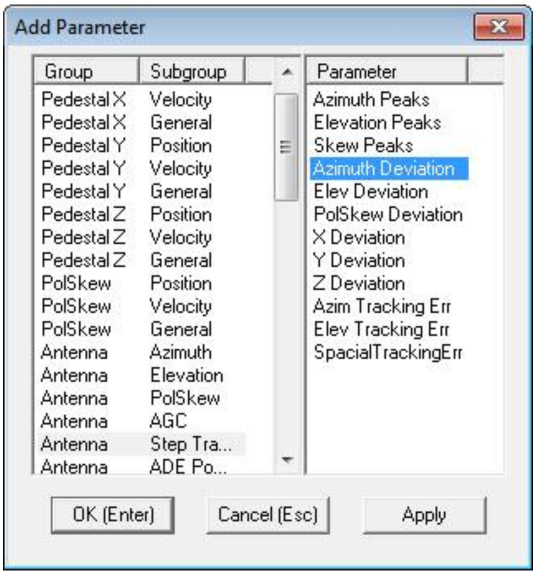


Figure 5-9: Add Parameter window

- Setting the `ANTENNA` to Peak Mode (see **Peak Mode** on page 138), and calculating the difference between the resulting azimuth and the nominal azimuth.

8. Calculate the degree to which the original ‘naked-eye’ estimation of the compass offset angle must be corrected in order to reach the accurate zero setting.

5.3 Integrating the Modem

Installation and integration of the modem is under the customer’s responsibility. Follow the instructions below and consult with Orbit’s Service Department for further assistance.

5.3.1 Installing the Modem

Connect the modem cable to COM Port 2 so that the modem IRD dry contact will connect pins 7 and 8 when indicating ‘Lock.’

When the modem is installed, verify the following:

- The Rx signal (into the modem) is within the modem’s dynamic range.

- The Tx signal (from the modem) is set so that the `BUC` is not saturated, yet strong enough for quality transmission (1dB compression point).

5.3.2 Configuring IRD Lock/Unlock Feedback

1. From the **Operation Screen**, open the **InConfig** menu and select **Satellite Validation**. The **Satellite Validation** dialog box appears.

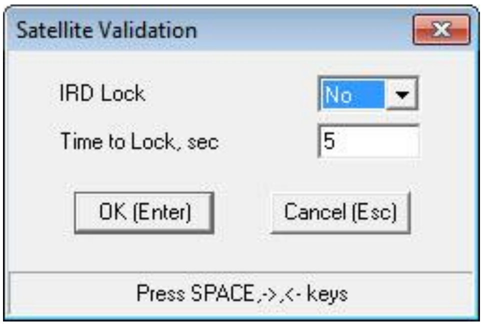


Figure 5-10: Satellite Validation Dialog Box

2. Set the **IRD Lock** option to ‘Yes’ and click **OK (Enter)**.

3. In the **Time to Lock, sec** field, enter the interval in seconds after the activation of Step-Track Mode at which the IRD Lock is checked. The default value is 5 seconds.

- The Time to Lock value should be set to 40 seconds when using iDirect modems, whether connected through the OpenAMIP interface or any other interface.
- When the OpenAMIP interface is used to read the IRD Lock, make sure that that IRD source is set to ‘None’ in the **Host Hardware Interface** dialog box, accessed from the `MTSLINK` **Host** menu.

---

4. Open the **Config** menu and select **External Hardware IP**. The **External Hardware Address** dialog box appears.

Figure 5-11: External Hardware IP dialog box

5. The **IP Addresses of Hosts** field displays the IP address of the `CCU`. Add the IP address of the modem, separated by a semi-colon.

   In the following example, 192.9.200.40 is the IP address of the `CCU`, and 172.22.34.17 is the IP address through which the `SBC` communicates with the modem.

Figure 5-12: External Hardware IP dialog box

6. Click **OK (Enter)**.

5.3.3 Setting up GPS Output on CCU COM2

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

➢ **To set up the GPS Output:**

1. From the **Operation Screen**, open the **Host** menu and select **Hardware Interface**. The **Host Hardware Interface** dialog box appears.

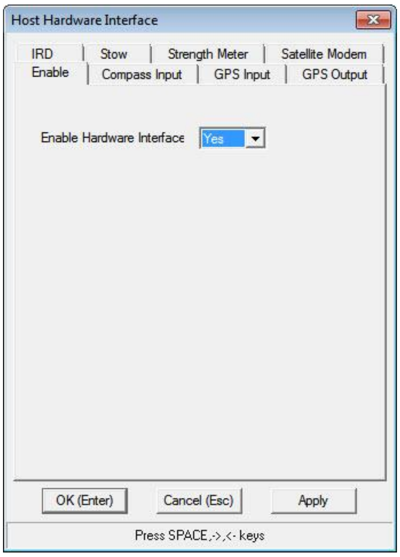


Figure 5-13: Host Hardware Interface dialog box

2. Open the **Enable** tab and verify that the **Enable Hardware Interface** field is set to 'Yes.'

3. Open the **GPS Output** tab and set the following parameters:

 - **Enable**: 'Yes'
 - **COM Port Number**: '2'
 - **Baud Rate**: Should match the baud rate of the ship's modem
 - **Format**: '8_NON_1'
 - **Device**: 'GP'
 - **Sentence**: 'GGA'
 - **Send Interval, sec**: '1.0000'

4. Click **OK (Enter)**.

5.3.4 Calculating Rx/Tx Path Gain Budgets

This section provides examples of Rx/Tx gain calculations for a 50m `ADE-BDE` cable. For any other cable type or length, the calculation parameters should be adjusted accordingly.

For short range `ADE-BDE` connections (up to 30m), use a 30m LMR-200 cable (in order to achieve sufficient cable loss) or use the following `CCU` rear-panel attenuator selectors:

- **ATTEN RX Selector –** Selects Rx Attenuator ('I' position: 0dB, '0' position: 8dB)
- **ATTEN TX Selector** – Selects Tx Attenuator ('I' position: 0dB, '0' position: 15dB)

Figure 5-14: CCU Rear Panel Attenuator Selectors

The following figures display the system's frequency range scheme and attenuation calculation charts for the LMR-200, 400, and 600 cables:

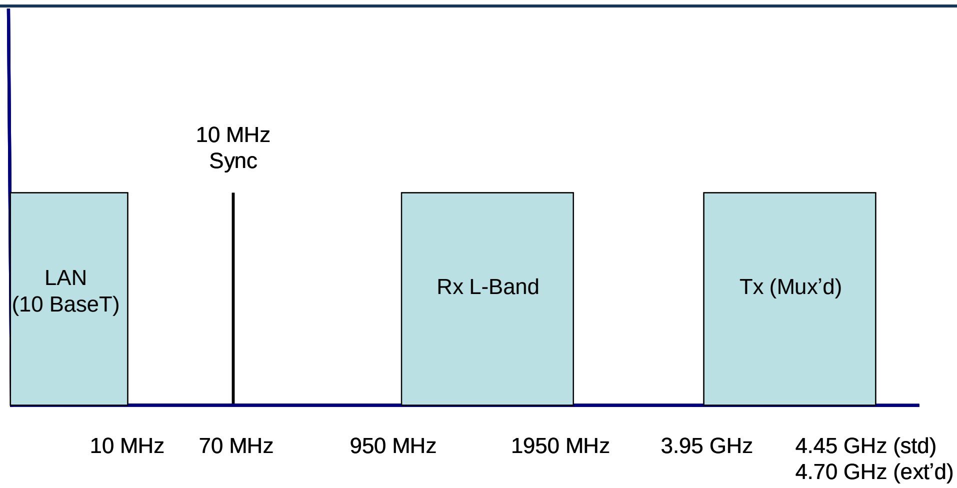
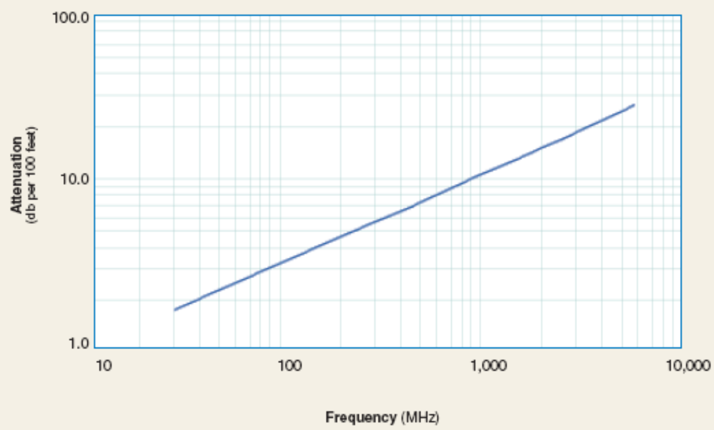


Figure 5-15: System Frequency Ranges

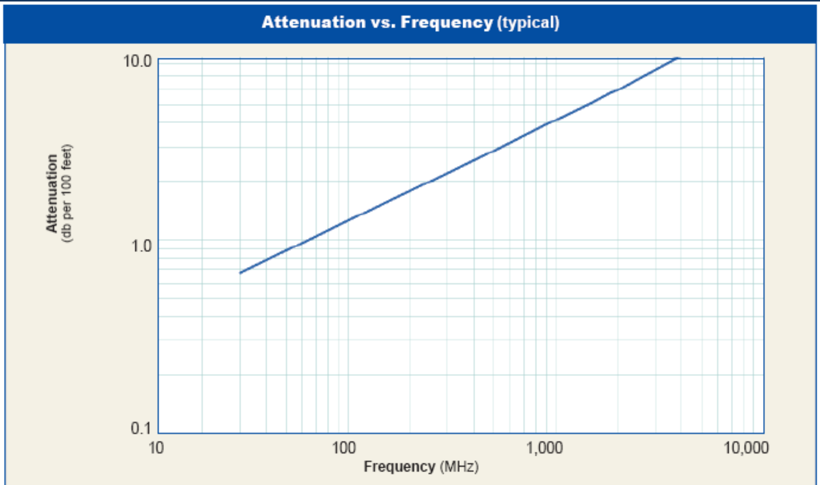
Attenuation vs. Frequency (typical)



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	1.8	2.3	4.0	4.8	7.0	9.9	12.9	14.2	15.0	16.9	26.4
Attenuation dB/100 m	5.8	7.5	13.1	15.9	22.8	32.6	42.4	46.6	49.3	55.4	86.5
Avg. Power kW	1.02	0.79	0.45	0.37	0.26	0.18	0.14	0.13	0.12	0.11	0.07

Calculate Attenuation =
$(0.320900) \cdot \sqrt{FMHz} + (0.000330) \cdot FMHz$ (interactive calculator available at http://www.timesmicrowave/telecom)
Attenuation:
VSWR=1.0; Ambient = +25°C (77°F)
Power:
VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

Figure 5-16: LMR-200 Cable Attenuation



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	0.7	0.9	1.5	1.9	2.7	3.9	5.1	5.7	6.0	6.8	10.8
Attenuation dB/100 m	2.2	2.9	5.0	6.1	8.9	12.8	16.8	18.6	19.6	22.2	35.5
Avg. Power kW	3.33	2.57	1.47	1.20	0.83	0.58	0.44	0.40	0.37	0.33	0.21

Calculate Attenuation =

$(0.122290) \cdot \sqrt{FMHz} + (0.000260) \cdot$ FMHz (interactive calculator available at http://www.timesmicrowave/telecom)

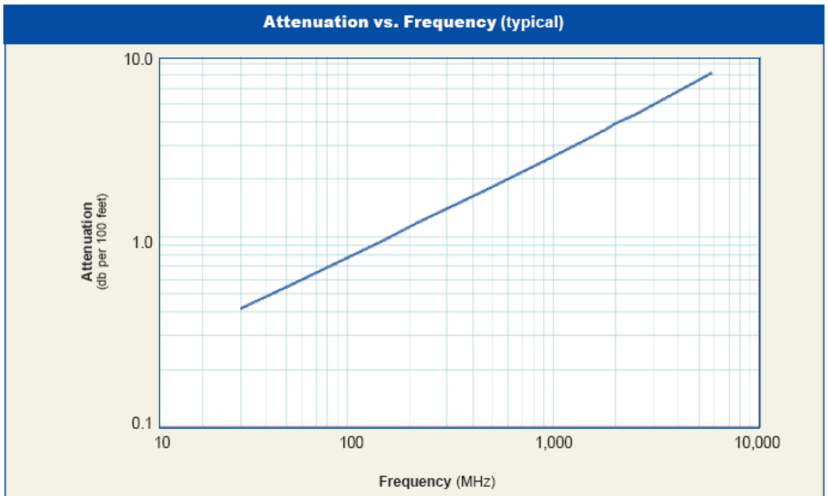
Attenuation:

VSWR=1.0 ; Ambient = +25°C (77°F)

Power:

VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

Figure 5-17: LMR-400 Cable Attenuation



Frequency (MHz)	30	50	150	220	450	900	1500	1800	2000	2500	5800
Attenuation dB/100 ft	0.4	0.5	1.0	1.2	1.7	2.5	3.3	3.7	3.9	4.4	7.3
Attenuation dB/100 m	1.4	1.8	3.2	3.9	5.6	8.2	10.9	12.1	12.8	14.5	23.8
Avg. Power kW	5.51	4.24	2.41	1.97	1.35	0.93	0.70	0.63	0.59	0.52	0.32

Calculate Attenuation =

$(0.075550) \cdot \sqrt{FMHz} + (0.000260) \cdot$ FMHz (interactive calculator available at http://www.timesmicrowave/telecom)

Attenuation:

VSWR=1.0; Ambient = +25°C (77°F)

Power:

VSWR=1.0; Ambient = +40°C; Inner Conductor = 100°C (212°F); Sea Level; dry air; atmospheric pressure; no solar loading

Figure 5-18: LMR-600 Cable Attenuation

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 and 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

The calculated Rx Input level to the modem (-47dBm) is typical of the dynamic range of most modems, but may vary according to modem type, modulation scheme and data rate.

Tx Chain Gain Budget (from modem to BUC input)

Coarse Adjustment

#	Parameter	Value
1	Typical total Tx chain gain (ADMX/BDMX)	21dB
2	Typical loss of LMR-400 cable	15dB@4.7GHz (50m)
3	Typical loss of cables, DC INSERTER and ROTARY JOINT within the PEDESTAL	6dB
4	Total loss (#2 + #3)	21dB
5	Total Tx system gain (# 1 – #4)	0 dB
6	Typical BUC input level for 1dB BUC compression	4W BUC: -16dBm 8W BUC: -24dBm
7	Typical coarse value of modem output, for 1dB BUC compression (#6 - #5)	4W BUC: -16dBm 8W BUC: -24dBm
8	Typical modem dynamic output range	0 to -30dBm

The calculated coarse value of the modem output for 1dB BUC compression is well within the typical modem dynamic output range (0 to -30dB).

Fine Adjustment (using the HUB station)

➢ **To set the modem power to drive the BUC to 1dB compression:**

1. Activate ‘Tx on’ in the modem.

Use the coarse typical calculated values as a starting power level (to avoid BUC saturation).

---

2. Raise the modem power 1dB at a time while monitoring the signal on the HUB Spectrum Analyzer (1dB of power corresponds to a 1dB increase in signal level).
3. 1dB compression is achieved when a 1dB increase of modem power causes less than a 0.5dB increase in the signal level. Do not increase the power beyond this point, because it will drive the BUC into compression.

When the system is supplied with a BUC that receives its DC supply via the L-Band coaxial connector, a DC INSERTER is installed. For all other BUCs, power is supplied via the M&C cable.

In cases where the system is upgraded on-site to include a BUC that does not receive its DC supply via the L-Band coaxial connector, the DC INSERTER, although physically present, is bypassed.

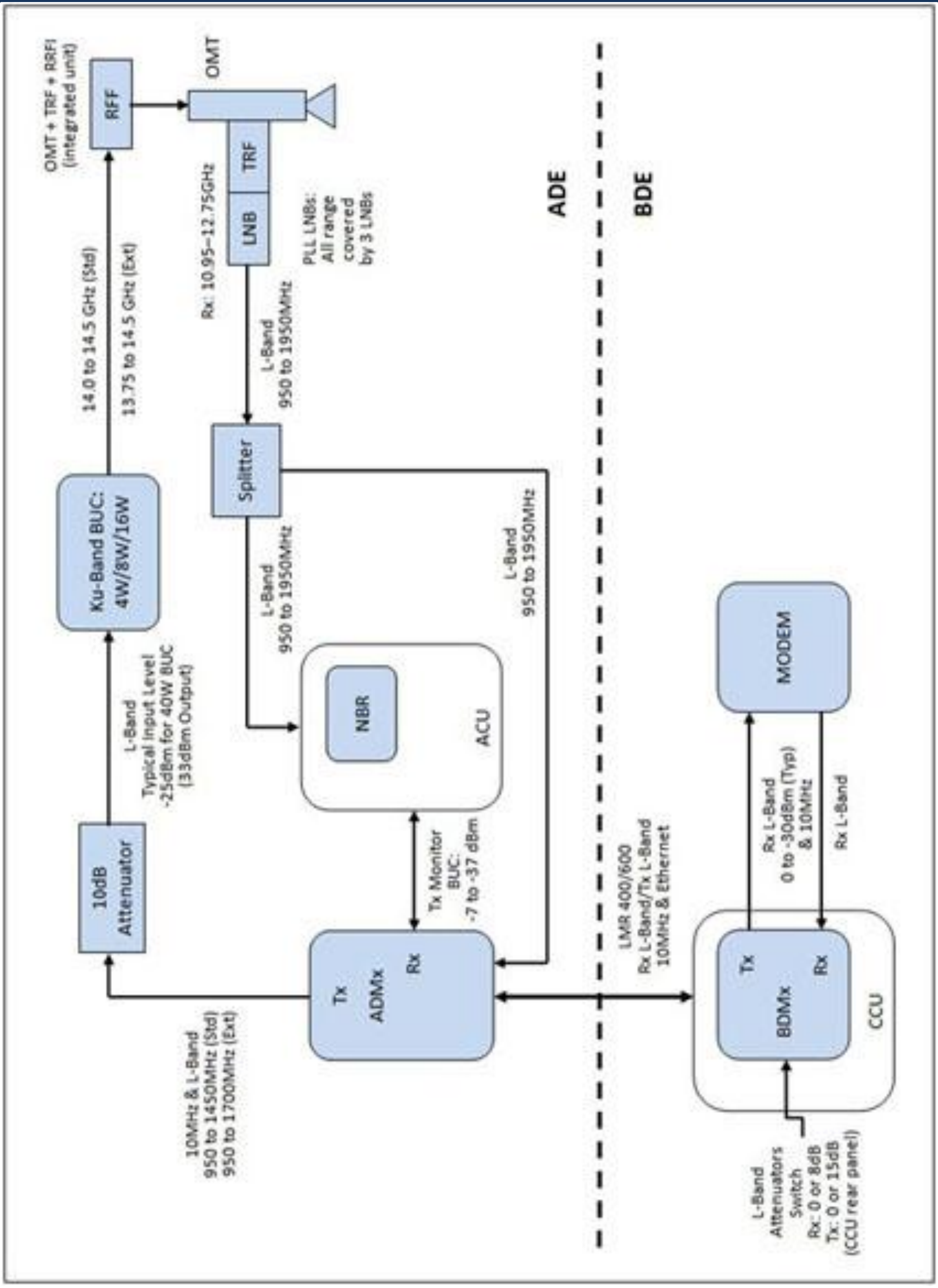


Figure 5-19: AL-7103 MKII RF System Layout – Cross Polarization (X-POL)

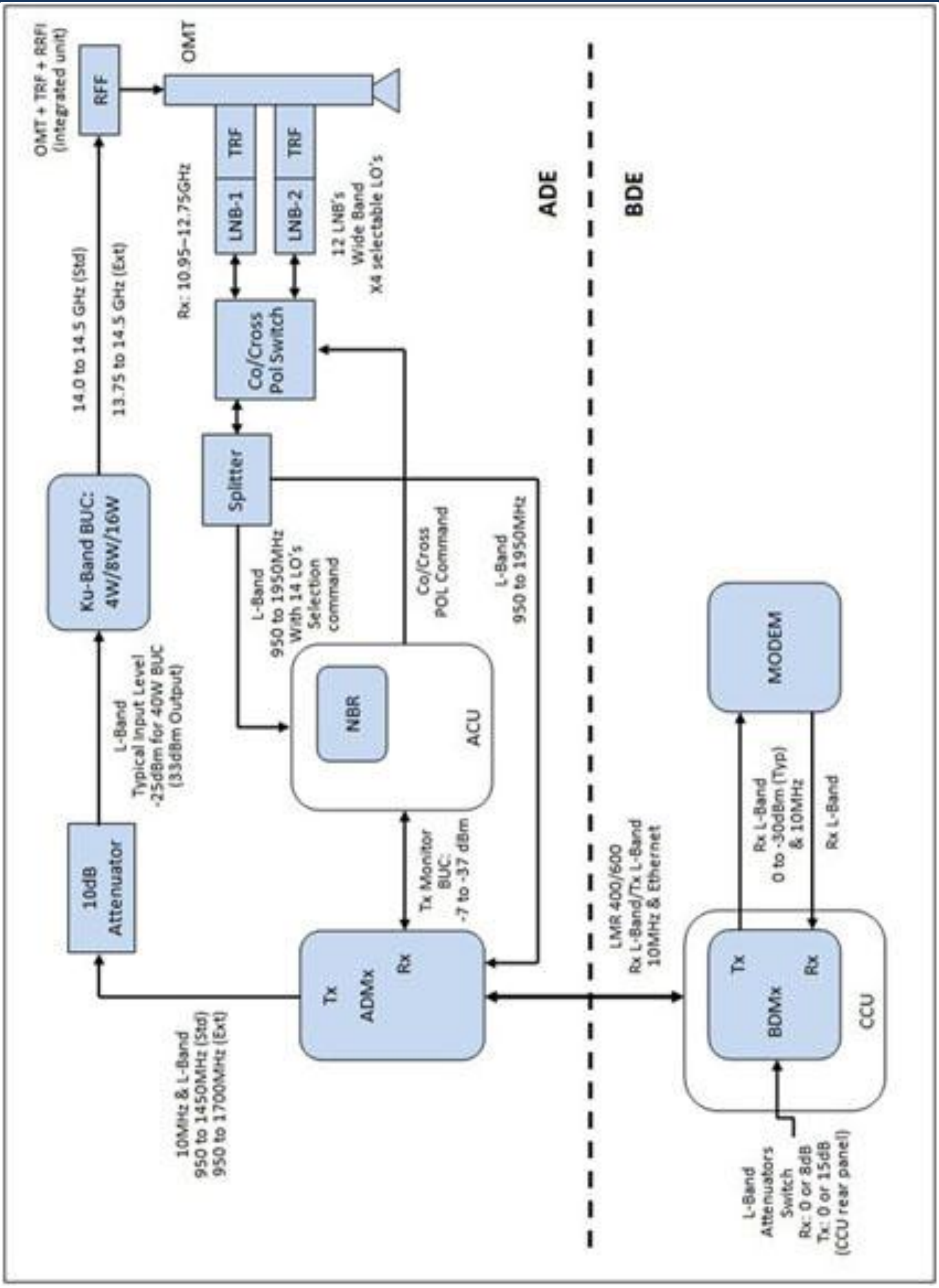


Figure 5-20: AL-7103 MKII RF System Layout – Global LNB & Co-Cross Polarization

5.4 Configuring the Cease Tx Function

The *Cease Tx* function allows you to define the conditions under which the system automatically interrupts transmission to the satellite (for example, when the `ANTENNA` is pointing towards a predefined blockage zone). The following description applies to all `BUC`s currently defined as valid options for the AL-7103 OrSat™ system.

Configuring this function is under the customer's responsibility. Follow the instructions below and consult with Orbit's Service Department for further assistance.

5.4.1 The Tx Chain and Tx Dependency Windows

The *Tx chain* consists of the `BUC`, the `ADMX`, and the Cease Tx software function.

The **Tx Chain** window is displayed on the **Maintenance Screen**, which is accessed from the **Maint** control on the **Operation Screen** Menu Bar.

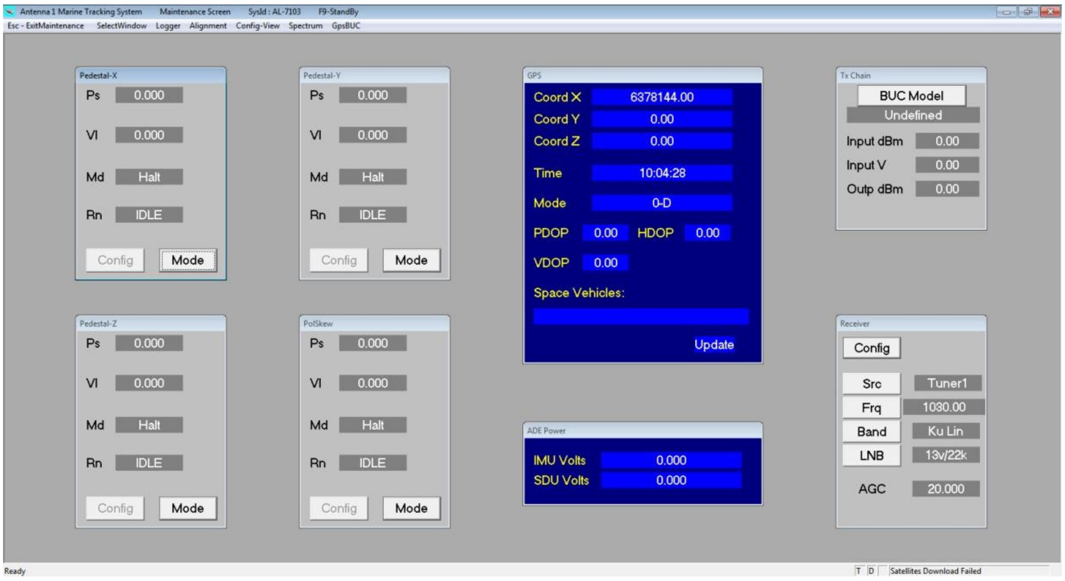


Figure 5-21: Maintenance Screen

Figure 5-22: Tx Chain window

The **Tx Chain** window contains the following controls and fields:

- **BUC Model –** Select the relevant `BUC` model from the pop-up menu.
- **Input dBm** – Displays L-Band signal power, measuring `ADMX` output in decibels. You can subtract the `ADMX`-to-`BUC` input loss from this value to determine the amount of L-Band power supplied to the `BUC`.
- **Input V –** Displays L-Band signal power in volts, as measured by the `ADMX MONITOR` prior to conversion to decibels.
- **Outp dBm –** Displays `BUC` output power, measured in decibels. This value is only displayed for `BUC`s equipped with an output power monitor compatible with the `SBC` interface.

Disclaimer

The **Input dBm** and **Output dBm** values do not represent precise measurements – their accuracy is strongly dependent on the type of `BUC` as well as the current environmental conditions. Nonetheless, they serve as extremely effective aids for in-field integration.

- **Temper –** Displays `BUC` temperature measured in °C. This value is only displayed for `BUC`s equipped with a temperature monitor compatible with the `SBC` interface.

- **Depend –** This button opens the **Tx Chain Dependency** dialog box.

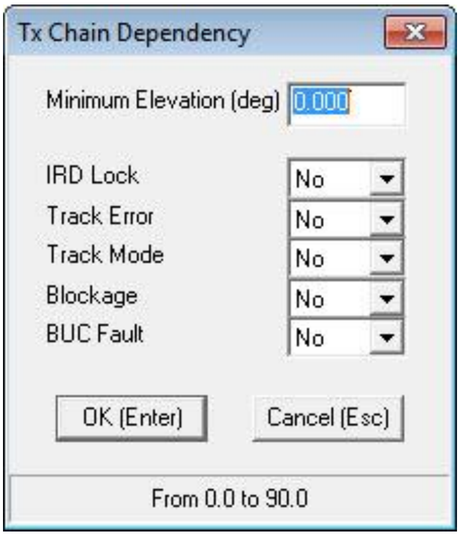


Figure 5-23: Tx Chain Dependency dialog box

The **Tx Chain Dependency** dialog box contains the following controls:

- **Minimum Elevation (deg)** – The ANTENNA elevation angle, relative to the horizon, below which the system automatically shuts down. The default value is 5°.
- **IRD Lock** – When set to 'Yes', the system shuts down when the modem reports an 'Unlock' status. The default setting is 'No'.
- **Track Error** – When set to 'Yes' (default), the system shuts down when a tracking error generated by the ConScan Step-Track exceeds 0.5°.
- **Track Mode** – When set to 'Yes' (default), the system shuts down when the current operating mode is not Step-Track or Peak.
- **Blockage –** When set to 'Yes' (default), the system shuts down when the ANTENNA's view enters one of the predefined blockage zones.
- **BUC Fault –** When set to 'Yes', the system stops transmitting when a BUC fault is identified.

- When a Cease-Tx condition is identified, the BUC ceases transmitting immediately (less then 100msec). However, when the condition disappears, transmission is only renewed after a 2-second delay, in compliance with regulatory requirements.
- When the **Tx Control** field in the **Tx Chain** window is set to 'On' or 'Off', the **Tx Dependency** parameters are disabled (grayed out).

- **Atten** – This button opens the **BUC Attenuator** dialog box, which is used to define the attenuator control capability of the Orbit-certified `BUC` units (for example: KoSpace, Agilis, Codan, ITS).

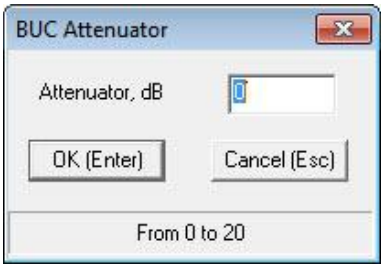


Figure 5-24: BUC Attenuator dialog box

- **Control** – This button opens a selection list, which includes the following options:
    - **On:** Sends a Tx-On command.
    - **Off:** Sends a Tx-Off command.
    - **Auto:** Sends a Tx-On command when all **Tx Dependency** parameters (see below) are true *for at least two consecutive seconds*, and a Tx-Off command when at least one parameter is false.

The default setting is **Auto**.

5.4.2 Defining Blockage Zones

Blockage zones comprise specific ranges of `ANTENNA` elevation and azimuth angles within which the `ANTENNA`'s line of sight is physically blocked (for example: by the ship's mast).

The `CCU` displays the warning message `WRN 033: Antenna View Blocked` when the `ANTENNA` enters one of the defined zones, and automatically reverts to Point-to-Satellite Mode, on the assumption that the `ANTENNA` signal is not available for step-tracking. When the `ANTENNA` leaves the blockage zone, a re-acquisition sequence is initiated automatically.

The warning message may also be read by an external device, such as the iDirect modem.

➢ **To define blockage zones:**

1. From the **Operations Screen**, open the **InConfig** menu and select **Antenna Blockage**. The **Antenna Blockage** dialog box appears.

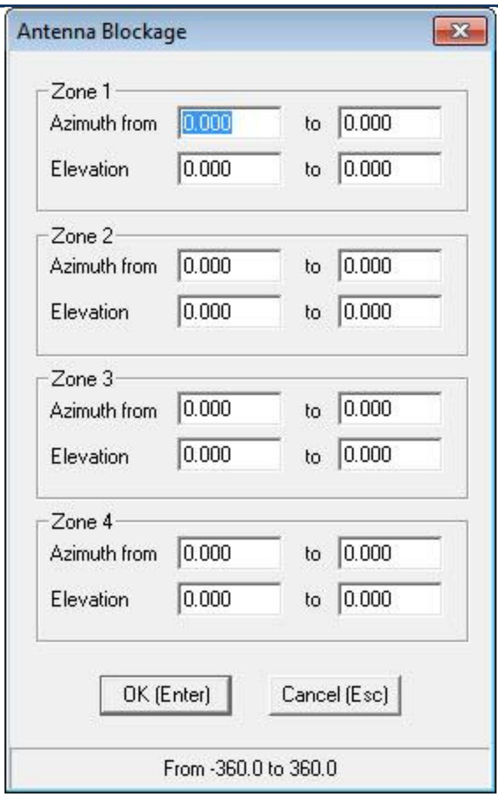
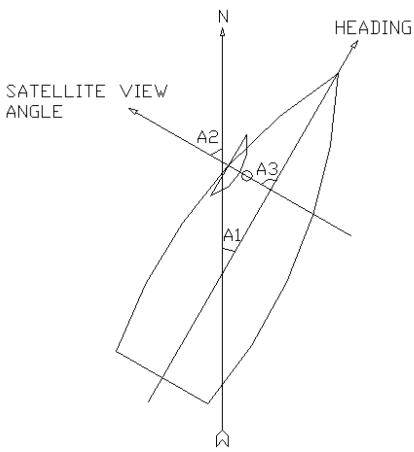


Figure 5-25: Antenna Blockage dialog box

2. Define up to four blockage zones, in four angular measurements relative to the `ANTENNA`:

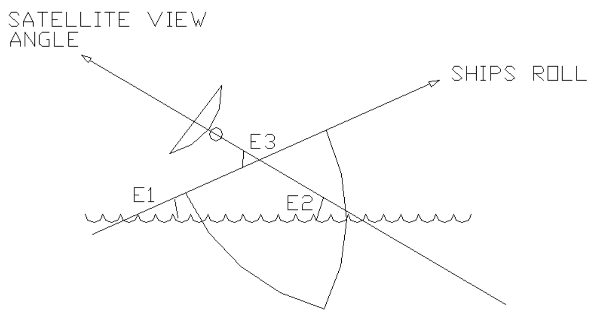
- In the **Azimuth from** and **to** fields, enter the azimuth range of the blockage zone relative to the ship's bow (in a clockwise direction).
- In the **Elevation** and **to** fields, enter the elevation range of the blockage zone relative to the ship's deck (from bottom to top).

In the following simplified model, the ship's pitch and roll values are assumed to be zero:



- **A1** – Ship's heading
- **A2** –True azimuth
- **A3** –Local azimuth

In the following simplified model, the ship's pitch and heading values are assumed to be zero:



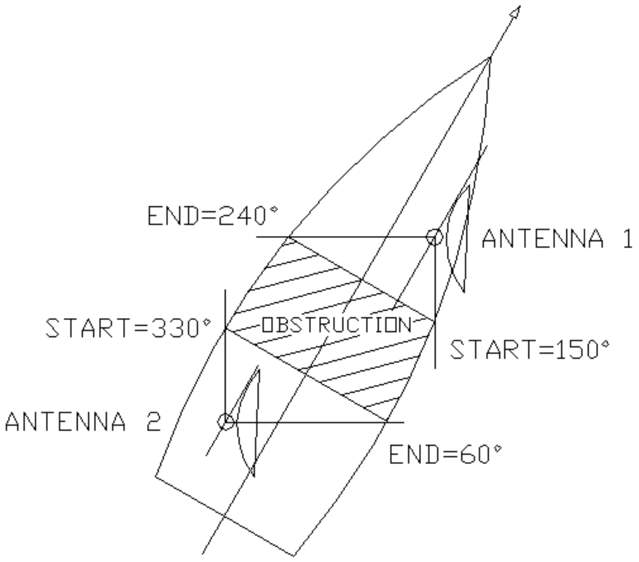
- **E1** – Ship's roll
- **E2** – True elevation
- **E3** – Local elevation

One can see from the above models that the local azimuth is the `ANTENNA` azimuth relative to the ship's bow-to-stern line, rather than to true north, and that the local elevation is the `ANTENNA` elevation relative to the ship's deck, rather than to the horizon.

Note: The local angles depicted in these models are for illustrative purposes only. The actual mathematical definition of these angles is more complex, taking into account the ship's pitch, roll, and heading at all times.

The use of local position angles makes the definition of blockage zones more convenient, because it allows you to measure the angles of obstruction between the `ANTENNA` and other objects on the ship's deck.

The following model illustrates a simple blockage zone for a dual-antenna system:



In the above model, ANTENNA 1 is blocked within a range of 90°, from 150° to 240° local azimuth. ANTENNA 2 is also blocked within a range of 90°, from 330° to 60° degrees local azimuth. The blockage zones for both ANTENNAs are defined as follows:

Antenna 1	Antenna 2
Zone 1	**Zone 1**
Azimuth from: **150.0** to: **240.0** Elevation from: **-90.0** to: **90.0**	Azimuth from: **330.0** to: **60.0** Elevation from: **-90.0** to: **90.0**

- If a zone is to be defined strictly by azimuth angles, the elevation angles should be set from –90 to +90 degrees.
- It is not necessary to enter values for all four zones. The default setting of 0.0000 to 0.0000 effectively disables any unused zones.

3. Click **OK (Enter)**.

5.5 Setting the Restart Mode

By default, the system automatically enters Acquire mode after it restarts. You can change the default setting to a different operating mode, for purposes of checkout, integration, installation or debugging.

➢ **To set the default restart mode:**

1. From the **Operation Screen**, open the **InConfig** menu and select **Restart**. The **Restart Mode** dialog box appears.

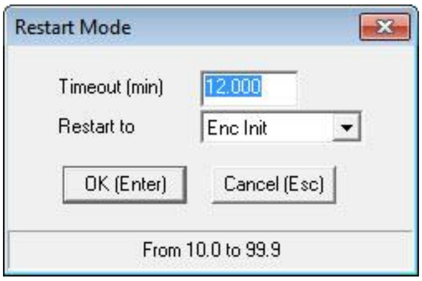


Figure 5-26: Restart Mode dialog box

2. Open the **Restart to** drop-down list and select one of the following values:

   - **Standby** – Halts the axes in their current position
   - **Acquire** – Initializes the `IMU` and axis encoders, activates Acquire
   - **Slave** – Puts the system on call for commands from an external 'Master' controller
   - **Enc Init** – Initializes the axis encoders
   - **Test Traj** – Initializes the axis encoders and moves all axes on their test trajectories.
   - **AcqSatPreset** –Activates Acquire Satellite Preset Mode

3. In the **Timeout (min)** field, enter the number of minutes after which the system will automatically reboot if it fails to engage the defined operating mode.

4. Click **Ok (Enter)**.

5. Click the **Save** command on the Menu Bar to save your setting to non-volatile memory.

   The next time the system restarts, it will engage the selected mode.

For normal system operation, the restart mode should be set to Acquire.

5.6 Calibrating the Noise Floor

Noise floor calibration eliminates the effect of atmospheric noise on **Spectrum Analyzer** measurements.

➢ **To calibrate the noise floor:**

1. Point the `ANTENNA` away from any radiation source. Unless the ship is on the equator, do this by activating Stow-up Mode.
2. From the **Operation Screen**, click the **Spectrum** control on the Menu Bar. The **Spectrum Analyzer Screen (SAS)** appears.

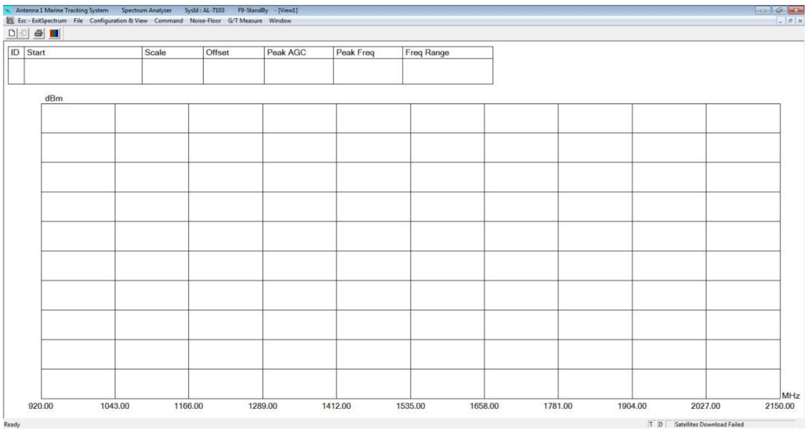


Figure 5-27: Spectrum Analyzer Screen

3. Open the **Noise-Floor** menu and select **Start Calibration**. The **Start Noise-Floor Calibration** dialog box appears.

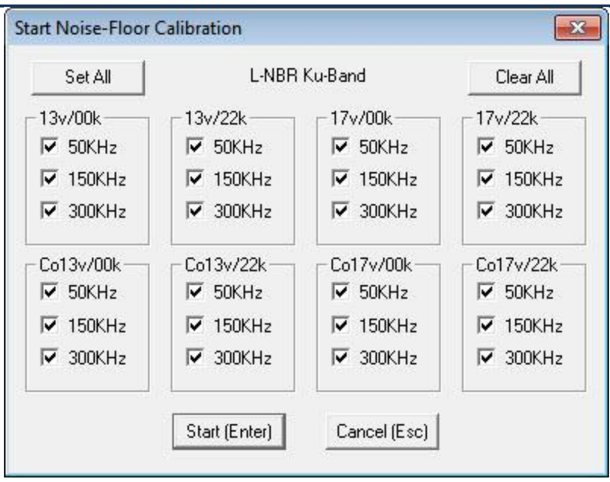


Figure 5-28: Start Noise-Floor Calibration dialog box

4. Check the relevant calibration lines as listed below:

- For a single-band LNB (for example: Norsat 1000HA/B/C):
  - 17v/00 KHz – 50 KHz
  - 17v/00 KHz – 150 KHz
  - 17v/00 KHz – 300 KHz
- For a dual-band LNB (for example: SMW Q-pll Type-C):
  - 13v/00 KHz – 50 KHz
  - 13v/00 KHz – 150 KHz
  - 13v/00 KHz – 300 KHz
  - 17v/00 KHz – 50 KHz
  - 17v/00 KHz – 150 KHz
  - 17v/00 KHz – 300 KHz
- For a quad-band LNB (for example: SMW Q-pll Type-O):
  - 13v/00 KHz – 50 KHz
  - 13v/00 KHz – 150 KHz
  - 13v/00 KHz – 300 KHz
  - 17v/00 KHz – 50 KHz
  - 17v/00 KHz – 150 KHz
  - 17v/00 KHz – 300 KHz
  - 13v/22 KHz – 50 KHz
  - 13v/22 KHz – 150 KHz

- 13v/22 KHz – 300 KHz
- 17v/22 KHz – 50 KHz
- 17v/22 KHz – 150 KHz
- 17v/22 KHz – 300 KHz

Calibrating an excess number of lines (for example: all 24 lines for a single-band `LNB`) does not affect the system adversely. Any surplus information is ignored.

5. Press the **Start (Enter)** button.

   The calibration process runs in a fully automatic manner, scanning the calibration lines one by one. Each line takes approximately 20 seconds. The interim scan results are displayed in the **Write Noise-Floor Calibration** dialog box, and may be compared to the examples displayed in the figures below in the section **Typical Noise Floor Curves** on page 116.

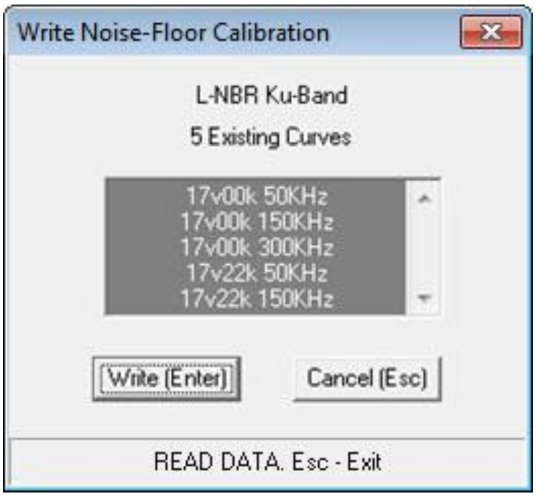


Figure 5-29: Write Noise-Floor Calibration dialog box

6. After the process is completed, the final results are displayed. Click **Write (Enter)**.
7. To review the measured data, open the **Noise-Floor** menu and select **Read Calibration**. The **Read Noise-Floor Calibration** dialog box appears.

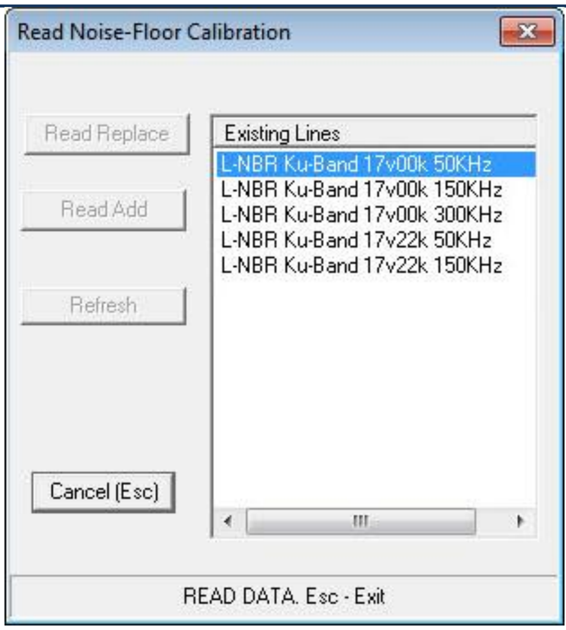


Figure 5-30: Read Noise-Floor Calibration dialog box

The curves may be presented in pairs. You can press the **Read Replace** button to view a single curve, and the **Read Add** button to add a second curve.

It is recommended to review all the lines and compare them to the relevant example displayed below in the section **Typical Noise Floor Curves** on page 116. The curves do not have to be identical with the examples, but should attain a reasonable level of correlation.

8. Enter the **Maintenance Screen** and click the **Config** button in the **Receiver** window. The **Receiver Configuration** dialog box appears. Verify that the **Noise-Floor Corr.** field is set to 'Yes'.

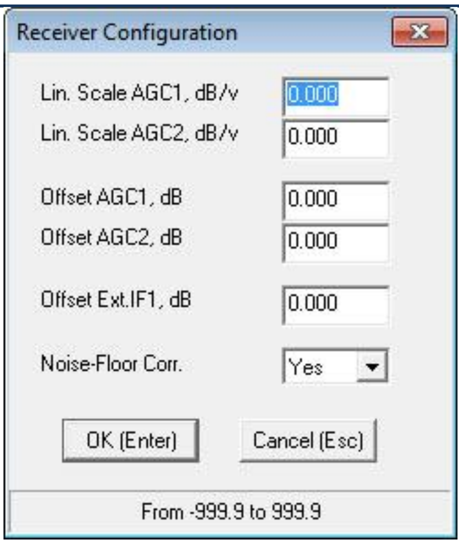


Figure 5-31: Receiver Configuration dialog box

- The **Noise-Floor Corr.** setting is not important during the calibration process. It is handled automatically by the calibration program.
- If there are no calibration files in the `SBC` memory when the process is activated, the warning message `WRN 180: No Noise Floor Table` is displayed.

9. Return to the **Operations Screen**, open the **InConfig** menu, and select **Display**. The **Display Configuration** dialog box appears.

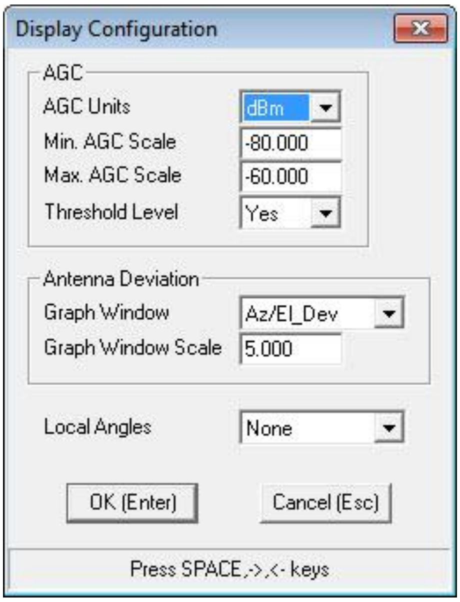


Figure 5-32: Display Configuration dialog box

10. Set the **Min. AGC Scale** value to '-80.000' and the **Max. AGC Scale** value to '-60.000'.

11. Open the **Commands** menu and select **Set Threshold**. The **Set Threshold Level** dialog box appears.

Figure 5-33: Set Threshold Level dialog box

12. Set the **Threshold Level, dBm** value to '-75.000'.

13. Click **OK (Enter)**.

Typical Noise Floor Curves

Typical noise-floor curves for the various `LNB`s are displayed below for reference:

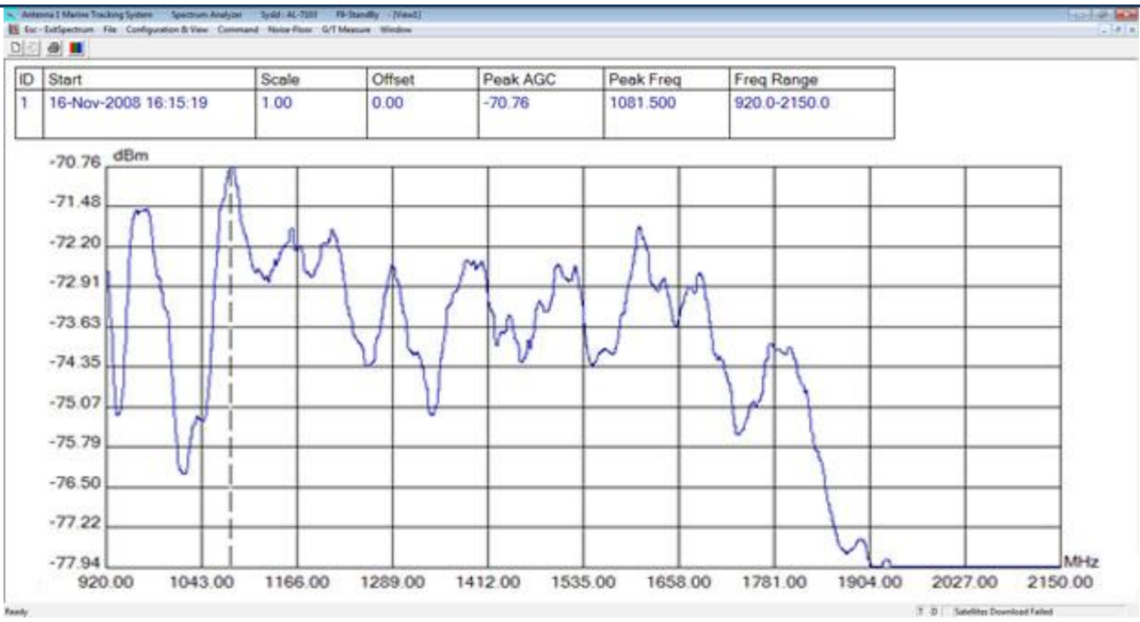


Figure 5-34: Norsat 1x07HC (10 GHz LO), NBR 50 KHz

Figure 5-35: Norsat 1x07HC (10 GHz LO), NBR 150 KHz

Figure 5-36: Norsat 1x07HC (10 GHz LO), NBR 300 KHz

Figure 5-37: Norsat 1x07HB (11.3 GHz LO), NBR 50 KHz

Figure 5-38: Norsat 1x07HB (11.3 GHz LO), NBR 150 KH

Figure 5-39: Norsat 1x07HB (11.3 GHz LO), NBR 300 KHz

Figure 5-40: Norsat 1x07HA (10.75 GHz LO), NBR 50 KHz

Figure 5-41: Norsat 1x07HA (10.75 GHz LO), NBR 150 KHz

Figure 5-42: Norsat 1x07HA (10.75 GHz LO), NBR 300 KHz

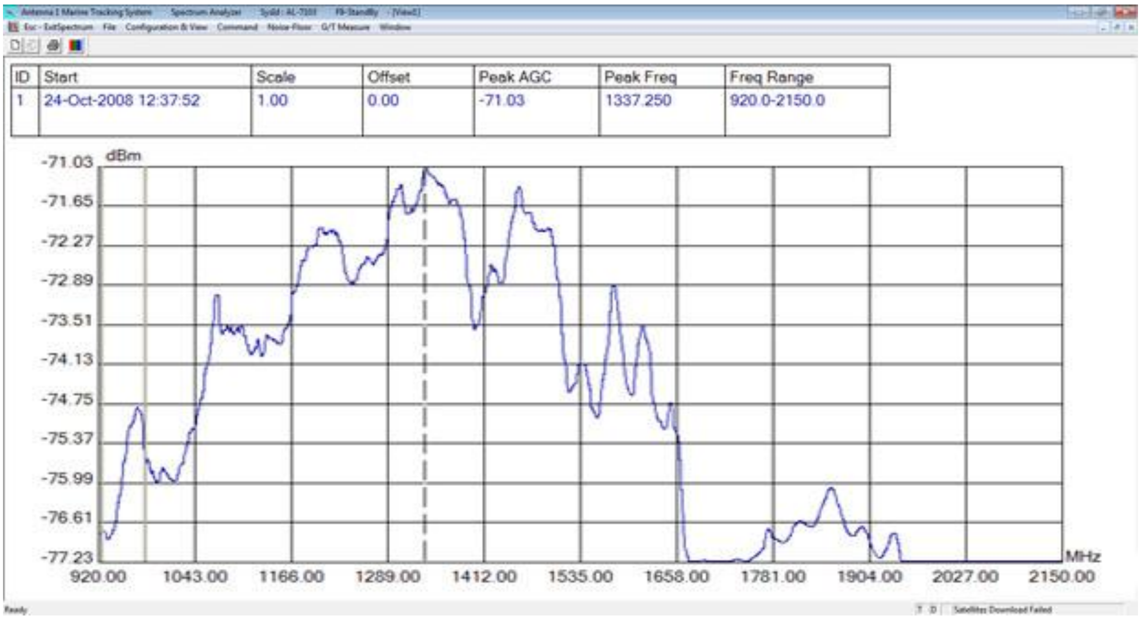


Figure 5-43: SMW QPLL Type-O 13v/00KHz, NBR: 50 KHz

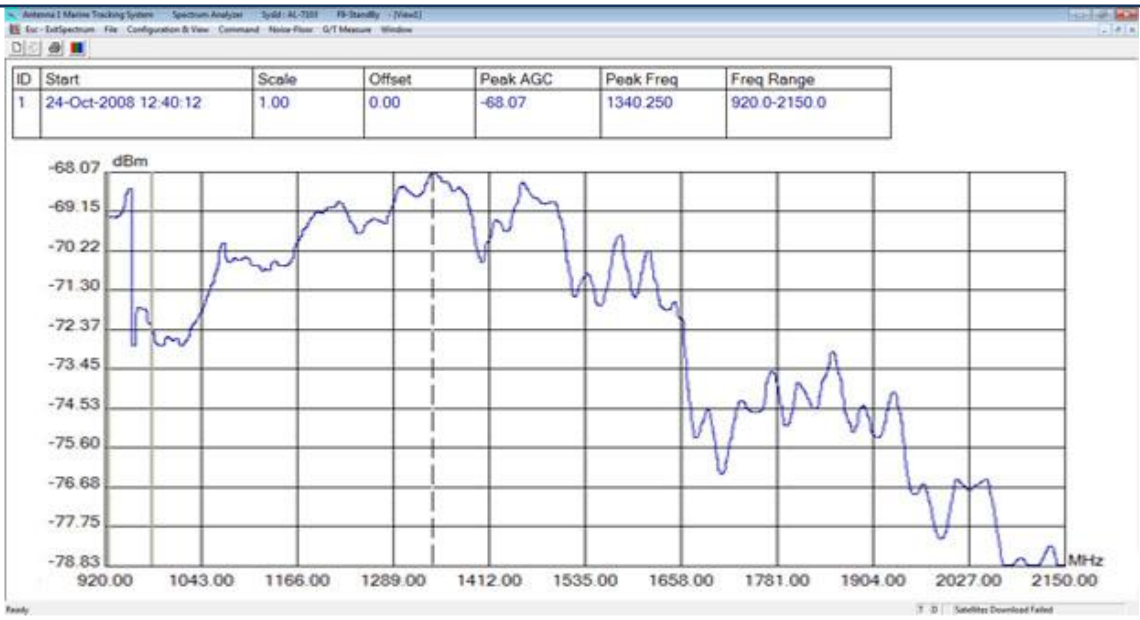


Figure 5-44: SMW QPLL Type-O 13v/00KHz, NBR: 150 KHz

Figure 5-45: SMW QPLL Type-O 13v/00KHz, NBR: 300 KHz

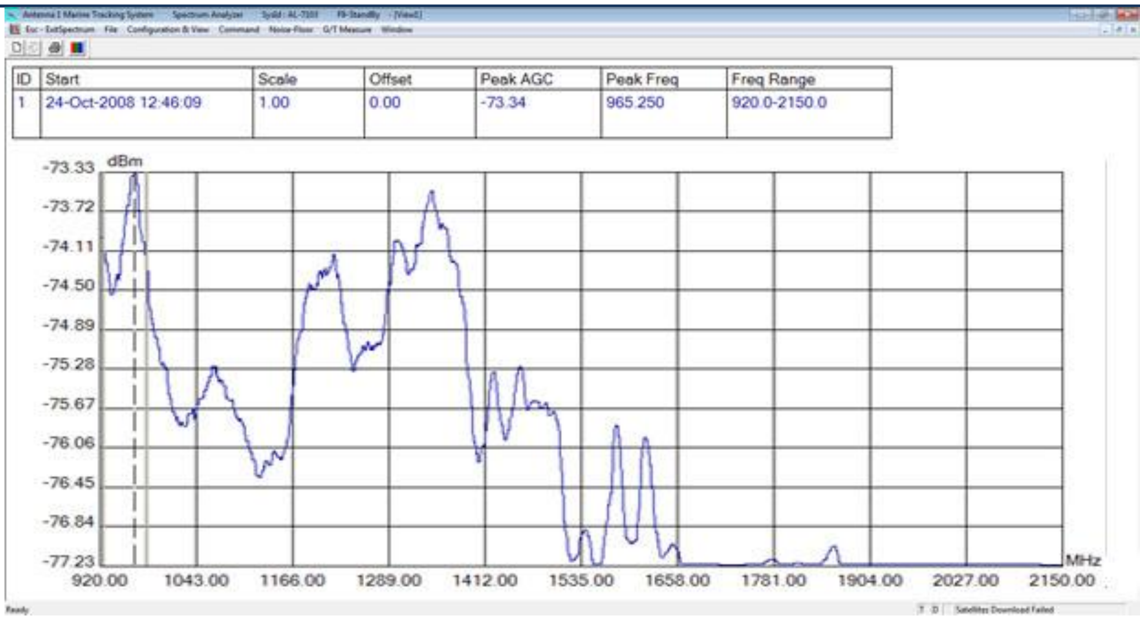


Figure 5-46: SMW QPLL Type-O 17v/00KHz, NBR: 50 KHz

Figure 5-47: SMW QPLL Type-O 17v/00KHz, NBR: 150 KHz

Figure 5-48: SMW QPLL Type-O 17v/00KHz, NBR: 300 KHz

Figure 5-49: SMW QPLL Type-O 13v/22KHz, NBR: 50 KHz

Figure 5-50: SMW QPLL Type-O 13v/22KHz, NBR: 150 KHz

Figure 5-51: SMW QPLL Type-O 13v/22KHz, NBR: 300 KHz

Figure 5-52: SMW QPLL Type-O 17v/22KHz, NBR: 50 KHz

Figure 5-53: SMW QPLL Type-O 17v/22KHz, NBR: 150 KHz

Figure 5-54: SMW QPLL Type-O 17v/22KHz, NBR: 300 KHz

5.7 Submitting the Commissioning Checklist

Once the commissioning process is completed, complete the Commissioning Checklist (provided in Appendix F: Commissioning Checklist on page 205) and submit it to your Orbit representative to activate the system warranty and to allow Orbit to follow up on field installation and commissioning issues.

6 System Operation

6.1 Principles of Operation

6.1.1 Acquisition and Tracking Algorithm

Maintaining a constant view angle towards the satellite is achieved by a combination of two processes:

- *Stabilization*, which compensates for the ship's sea movement on the basis of input from the IMU.
- *Step-tracking*, which periodically corrects any slight off-bore-site movement of the ANTENNA so as to move it to the point of maximal reception.

Together, stabilization and step-tracking of the ANTENNA constitute what is referred to by the general term of *tracking*.

The OrSat™ AL-7103 system is designed to acquire and track a pre-selected satellite, defined by the system according to three functional parameters:

- Satellite location on the geo-stationary arch – positive for east and negative for west longitudes (for example, "-4.0" for Amos 4.0° West)
- Tracking (or *hunt*) frequency, measured in L-Band MHz (for example, 1200.0MHz)
- Rx Polarization selection – Vertical ('Pol-A') or Horizontal ('Pol-B')

Upon activation of Acquire Mode, the system executes a series of automatic actions designed to acquire and track the selected satellite according to the above parameters, as depicted in the following diagram:

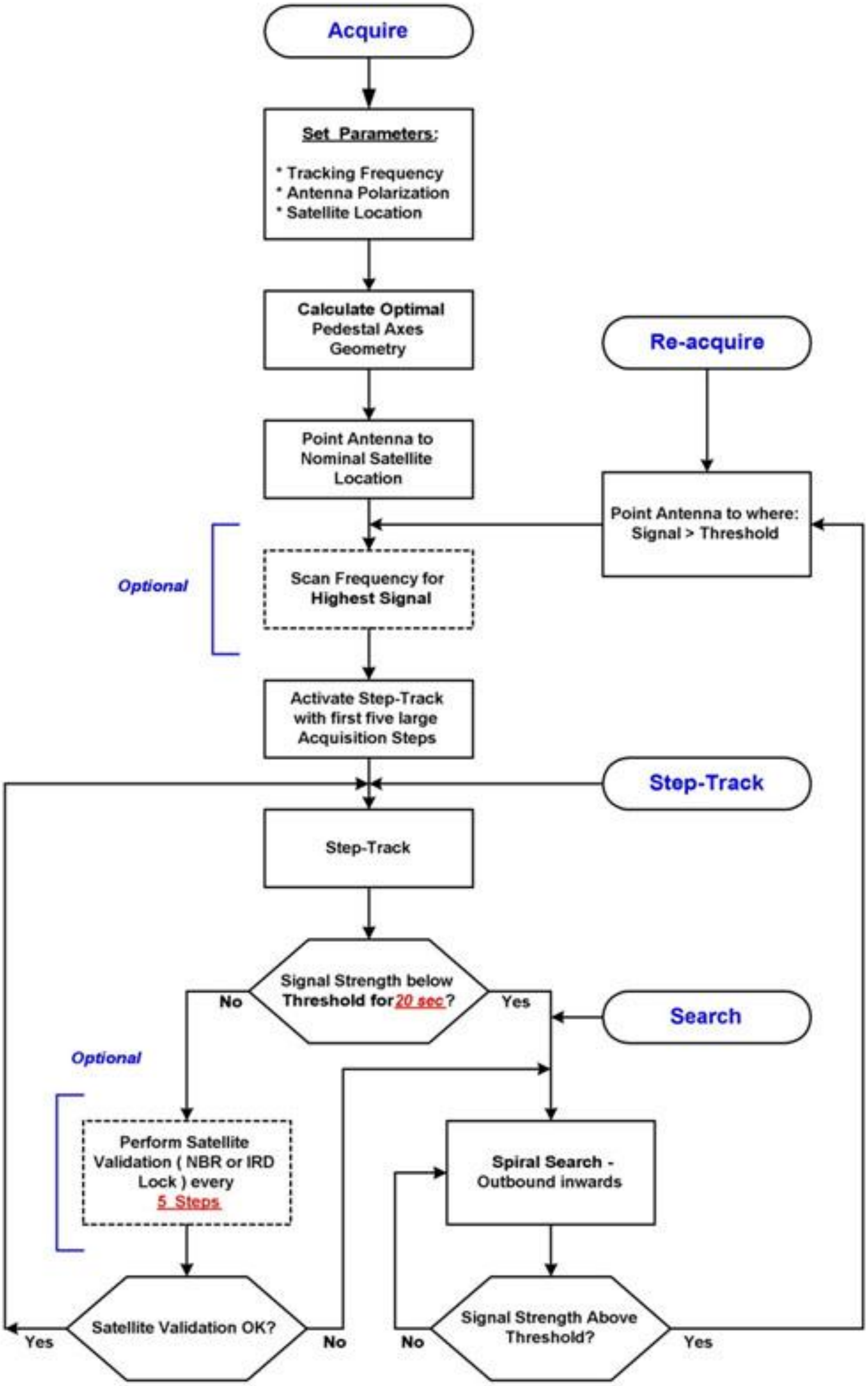


Figure 6-1: AL-7103 MKII System – Simplified Acquisition and Tracking Algorithm

6.1.2 Modes of Operation

In principal, after proper installation, configuration, and alignment, the OrSat™ AL-7103 system functions in a completely automatic manner. Upon power-up, the system acquires and tracks the last selected satellite without any manual intervention from a human operator. This process entails the utilization of several lower-level modes of operation: satellite acquisition, tracking, validation, searching, and re-acquisition.

Nonetheless, the advanced OrSat™ HMI (the `CCU` screen and keyboard) allows you to activate a number of operating modes independently, for purposes of installation, configuration, alignment, and maintenance.

The HMI supports the following operational modes:

- **Stand-by** – Halts all axes in their current position
- **Manual** – Allows you to move the `ANTENNA` manually in small steps
- **Restart** – Restarts the `SBC`
- **Search** – Moves the `ANTENNA` in an expanding and contracting spiral until the AGC threshold is tripped
- **Peak** – Points the `ANTENNA` at the position of maximum AGC as determined by the last step-track iteration
- **Step-Track** – Nudges the `ANTENNA` to the point of maximum AGC
- **Pnt-to-Sat** – Points the `ANTENNA` to the last satellite selected from the database
- **Acquire** – Points the `ANTENNA` to the last satellite selected from the database, and initiates step-tracking
- **Test Traj** – Tests the performance of all axes by moving them in the test trajectories defined in the **Maintenance Screen**
- **Stow** – Moves all axes to the stow positions defined in the **Maintenance Screen**
- **Stow-Up** – Moves all axes to zero encoder positions
- **Sat. Preset** – Points the `ANTENNA` to a user-defined geo-stationary longitude
- **Acquire Sat. Preset** – Points the `ANTENNA` to the last preset geo-stationary longitude and initiates step-tracking

6.1.3 Tracking Receiver Feedback

A good-quality signal strength – defined as the highest possible signal-to-noise ratio – is required to perform step-tracking of the ANTENNA. The tracking signal received from the satellite may be one of the following:

- **Satellite Beacon** – Typically an un-modulated CW
- **Customer Data Channel** – Typically occupying a few hundred KHz to a few MHz of bandwidth, with digital modulation (QPSK or BPSK)
- **Unique tracking channel** – Used by the customer specifically for tracking
- **Wide-band TV transponder** – Digital only

The AL-7103 OrSat™ system uses a narrow-band tracking receiver (NBR) to receive each of the above signals. To achieve optimal performance, the following specifications are recommended:

- **Satellite beacon** –50 KHz filter
- **Customer data channel** –50, 150, or 300 KHz filter, according to the channel's occupied bandwidth
- **Special tracking channel** (typically a 16Kbps or 32Kbps QPSK-modulated signal) – NBR with a 50KHz filter

The selected tracking signal should be unique to the selected satellite, or received on a considerably lower level from adjacent satellites. Otherwise, the system may lock onto the wrong satellite.

In general, a unique tracking channel is preferable to a satellite beacon (which may be the same for multiple satellites of the same type), and the latter is preferable to a data channel.

6.1.4 Satellite Validation

During the tracking process, a situation may develop where the ANTENNA locks onto an incorrect target, due to any of the following factors:

- An adjacent satellite producing signals in the same frequency spectrum as the OrSat™ tracking feedback.
- A terrestrial source of electromagnetic interference in the same frequency spectrum.
- Strong reflections from obstructing structures, producing wide-band noise in the same frequency spectrum.

The OrSat™ system can be configured to perform periodic checks to verify that the `ANTENNA` is locked on the right satellite, provided that the necessary satellite information can be obtained.

The IRD Lock function checks the status of a Go/No-go indication returned from the modem, at a predefined interval. Since there are numerous parameters defining a given data stream (for example: frequency, modulation, data rate, coding, rate of forward error correction), the probability of the exact same signal being transmitted by another satellite is quite low.

6.2 System Operation

The first operational task to perform once the system is set up is locking the `ANTENNA` onto a satellite. This satellite will serve as the default after the system is shut down or restarts.

6.2.1 Selecting a Satellite

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

The power-up sequence is fully automatic, provided that the system is configured to auto-start (the default setting).

➢ **To select a satellite:**

1. From the **Operation Screen**, open the **Mode** menu and select **Sat. Preset**. The **Satellite Preset Mode** dialog box appears.

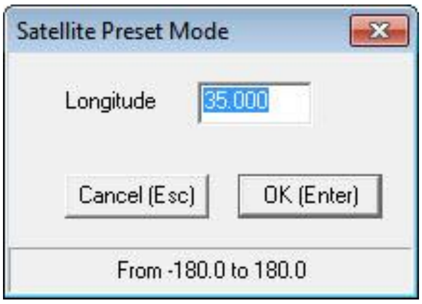
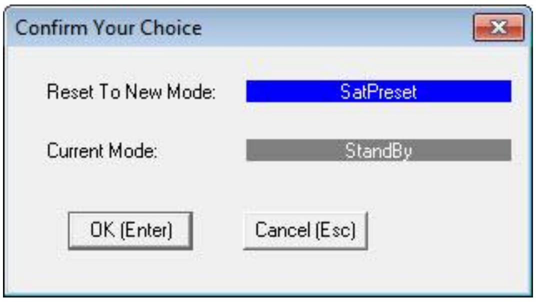


Figure 6-2: Satellite Preset Mode dialog box

2. Enter the satellite's geostationary arch longitude in the following format: a positive number from 0.0° to 180.0° for east, or a negative number from -0.0° to -180.0° for west. For example:

   - Amos at 4° West is entered as "-4.0".
   - Hotbird at 13° East is entered as "13.0"

3. Click **OK (Enter)**. A confirmation message box appears.



4. To confirm, click **OK (Enter)**. Once the process is complete, the satellite is centered in the **Az/El Deviation** window.

Alternatively, you can click the **Satellite** control on the **Operation Screen** Menu Bar and select a satellite from the Satellite Database. The satellite's name and channel appear in the **Satellite and Channel Select** window.

Figure 6-3: Satellite and Channel Select Window

6.2.2 Setting the Tracking Frequency, NBR Bandwidth, and LNB Voltage

1. Make sure that the `NBR` is activated.

2. From the **Operation Screen**, open the **InConfig** menu and select **Receiver**. The **Receiver** dialog box appears.

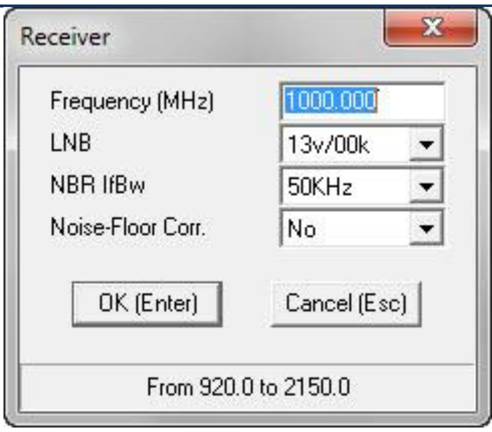


Figure 6-4: Receiver dialog box

3. In the **Frequency (MHz)** field, enter the relevant tracking frequency.

4. Select the appropriate control voltage in the **LNB** field:

   - For the NORSAT `LNB` (1X07HA, 1X07HB, or 1X07HC), select ‘17v/00k.’
   - For the SMW Q-PLL Type O `LNB`:

     - Select 13v/00k for the 10.70-11.20GHz frequency range.
     - Select 13v2/2k for the 11.20-11.70GHz frequency range.
     - Select 17v/00k for the 11.70-12.20GHz frequency range.
     - Select 17v/22k for the 12.20-12.75GHz frequency range.

5. In the **NBR IfBw** field, select one of the available options: ‘50KHz,’ ‘150KHz,’ or ‘300KHz’.

6. Click **OK (Enter)**.

6.2.3 Setting Polarization

Check the system’s current polarization in the **Polariz** field of the **System Status** window.

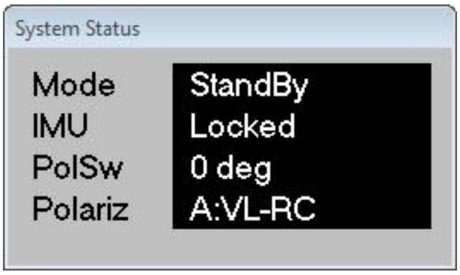


Figure 6-5: System Status window

There are two possible values:

- 'A:VL-RC' – Vertical Rx (or Right-hand Circular Rx in the case of a circular polarized ANTENNA)
- 'B:HL-LC' – Horizontal Rx (or Left-hand Circular Rx in the case of a circular polarized ANTENNA)

➢ **To switch polarization:**

1. From the **Operation Screen**, open the **Commands** menu and select **Polarization**. The **Polarization Status** message box appears.

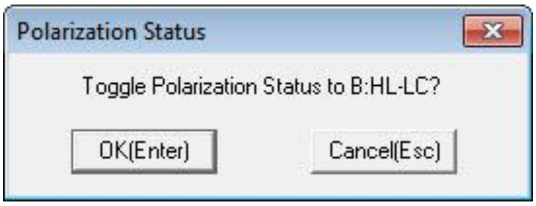


Figure 6-6: Polarization Status message box

2. Click **OK (Enter)** to confirm your command.

6.2.4 Activating Operating Modes

Once a satellite has been acquired, you can manually activate the various operating modes from the **Mode** menu on the **Operation Screen** Menu Bar.

Satellite Preset Mode

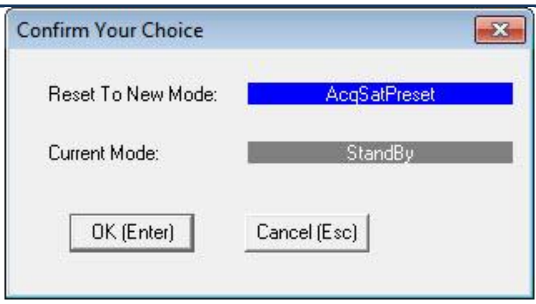
See **Selecting a Satellite** on page 132.

Acquire Satellite Preset Mode

Activating Acquire Satellite Preset Mode moves the ANTENNA to the last preset satellite position and activates Step-Track Mode, which brings the ANTENNA to the peak position based on RF signal feedback.

➢ **To acquire a preset satellite:**

1. From the **Operation Screen**, open the **Mode** menu and select **Acquire Sat. Preset**. A confirmation message box appears.



2. To confirm, click **OK (Enter)**.

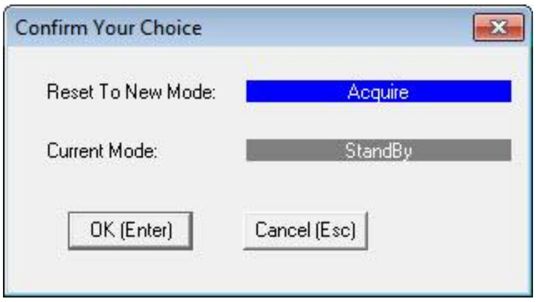
   The ANTENNA points to the defined position.

Acquire Mode

Activating Acquire Mode moves the ANTENNA to the satellite position defined for the selected satellite in the Satellite Database and activates Step-Track Mode, which brings the ANTENNA to peak position on the basis of RF signal feedback.

➢ **To acquire a satellite from the database :**

1. From the **Operation Screen**, open the **Mode** menu and select **Acquire**. A confirmation message box appears.



2. To confirm, click **OK (Enter)**.

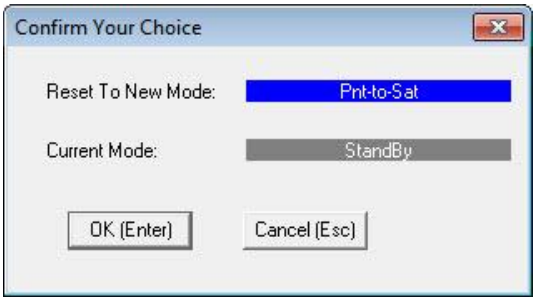
   The ANTENNA points to the selected satellite and step-tracks to the peak position.

Point to Satellite Mode

Activating Point-to-Satellite Mode moves the ANTENNA to the satellite position defined for the selected satellite in the Satellite Database (without taking into account RF signal feedback).

➢ **To point to a satellite:**

1. From the **Operation Screen**, open the **Mode** menu and select **Pnt-to-Sat**. A confirmation message box appears.



2. To confirm, click **OK (Enter)**.

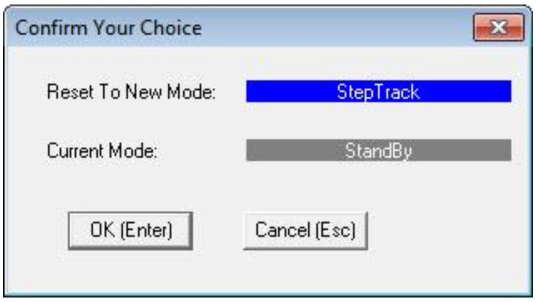
   The `ANTENNA` points to the nominal position of the selected satellite.

Step-Track Mode

Under normal working conditions, Step-Track Mode is activated automatically. However, you may need to activate it manually for maintenance and testing purposes.

➢ **To activate Step-Track Mode:**

1. Make sure you are locked onto the satellite using the correct tracking channel.
2. Make sure the AGC is above the defined threshold (see **Setting the AGC Threshold** on page 148). Otherwise, the system will automatically revert to Search Mode.
3. From the **Operation Screen**, open the **Mode** menu and select **Step-Track**. A confirmation message box appears.



4. To confirm, click **OK (Enter)**.

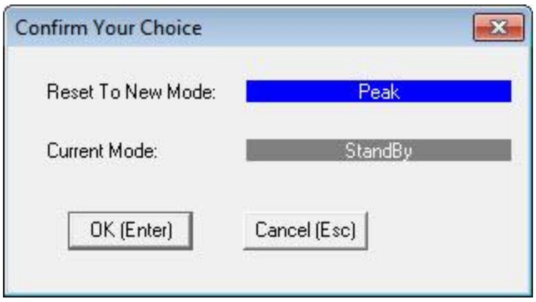
   The `ANTENNA` begins step-tracking.

Peak Mode

Activating Peak Mode stabilizes the `ANTENNA` at the point of maximum reception, as determined by the latest step-track iteration.

➢ **To peak the system:**

1. From the **Operation Screen**, open the **Mode** menu and select **Peak**. A confirmation message box appears.



2. To confirm, click **OK (Enter)**.

   The `ANTENNA` moves to the last determined peak position.

Manual Mode

Activating Manual Mode allows you to move the `ANTENNA` manually for maintenance and testing purposes, or to find the satellite when the system does not acquire it automatically.

➢ **To set up Manual Mode**

1. From the **Operation Screen**, open the **InConfig** menu and select **Manual**. The **Manual Mode** dialog box appears.

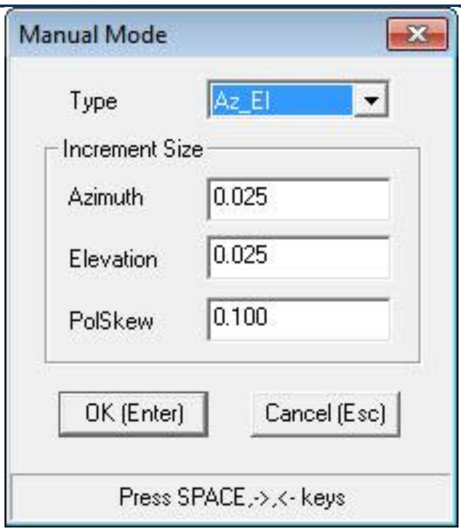


Figure 6-7: Manual Mode dialog box

2. Select the appropriate **Type** value:

   - **Az_El** (Default)

   Incremental values are measured relative to the ANTENNA location at the moment Manual Mode is activated. Azimuth angles reference elevation, rather than Earth horizon. In practical terms, this means that when taking an azimuthal ANTENNA cut, there is no need to translate the horizontal axis by the cosine of elevation. However, when moving the azimuth angle by a considerable amount (more than a few degrees), the elevation angle also changes.

   - **Earth_Az_El**

   Absolute ANTENNA angles are used – azimuth references Earth true north, and the elevation references the horizon. If only the azimuth is moved, the elevation remains constant.

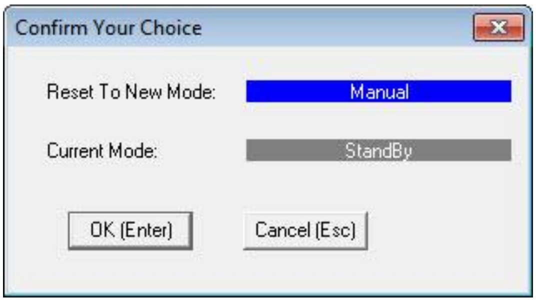
   - **SatArch**

   The azimuth represents the angular displacement along the satellite arch, in reference to the Greenwich Meridian. The azimuth and elevation change in accordance with the ANTENNA displacement on the arch. This mode is most useful in 'hunting' for adjacent satellites.

3. Set the desired **Increment Size** for each angle, representing the size of one step in degrees. Default settings are 0.05º for azimuth and elevation, and 0.1º for polarization skew.

- **To move the antenna manually:**

1. From the **Operation Screen**, open the **Mode** menu and select **Manual**. A confirmation message box appears.



2. To confirm, click **OK (Enter)**. The **Manual Mode** window appears in the bottom left-hand corner of the screen.

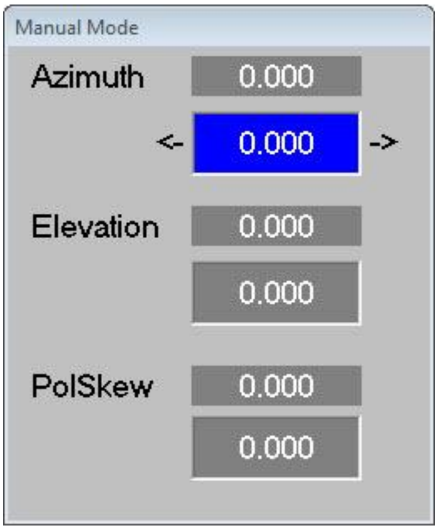


Figure 6-8: Manual Mode window

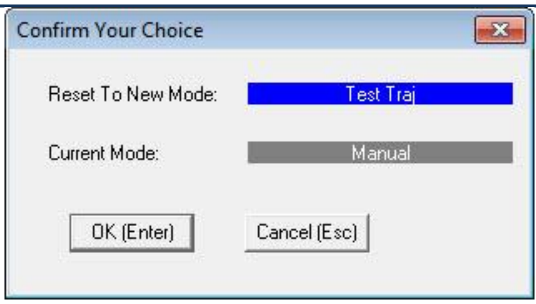
3. The upper field for each axis displays the current angle of the axis. Click the lower field of the axis you wish to move, and click the left or right arrow next to the field to decrease or increase the angle of the axis in step increments.

Test Trajectory Mode

Activating Test Traj Mode allows you to analyze the accuracy of each `POSITIONER AXIS`.

- **To run the axes in their test trajectories:**

1. Open the **Mode** menu and select **Test Traj**. A confirmation message box appears.



2. To confirm, click **OK (Enter)**.

   The system moves all three axes to their starting positions (-90° for X and Z, -165° for Y), then moves them forwards and back on their test trajectories, until stopped by the operator.

While running the test, you can monitor the following axes parameters in the **Graphic Data Logger**: Position Feedback, Position Error, and Velocity Feedback (for instructions, see **Using the Graphic Data Logger** on page 154).

The following figure displays a typical X-axis response on the **Logger** screen (the Position Error curve is multiplied by 100 to bring it to a readable scale).

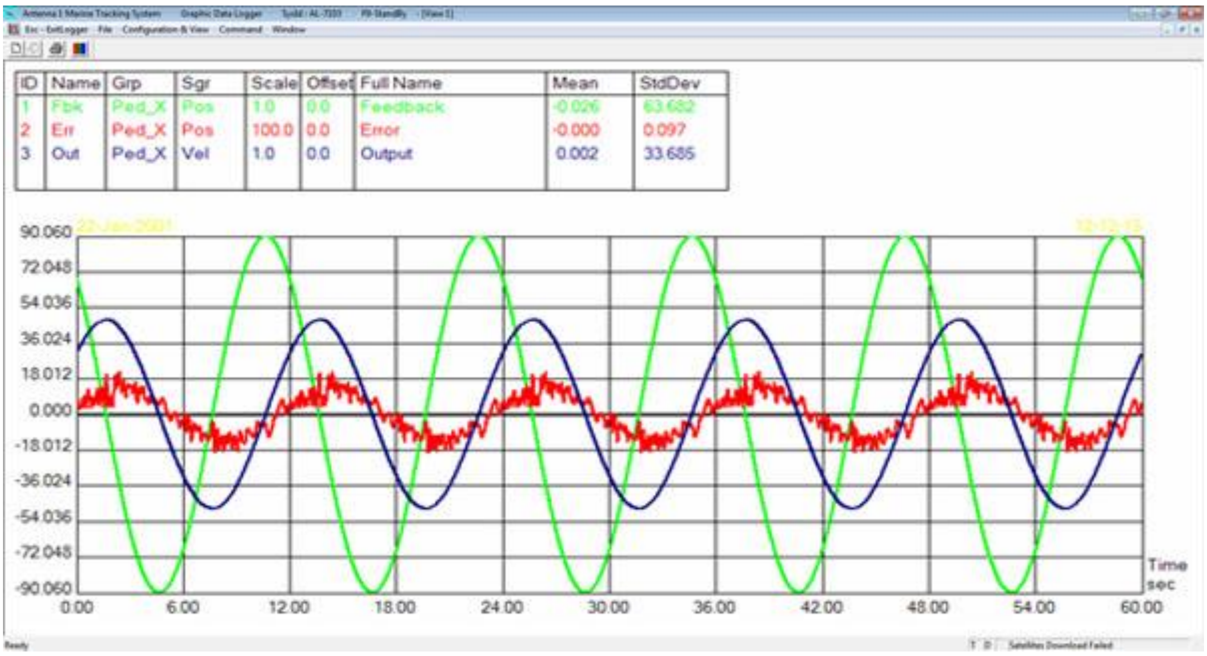


Figure 6-9: Monitoring axes test parameters in the Logger

Stand-by Mode

Activating Stand-by Mode halts all axes in their current position.

➢ **To put the antenna on stand-by:**

1. From the **Operation Screen**, open the **Mode** menu and select **Stand-by**. A confirmation message box appears.
2. To confirm, click **OK (Enter)**.

   All axes are halted in their current position.

Stow and Stow-up Modes

Activating Stow Mode moves the three `POSITIONER AXES` to a predefined position in order to allow easy access to the `ADE` for maintenance purposes. Stow-up Mode is used to move the `POSITIONER AXES` to the zero encoder reading.

➢ **To define the stow position**

1. From the **Operation Screen**, open the **InConfig** menu and select **Axes Parameters**. The **Axes Parameters** dialog box appears.

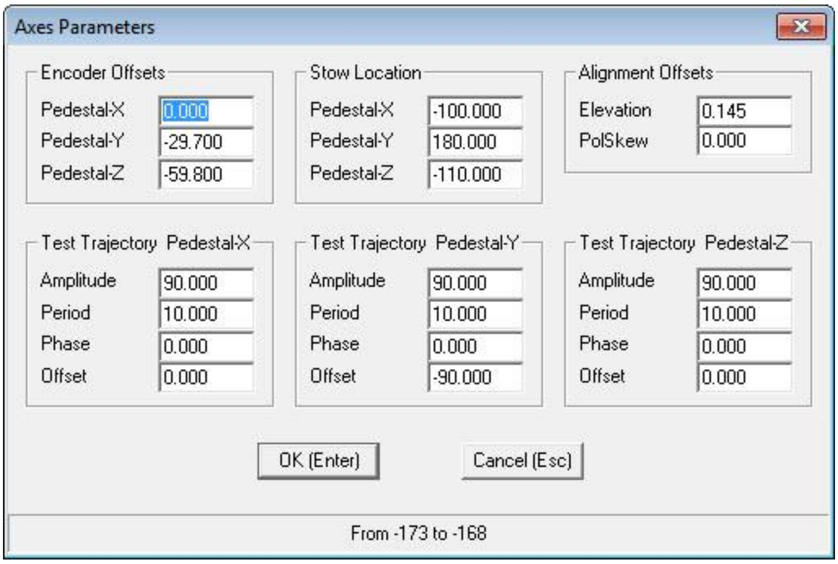
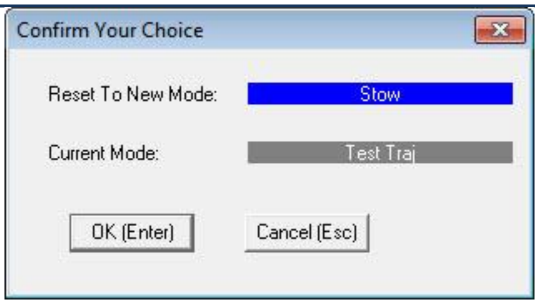


Figure 6-10: Axes Parameters dialog box

2. Set the desired axis angles in the **Stow Location** fields.
3. Click **OK (Enter)** to save the settings.

➢ **To Stow the system:**

1. From the **Operation Screen**, open the **Mode** menu and select **Stow**. A confirmation message box appears.

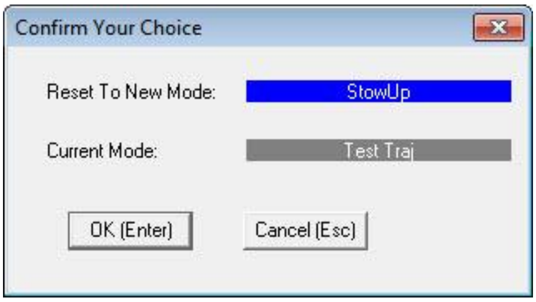


2. To confirm, click **OK (Enter)**.

   The POSITIONER AXES move to the defined stow location.

➢ **To Stow-up the system:**

1. From the **Operation Screen**, open the **Mode** menu and select **Stow-Up**. A confirmation message box appears.



2. To confirm, click **OK (Enter)**.

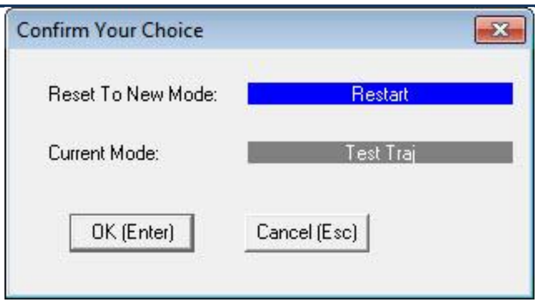
   The POSITIONER AXES move to the zero encoder reading.

Restarting and Rebooting the ACU

Perform one of the following procedures:

➢ **To initialize the IMU and pedestal axes:**

1. From the **Operation Screen**, open the **Mode** menu and select **Restart**. A confirmation message box appears.



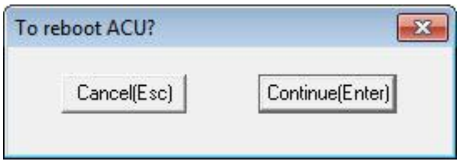
2. To confirm, click **OK (Enter)**.

   The system initializes the `IMU` and the `PEDESTAL`'s X, Y, and Z `ENCODERS`. The message 'Auto Restart in Progress' appears in the **System Messages** window, and a 6-minute countdown begins. After the countdown is finished, the system locks on the last saved satellite.

You cannot operate the system while Restart is in progress.

➢ **To reboot the CCU:**

1. From the **Operation Screen**, open the **Commands** menu and select **Reboot**. A confirmation message box appears.



2. To confirm, click **OK (Enter)**.

   The `CCU` reboots.

Use the **Reboot** command after upgrading system software.

6.2.5 Manually Adjusting the System

The following adjustments may be made in response to conditions encountered during system operation.

Warning!

The OrSat™ AL-7103 Maritime Satellite Communication System is pre-configured and tested before it is shipped. Tampering with any of the system settings that are not explicitly mentioned in this manual can impair the functioning of the system.

Setting the Ship's Heading

If the ship uses a Step-By-Step compass, or if the compass becomes inactive or unconnected (for example: during system installation), you need to set the ship's heading manually.

➢ **To set the heading:**

1. Put the ANTENNA into Stand-by Mode (for instructions, see **Stand-by Mode** on page 141).
2. From the **Operation Screen**, open the **Commands** menu and select **Set Compass**. The **Ship Heading** dialog box appears.

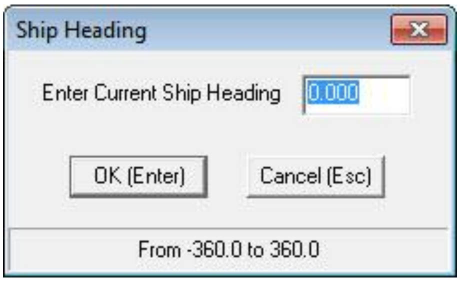


Figure 6-11: Ship Heading dialog box

3. Do **one** of the following:
    - For an incremental compass (Step-by-Step, Synchro 36:1, Synchro 360:1), enter a start value in the **Enter Current Ship Heading** field.
    - For an absolute compass (NMEA-0183, Synchro 1:1), a default compass value may be entered (for example: during ANTENNA commissioning). This value will be used until a valid compass update is received.
4. To confirm, click **OK (Enter)**.

The ship's heading is updated in the **Compass** field of the **Ship Coordinates** window.

Figure 6-12: Ship Coordinates window

Setting the GPS Position

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

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

1. From the **Operation Screen**, open the **Commands** menu and select **Set GPS**. **The Set GPS** dialog box appears.

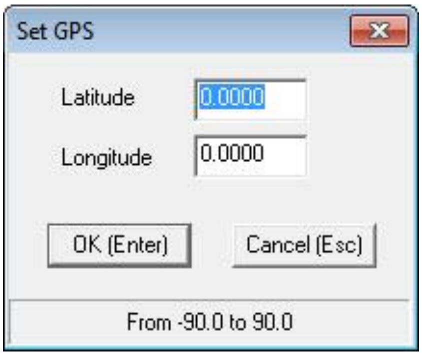


Figure 6-13: Set GPS dialog box

2. Enter values in the **Latitude** and **Longitude** fields.

   The latitude and longitude angles are entered in decimal format. When calculating decimal values remember that 1° of arch is divided into 60 minutes, which are in turn divided into 60 seconds. Therefore, each degree of arch contains 3600 seconds.

For example, 32.5125° of latitude are equivalent to 32° + 0.5125 ×3600 = 1845 seconds. 1845 seconds equal 1845 ÷ 60 = 30 minutes and 45 seconds. 32.5125° of latitude are therefore equivalent to 32° 30 minutes and 45 seconds North (the positive latitude value indicates that the position is north of the equator).

Similarly, -128.7523° of longitude is equivalent to 128° 45 minutes and 8 seconds West (the negative longitude value indicates that the position is west of the Greenwich Meridian).

3. To confirm, click **OK (Enter)**.

   The new values are updated in the **Lat** and **Long** fields in the **Ship Coordinates** window.

Figure 6-14: Ship Coordinates window

Clearing the GPS

It is sometimes necessary to initialize the GPS data when a GPS-related error message is received.

➢ **To clear the GPS:**

1. From the **Operation Screen**, open the **Commands** menu and select **Clear GPS**. A warning message box appears.
2. To confirm, click **OK (Enter)**.

   The `GPS RECEIVER` is reset. All GPS readings will be lost for a few minutes, until the GPS signal is re-acquired.

Setting the AGC Threshold

The OrSat™ system is supplied from the factory with noise-floor correction calibrated and activated. AGC values are set to a constant value of -75dBm.

If for some reason noise-floor correction is deactivated, or the operator wants to introduce a user-defined threshold, the threshold level can be set manually.

➢ **To set the AGC threshold:**

1. From the **Operation Screen**, open the **Commands** menu and select **Set Threshold**. The **Set Threshold Level** dialog box appears.

Figure 6-15: Set Threshold Level dialog box

2. Enter a new value in the **Threshold Level, dBm** field, according to the following guidelines:
   - The threshold level should be at least 3dB higher than the off-satellite noise background. To check the off-satellite noise, move the `ANTENNA` away from the satellite (for example: by activating Stow-up Mode) and check the AGC level.
   - The level should be lower than the selected tracking signal level, but not by more than 7dB.

Note: You can also configure the threshold level in the relevant **Step-Track** configuration dialog box, accessed from the **Config** menu.

---

3. To confirm, click **OK (Enter)**.

   The new threshold level appears in the **AGC (dBm)** window.

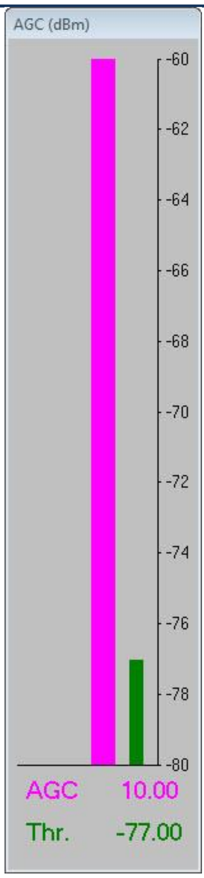


Figure 6-16: AGC (dBm) window

6.2.6 Using the Spectrum Analyzer Screen

The **Spectrum Analyzer Screen (SAS)** is accessed with the **Spectrum** command from both the **Operation Screen** and **Maintenance Screen**.

➢ **To configure the SAS:**

1. Open the **Configuration & View** menu on the **SAS** Menu Bar and select **General Config**. The **Configuration** dialog box appears.

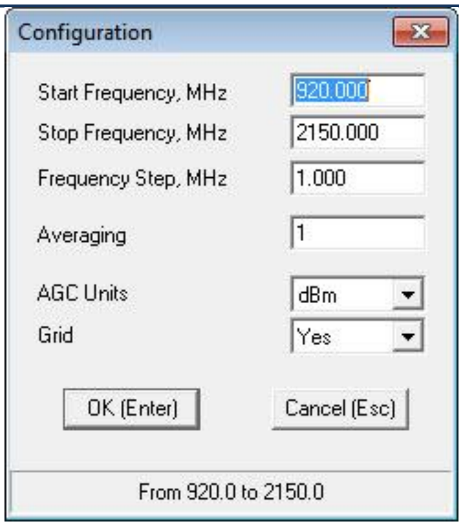


Figure 6-17: Spectrum Analyzer Configuration dialog box

2. Set the start and stop frequencies to the relevant range of measurement (Ku-Band frequencies range between 920 and 2150 MHz).
3. The frequency step is set to 1 MHz by default. You should decrease the frequency step when measuring smaller frequency spans (the minimal step is 0.005 MHz).

The spectral scan may take some time. The time required can be calculated by multiplying the amount of measurements to be performed by 2.5 milliseconds.

The number of measurements is in turn a multiplication of measured points by the selected averaging factor (the minimum value is 8). For example, a scan of 1000 MHz to 1010 MHz with a 0.005 MHz step and an averaging factor of 8 will take 40 seconds (0.0025 × 8 × (1010-1000)/0.005).

The maximum number of measured points is limited to 25,000. If the scan-to-step ratio exceeds this number, an error message is received.

IF filters (which effectively function as the SAS resolution bandwidth) can be set to 50, 150, and 300 KHz bands, depending on the carrier's bandwidth.

➢ **To run a measurement**

1. Make sure the system is not in Step-Track Mode, which deploys the tracking receiver. If the system is in Step-Track Mode, move the system to Peak Mode.
2. Open the **Command** menu and select **Run** (or press <R> from the **SAS**).

Below is an example of an actual satellite signal, consisting of two narrow adjacent carriers.

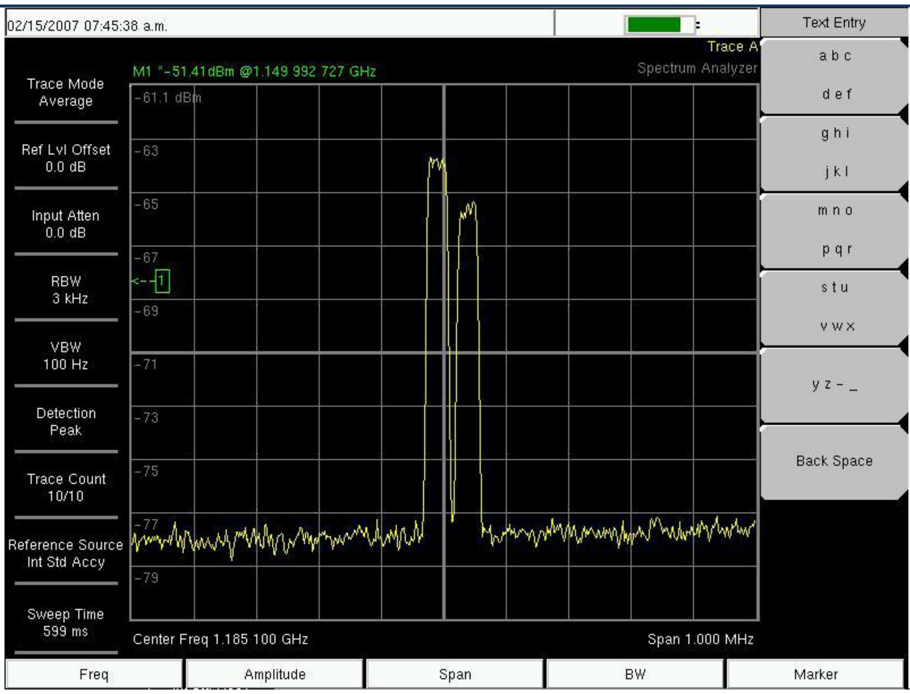


Figure 6-18: Satellite signal displayed on an Anritsu MS2721A Spectrum Analyzer

The following figure displays the same signal taken with a 30 KHz RBW:

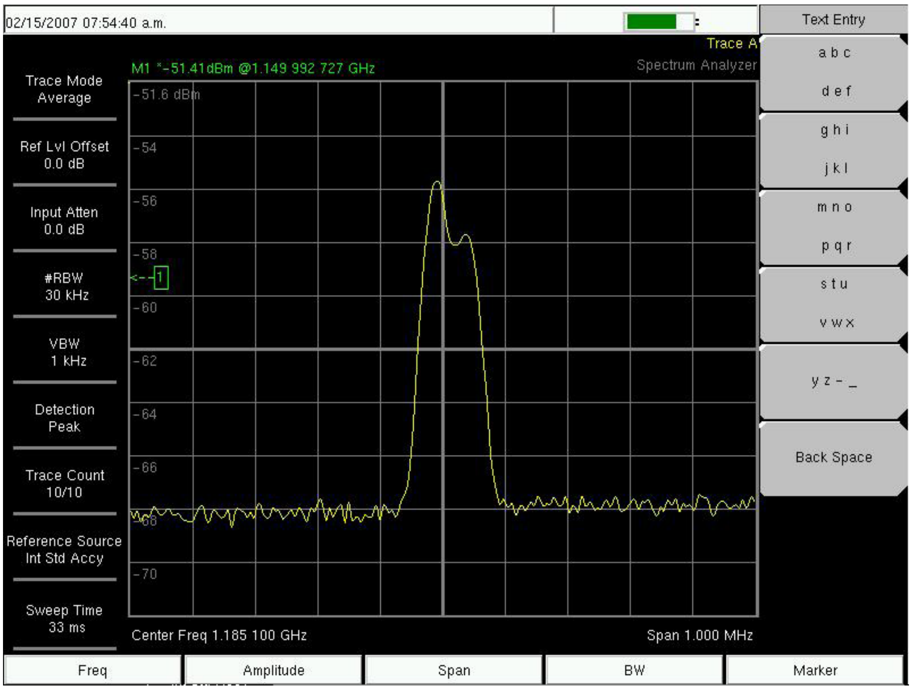


Figure 6-19: Satellite signal displayed on an Anritsu MS2721A Spectrum Analyzer with a 30 KHz RBW

The following figure displays the same signal taken with a 50 KHz RBW:

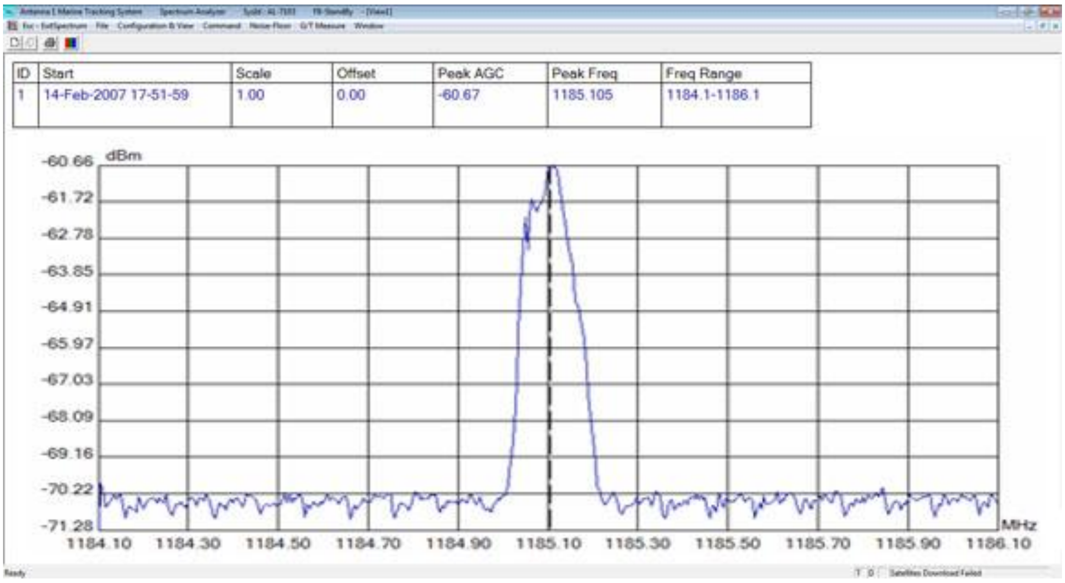


Figure 6-20: Satellite signal displayed on the MtsLink Spectrum Analyzer with a 50 KHz RBW

The following figure displays the same signal taken with a 150KHz RBW:

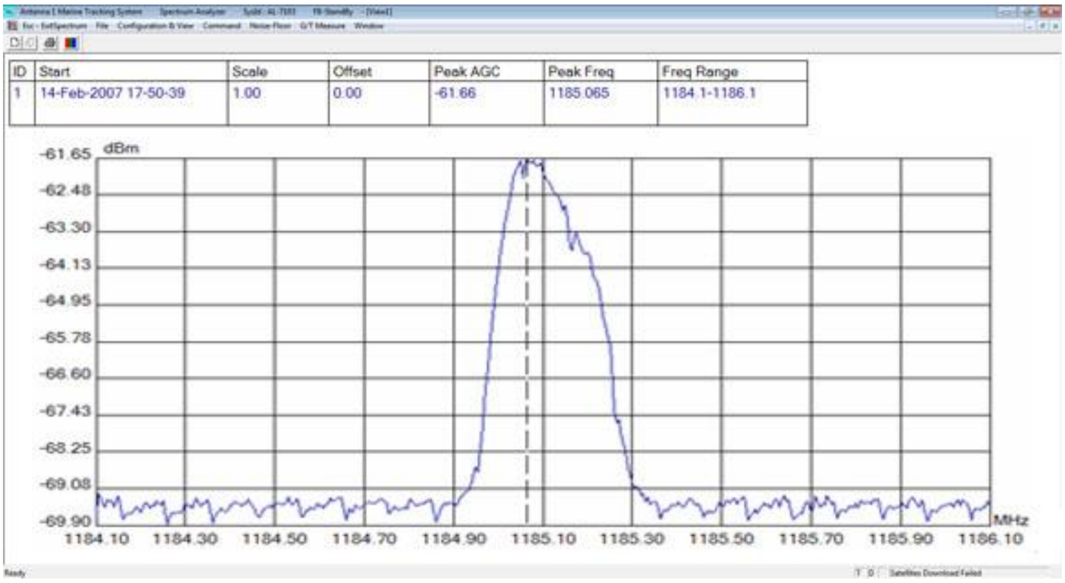


Figure 6-21: Satellite signal displayed on the MtsLink Spectrum Analyzer with a 150 KHz RBW

Wide band scans are also possible, although the scan resolution must be taken into account. In the figure below, a 200 MHz scan is taken on a 300 KHz bandwidth at a resolution of 0.1 MHz with 8-point averaging. This scan will take about a minute.

Figure 6-22: 200MHz signal displayed on the MtsLink Spectrum Analyzer with a 300 KHz RBW

For the purpose of comparison, the figure below displays the same scan on an Anritsu MS2721A Spectrum Analyzer:

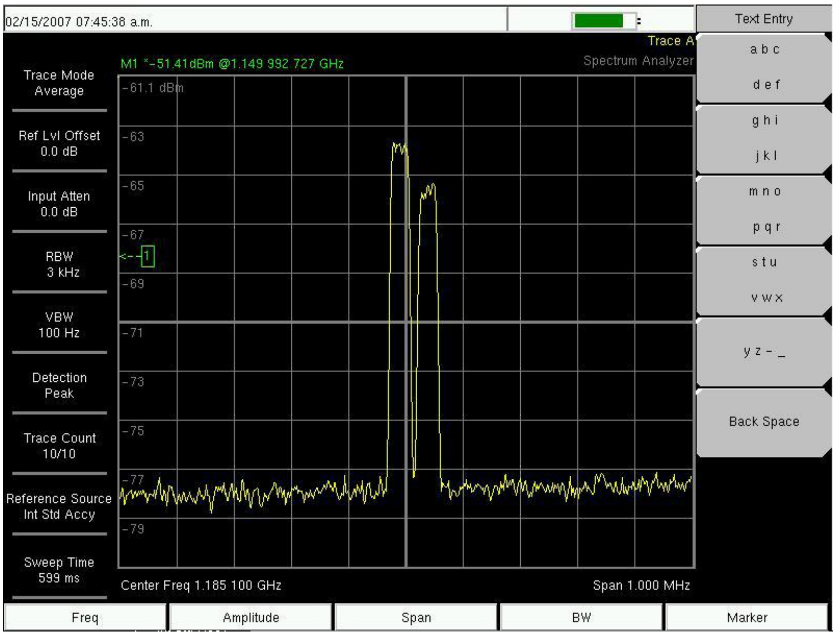


Figure 6-23: 200 MHz signal displayed on Anritsu MS2721A Spectrum Analyzer

6.2.7 Monitoring SBC Voltage and Temperature Test Points

From the **Maintenance Screen**, open the **Config-View** menu and select **Show PowerState**. The **Power Parameters State** window appears.

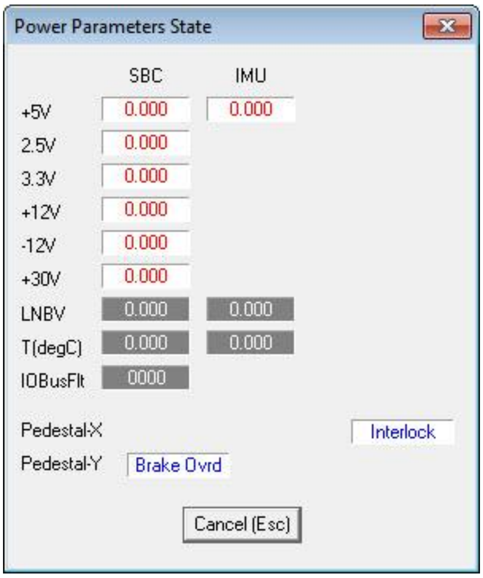


Figure 6-24: Power Parameters State window

In the figure above, test points out of the normal range are highlighted in red on a white background.

Test points may also be recorded in the **Graphic Data Logger** (see below).

6.2.8 Using the Graphic Data Logger

The **Graphic Data Logger** can record up to four simultaneous channels of data for a specified time interval and calculate the mean value and standard deviation for the recorded period. The **Logger** can be configured to sample data at a specific rate – from 1 sample per tick (app. 2 milliseconds) to 1 sample per 20,000 ticks (app. 39 seconds). Each data channel can contain up to 40,960 points. At the fastest sample rate, this allows data to be logged for up to 80 seconds. At the slowest rate, data can be logged for up to 18.5 days.

➢ **To configure the Graphic Data Logger:**

1. Click the **Logger** control on the **Operation Screen** Menu Bar. The **Graphic Data Logger** screen appears.

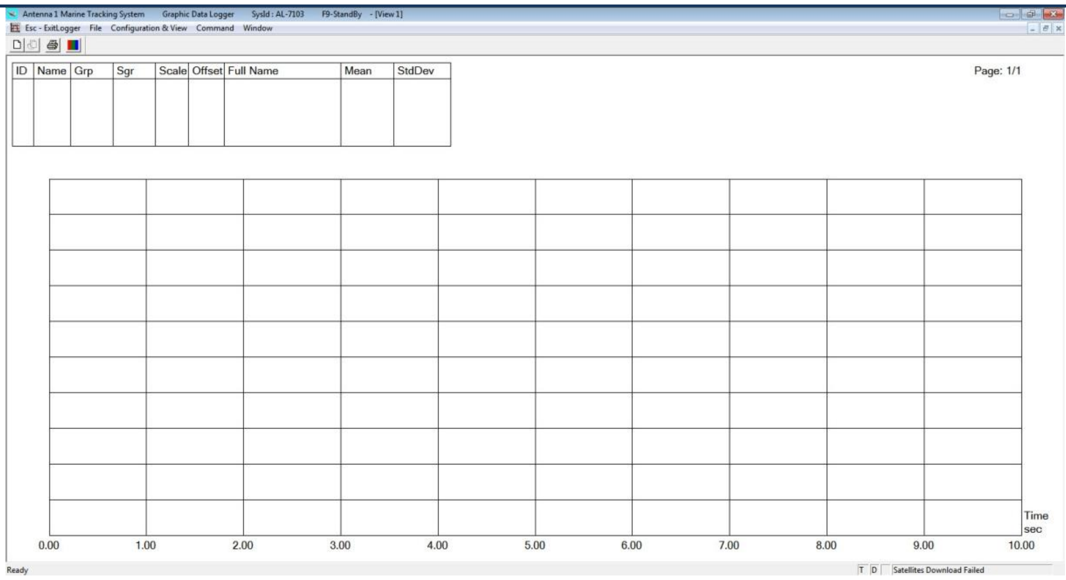


Figure 6-25: Graphic Data Logger

2. Open the **Configuration & View** menu and select **General Config** (or press <C> from the **Logger** screen). The **Logger Configuration** dialog box appears.

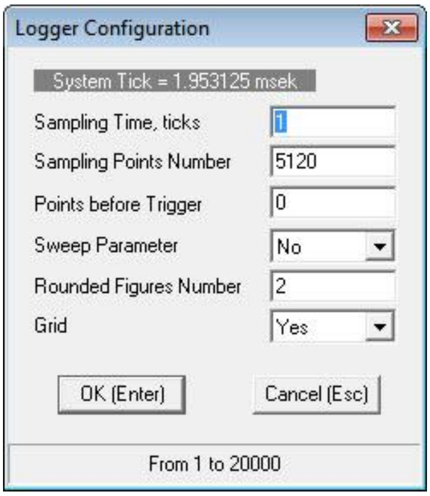


Figure 6-26: Logger Configuration dialog box

3. Set the desired sampling time and sampling points.

When logging data at 1 sample per tick, it is recommended to set the number of points to 30,720, corresponding to 60 seconds of logging time per tick. Consequently, each additional minute represents a single tick.

➢ **To log data:**

1. Open the **Configuration & View** menu and select **Add Parameter** (or press <A>). The **Add Parameter** dialog box appears.

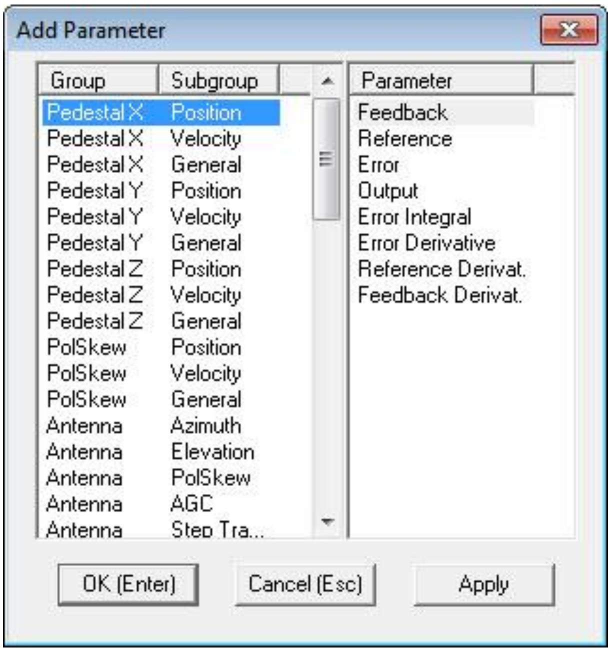


Figure 6-27: Add Parameter dialog box

2. Select a **Group** and **Subgroup** in the left-hand pane (for example: Antenna/Step Tack), then select the **Parameter** you wish to log in the right-hand pane (for example: Azimuth Deviation).

3. Click **OK (Enter)**. The parameter appears in the **Logger** control table.

4. To log additional parameters simultaneously, reopen the **Add Parameter** window and repeat steps 2 and 3 for each parameter. Each parameter appears in the control table highlighted in a different color.

To delete a parameter from the **Logger** control table, open the **Configuration & View** menu and select **Delete** (or press <D> from the **Logger** screen).

ORBIT

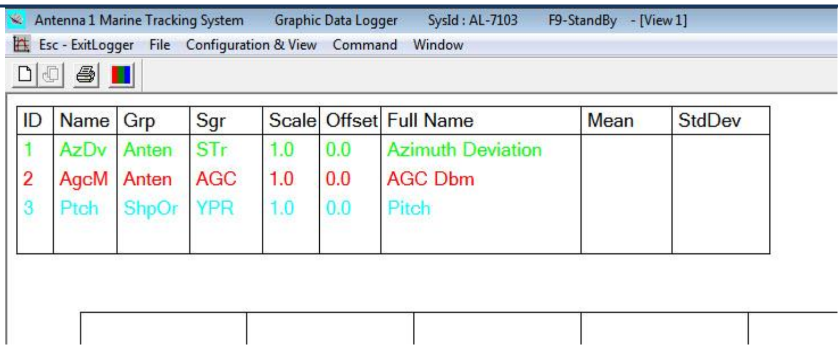


Figure 6-28: Logging multiple parameters

5. Open the **Command** menu and select **Run** (or press <R>). The **Logger** begins recording data.

   A progress bar appears during the logging process, and intermediate results are displayed for measurements that last a considerable time (more than a few minutes).

6. When the defined sampling time is complete, the recorded data appear as curves in the **Logger** display, and the mean value and standard deviation for each parameter appears in the **Mean** and **StdDev** columns of the control table, respectively.

Analyzing and Saving

The **Logger** provides a scaling and offsetting feature that facilitates analysis by making the graphic display more readable. This is particularly useful when logging multiple parameters.

➢ **To scale and offset logged data:**

1. Open the **Configuration & View** menu and select **Scale** (or press <S>). The **Graph Scaling** dialog box appears.

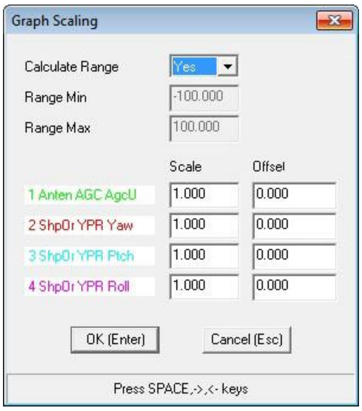


Figure 6-29: Graph Scaling dialog box

2. Use the **Range Min** and **Range Max** fields to define the range of values that you want to display, and the **Scale** and **Offset** values to determine how each parameter appears on the graph. For example, the following figures show the **Logger** display before and after scaling:

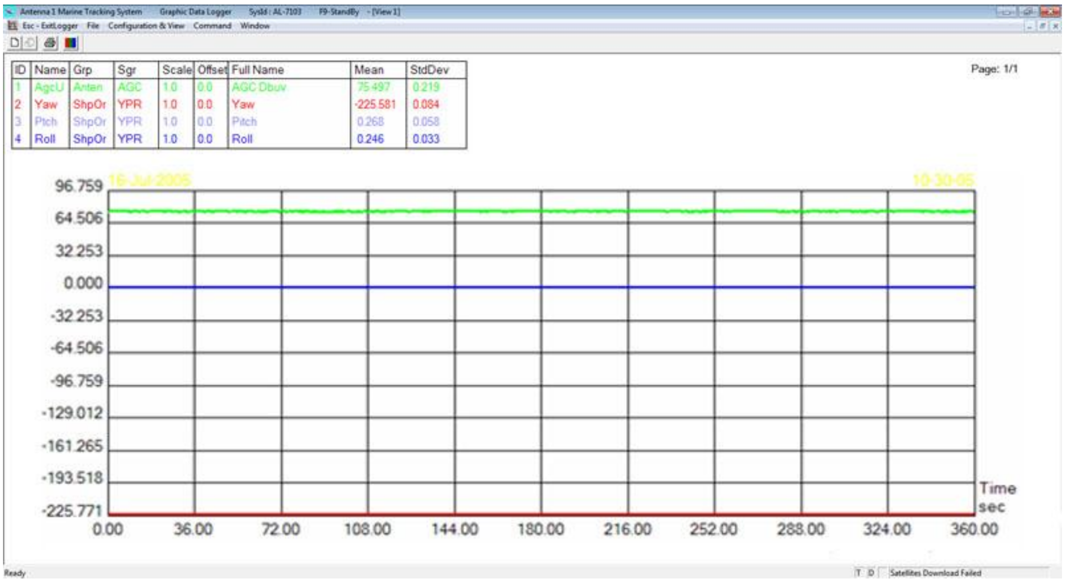


Figure 6-30: Logger results before scaling

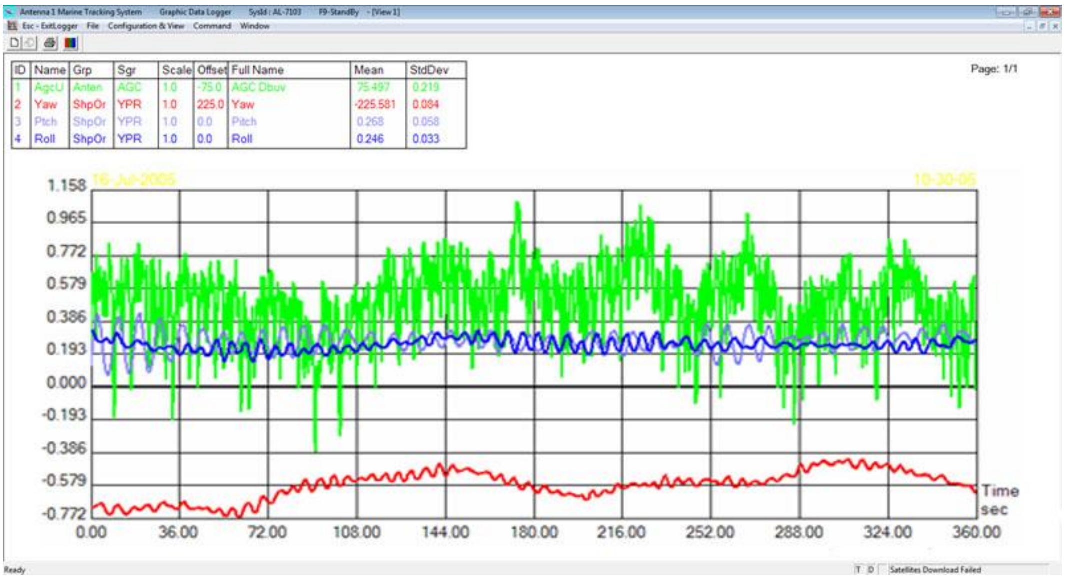


Figure 6-31: Logger results after scaling

In the above example, the Yaw curve was offset by 225.0° and the AGC curve by -75.0dB.

➢ **To save the logged data:**

1. Open the **File** menu and select **Write Graph** (or press <W>).

2. Save one or all parameters to the desired folder.

➢ **To retrieve a data file:**

1. Open the **File** menu and select **Read Graph** (or press <G>).

2. Do one of the following:

    - Select **Replace** to overwrite the data currently displayed
    - Select **Add** to add the saved data to the data currently displayed

➢ **To save the current Logger settings:**

1. Open the **File** menu and select **Save Setup** (or press <V>).

2. Save the current configuration to the desired folder.

➢ **To load saved Logger settings:**

1. Open the **File** menu and select **Restore Setup** (or press <E>).

2. Retrieve the settings file. The **Logger** is automatically configured according to the saved settings.

6.2.9 Saving Parameters in SBC Non-Volatile Memory

The system allows you to choose which parameters will be saved in `SBC` non-volatile memory when you click **OK** to confirm a change in configuration. The **Save Configuration** dialog box, accessed by the **Save** control on the Menu Bar, provides the following options:

Figure 6-32: Save Configuration dialog box

- **Operation –** Only changes made from the **Operation Screen** are saved in `SBC` non-volatile memory.

- **Maintenance –** Only changes made from the **Maintenance Screen** are saved in `SBC` non-volatile memory.
- **System –** Only changes made from the **System** menu on the **Operation Screen** are saved in `SBC` non-volatile memory.
- **Ship Coordinates –** Only changes made in the **Ship Coordinates** window on the **Operation Screen** are saved in `SBC` non-volatile memory.
- **All –** All changes are saved in `SBC` non-volatile memory.

It is recommended to activate the **All** option, so that no important settings are lost when the system shuts down.

6.2.10 Monitoring the MTSLink Work Session

➢ **To determine how long MTSLink has been working continuously:**

- Open the **Host** menu and select **Work Time**. The **Work Time** window appears, displaying the duration of the current MTSLink and ACU (`SBC`) sessions.

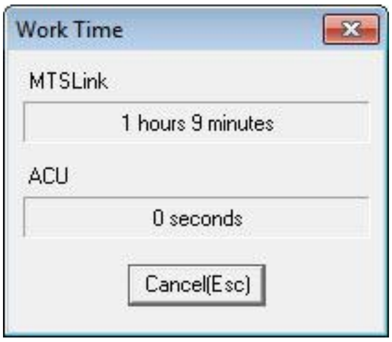
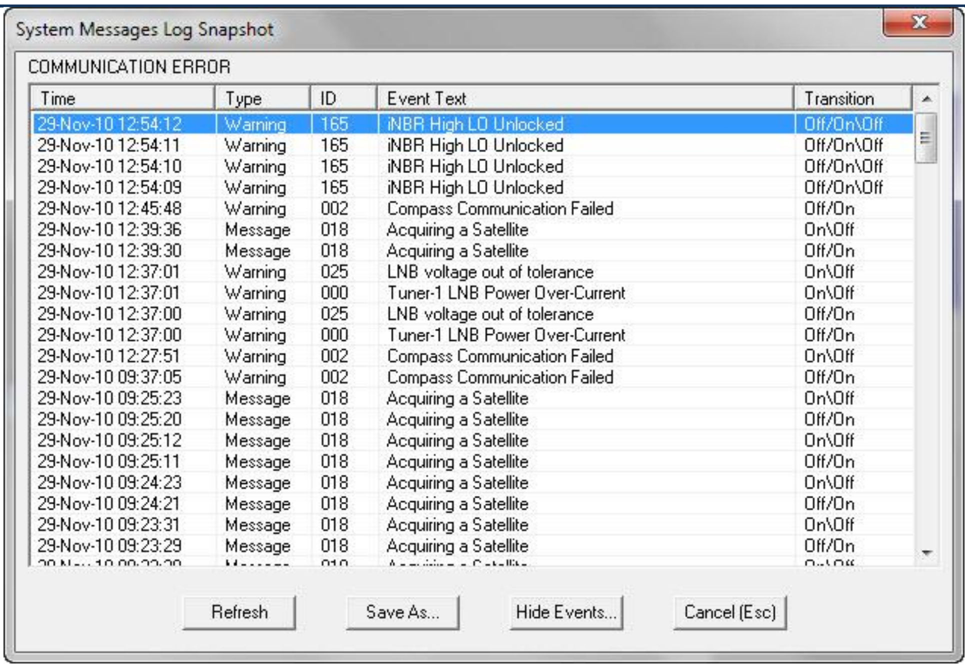


Figure 6-33: Work Time window

6.2.11 System Messages Log

➢ **To view the last 1000 status messages generated by the system:**

Open the **Host** menu, select **System Messages Log**, then select **Show**. The **System Messages Log Snapshot** window appears.



Time	Type	ID	Event Text	Transition
29-Nov-10 12:54:12	Warning	165	iNBR High LO Unlocked	Off/On\Off
29-Nov-10 12:54:11	Warning	165	iNBR High LO Unlocked	Off/On\Off
29-Nov-10 12:54:10	Warning	165	iNBR High LO Unlocked	Off/On\Off
29-Nov-10 12:54:09	Warning	165	iNBR High LO Unlocked	Off/On\Off
29-Nov-10 12:45:48	Warning	002	Compass Communication Failed	Off/On
29-Nov-10 12:39:36	Message	018	Acquiring a Satellite	On\Off
29-Nov-10 12:39:30	Message	018	Acquiring a Satellite	Off/On
29-Nov-10 12:37:01	Warning	025	LNB voltage out of tolerance	On\Off
29-Nov-10 12:37:01	Warning	000	Tuner-1 LNB Power Over-Current	On\Off
29-Nov-10 12:37:00	Warning	025	LNB voltage out of tolerance	Off/On
29-Nov-10 12:37:00	Warning	000	Tuner-1 LNB Power Over-Current	Off/On
29-Nov-10 12:27:51	Warning	002	Compass Communication Failed	On\Off
29-Nov-10 09:37:05	Warning	002	Compass Communication Failed	Off/On
29-Nov-10 09:25:23	Message	018	Acquiring a Satellite	On\Off
29-Nov-10 09:25:20	Message	018	Acquiring a Satellite	Off/On
29-Nov-10 09:25:12	Message	018	Acquiring a Satellite	On\Off
29-Nov-10 09:25:11	Message	018	Acquiring a Satellite	Off/On
29-Nov-10 09:24:23	Message	018	Acquiring a Satellite	On\Off
29-Nov-10 09:24:21	Message	018	Acquiring a Satellite	Off/On
29-Nov-10 09:23:31	Message	018	Acquiring a Satellite	On\Off
29-Nov-10 09:23:29	Message	018	Acquiring a Satellite	Off/On

Figure 6-34: System Messages Log Snapshot

➢ **To remove a specific message or message type from the display:**

1. Click **Hide Events**. The **Hide Events** dialog box appears.

Figure 6-35: Hide Events dialog box

2. Select a type option or enter the Event ID of the specific message you wish to hide.

3. Click **OK (Enter)**. The selected messages are hidden from the **System Messages Log Snapshot** window.

Click the **Refresh** button to update the display with any new messages that do not belong to a category defined as hidden.

➢ **To save the current message log:**

Click **Save As** and save the file to the desired location.

6.2.12 Status Dump

When activated, the Status Dump command generates an ASCII file containing textual information that can be used for system troubleshooting.

➢ **To activate the status dump:**

From the **Operation Screen** (or the **Basic Operation Screen**), open the **Host** menu and select **Status Dump**. A browser window opens, in which you can indicate where to save the file using the **Save as** command. You can save the report to the `CCU` desktop or directly to a disk-on-key.

A typical Status Dump report can be found in the OrBand AL-7107 *Maintenance and Troubleshooting Guide.*

6.2.13 Software Version Details

Click the **Version** control on the **Operation Screen** Menu Bar. The **Version** window appears, displaying the version numbers and dates of the MtsLink and ACU software modules.

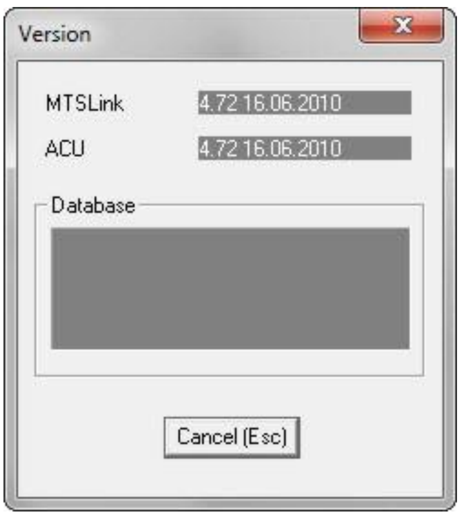


Figure 6-36: Version window

7 Status Messages

7.1 Introduction

The CCU displays system status messages for a variety of purposes. These are classified into three categories, each identified by a different color:

- **Message (informative)** – green (for example: System Shutdown)
- **Warning** – blue (for example: Compass Communication Failed)
- **Error** – red (for example: Pedestal X Axis Encoder Fault).

7.2 Messages (Informative)

Controller Screen Label	Description
`016: Auto-Restart in progress`	The system is undergoing initialization, including IMU init, Encoder init, and, optionally, satellite acquisition.
`018: Acquiring a Satellite`	The system is currently acquiring a satellite.
`020: System Shutdown`	The system was shut down.
`041: System Shut-Down, Ped-X Jammed`	The system was shut down due to a 'Pedestal-X Jammed' fault (Error No. 036).
`042: System Shut-Down, Ped-Y Jammed`	The system was shut down due to 'Pedestal-Y Jammed' fault (Error No. 037).
`045: PolSkew Disabled, Polrz Jammed`	The system was shut down because no movement was recorded when the controller produced a steering command.
`046: System Shut-Down, Ped-X Encoder`	The system was shut down due to a 'Pedestal-X Encoder Fault' (Error No. 008), a 'Pedestal-X NE2 Encoder Fault' (Error No. 104), or a 'Pedestal-X NE2 Enc Init Fault' (Error No. 111).
`047: System Shut-Down, Ped-Y Encoder`	The system was shut down due to a 'Pedestal-Y Encoder Fault' (Error No. 009), a 'Pedestal-Y NE2 Encoder Fault' (Error No. 105), or a 'Pedestal-Y NE2 Enc Init Fault' (Error No. 112).
`059: System Shut-Down, Power Loss`	The system was shut down due to a 'SDU/IMU power out of tolerance' fault (Error No. 015).

Controller Screen Label	Description
060: System Shut-Down, Restrt Time	The system was shut down due to a 'Restart time-out' fault (Error No. 017).
061: System Shut-Down, I/O Power	The system was shut down due to an 'I/O power out of tolerance' fault (Error No. 024).
062: System Shut-Down, CPU Power	The system was shut down due to a 'CPU power out of tolerance' fault (Error No. 022).
063: System Shut-Down, CPU Temprture	The system was shut down due to a 'CPU temperature out of tolerance' fault (Error No. 023).
077: Spectral Correlation in process	The system is currently running a spectral correlation process.
115: Dig Recognition in process	The system is currently running a digital recognition process.
116: Frequency Scan…	The system is currently scanning for a tracking frequency.
117: IRD Validation in process	IRD is being re-validated during a Step-track operation. **Note:** This message is presented for a very short time and is barely visible on the controller screen.
120: System Shut-Down, Ped-Z Jammed	The system was shut down due to a 'Pedestal-Z Jammed' fault (Error No. 119).
122: System Shut-Down, SBC Power/Tempr	The system was shut down due to a 'SBC Pwr/Tmpr out of tolerance' fault (Error No. 121).
125: System Shut-Down, Ped-Z Encoder	The system was shut down due to a 'Pedestal-Z NE2 Encoder Fault' (Error No. 106) or a 'Pedestal-Z NE2 Enc Init Fault' (Error No. 113).
132: System Shut-Down, SDM-X Power	The system was shut down due to a 'SDM-X Servo Power Loss' fault (Error No. 126).
133: System Shut-Down, SDM-Y Power	System was shut down due to 'SDM-Y Servo Power Loss' fault (Error No. 127).
134: System Shut-Down, SDM-Z Power	System was shut down due to 'SDM-Z Servo Power Loss' fault (Error No. 128).
135: System Shut-Down, SDM-X Drv Flt	The system was shut down due to an 'SDM-X Stepper Driver Fault' (Error No. 129).
136: System Shut-Down, SDM-Y Drv Flt	The system was shut down due to an 'SDM-Y Stepper Driver Fault' (Error No. 130).

Controller Screen Label	Description
137: System Shut-Down, SDM-Z Drv Flt	The system was shut down due to an 'SDM-Z Stepper Driver Fault' (Error No. 131).
141: System Halted, Axes Jammed	The system has been halted due to multiple jammed-axis faults (more than 6 within 2 minutes).
142: X NE2 Checked OK	The X-Axis NE2 encoder passed the self test.
143: X NE2 Check Failed, Test Halted	The X-Axis NE2 encoder failed the self test.
144: Y NE2 Checked OK	The Y-Axis NE2 encoder passed the self test.
145: Y NE2 Check Failed, Test Halted	The Y-Axis NE2 encoder failed the self test.
146: Z NE2 Checked OK	The Z-Axis NE2 encoder passed the self test.
147: Z NE2 Check Failed, Test Halted	The Z-Axis NE2 encoder passed the self test.
154: Ax-X Ne2 Enc Reg Read Failed	During initialization of the Axis-X Ne2 encoder, one of the registers was not read correctly (CRC check failed). If not accompanied by another Warning or Error Message, this message is strictly informative, as the register is automatically re-read.
155: Ax-Y Ne2 Enc Reg Read Failed	During initialization of the Axis-Y Ne2 encoder, one of the registers was not read correctly (CRC check failed). If not accompanied by another Warning or Error Message, this message is strictly informative, as the register is automatically re-read.
156: Ax-Z Ne2 Enc Reg Read Failed	During initialization of the Axis-Z Ne2 encoder, one of the registers was not read correctly (CRC check failed). If not accompanied by another Warning or Error Message, this message is strictly informative, as the register is automatically re-read.
157: Ax-X Ne2 Enc Reg Write Failed	During initialization of the Axis-X Ne2 encoder, writing to one of its registers has failed. If not accompanied by another Warning or Error Message, this message is strictly informative, as the register is automatically re-written.
158: Ax-Y Ne2 Enc Reg Write Failed	During initialization of the Axis-Y Ne2 encoder, writing to one of its registers has failed. If not accompanied by another Warning or Error Message, this message is strictly informative, as the register is automatically re-written.

Controller Screen Label	Description
159: Ax-Z Ne2 Enc Reg Write Failed	During initialization of the Axis-Z Ne2 encoder, writing to one of its registers has failed. If not accompanied by another Warning or Error Message, this message is strictly informative, as the register is automatically re-written.
160: Ax-X Ne2 Enc M-by-N Calc Failed	The X-Axis NE2 encoder failed in ratio calculation.
161: Ax-Y Ne2 Enc M-by-N Calc Failed	The X-Axis NE2 encoder failed in ratio calculation.
162: Ax-Z Ne2 Enc M-by-N Calc Failed	The X-Axis NE2 encoder failed in ratio calculation.
163: iNBR Validation in process	The NBR is being re-validated during a Step-track operation. **Note:** That this message is presented for a very short time and is barely visible on the controller screen.

7.3 Warning Messages

Controller Screen Label	Description
WRN 000: Tuner-1 LNB Power Over-Current	The Controller 13/18VDC power supply feeding the LNB is overloaded.
WRN 002: Compass Communication Failed	No communication with the compass.
WRN 003: GPS Communication Failed	No communication with the GPS ANTENNA.
WRN 004: No GPS Position Updates	No GPS position.
WRN 005: Incorrect BUC Firmware Version	An incorrect BUC firmware version was detected.
WRN 006: Illegal Step-by-Step Compass	Illegal Step-by-Step compass.
WRN 007: Synchro Compass Fault	A fault related to the Synchro compass was detected.
WRN 019: System not initialized	The AL-7103 did not undergo initialization, including all axes Encoder init and IMU init.
WRN 021: AXIS IMITATION	The system is in Axis Imitation Mode.

Controller Screen Label	Description
WRN 025: LNB voltage out of tolerance	The Controller 13/18VDC power supply feeding the LNB is exceeding its predefined tolerance levels.
WRN 033: Antenna view blocked	The antenna has moved into one of the predefined blockage areas.
WRN 070: IMU-ACU Communication fault	Communication between the IMU and the Controller has timed-out.
WRN 071: RG-X Drift above normal	The IMU's rate gyro X developed a drift above the normal.
WRN 072: RG-Y Drift above normal	The IMU's rate gyro Y developed a drift above the normal.
WRN 073: RG-Z Drift above normal	The IMU's rate gyro Z developed a drift above the normal.
WRN 074: No Tracking, Wait UTC	The system is waiting for a Coordinated Universal Time update to start tracking.
WRN 075: UTC From Internal Clock	The Coordinated Universal Time update is based on the internal CPU clock.
WRN 076: UTC Update Timeout	The Coordinated Universal Time update is timed out.
WRN 078: Tuner Initialization Error	Wideband tuner initialization error.
WRN 079: Tuner Operation Error	Wideband tuner operation error.
WRN 101: Satellite Database is Truncated	The satellite database file is truncated.
WRN 102: Receiver Cal Table not Found	The SBC could not find the internal wide-band receiver linearization calibration file in its Flash memory (disk C:\), on power-up.
WRN 107: Pedestal X Ne2 Debug mode	The Pedestal-X NE2 encoder is in debug mode.
WRN 108: Pedestal Y Ne2 Debug mode	The Pedestal-Y NE2 encoder is in debug mode.
WRN 109: Pedestal Z Ne2 Debug mode	The Pedestal-Z NE2 encoder is in debug mode.
WRN 138: BUC L-Band Cal Table not Found	The SBC could not find the ADMx (BUC Input) analogue detector linearization calibration file in its Flash memory (disk C:\), on power-up. **Note:** This Warning is only issued if the BUC L-Band Power indicator is enabled.

Controller Screen Label	Description
WRN 140: 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 an unconnected PolSwitch.
WRN 148: X-Axis Forward Limit	The position encoder readout of the X-axis exceeded its Forward Limit configuration definition.
WRN 149: X-Axis Reverse Limit	The position encoder readout of the X-axis exceeded its Reverse Limit configuration definition.
WRN 150: Y-Axis Forward Limit	The position encoder readout of the Y-axis exceeded its Forward Limit configuration definition.
WRN 151: Y-Axis Reverse Limit	The position encoder readout of the Y-axis exceeded its Reverse Limit configuration definition.
WRN 152: Z-Axis Forward Limit	The position encoder readout of the Z-Axis exceeded its Forward Limit configuration definition.
WRN 153: Z-Axis Reverse Limit	The position encoder readout of the Z-Axis exceeded its Reverse Limit configuration definition.
WRN 164: iNBR Interface not recognized	NBR interface card is not present or recognized.
WRN 165: iNBR High LO Unlocked	High local oscillator of the NBR is unlocked.
WRN 166: iNBR Low LO Unlocked	Low local oscillator of the NBR is unlocked.
WRN 167: Tracking Error Exceeds Limit	Tracking errors exceed the predefined limit.
WRN 169: GPS Antenna Not Connected	The GPS antenna cable is not connected to the GPS port on the SBC panel.
WRN 173: BUC Tx Stopped	BUC transmission has been stopped by the Controller.
WRN 174: External Stow Switch: ON	An external Stow switch is in ON position.
WRN 178: Not supported 22KHz or DiSEqC	The system's SBC does not support 22kHz tone or DiSEqC.
WRN 179: NBR Powr/Tempr out of tolerance	The NBR's power supply/temperature is exceeding its predefined tolerance levels.

Controller Screen Label	Description
WRN 180: No Noise Floor Table	The LNB noise floor level is not calibrated.
WRN 181: No Communication with BUC	No valid communication with BUC.
WRN 182: Ax-X Ne2 Enc Parameters Changed	The X Axis NE2 encoder parameters have changed.
WRN 183: Ax-Y Ne2 Enc Parameters Changed	The Y Axis NE2 encoder parameters have changed.
WRN 184: Ax-Z Ne2 Enc Parameters Changed	The Z Axis NE2 encoder parameters have changed.

7.4 Error Messages

Controller screen label	Description
ERR 015: SDU/IMU Power out of tolerance	The IMU +5VDC or the Servo Drive power indications exceeded the predefined tolerance limits.
ERR 017: Restart timed out (REBOOTING)	The system was not able to complete the restart routine in the predefined time (normally set to 10 minutes).
ERR 022: CPU power out of tolerance	The CPU's power supply is exceeding its predefined tolerance levels.
ERR 023: CPU Temp out of tolerance	The CPU's temperature is exceeding its predefined tolerance levels.
ERR 024: I/O power out of tolerance	The I/O's power supply is exceeding its predefined tolerance levels.
ERR 034: I/O card not recognized	The SBC card is not recognized by the software.
ERR 036: Pedestal X Axis Jammed	No movement is recorded from the Pedestal's X-Axis encoder, while the controller produces a steering command.
ERR 037: Pedestal Y Axis Jammed	No movement is recorded from the Pedestal's Y-Axis encoder, while the controller produces a steering command.
ERR 040: Polarizer Axis Jammed	No movement is recorded from the Polarizer, while the controller produces a steering command.

Controller screen label	Description
ERR 053: No Maintenance Config. File	The SBC could not find the Maintenance Configuration file in its Flash memory (disk C:\) on power-up.
ERR 054: No Operational Config. File	The SBC could not find the Operational Modes Configuration file in its Flash memory (disk C:\) on power-up.
ERR 055: No Satellites Database File	The SBC could not find the Satellite Database file in its Flash memory (disk C:\) on power-up.
ERR 056: No Selected Satellite File	The SBC could not find the selected satellite file in its Flash memory (disk C:\) on power-up.
ERR 057: No System Configuration File	The SBC could not find the System Parameters Configuration file in its Flash memory (disk C:\) on power-up.
ERR 058: No Valid IMU Calibration File	The SBC could not find the IMU Calibration file in its Flash memory (disk C:\) on power-up.
ERR 100: Satellite File Read Error	The SBC could not read the Satellite Database file from its Flash memory (disk C:\) during operation.
ERR 104: Pedestal X NE2 Encoder Fault	The BiSS digital communication protocol with the axis-X NE2 encoder has a more than 10% failure rate.
ERR 105: Pedestal Y NE2 Encoder Fault	The BiSS digital communication protocol with the axis-Y NE2 encoder has a more than 10% failure rate.
ERR 106: Pedestal Z NE2 Encoder Fault	The BiSS digital communication protocol with the axis-Z NE2 encoder has a more than 10% failure rate.
ERR 111: Pedestal X NE2 Enc Init Fail	Axis-X NE2 encoder initialization has failed.
ERR 112: Pedestal Y NE2 Enc Init Fail	Axis-Y NE2 encoder initialization has failed.
ERR 113: Pedestal Z NE2 Enc Init Fail	Axis-Z NE2 encoder initialization has failed.
ERR 119: Pedestal Z Axis Jammed	No movement is recorded from the Pedestal’s Z-Axis encoder, while the controller produces a steering command.

Controller screen label	Description
ERR 121: SBC Pwr/Tempr out of tolerance	One of the SBC power indications (+5v,+/-12v,+2.5v etc.) exceeded the predefined tolerance limits. **Note:** This error also appears when the SBC internal temperature exceeds its tolerance limits.
ERR 126: SDM-X Servo Power Loss	SDM-X Power is down or disconnected.
ERR 127: SDM-Y Servo Power Loss	SDM-Y Power is down or disconnected.
ERR 128: SDM-Z Servo Power Loss	SDM-Z Power is down or disconnected.
ERR 129: SDM-X Stepper Driver Fault	The SDM-X Stepper Driver Fault indicator is on (red). **Note:** This is only relevant to IM805 drivers.
ERR 130: SDM-Y Stepper Driver Fault	The SDM-Y Stepper Driver Fault indicator is on (red). **Note:** This is only relevant to IM805 drivers.
ERR 131: SDM-Z Stepper Driver Fault	The SDM-Z Stepper Driver Fault indicator is on (red). **Note:** This is only relevant to IM805 drivers.
ERR 168: I/O Bus Fault	The I/O bus between the CPU and SBC is faulty.

8 Appendix A: MIB for the Antenna Control Unit

Object ID	Node Name	Description
nodeMarineSatcom 1	Acu7103	MIB for Antenna Control Unit of Marine Satellite Communication System AL-7103
nodeAcu7103 1	od	Operating Dynamic Data
nodeOd 1	odMode	SET operation assigns new operating mode GET operation returns current operating mode
	Mode	**String**
	Stand-by	halt
	Manual	man
	Restart	rest
	Preset	pset
	Search	srch
	Peak	peak
	Step-Track	stept
	Pnt-to-Sat	pntsat
	Enc Init	enci
	Acquire	acqr
	Test Trajectory	tst2
	Stow	stow
	Stow-up	stup
	Maintenance	maint
	Sat. Preset	satpr
	Shut Down	shdwn
	Slave	slv
	Acquire Satellite (Preset)	acqs

Object ID	Node Name	Description
	IMU Sn Clb	snclb
	IMU IL Clb	ilclb
	IMU IL Chk	ilchk
	IMU Sn Chk	snchk
	IMU Chk	imuchk
	IMU AutoClb	autoclb
	IMU EncOffs	imuencof
	IMU EncInit	imuencin
	IMU Stp	imustep
	IMU RnC	imurcl
	ProgTrack	progtr
	AcqPrTrack	aprgtr
	StepToAcqr	stepacq
	JammRelease	jmmrls
nodeOd 2	odSms	System Messages
nodeOdSms 1	odSmsAll	GET operation returns a hexadecimal value reflecting the state of all system messages, according to their ID.
	ID	**Message**
	0	Tuner-1 LNB Power Over-Current
	1	Tuner-2 LNB Power Over-Current
	2	Compass Communication Failed
	3	GPS Communication Failed
	4	No GPS Position Updates
	5	Incorrect BUC Firmware Version
	6	Illegal Step-by-Step Compass
	7	Synchro Compass Fault

Object ID	Node Name	Description
	8	Pedestal X Axis Encoder Fault
	9	Pedestal Y Axis Encoder Fault
	10	IMU X Axis Encoder Fault
	11	IMU Y Axis Encoder Fault
	12	
	13	
	14	
	15	SDU/IMU power out of tolerance
	16	Auto-Restart in progress
	17	Restart timed out (REBOOTING)
	18	Acquiring a Satellite
	19	System not initialized
	20	System Shutdown
	21	AXIS IMITATION
	22	CPU Power out of tolerance
	23	CPU Temp out of tolerance
	24	I/O Power out of tolerance
	25	LNB voltage out of tolerance
	26	Pedestal X motor overheat
	27	Pedestal Y motor overheat
	28	Pedestal X interlock open
	29	Pedestal Y interlock open
	30	
	31	Pedestal X brakes override
	32	Pedestal Y brakes override
	33	Antenna view blocked

Object ID	Node Name	Description
	34	I/O card not recognized
	35	
	36	Pedestal X Axis Jammed
	37	Pedestal Y Axis Jammed
	38	IMU X Axis Jammed
	39	IMU Y Axis Jammed
	40	Polarizer Axis Jammed
	41	System Shut-Down, Ped-X Jammed
	42	System Shut-Down, Ped-Y Jammed
	43	
	44	
	45	PolSkew Disabled, Polrz Jammed
	46	System Shut-Down, Ped-X Encoder
	47	System Shut-Down, Ped-Y Encoder
	48	
	49	
	50	
	51	
	52	COM Port - TCP/IP Bridge
	53	No Maintenance Config. File
	54	No Operational Config. File
	55	No Satellites Database File
	56	No Selected Satellite File
	57	No System Configuration File
	58	No Valid IMU Calibration File

Object ID	Node Name	Description
	59	System Shut-Down, Power Loss
	60	System Shut-Down, Restrt Timout
	61	System Shut-Down, I/O Power
	62	System Shut-Down, CPU Power
	63	System Shut-Down, CPU Temprture
	64	
	65	
	66	
	67	
	68	ShutDown, Extreme Sea Conditions
	69	Signal below threshold
	70	IMU-ACU Communication Fault
	71	RG-X Drift above normal
	72	RG-Y Drift above normal
	73	RG-Z Drift above normal
	74	No Tracking, Wait UTC
	75	UTC From Internal Clock
	76	UTC Update Timeout
	77	Spectral Correlation in process
	78	Tuner Initialization Error
	79	Tuner Operation Error
	80	
	81	
	82	
	83	

Object ID	Node Name	Description
	84	
	85	
	86	
	87	
	88	
	89	
	90	
	91	
	92	
	93	
	94	
	95	
	96	
	97	
	98	
	99	
	100	Satellite File Read Error
	101	Satellite Database is Truncated
	102	Receiver Cal Table not Found
	103	
	104	Pedestal X NE2 Encoder Fault
	105	Pedestal Y NE2 Encoder Fault
	106	Pedestal Z NE2 Encoder Fault
	107	Pedestal X Ne2 Debug mode
	108	Pedestal Y Ne2 Debug mode
	109	Pedestal Z Ne2 Debug mode

Object ID	Node Name	Description
	110	
	111	Pedestal X NE2 Enc Init Fail
	112	Pedestal Y NE2 Enc Init Fail
	113	Pedestal Z NE2 Enc Init Fail
	114	GPS Pulse per Second
	115	Dig Recognition in process
	116	Frequency Scan...
	117	IRD Validation in process
	118	Satellite Recognition Running
	119	Pedestal Z Axis Jammed
	120	System Shut-Down, Ped-Z Jammed
	121	SBC Pwr/Tempr out of tolerance
	122	System Shut-Down, SBC Pwr/Tempr
	123	SDM-X Servo Power Loss
	124	SDM-Y Servo Power Loss
	125	System Shut-Down, Ped-Z Encoder
	126	SDM-X Servo Power Loss
	127	SDM-Y Servo Power Loss
	128	SDM-Z Servo Power Loss
	129	SDM-X Stepper Driver Fault
	130	SDM-Y Stepper Driver Fault
	131	SDM-Z Stepper Driver Fault
	132	System Shut-Down, SDM-X Power
	133	System Shut-Down, SDM-Y Power
	134	System Shut-Down, SDM-Z Power
	135	System Shut-Down, SDM-X Drv Flt

Object ID	Node Name	Description
	136	System Shut-Down, SDM-Y Drv Flt
	137	System Shut-Down, SDM-Z Drv Flt
	138	UC L-Band Cal Table not Found
	139	BUC Rf Monitor Table not Found
	140	PolSwitch Not Connected
	141	System Halted, Axes Jammed
	142	X NE2 Checked OK
	143	X NE2 Check Failed, Test Halted
	144	Y NE2 Checked OK
	145	Y NE2 Check Failed, Test Halted
	146	Z NE2 Checked OK
	147	Z NE2 Check Failed, Test Halted
	148	X-Axis Forward Limit
	149	X-Axis Reverse Limit
	150	Y-Axis Forward Limit
	151	Y-Axis Reverse Limit
	152	Z-Axis Forward Limit
	153	Z-Axis Reverse Limit
	154	Ax-X Ne2 Enc Reg Read Failed
	155	Ax-Y Ne2 Enc Reg Read Failed
	156	Ax-Z Ne2 Enc Reg Read Failed
	157	Ax-X Ne2 Enc Reg Write Failed
	158	Ax-Y Ne2 Enc Reg Write Failed
	159	Ax-Z Ne2 Enc Reg Write Failed
	160	Ax-X Ne2 Enc M-by-N Calc Failed
	161	Ax-Y Ne2 Enc M-by-N Calc Failed

Object ID	Node Name	Description
	162	Ax-Z Ne2 Enc M-by-N Calc Failed
	163	iNBR Validation in process
	164	iNBR Interface not recognized
	165	iNBR High LO Unlocked
	166	iNBR Low LO Unlocked
	167	Tracking Error Exceeds Limit
	168	I/O Bus Fault
	169	GPS Antenna Not Connected
	170	
	171	
	172	
	173	BUC TX Stopped
	174	External Stow Switch: ON
	175	
	176	
	177	
	178	Not supported 22KHz or DiSEqC
	179	NBR Powr/Tempr out of tolerance
	180	No Noise Floor Table
	181	No Communication with BUC
	182	Ax-X Ne2 Enc Parameters Changed
	183	Ax-Y Ne2 Enc Parameters Changed
	184	Ax-Z Ne2 Enc Parameters Changed
nodeOd 3	odAgc	AGC
OdAgc 1	odAgcM	Current AGC value in dBm
nodeOd 4	odAntpos	Antenna Position

Object ID	Node Name	Description
nodeOdAntpos 1	odAntposAz	Current Antenna Azimuth
nodeOdAntpos 2	odAntposEl	Current Antenna Elevation
nodeOdAntpos 3	odAntposPol	Current Polarization Skew
nodeOd 5	odShipc	Ship Coordinates
nodeOdShipc 1	odShipcLat	Current Ship Coordinates: Latitude
nodeOdShipc 2	odShipcon	Current Ship Coordinates: Longitude
nodeOd 6	odShipm	Ship Motion
nodeOdShipm 1	odShipmPit	Current Ship Motion: Pitch
nodeOdShipm 2	odShipmRol	Current Ship Motion: Roll
nodeOdShipm 3	odShipmYaw	Current Ship Motion: Yaw
nodeOd 7	odPolst	Current Polarization Status
nodeAcu7103 2	os	Operating Static Data
nodeOs 1	osSatset	Satellite Preset
nodeOsSatset 1	osSatsetLon	Satellite Preset Geostationary Arch Longitude Command (interval: -180.0 – 180.0; resolution: 0.1°)
nodeOs 2	osPolcmd	Polarization Status Command
	Setting	**String**
	Horizontal (HL-LHCP)	hl
	Vertical (VL-RHCP)	Vl
nodeAcu7103 3	sc	System Configuration
nodeSc 1	scComp	Compass
nodeScComp 1	scCompOfs	Compass Offset Command (interval: -180.0 – 180)
nodeAcu7103 5	ms	Maintenance Static Data

Object ID	Node Name	Description
nodeMs 1	msRcv	Receiver
nodeMsRcv 1	msRcvFreq	L-Band Tracking Frequency Command (interval: 920.000 – 2150.000
nodeMsRcv 2	msRcvIffr	If-Band Tracking Frequency Command (interval: 60.000 – 150.000
nodeMsRcv 3	msRcvLnb	Set `LNB` Command, according to setting.
	Setting	**String**
	13v00KHz	1300
	13v22KHz	1322
	17v00KHz	1700
	17v22KHz	1722
	Col13v00KHz	co1300
	Col13c22KHz	co1322
	Col17v00KHz	co1700
	Col17v22KHz	co1722
	DISABLE	Dis
nodeMs 3	msNbr	Narrow Band Receiver
nodeMsNbr 1	msNbrIfbw	NBR Bandwidth Command (50KHz, 150KHz, 300KHz)
nodeMs 4	msAntblcTable	Antenna Blockage Zones Table
nodeMsAntblcTable 1	msAntblcEntry	Row of Antenna Blockage Zones Table
nodeMsAntblcEntry 1	msAntblcZone	Blockage Zone Number
nodeMsAntblcEntry 2	msAntblcAzmin	Obstruction Zone Azimuth Minimum (interval: -360.0 – 360.0; resolution: 0.1°)
nodeMsAntblcEntry 3	msAntblcAzmax	Obstruction Zone Azimuth Maximum (interval: -360.0 – 360.0; resolution: 0.1°)
nodeMsAntblcEntry 4	msAntblcElmin	Obstruction Zone Elevation Minimum (interval: -360.0 – 360.0; resolution: 0.1°)

Object ID	Node Name	Description
nodeMsAntblcEntry 5	msAntblcElmax	Obstruction Zone Elevation Maximum (interval: -360.0 – 360.0; resolution: 0.1°)
nodeAcu7103 6	cmd	Commands
nodeCmd 1	cmdReboot	ACU Reboot Command (SET)

9 Appendix B: Preparing the ADE-BDE Cable

Tools

You will need the following tools to prepare the connectors of the ADE-BDE coaxial cable.

- Prep tool for LMR-400 crimp-style connectors

Part No.: ST-400EZ

Stock No.: 3190-401

- Debarring tool

Part No.: DBT-01

Stock No.: 3190-406

- Crimp tool for LMR-400

Part No.: CT-400/300

Stock No.: 3190-666

or

Part No.: HX-4

Stock No.: 3190-200

- 0.429" hex dies for EZ-400 crimp connectors

Part No.: Y1719

Stock No.: 3190-202

Preparing the Cable

Perform the following procedure to prepare 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.

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 the heart gun to form a weather-tight seal.

10 Appendix C: Central Control Unit – 5U Height

The CENTRAL CONTROL UNIT (CCU) is the interface between the system and the ship's equipment. The CCU provides the following functions:

- Modem interface
- Conversion of compass inputs
- IRD Lock Indicator interface
- Adjustable Tx/Rx channel amplification
- De-muxing and muxing of Ethernet and RF channels
- Ethernet Hub (for dual CCU option)
- Running platform for the MTSLINK user interface
- Transmission of on-line GPS data to the satellite modem

The CCU is installed on a 19" rack-mounted 5U industrial PC (including a 1U keyboard-and-mouse drawer), which is usually located in the ship's radio room.

The front panel includes a TFT screen which, together with an external keyboard, constitutes the system's human-machine interface (HMI). Manual monitoring and control is performed using provided software applications running on a Windows Embedded CE 5.0 operating system (see **Commissioning the System** on page 86 and **System Operation** on page128).

The rear panel includes several connectors, which connect to the ADE, the modem and the ship's gyrocompass (NMEA-0183, Synchro or Step-By-Step). Two ATTENUATOR SWITCHES allow adaptation to various ADE-BDE cable lengths.

The CCU contains the BDMX module that connects to the ADMX via a single coaxial cable through the rotary joint/multiple slip-ring assembly in the AZIMUTH AXIS. Like the ADMX, the BDMX also provides integral amplification of the Rx and Tx paths.

System operation is fully controlled from the CCU. Using the HMI, the operator can select the desired satellite and channel from the CCU's Global Satellite Coverage database. The system automatically extracts the required data and deploys the SBC to acquire and track the selected satellite, while compensating for the platform's pitch, roll and yaw movements.

Figure 10-1: CCU Front Panel

Figure 10-2: CCU Rear Panel

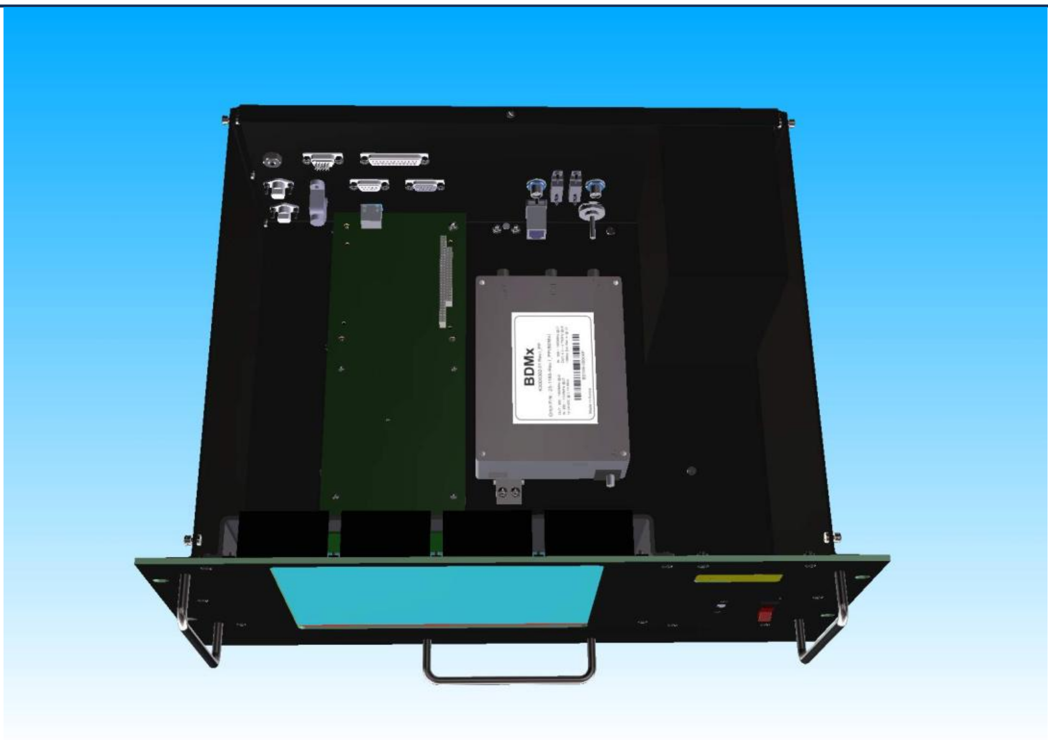


Figure 10-3: CCU Internal View (BDMx)

Installing the BDE (For CCU 5U Height)

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

Figure 10-4: Typical BDE rack installation

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

The front panel includes a 10.4" TFT screen, keyboard and USB connector (for software maintenance). You can also connect the `CCU` to an external computer or VGA screen.

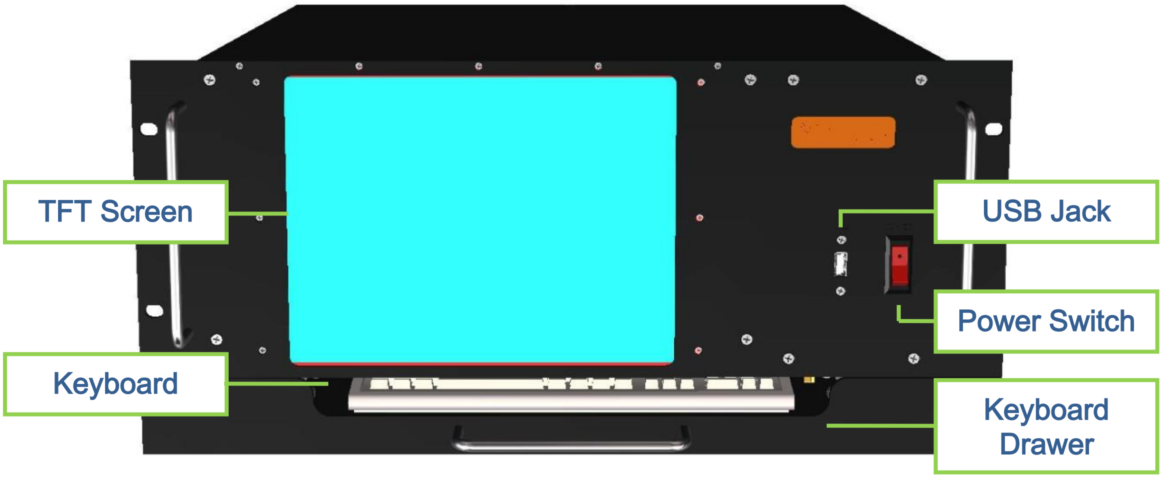


Figure 10-5: CCU Front Panel

Connecting the CCU Cables

Once the `CCU` is installed, you need to connect it to the various instruments with which it interacts: the `ANTENNA` terminals, the modems, the ship's compass and the LAN line.

The following table specifies the type and function of each connector.

Table 0-1. AL-7103 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 the CCU to the keyboard located in the CCU drawer.
MOUSE	MINI-DIN	Connects the CCU to the mouse located in the CCU drawer.

SYNCHRO & SBS COMPASS	DB25 male	Connects the CCU to the ship's compass (Synchro or SBS).
COM1-RS422	DB9 male	Connects the CCU to the ship'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
IF OUT RX	F-Type	Connects to modem RX input
IF OUT TX	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
ATTEN RX	Selector	Selects the Rx attenuator ("I" position - 0dB, "0" position - 8dB)
ATTEN TX	Selector	Selects Tx attenuator ("I" position - 0dB, "0" position - 15dB)

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

The following figure depicts the general-purpose cables that connect to the `CCU`:

- Power cable
- LAN jumper between the BDMx LAN and LAN connectors
- Keyboard
- Mouse
- Ground Cable

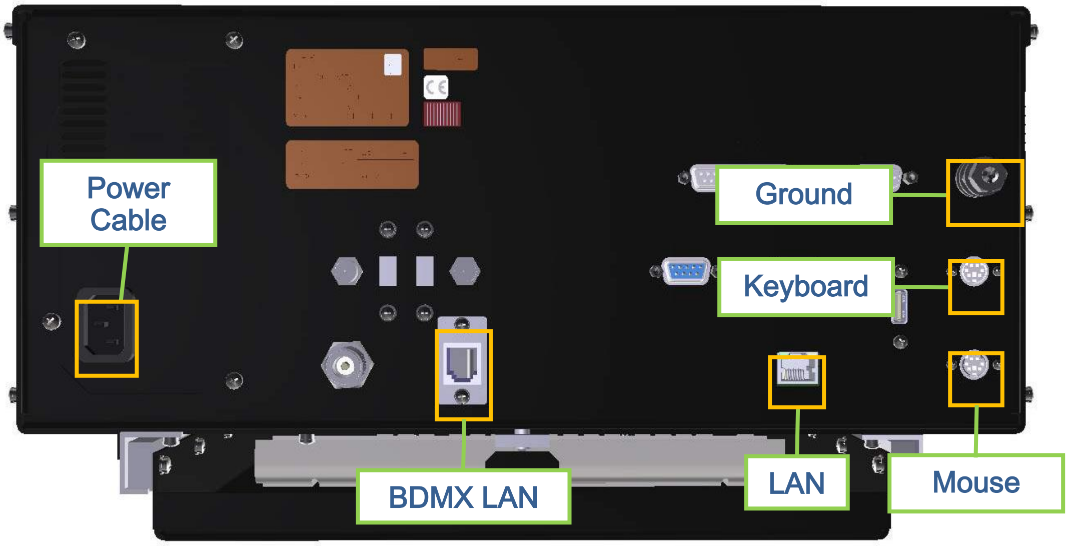


Figure 10-6: CCU rear panel – general-purpose connections

ADE-BDE Cable Connection

The ADE is connected to the BDE via a single LMR-200/400/600 coaxial cable.

➢ **To connect the cable to the CCU:**

1. Install an EZ-400-NMH connector on the BDE side of the LMR-200/400/600 cable (see **Appendix B**: Preparing the ADE-BDE Cable on page 184).

2. Connect the cable connector to the CCU ADMx/BDMx connector, as displayed in the following figure.

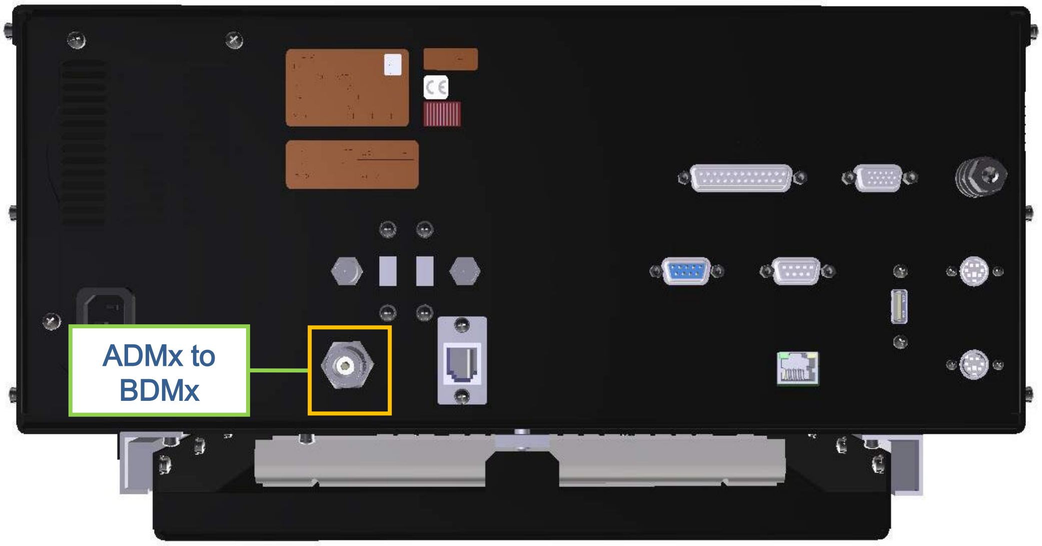


Figure 10-7: CCU rear panel – ADMx/BDMx connector

Serial Communication and Compass Connectors

The `CCU` rear panel includes three communication connectors:

- **Synchro and SBS Compass** – Connects the `CCU` to the ship's compass (Synchro or SBS)
- **COM1 - RS-422** – Connects the `CCU` to the ship's compass (RS-422 port)
- **COM2 - RS-232** – General-purpose serial port

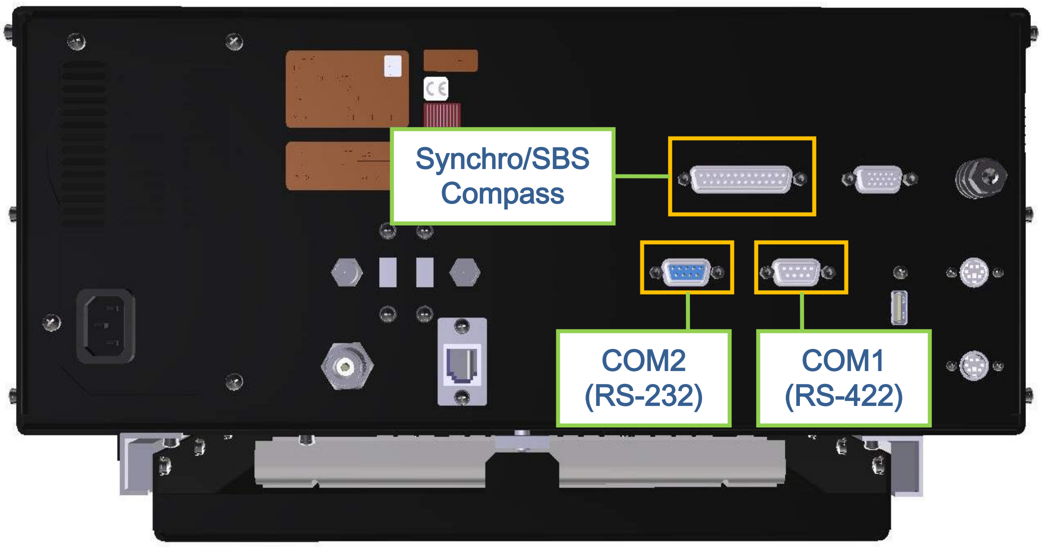


Figure 10-8: CCU rear panel – serial and compass connectors

The system supports the NMEA-0183 gyro compass interface as a default. If a Synchro interface is required, the system should be ordered as such.

The following table specifies the communication connector pin-out. The subsequent sections describe how to use each connector.

Table 10-1: 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	AGN IN
PIN 7	12V
PIN 8	IRD
PIN 9	GND

Synchro & SBS 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	SBS – COM
PIN 13	SBS – 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	SBS – C
PIN 25	SBS - 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 maritime instrumentation. The NMEA-0183 standard is 4800 baud and consists of several different ASCII sentences.

Electrical Interface

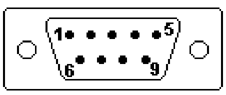
This standard allows a single ‘talker’ and several ‘listeners’ on one circuit. The recommended interconnecting wiring is a shielded twisted pair, with the shield grounded only at the talker. These standards do not specify the use of any particular connector.

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 (i.e. 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 shows 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  **COM1-RS422**	**Mating Connector Wiring Diagram** 

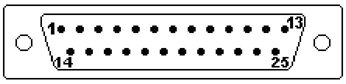
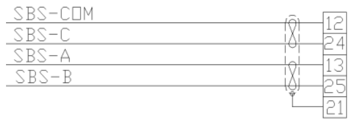
Mating Connector Pin Out	
Pin	**Signal**
2	RXD-
4	RXD+

5	GND

Figure 10-9: NMEA-0183 compass connection scheme

Step-by-Step Compass connection

The following figure shows how to connect a Step-by-Step compass to the CCU's Synchro & SBS connector.

Connecting a Step-by-Step Compass to SYNCHRO & SBS Connector:	
CCU Connector	**Mating Connector Wiring Diagram**
 **Synchro & SBS**	

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

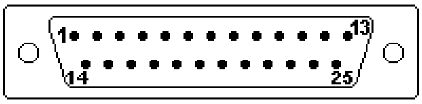
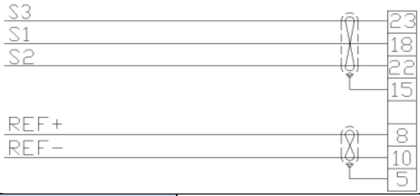
Figure 10-10: Step-by-Step compass connection scheme

- 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

Synchro compass connection

The following figure shows 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	

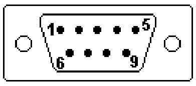
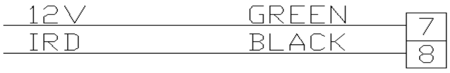
Mating Connector Pin Out	
Pin	**Signal**
8	REF+
10	REF-
5	GND
18	S1
22	S2
23	S3
15	GND

Figure 10-11: Synchro compass connection scheme

Note: Supports 115 VAC reference – 60 VAC reference is optional.

IRD Lock Connection

The following figure shows how to connect the IRD lock modem signal to the CCU's COM2 connector. Pins 7 & 8 should be connected via a 'dry-contact' relay.

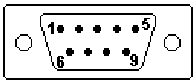
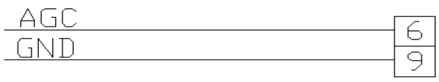
Connecting IRD LOCK to COM2 Connector:	
CCU Connector  **COM2-RS232**	**Mating Connector Wiring Diagram** 

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

Figure 10-12: IRD lock connection scheme

External AGC Connection

The following figure shows how to connect external AGC to the CCU's COM2 connector.

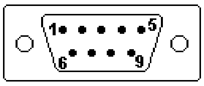
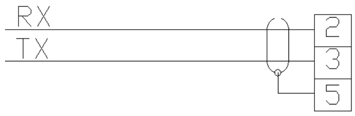
Connecting External AGC to COM2 Connector:	
CCU Connector  **COM2-RS232**	**Mating Connector Wiring Diagram** 

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

Figure 10-13: External AGC connection scheme

RS-232 Communication Channel

The RS-232 port is usually used for GPS output. The following figure illustrates how to connect the RS-232 channel to the CCU's COM2 connector.

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

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

Figure 10-14: RS-232 connection scheme

11 Appendix D: Pre-Installation Checklist

Dear customer, please review and fill out this document in accordance with the *AL-7103 Installation and Operations Manual*. For any assistance or questions, please contact Orbit Service team at support@orbit-cs.com.

Customer and Ship Information

Customer Name	
Country	
P.O No.	
Contact Name	
Phone No.	
Email	
Vessel Name	
Vessel Size	
Vessel Type	
Sailing Area	

Site Survey

- [ ] Thorough on-board ship survey was conducted
- [ ] Required system lifting harness and crane available
- [ ] Required RADOME lifting harness and crane available
- [ ] UPS – On-line or Line Interactive type (see **UPS** on page 48 for power specifications)
- [ ] Power source available within the range of 90-220 VAC

Location Considerations

Mechanical Stability

- ☐ Stable flat surface
- ☐ Natural resonance frequency of above 30 Hz
- ☐ Support for 300 Kg

Maintenance Access

- ☐ RADOME mounted at a height of at least 1.2m above deck

Line of Sight

- ☐ Straight line between the ANTENNA and the satellite

Other Considerations

- ☐ 10m and 10° from main lobe of any radar (IEC 60945, section 10.4)
- ☐ Maximum non-blocked hemispheric view down to 10° visibility

Mounting Surface

- ☐ RADOME support bolted to mounting surface
- ☐ Both central and peripheral support for the system's base plate

BDE

- ☐ Available 5U height in 19'' rack below deck with supporting rails
- ☐ Rx/Tx cables between the BDE and the modem
- ☐ ADE-BDE cable:
  ☐ LMR-200 ☐ LMR-400 ☐ LMR-600
- ☐ GPS compass cable with correct pin-out for connection with BDE
- ☐ Modem-to-BDE cable with correct pin-out
- ☐ NMS special connection cable with correct pin-out

12 Appendix E: Installation Checklist

Dear customer, please review and fill out this document in accordance with the *AL-7103 Installation and Operation Manual*. For any assistance or questions please contact Orbit Service team at support@orbit-cs.com.

CUSTOMER INFORMATION

Customer/Company Name	
Vessel/Platform Name	
Orbit SL No./Customer PO No.	
Orbit's Sales Director	

RECEIPT OF SHIPMENT

Orbit systems are packaged and secured for smooth shipment to the customer's address. Each system delivered includes the following G-Shock detector labels:

- 1 internal (15G) on the system assembly
- 2 external (25G) on the system's packing crate

The G-Shock detector changes its color from WHITE to RED if the delivered items have suffered extreme shock or vibration when in transit. If this occurs it can cause damage to the deliverables. In such a case please report immediately to Orbit Communications Ltd. for clarification with the shipping company.

Please check the state of the G-Shock detectors and mark their color:

Shock Label #	Location	Status upon shipment arrival
#1	External – Packing Crate	Color: White/Red
#2	External – Packing Crate	Color: White/Red
#3	Internal System – Pedestal	Color: White/Red

Please conduct a general visual inspection of each crate to verify that no external damage has occurred.

Crate #	Inspection Date	Reported Condition
#1 System	/ /	
#2 Radome	/ /	
#3 Other	/ /	

CHECKLIST

- ☐ System crate is unpacked –4 side walls and top of crate removed
- ☐ Tie-wraps removed from RF Feed, Azimuth, Elevation, and Tilt Axes
- ☐ RADOME assembled according to instructions
- ☐ System lifted to designated location using RADOME lifting harness
- ☐ System mounted on RADOME support using the installation kit
- ☐ Coaxial cable connected between ADE and BDE
- ☐ Ship mains power cable connected to ADE
- ☐ CCU installed in 19'' rack below deck with supporting rails
- ☐ Ship's compass connected to CCU
- ☐ Rx and Tx cables connected between modem and CCU
- ☐ Modem connected to CCU
- ☐ All other required connections (LAN, NMS)

13 Appendix F: Commissioning Checklist

Dear customer, please review and fill out this document in accordance with the *AL-7103 Installation and Operation Manual*. For any assistance or questions please contact Orbit Service team at support@orbit-cs.com.

CUSTOMER INFORMATION

Customer/Company Name	
Vessel/Platform Name	
Location of Commissioning	
Date of Commissioning	
Orbit SL No./Customer PO No.	
Orbit's Sales Director	

Commissioning Requirements

☐	System is connected to a UPS unit – On-line or Line Interactive type (see **UPS** on page 48 for power specifications)
☐	Power source is within the range of 90-220 VAC

Installation Location

The System is installed on the ship's mast as per the mast design recommended by Orbit or its equivalent. Installation location complies with the following requirements:

Mechanical Stability

☐	Stable flat surface
☐	Natural resonance frequency of above 30 Hz
☐	Support for 300 Kg

Maintenance Access

☐ RADOME mounted at a height of at least 1.2m above deck

Line of Sight

☐ Straight line between the ANTENNA and the satellite

Other Considerations

☐ 10m and 10° from main lobe of any radar (IEC 60945, section 10.4)

☐ Maximum non-blocked hemispheric view down to 10° visibility

Mounting Surface

☐ RADOME support bolted to mounting surface

☐ Both central and peripheral support for the system's base plate

BDE

☐ CCU is installed in a 19'' rack below deck, stable and secured with supporting rails

☐ Rx/Tx cables are connected between the CCU and the modem

☐ Coaxial cable is connected between the ADE and BDE :
☐ LMR-200 ☐ LMR-400 ☐ LMR-600

☐ Ship's GPS compass is connected with the CCU

☐ Main modem parameters are configured per customer definition:
- ☐ Rx Frequency
- ☐ Tx Frequency
- ☐ Data Rate
- ☐ FEC
- ☐ Coding

SYSTEM INSPECTION

Criteria	Pass / Fail	Remarks
Radome Condition		
External damage		Immediately report any damage to support@orbit-cs.com
Internal damage		
Antenna moves without obstruction		
Visual inspection		
GPS Antenna is secured		
Wiring		
Loose or free cable		
Damage to cables		
Dish		
Visual damage check		
System Checkup		
System Power up		
Green LED on SBC panel		
Green LED on BUC		
ADE/BDE communication: System data is displayed on the CCU main screen		
System restart sequence: AZ, Tilt, EL, PolSkew, and IMU finished their initialization process		
Test trajectory: AZ, Tilt, EL, and Pol Skew movement is smooth, with no noises or leakage		
CCU power up: MTSVLink software starts up		

The required satellite is selected and displayed on the CCU Main screen		
Polarization set to V/H on CCU main screen		
Compass offset procedure performed as per instructions in Installation Manual		
Tracking frequency selected		
IF BW filter was set up as per instructions in Installation Manual		
Satellite Acquisition: Selected satellite was acquired and system went to Step Track Mode		
Modem is locked: Rx and Tx are locked		
System restarted and satellite automatically re-acquired		

CCU Settings

Satellite Information	
Satellite Name	
Location	
Antenna Position	
Azimuth	
Elevation	
Polarization – Vertical/Horizontal	
System Status	
Mode (Should be in Step-Track Mode)	
IRD Lock	

IMU	
Polarization (degree)	
Modem Type and Model	
AGC Status	
AGC level (dBm)	
Threshold level (dBm)	
L-Band Settings	
L-Band Bandwidth setting (50,150 or 300 KHz)	
Tracking Frequency	
LNB Power (13V:00, 13V:22,17V:00 or 17V:22 KHz)	
Software Version	
CCU	
SBC	
Compass	
Compass model	
Compass offset	

System Cables

ADE-BDE Cable			
Brand/Type		**Length (M)**	
CCU-Modem Cable			
Brand/Type		**Length (M)**	
CCU-Modem Console GPS Cable			
Brand/Type		**Length (M)**	
CCU-Gyrocompass Cable			
Brand/Type		**Length (M)**	

System Configuration

Network	
Modem IP Address	
SBC IP address	
CCU IP address	
Parameter Configuration	
SNR value	
Rx-power (dBm)	
TX-power (dBm)	
Temperature (Celsius)	

System Components

System Manufacturer	**Orbit Communication Ltd.**	
System Model	**AL-7103**	
Above Deck Equipment		
Item	**Part Number**	**Serial Number**
CCU	**AL-7103-CCU-B2**	
IMU	**L01323001**	
SBC	**L00322001**	
Power Supply 8W/20W	**L00321001** **L00321002**	
Servo Driver Module with Axis Motor × 3	**AL-7103-SDM-COM3** **AL-7103-SDM-COM6A**	
Pol Step Motor	**24-0918-9-1**	
Antenna Feed	**L00727001**	
BUC	**E12000006** **E12000007** **E12000008** **E12000055** **E12000051** **K30ALK501-06**	
LNB	**1507HAF** **1507HBF** **1507HCF** **E12000037**	
White RAL9010 RADOME **Grey RAL7035 RADOME**	**24-1166-2** **24-1166-3**	

14 Appendix G: Dual-Antenna Configuration

Physical obstructions on the deck of certain ships can impose severe limitations on the ANTENNA's line of sight. In such cases it is possible to install two OrSat™ (AL-7103 MKII) ADE terminals controlled by a 1U CCU and 1U Dual System Selector, which together are functioning as a one single point of a CENTRAL CONTROL UNIT (CCU). This configuration allows you to combine the view angles from two different locations on the ship by switching the received (Rx) and transmitted (Tx) signals from a blocked location to a clear one.

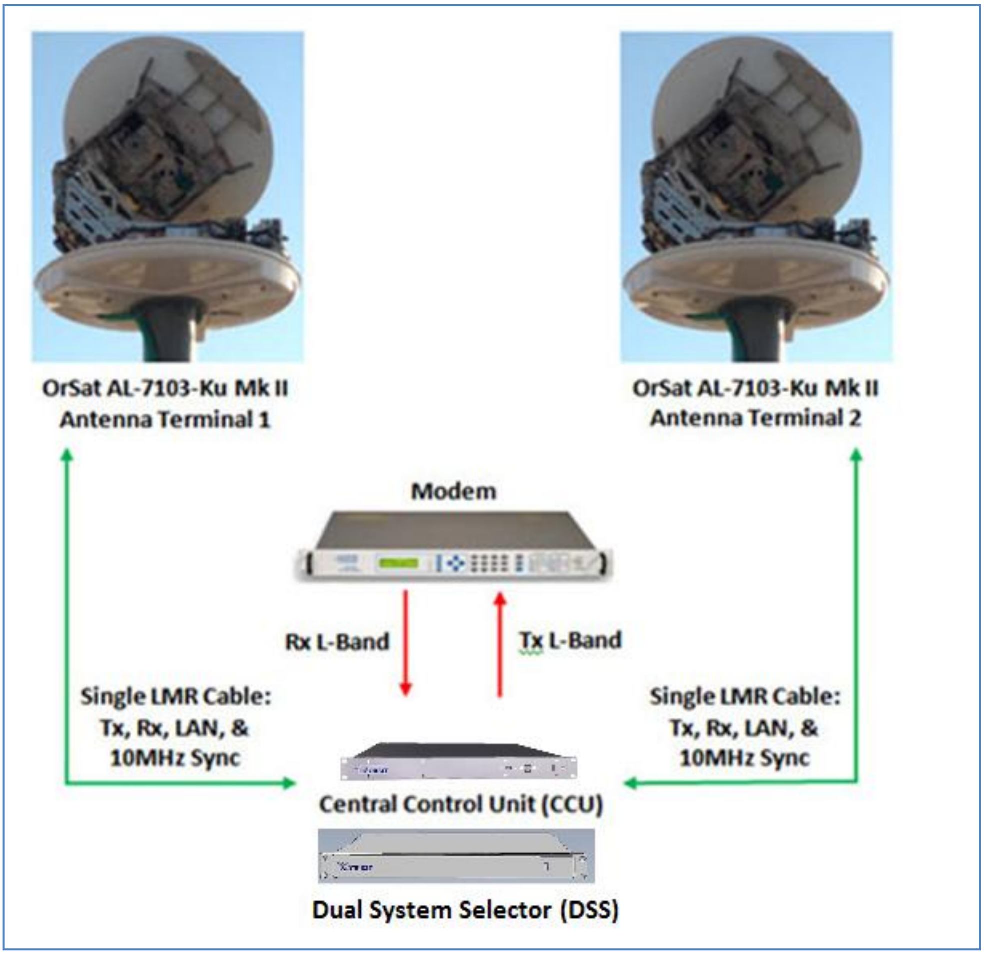


Figure 14-1: OrSat™ Dual-Antenna System Configuration

The CCU includes two BDMX modules connected to the ADMX units in their respective terminals via an LMR-200/400/600 coaxial cable with N-type connectors (depending on the CCU-ADE distance: LMR-200 for lengths of up to 30m; LMR-400 up to 50m; LMR-600 up to

100m). Two parallel switches connect the ship's modem to the active ANTENNA for the transmission (Tx) and reception (Rx) of L-Band signals.

Theory of Operation

The two OrSat™ ADE terminals are installed on the ship's deck while the CCU is installed below deck in an environmentally-controlled indoor compartment or control room.

The coaxial cables connecting the CCU with the terminals carry the following 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)

The CCU constantly monitors both ANTENNA systems, and switches operations from the active system to the inactive system on the basis of the following criteria:

- **Blockage zones –** The CCU calculates the local azimuth and elevation angles of each system and compares them with the predefined blockage zones. When the active ANTENNA's line of site enters a blockage zone, the CCU automatically switches operations to the unobstructed ANTENNA.
- **AGC threshold –** The CCU monitors the AGC level of each system, and activates the relevant ANTENNA according to one of the following AGC switching configurations:
    - **Auto** – Switching is performed on the basis of the difference between the AGC signal levels of the two ANTENNAs.
    - **Antenna 1** – ANTENNA 1 remains active as long as its AGC signal remains higher than its defined AGC threshold.
    - **Antenna 2** – ANTENNA 2 remains active as long as its AGC signal remains higher than its defined AGC threshold.

AGC-based switching can also be disabled entirely using the DAOLINK software interface.

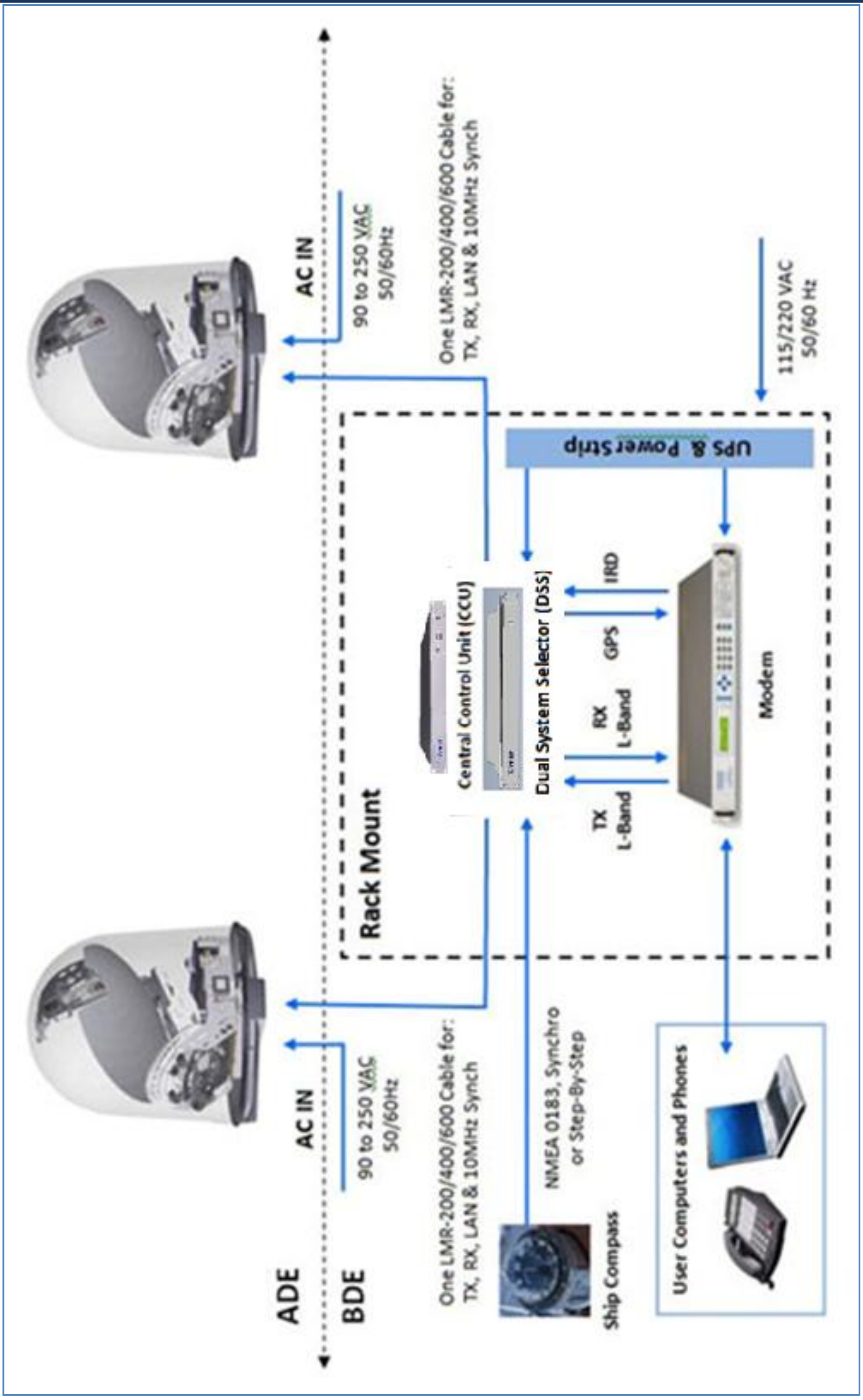


Figure 14-2: OrSat™ Dual-Antenna System Block Diagram

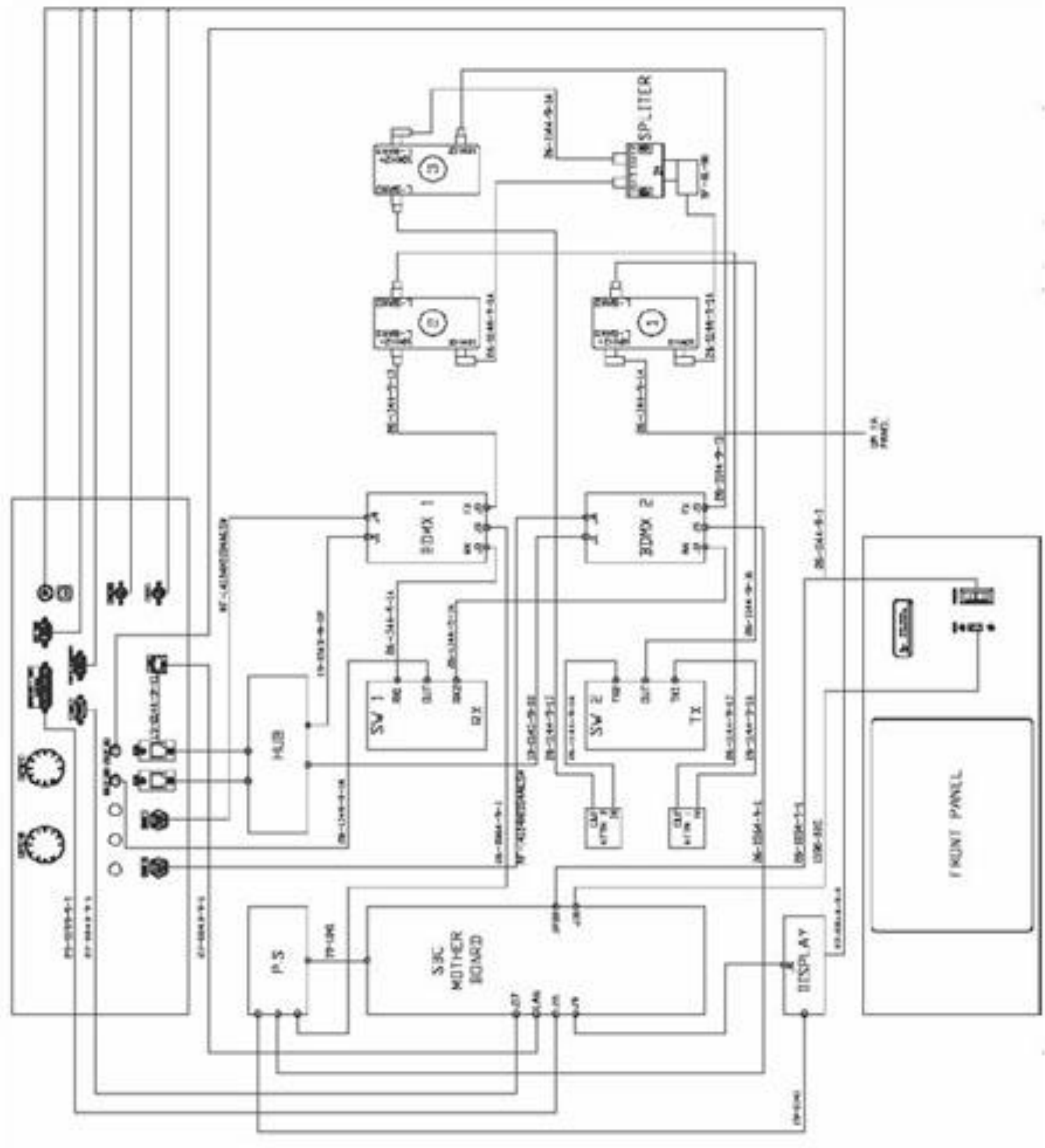


Figure 14-3: OrSat™ Dual-Antenna CCU Internal Block Diagram

DUAL SYSTEM SELECTOR

The DUAL SYSTEM SELECTOR (DSS) enhances the 1U CCU machine (presented in previous chapter) into a Dual System Control Unit, enabling the selection between two installed VSAT systems, to receive the optimal connection rate at any given time. The DSS is not a standalone unit – it must be connected to a 1U CCU.

The DSS provides the following functions:

- Adjustable TX and RX channel amplification
- De-muxing and muxing of Ethernet and RF channels
- Switching between two systems

The DSS is of 1U height and is typically installed on a dedicated 19-inch rack in the ship's radio room.

The rear panel includes several connectors that connect to the ADE, the modem and the ship's gyrocompass. An ATTENUATOR SWITCH allows adaptation to various ADE-BDE cable lengths.

Like the 1U CCU, The DSS contains the BDMX module that connects to the ADMX via a single coaxial cable through the rotary joint/slip-ring assembly in the AZIMUTH AXIS. Like the ADMX, the BDMX also provides integral amplification of the Rx and Tx paths.

The Dual System switching operation is controlled from the DOALINK application, installed on the 1U CCU. The Dual System operation is fully controlled from the 1U CCU. Via the HMI, the operator can select the desired satellite and channel from the CCU's Global Satellite Coverage database.

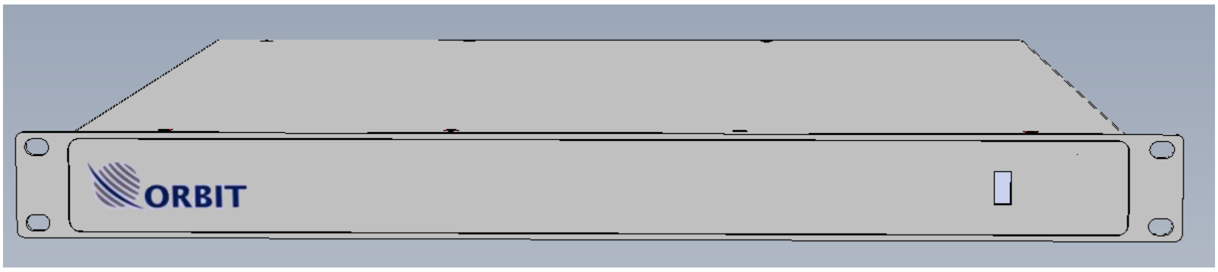


Figure 14-4: Dual System Selector

The `DSS` is of 1U height and is typically installed on a dedicated 19-inch rack in the ship's radio room, designed to be installed close to the CCU 1U unit, to provide a dual type Central control functionality for a Dual System configuration.

Connecting the DSS Cables

Once the DSS is installed, you need to connect it to the various instruments with which it interacts: the ANTENNA-2 terminal and the LAN line.

The following table specifies the type and function of each connector.

Table 14-1: CCU Rear Panel Connectors

Connector	Type	Function
Power Supply	Integrated Plug	Mains power connection (from the ship's power source)
ATTEN RX	Selector	Rx attenuator ('I' position - 0dB, '0' position - 8dB)
ATTEN TX	Selector	Tx attenuator ('I' position - 0dB, '0' position - 15dB)
ATTN- 1	Rotary	Tx attenuator-1 (0dB and up to 10dB selector)
ATTN- 2	Rotary	Tx attenuator-2 (0dB and up to 10dB selector)
RF-Switch AUX Com	DB15	RF-Switch card's command
VGA	DB 15-Pin HD	Connects to an external VGA monitor
Tx – CCU	F-Type	Connects to the CCU Tx output
Rx - CCU	F-Type	Connects to the CCU Rx input
Tx – MODEM	F-Type	Connects to the MODEM Tx output
Rx - MODEM	F-Type	Connects to the MODEM Rx input
BDMX to ADMx	N-Type	Connects to the ANTENNA's ADE-BDE coaxial cable

General-Purpose Connections

The following figure depicts the general-purpose cables to be connected to the CCU:

- Power cable
- LAN

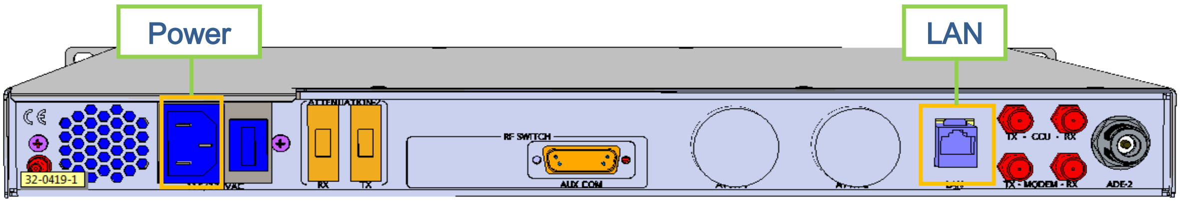


Figure 14-5: CCU Rear Panel – General Purpose Connections

ADE-BDE Cable Connection

The BDMX unit within the DSS communicates with the ADMX unit in the ANTENNA-2 terminal through a single coaxial cable, which connects to the N-Type jack on the DSS back panel.

➢ **To connect the cable to the CCU:**

1. Install an N-Type connector on the BDE side of the LMR cable (see **Appendix B: Preparing** the ADE-BDE Cable on page 184 for instructions).
2. Connect the cable connector to its respective ADMx/BDMx connector on the DSS, as displayed in the following figure.

DSS-CCU-Modem RF Cables Connection

The DSS is connected to the MODEM and to the CCU via the following connectors:

- Connects the MODEM's Rx input to the MODEM -Rx on the DSS
- Connects the MODEM's Tx output to the MODEM -Tx on the DSS
- Connect the CCU's Rx input to the CCU -Rx on the DSS
- Connect the CCU's Tx output to the CCU-Tx on the DSS
- Connect the CCU's AUX COM to the DSS AUC COM

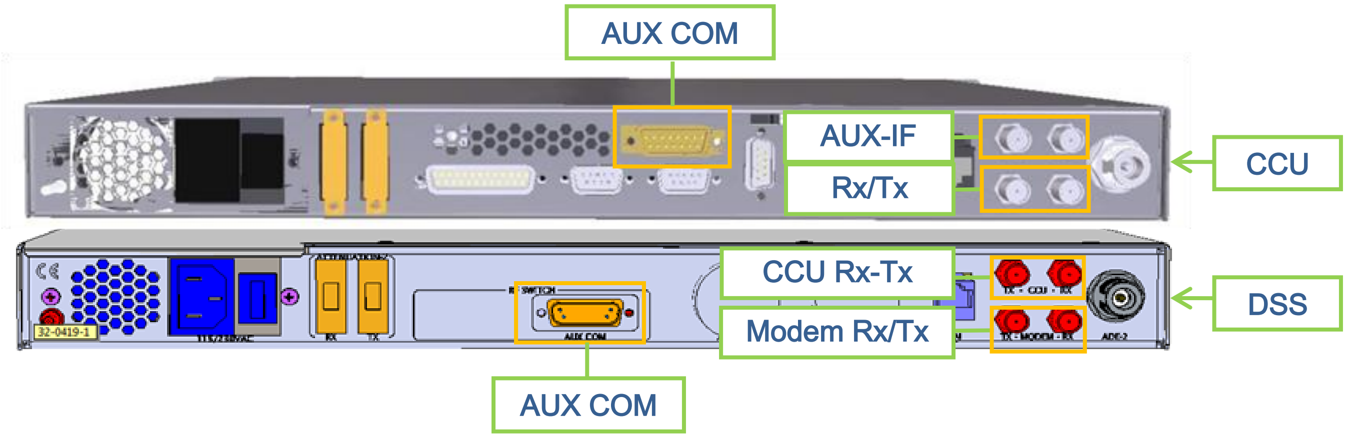
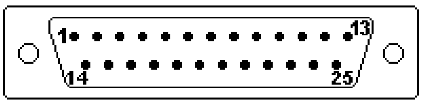
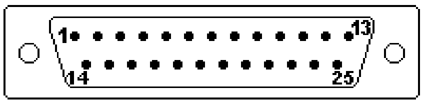


Figure 14-6: DSS Rear Panel – CCU Connector

Connecting RF-Switch COM to CCU AUX COM:	
CCU Connector  **COM AUX**	**DSS Connector**  **RF-Switch COM**

Mating Connector Pin Out

Optional: Central Control Unit Dual Type – 5U Height

The CCU is typically installed on a dedicated 19-inch rack in the ship's radio room.

Make sure that the CCU is installed at a distance of at least 5 meters from the ship's compass.

The front panel includes a 10.4" TFT screen, keyboard and USB connector (for software maintenance). You can also connect the CCU to an external computer or VGA screen.

Figure 14-7: CCU Front Panel

The following drawings display the external dimensions of the CCU.

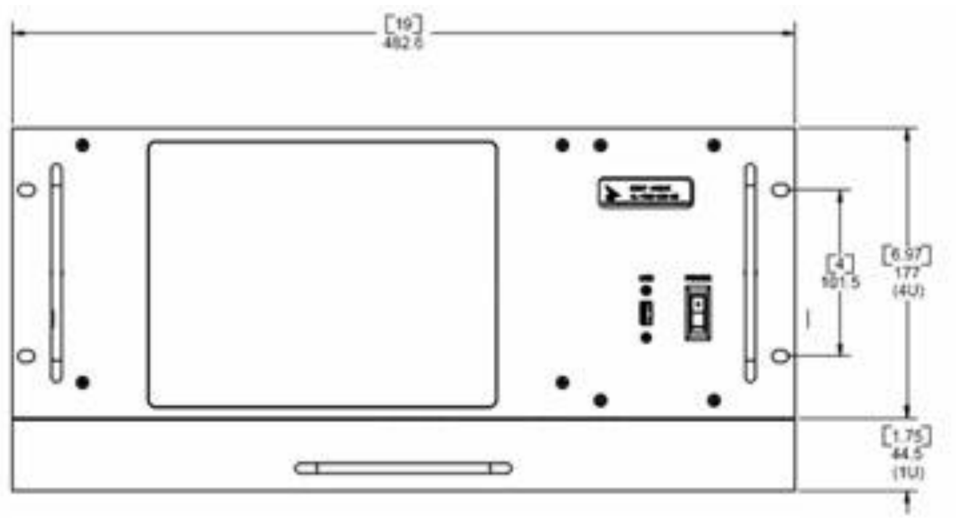


Figure 14-8: CCU External Dimensions - Front Panel

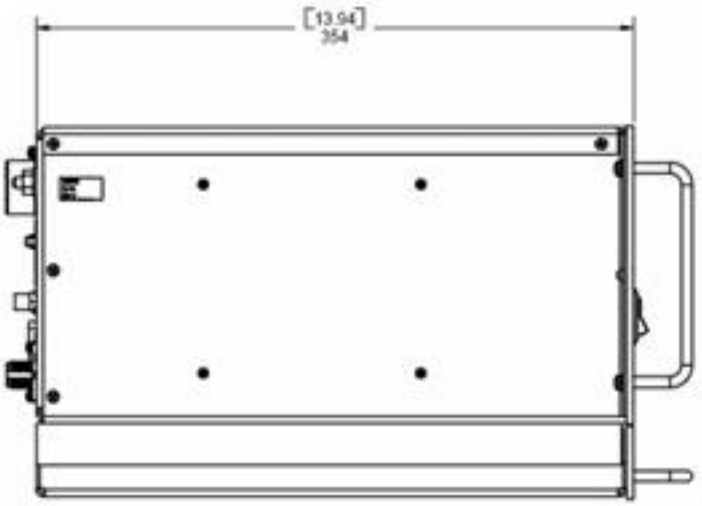


Figure 14-9: CCU External Dimensions – Side View

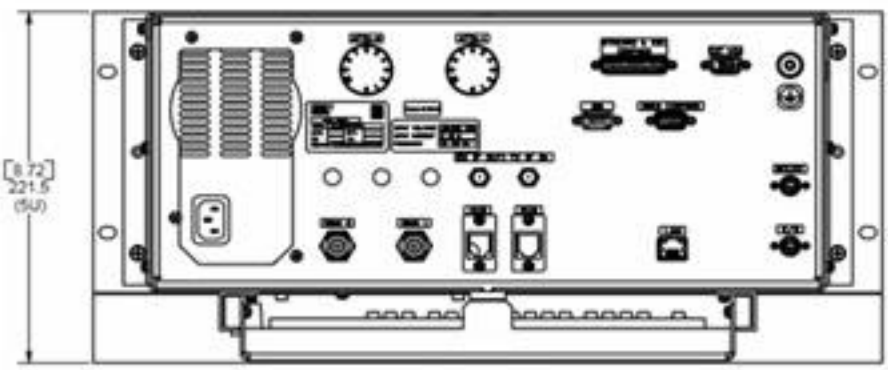


Figure 14-10: CCU External Dimensions - Rear Panel

Connecting the CCU 5U Cables

Once the CCU is installed, you need to connect it to the various instruments with which it interacts: the ANTENNA terminals, the modems, the ship's compass, and the LAN line.

The following table specifies the type and function of each connector.

Table 14-2: CCU Rear Panel Connectors

Connector	Type	Function
Power Supply	Integrated Plug	Mains power connection (from the ship's power source)
BDMX 2	N-Type	Connects to the second ANTENNA's ADE-BDE coaxial cable
BDMX 1	N-Type	Connects to the first ANTENNA's ADE-BDE coaxial cable
RX IF OUT	F-Type	Connects to the modem's Rx input
TX IF IN	F-Type	Connects to the modems Tx output
HUB	RJ-45	Connects to the CCU LAN connector via a jumper cable
HUB	RJ-45	Auxiliary HUB connector
LAN	RJ-45	Connects to the HUB connector via jumper cable
SYNCHRO & SBS COMPASS	DB25 male	Connects to the ship's SYNCHRO or Step-By-Step compass
NMEA COMPASS	DB9 male	Connects to the ship's NMEA-0183 compass
IRD	DB9 male	Connects to IRD Lock and external AGC
EXT VGA	DB 15-Pin HD	Connects to an external VGA monitor
MOUSE	MINI-DIN	Connects to the mouse located in the keyboard drawer
K/B	MINI-DIN	Connects to the keyboard located in the keyboard drawer

General-Purpose Connections

The following figure depicts the general-purpose cables to be connected to the CCU:

- Power cable
- Mouse and keyboard
- LAN to HUB

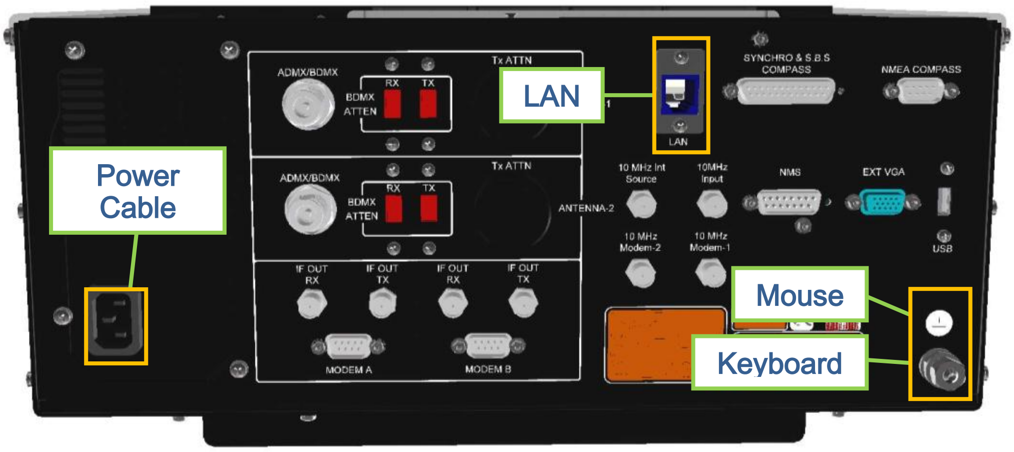


Figure 14-11: CCU Rear Panel – General Purpose Connections

ADE-BDE Cables Connection

The BDMX units within the CCU communicate with the ADMX units in their respective systems via coaxial cables, which connect to the N-Type jacks on the CCU back panel.

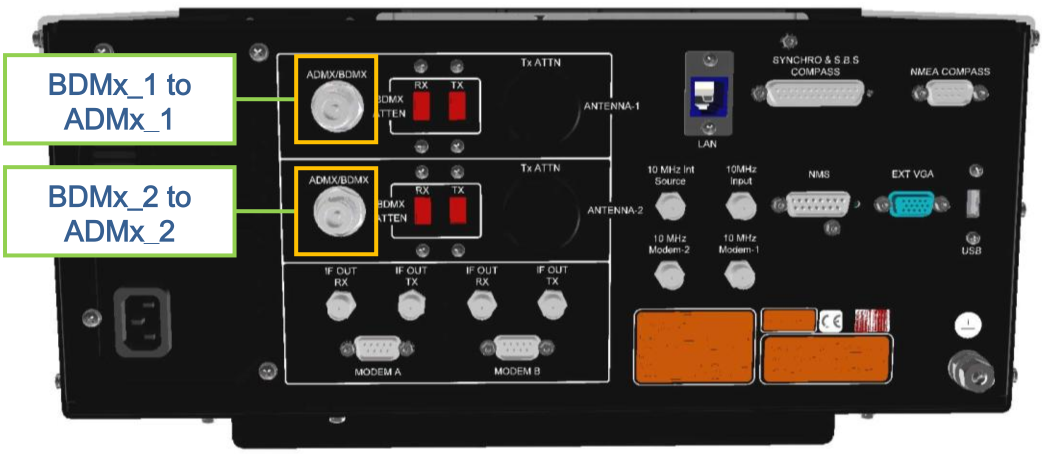


Figure 14-12: CCU Rear Panel – BDE-ADE Cables Connectors

CCU-Modem RF Cables Connection

The CCU is connected to the two modems via the following connectors:

- IF OUT RX (SW1 Output) - Connects to each modem's Rx input.
- IF OUT TX (SW2 Input) - Connects to each modem's Tx output.
- Modem A / Modem B – Connects to each modem's IRD Lock and GPS output.

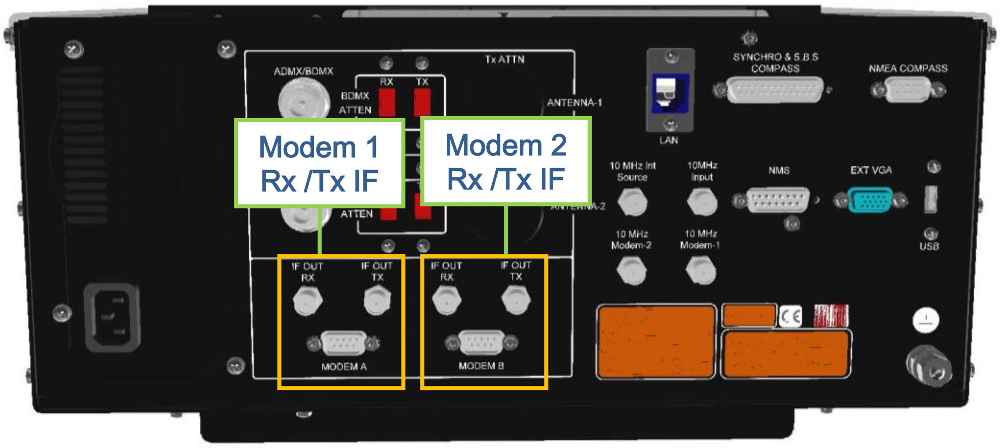


Figure 14-13: CCU Rear Panel – CCU-Modem Connectors

Compass Connectors

The CCU rear panel includes the following compass connectors:

- SYNCHRO & SBS COMPASS - Connects to the ship's SYNCHRO or SBS compass.
- NMEA COMPASS - Connects to the ship's NMEA-0813 Compass.

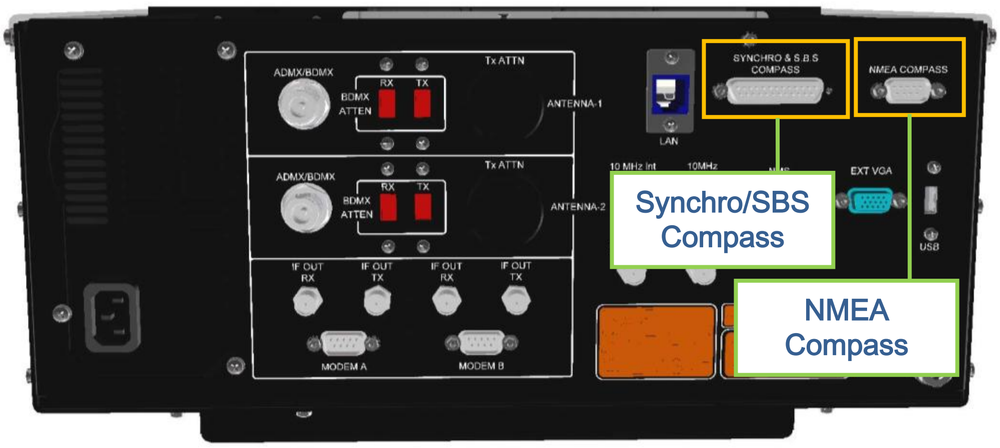


Figure 14-14: CCU Rear Panel – Compass Connectors

For detailed instructions on how to connect an NMEA compass to the CCU, see

NMEA-0183 RS-422 Compass Connection on page 196.

Dual-Antenna System Operation

This section describes the Dual-ANTENNA operating procedures, to be performed by the designated system operator via the CCU.

Getting Started

The CCU is based on an industrial PC running the Windows Embedded CE 5.0 operating system and several dedicated software applications. These applications control, monitor, and configure the dual-CCU system.

To turn on the CCU, set its power switch to the ON position.

The CCU activates Windows CE and automatically runs three applications: the DAOLINK software application for monitoring and control of the dual-CCU system, and two MTSLINK applications for monitoring and control of each ANTENNA.

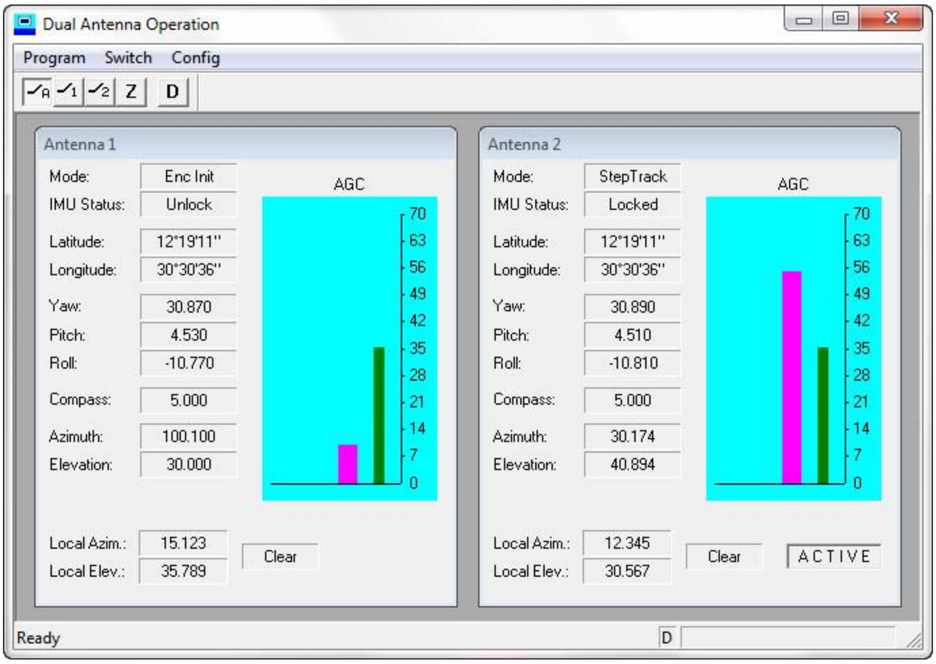


Figure 14-15: DaoLink Dual-Antenna Operation screen

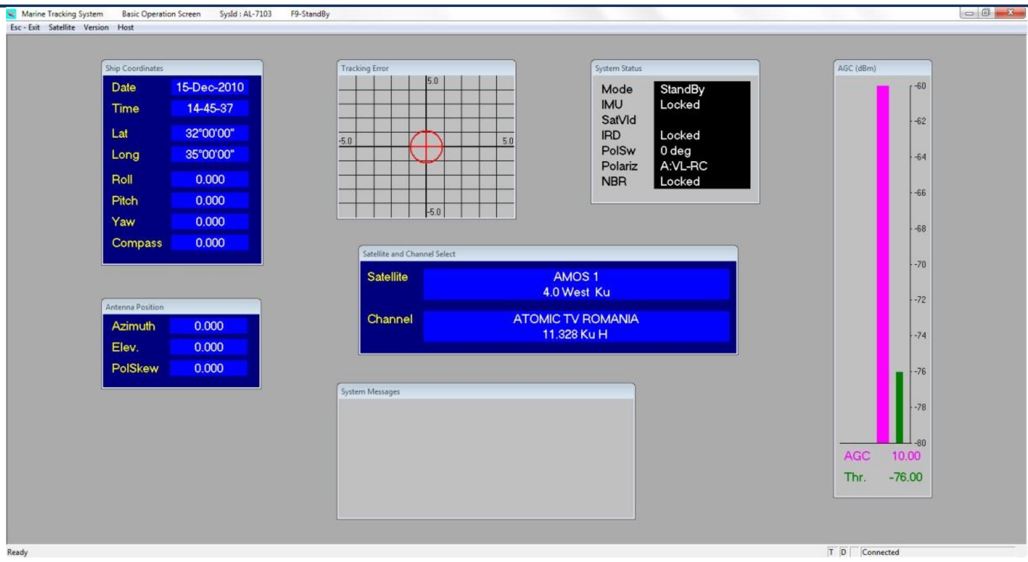


Figure 14-16: MtsLink Basic Operation screen

The Dual Antenna Operation Screen

The `DAOLINK` **Dual Antenna Operation** screen displays two **Antenna** windows containing monitoring and control fields for each terminal.

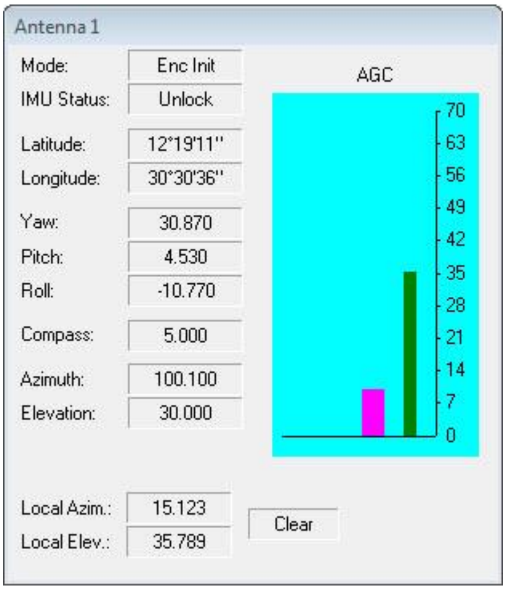


Figure 14-17: Antenna 1 wIndow

The window can display the following parameters:

- **Mode** – Current system operating mode (for example: Acquire, Enc Init)
- **IMU Status** – Current IMU status (Lock/Unlock)
- **Latitude** – Ship's current latitude (from GPS)

- **Longitude** – Ship's current longitude (from GPS)
- **Yaw** – Ship's current yaw angle (from the IMU)
- **Pitch** – Ship's current pitch angle (from the IMU)
- **Roll** – Ship's current roll angle (from the IMU)
- **Compass** – Ship's current heading (from the ship's compass)
- **Azimuth** – ANTENNA's azimuth axis angle
- **Elev.** – ANTENNA's elevation axis angle
- **Local Azim**. – The local azimuth angle
- **Local Elev.** – The local elevation angle
- **Clear/Blocked** – Local azimuth/elevation blockage indicator
- **Switching Indicator** – Displays 'ACTIVE' when the ANTENNA is activated
- **AGC** – Graphically displays the ANTENNA's AGC signal level and acquisition threshold.

Configuring the Dual Antenna System

➢ **To set up communication links with the ANTENNA terminals:**

1. Open the **Config** menu and select **Link**. The **Link Setup** dialog box appears.

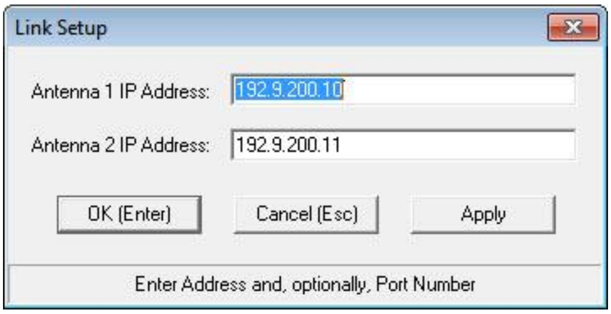


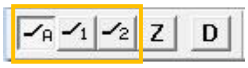
Figure 14-18: Antenna 1 wIndow

2. Enter the IP address of each ANTENNA's ACU.
3. Click **OK (Enter)**.

➢ **To set up AGC-based antenna switching:**

1. Open the **Switch** menu and select the desired switching method:
   - **Auto** – Switches automatically according to the difference between the ANTENNAs' AGC signals.

- **Antenna 1** – ANTENNA 1 remains active as long as its AGC signal exceeds its acquisition threshold.
- **Antenna 2** – ANTENNA 1 remains active as long as its AGC signal exceeds its acquisition threshold.

You can also click the relevant icon on the DAOLINK toolbar: 

2. Open the **Config** menu and select **AGC Switching**. The **AGC Switching** dialog box appears.

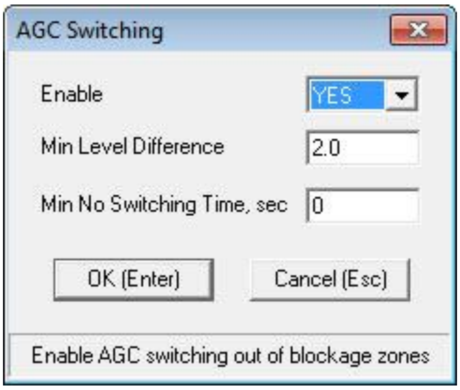


Figure 14-19: AGC Switching dialog box

3. To enable AGC-based switching, select 'YES' in the **Enable** field.
4. If you selected the Auto switching method, enter in the **Min Level Difference** field the minimum difference in AGC signal levels (in decibels) at which the system will switch from one ANTENNA to the other.
5. In the **Min No Switching Time, sec** field, enter the number of seconds the system will wait between switching ANTENNAs.
6. Click **OK (Enter)**.

➢ **To define antenna blockage zones:**

1. Open the **Config** menu and select **Zones** (or click the  icon on the DAOLINK toolbar). The **Blocked Zones** dialog box appears.

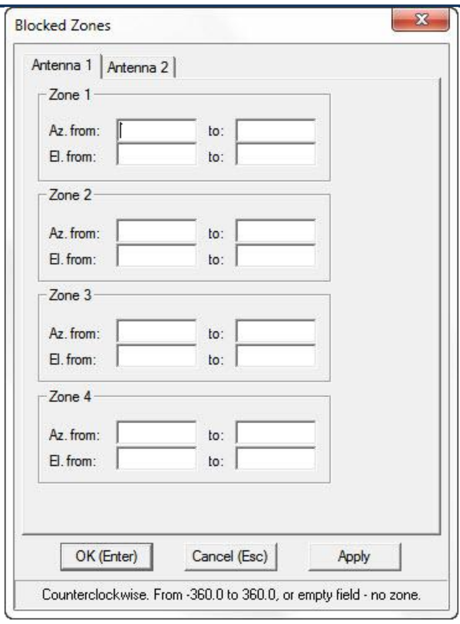


Figure 14-20: Blocked Zones dialog box

2. Define blockage zones for each ANTENNA terminal (see **Defining Blockage Zones** on page **106** for detailed instructions).
3. Click **OK (Enter)**.

The following figure illustrates a simple blockage zone setting for two ANTENNA terminals.

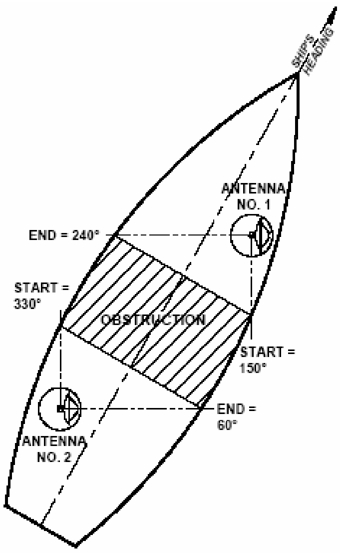


Figure 14-21: Dual blockage zones - example

In the above drawing, ANTENNA 1 is blocked in a 90° range from 150.0° to 240.0° local azimuth. ANTENNA 2 is also blocked in the same range from 330.0° to 60.0° local azimuth.

Note that each blockage zone is defined by a ‘start’ and ‘end’ angle moving in a clockwise direction.

The blockage zone settings in the above example would be defined as follows:

Figure 14-22: Blockage zone settings – example

➢ **To hide or display parameters in the Antenna windows:**

1. Open the **Config** menu and select **Display** (or click the  icon on the `DAOLINK` toolbar). The **Display Configuration** dialog appears.

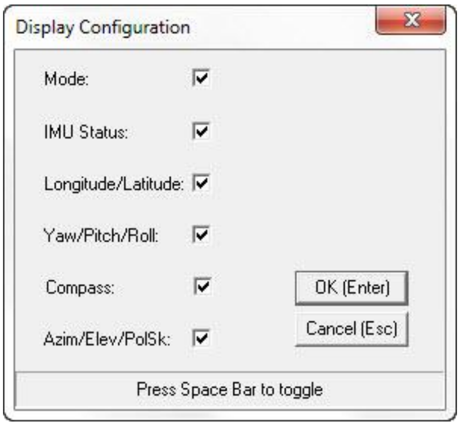


Figure 14-23: Display Configuration Screen

2. Check the parameters that you want to appear in the **Antenna** windows.
3. Click **OK (Enter)**.

15 Appendix H: Dual-Band Ku & X OrSat™ System

The Dual-Band AL-7103-Ku & X OrSatTM supports the following frequency bands:

- Ku Band :
  - Tx: 13.75 – 14.5GHz
  - Rx:10.7 – 12.75 GHz
- X Band:
  - Tx: 7.9 – 8.4 GHz
  - Rx: 7.25 – 7.75 GHz

A special installation kit is provided in order to allow conversion of the system to X-Band.

X-Band System Description

Antenna and RF Front End Assembly

The `ANTENNA` is installed on the `Y AXIS`, and carries the Tx/Rx X-Band `RF FRONT END`.

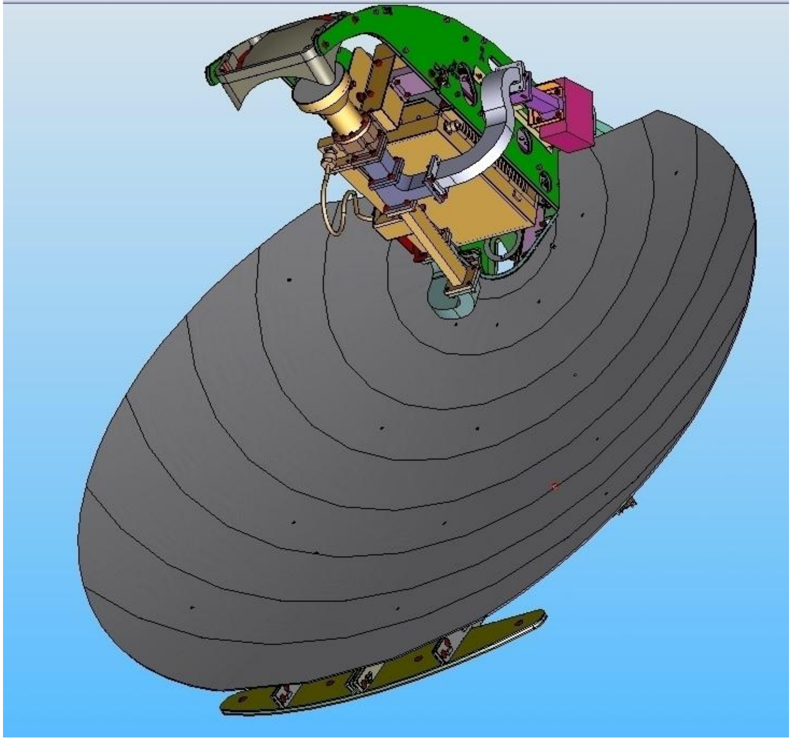


Figure 15-1: Reflector and RF Front End

The RF PACKAGE contains the following components:

- 16W BUC
- RF FRONT END
- X-BAND FEED
- SEPTUM POLARIZER
- 40 DB RX REJECT FILTER
- 60 DB RX REJECT FILTER
- TX REJECT FILTER
- LNB
- X-BAND WAVEGUIDE
- DC INSERTER

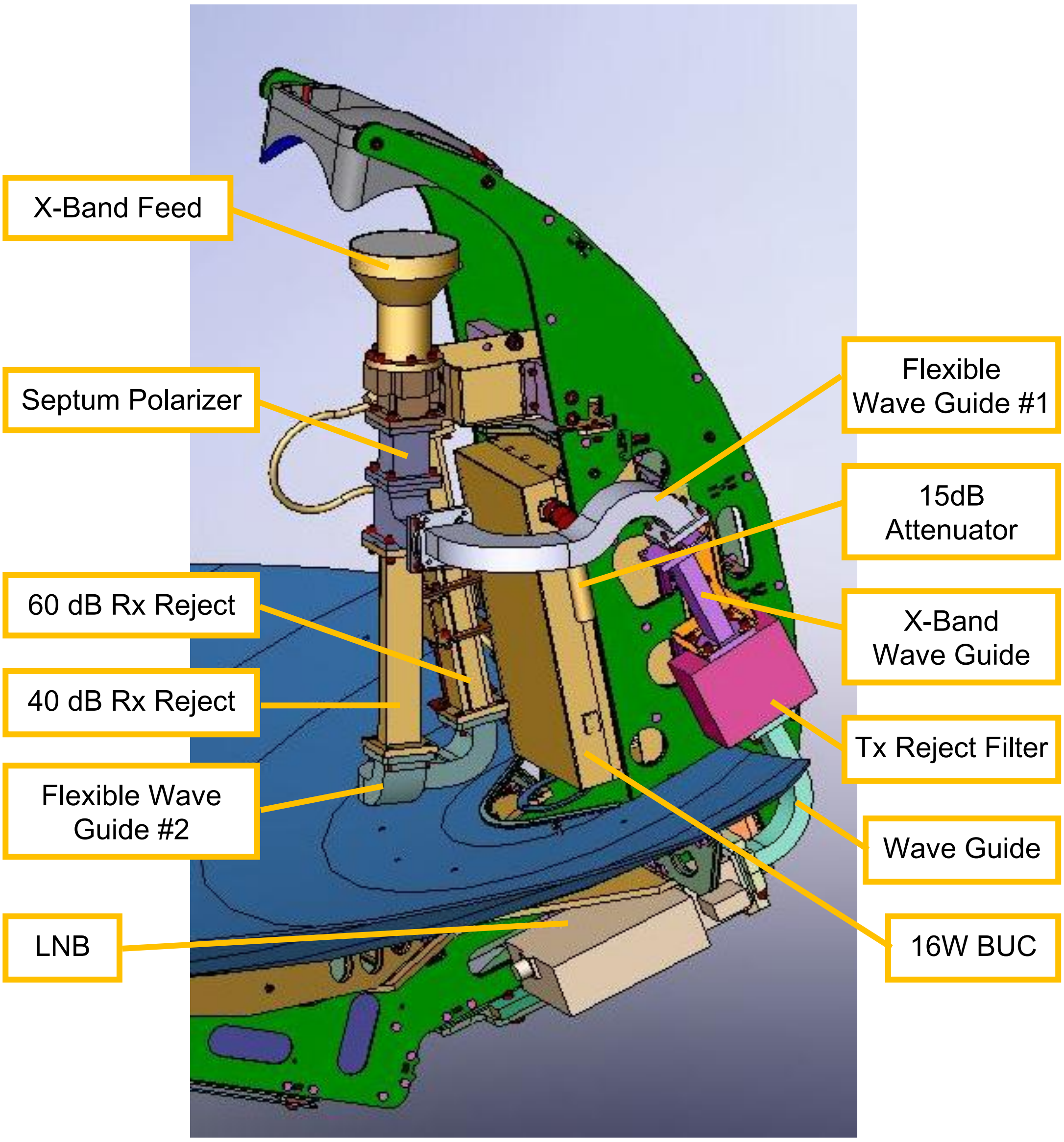


Figure 15-2: RF Package (1)

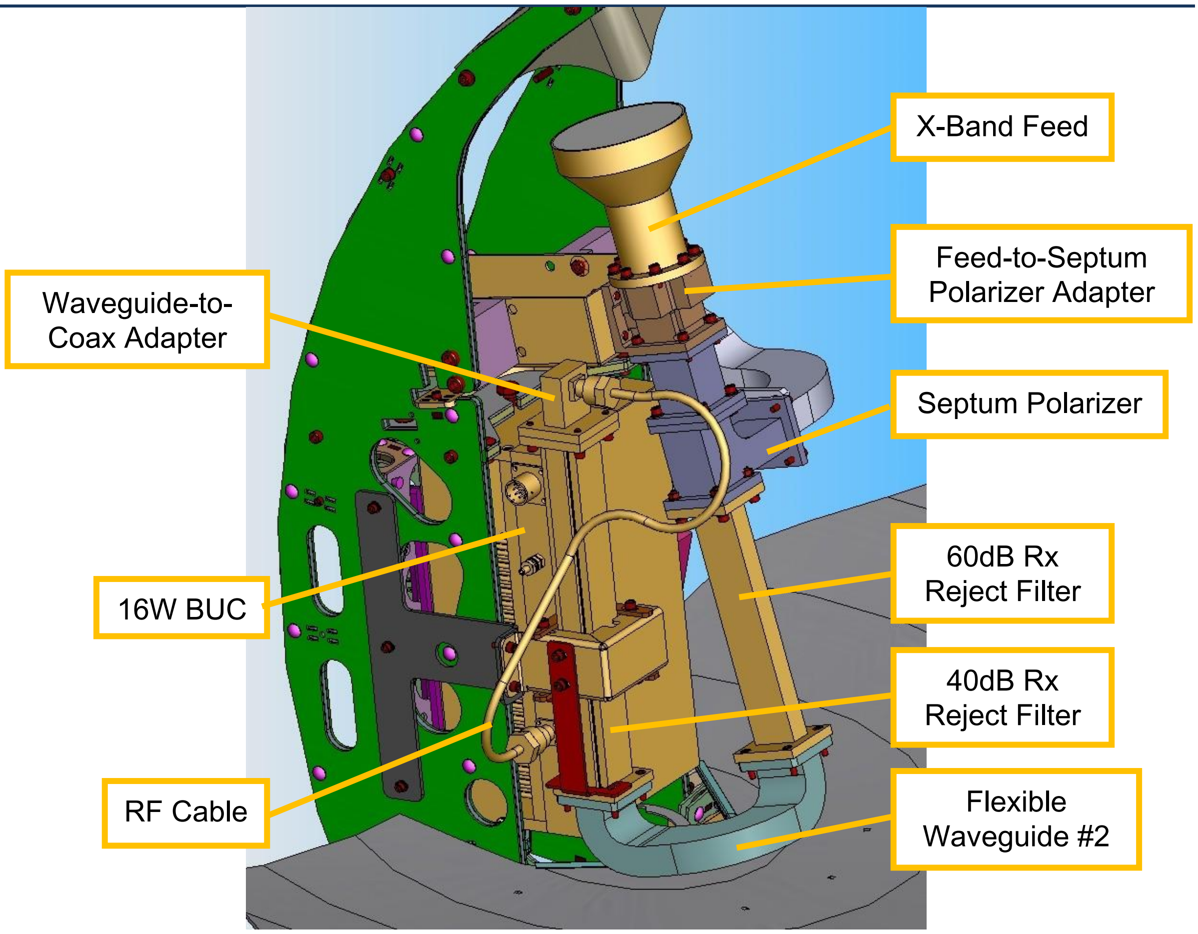


Figure 15-3: RF Package (2)

Block Up-Converter (BUC)

The 16W X-Band BUC (ITS Electronics Model No. UC-L7A98A4-4060) is a frequency translator with an integral power amplifier. It allows the translation of L-Band input signals to X-band.

In order to convert the frequency, the BUC uses an integral RF local oscillator, mixing stage, and the proper filtering. The local oscillator is able to phase-lock to an external signal received at 10 MHz in order to avoid frequency shifts. The 10 MHz reference signal is frequency multiplexed with the input transmit signal requiring a single interface cable.

The BUC can be controlled remotely via a serial interface. It can operate outdoors in all environmental conditions (for example: rain, snow, sand, solar radiation).

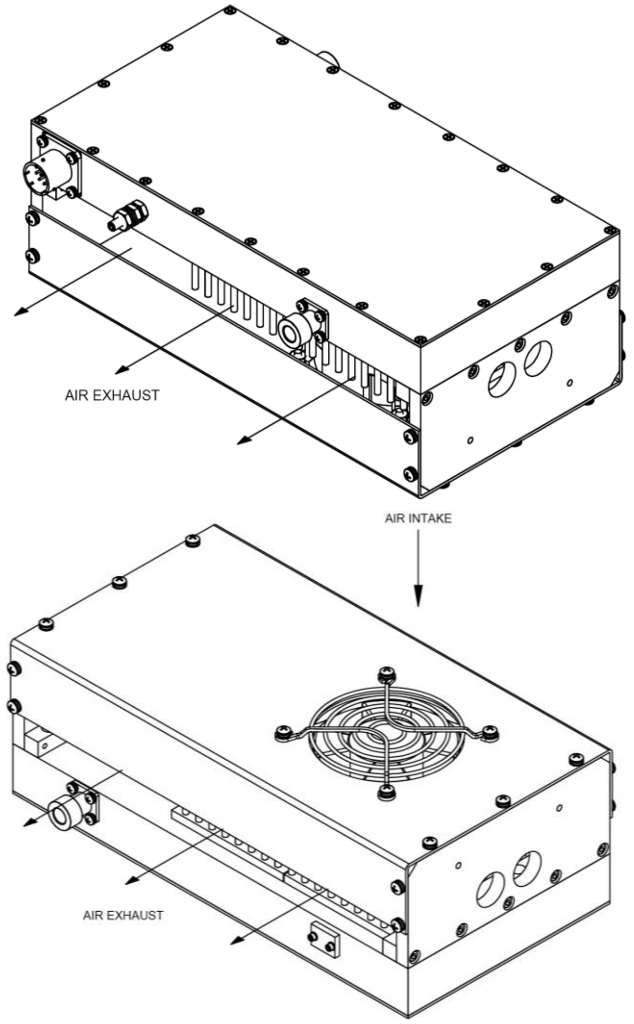


Figure 15-4: 16W BUC – General View

M&C Interface

The following commands are available on the remote control:

- List available RS-232 commands
- Toggle periodic diagnostic data / status report
- Send single diagnostic data / status report
- Mute / unmute the BUC
- Reset the unit
- Display Unit ID information

The following signaling is provided on the remote control:

- RF output power level (accuracy ±1.5 dB)
- Over temperature faults
- PA temperature too high
- BUC temperature too high
- Ambient temperature too high
- PA temperature too low
- BUC temperature too low
- Ambient temperature too low
- LO lock lost
- Fan spinning too fast
- Fan spinning too low

PORT	FREQUENCY RANGE
IF INPUT	950 to 1450 MHz
RF OUTPUT	7.90 to 8.40 GHz

Pin designation for connector		
Connector	Pin	Function
J2	3	RS232 TX-D
	4	RS232 RX-D
	12	Reserved
	13	Reserved
	2, 7, 8, 11	GND
	5, 9, 10	20 to 28 Vdc, 50mVpp, 90W total
	1, 6	Not connected

Figure 15-5: BUC IF, RF, and DC POWER/M&C Connectors

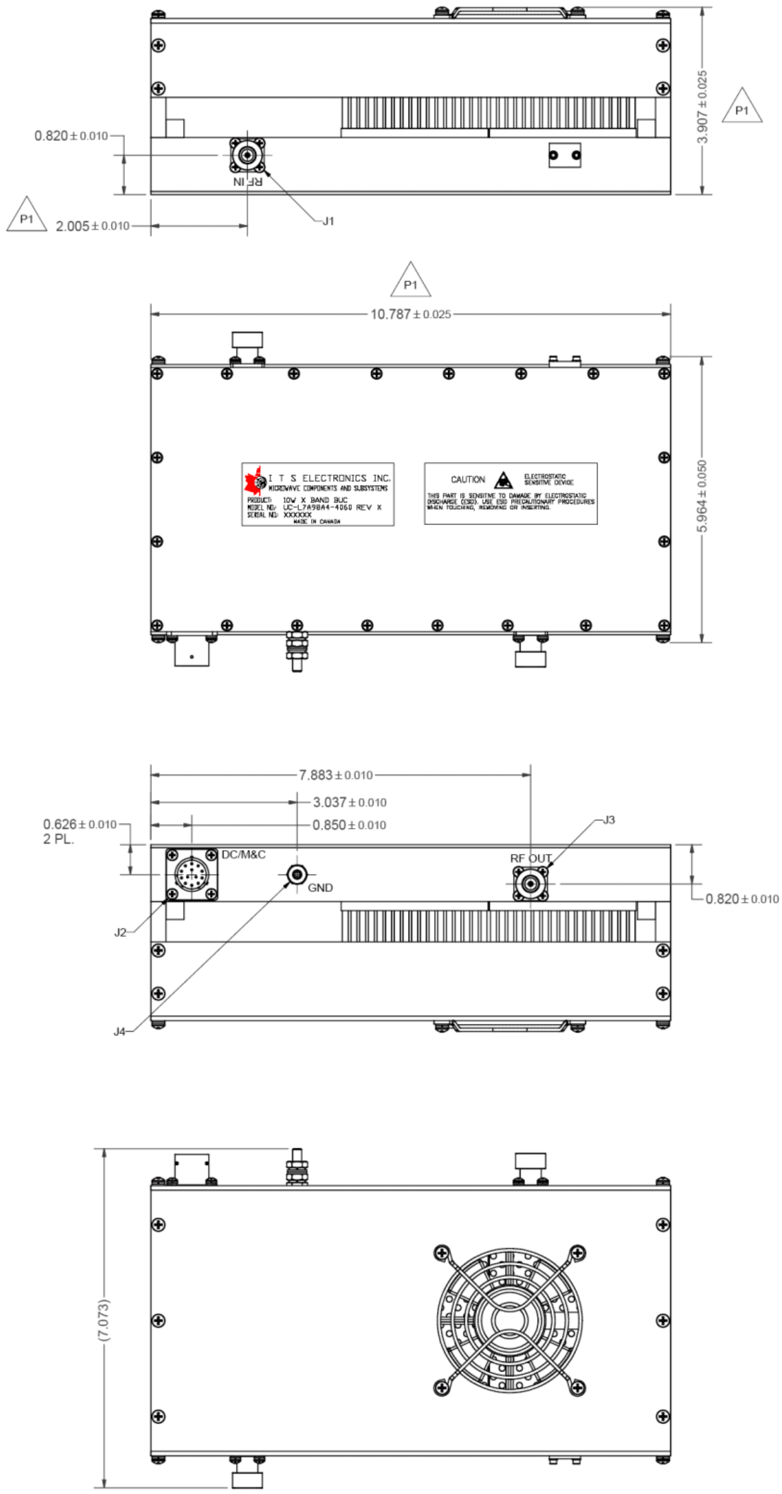
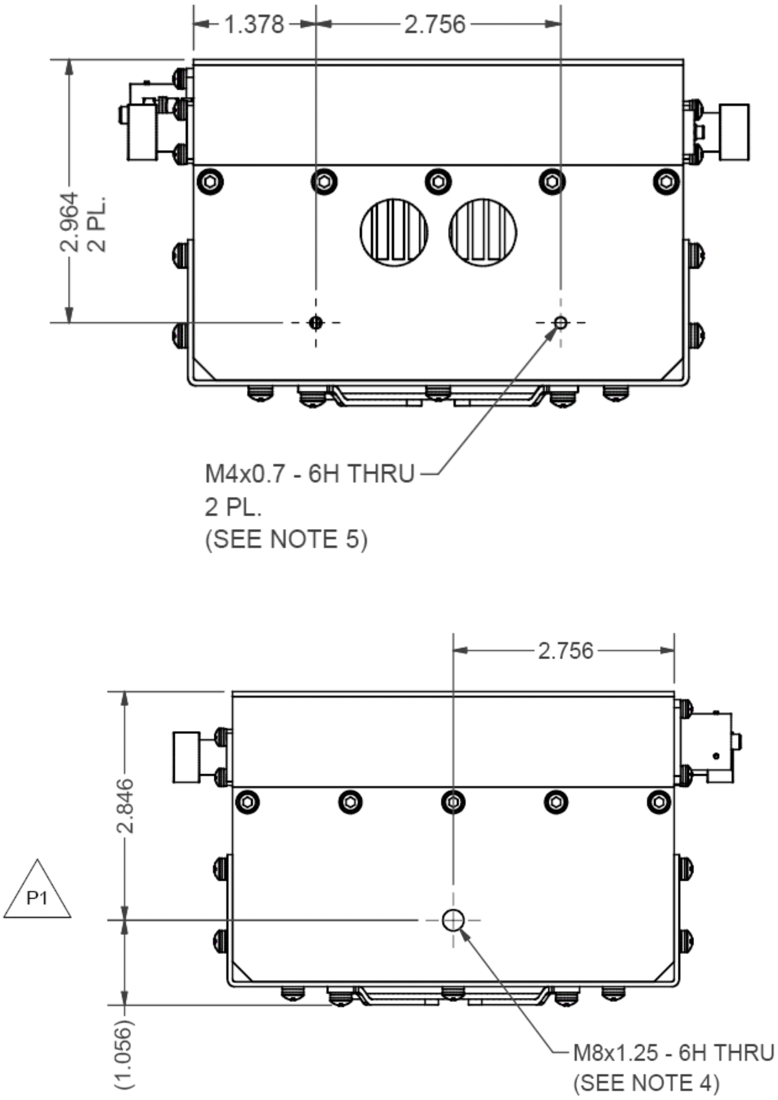


Figure 15-6: 16W BUC Layout Dimensions (1)



MECHANICAL SPECIFICATION

1. CONNECTORS:
   J1: RF INPUT, N-TYPE FEMALE, 50 Ohm.
   J2: DC INPUT / M&C, MIL-C-38999 SERIES I,
   13-PIN, PN# MS27466T-11B35P.
   J3: RF OUTPUT, N-TYPE FEMALE, 50 Ohm.
   J4: GROUND, #10-32 STUD.
2. MARKINGS: LABELS.
3. FINISH: NATO GREEN STANAG IR 2338.
4. M8 MOUNTING HOLE: 7.9mm OF AVAILABLE THREAD WITH 10mm OF MINIMUM CLEARANCE.
5. M4 MOUNTING HOLES: 7.9mm OF AVAILABLE THREAD WITH 8mm OF MINIMUM CLEARANCE.

Figure 15-7: 16W BUC Layout Dimensions (2)

Electrical Characteristics

Table 15-1 : X-band Electrical Characteristics

Parameter	Unit	Value
Input frequency range	MHz	950 ÷ 1450
Output frequency range	MHz	7900 ÷ 8400
Output power @1dBcp	dBm	+ 40.0 min
Output saturated power	dBm	+ 41.0 typ.
Max input level (no damage)	dBm	-10
Input VSWR	-	1.5:1 max
Output VSWR	-	1.5:1 max
Gain	dB	55 min
Gain flatness full band	dB	± 1 max
Gain flatness in 40 MHz	dB	± 0.25 max
Gain stability v/s temp.	dB	± 2.0 max
Gain mute (ext command or unit fault)	dB	60 dB min
Two-tone intermodulation @3dB back off from 1dBcp (total power)	dBc	- 26 max
Spurious, signal related	dBc	-50 max
Spurious, signal independent	dBm	-10 max in 7900÷8400 MHz
Spurious, out of Tx RF band including IM products falling in Rx band	dBm	-10 max
LO leakage	dBm	-40 dBm @ 6950 MHz
Noise power density	dBm/KHz	-93 max in 7250÷7750 MHz

Phase noise	dBc/Hz	-65 max @100Hz [ext. ref. –135 min]
		-75 max @1000Hz [ext. ref. –145 min]
		-85 max @10KHz [ext. ref. –145 min]
		-95 max @100KHz [ext. ref. –145 min]
Ext reference frequency	MHz	+10.00
Ext. reference level	dBm	-5 ÷ +5
2^{nd} harmonic	dBc	-60 max
Noise figure	dB	12 max @ max gain
Power requirements		20÷28 Vdc, 50mVpp, 90W
Serial interface		RS 232 - 9600 b/s, 8 bits ASCII, 1 start, 1 stop bit

Mechanical Characteristics

Table 15-2: X-band Mechanical Characteristics

Parameter	Unit	Value
Weight	Kg	6 max
Painting		NATO White Stanag IR 2338
Cooling		Forced air
Air inlet		Fan guards with integral filter; no additional filters required in the specified environmental conditions
RF input connector		N female 50 Ω
RF output flange		CPR 112 grooved
DC Power / M&C connector		13-pin MIL -38999 series MS27468T-11B35P

Environmental characteristics

Parameter	Unit	Value
Operating temperature	°C	-40 ÷ +65
Storage temperature	°C	-40 ÷ +80
Relative humidity	100% MIL-STD810F Method 507.4 - Procedure I max. temp. 60ºC max R.H. 100%	
Rain	2”/hour max	
Altitude	10000 amsl min, derated by 6°C/1000m	
Sand and dust	MIL-STD810F Method 510.4 - Procedure I	
Salt fog	MIL-STD810F Method 509.4 - Procedure I	
Solar radiation	1120 W/m2 MIL-STD810F Method 505.4 - Procedure I 3 cycles 32-49ºC 0/1120 W/m2	
Shock	MIL-STD 810 F – Method 516.5 proc. 1 – Functional Shock	
Vibrations	MIL-STD 167 -1 Mast Mounted	
EMI/EMC	Radiated emissions according to MIL-STD-461E Method RE102 (army ground) Radiated susceptibility according to MIL-STD-461E Method RS103 (army ground) Conducted susceptibility according to MIL-STD-461E Method CS114 (army ground)	
Safety	According to IEC 60950	

ORBIT

AL-7103 MKII RF System Layout

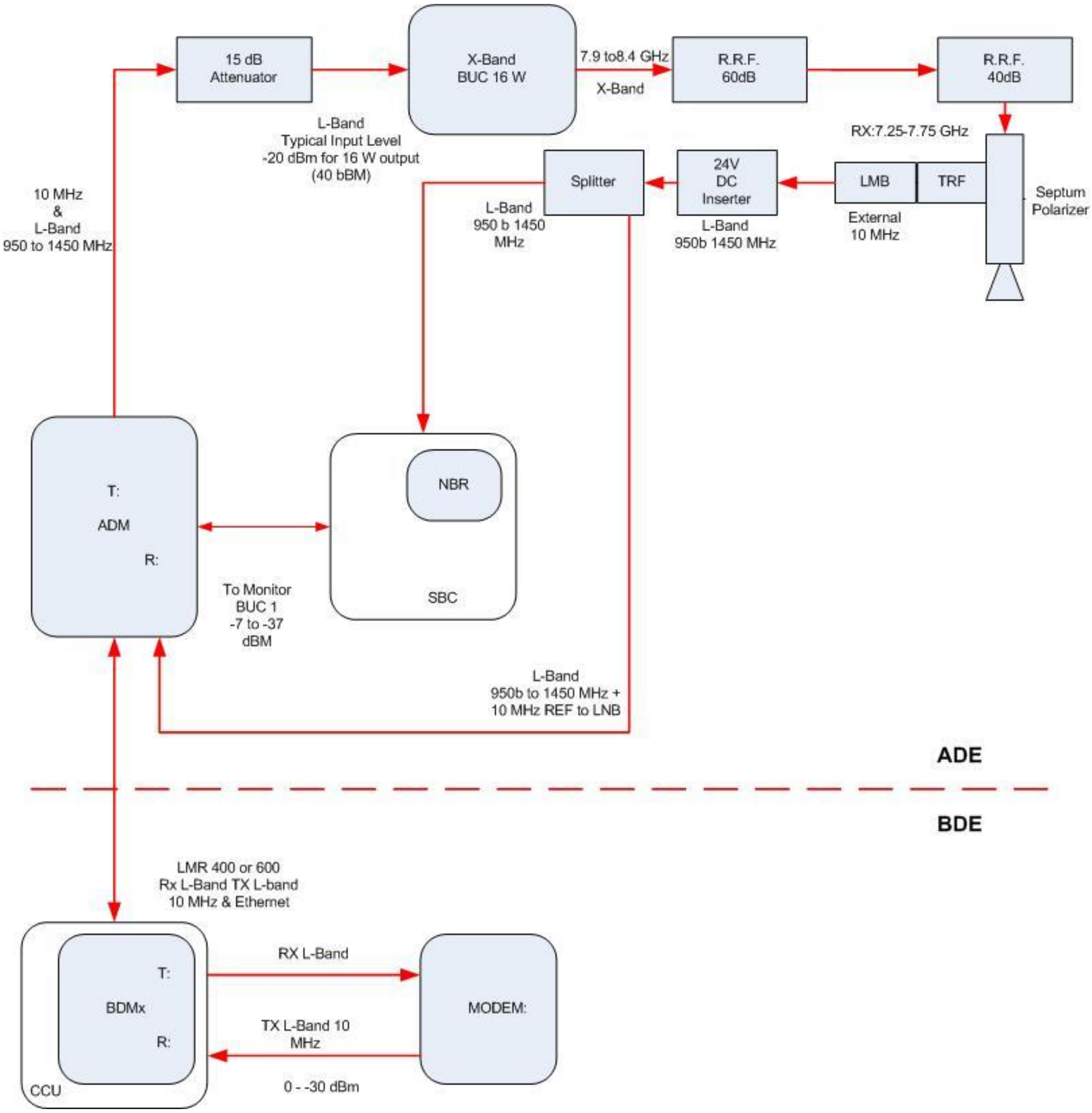


Figure 15-8: AL 7103 MKII System - RF Layout

Installation and Removal of Ku-Band and X-Band RF Kits

This section provides information and instructions required for on-site integration of Ku-Band and X-Band RF Kits of the OrSat AL-7103 MKII System:

Change the System Configuration from Ku-Band to X-Band

- Removal of Ku-Band RF Kit
- Installation of X-Band RF Kit
    - Ku-Band 8W BUC to X-Band 10W BUC

      OR
    - Ku-Band 8W BUC to X-Band 16W BUC

      OR
    - Ku-Band 16W BUC to X-Band 16W BUC

Only authorized and qualified Orbit technicians should perform the following procedures.

Change the System Configuration from X-Band to Ku-Band

- Removal of X-Band RF Kit
- Installation of Ku-Band RF Kit
    - X-Band 10W BUC to Ku-Band 8W BUC

      OR
    - X-Band 16W BUC to Ku-Band 8W BUC

      OR
    - X-Band 16W BUC to Ku-Band 16W BUC

Changing the System Configuration from Ku-Band to X-Band

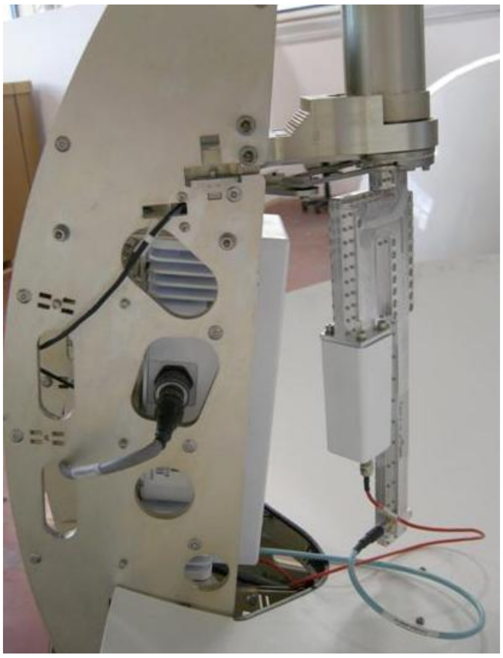
➲ To Remove Ku-Band RF Kit

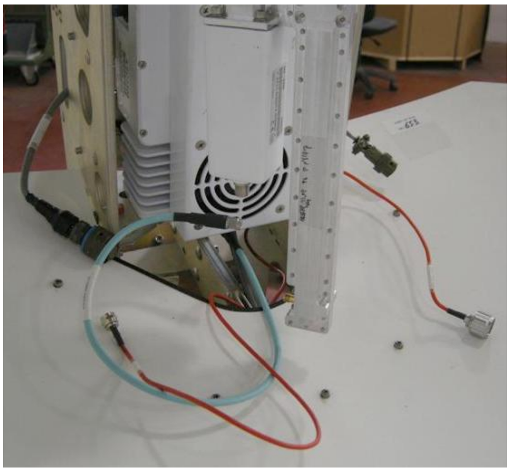
- In the following procedure we use 8W Ku-Band BUC in pictures; you can also use section **To Remove 8W Ku-Band BUC**.
- In Case your system includes a 16W Ku-Band BUC, please follow the section **To Remove 16W Ku-Band BUC**.
- In case your system includes an 8W Ku-Band and you are changing to a 16W X-Band BUC, please follow the section To **Remove PSU L00321001 - PSU ASSEMBLY FOR 4W and 8W BUC Systems**.
    - Removal of X-Band RF Kit
    - Installation of Ku-Band RF Kit

When performing the following procedures, be careful not to bend or damage the highly sensitive RF cables.

Step 1

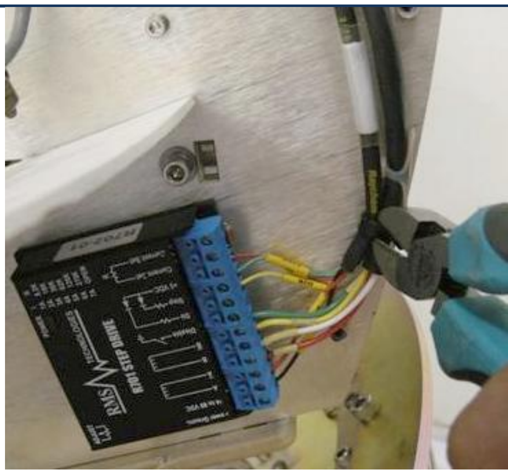
Disconnect the cables from the BUC and LNB connectors.





Step 2

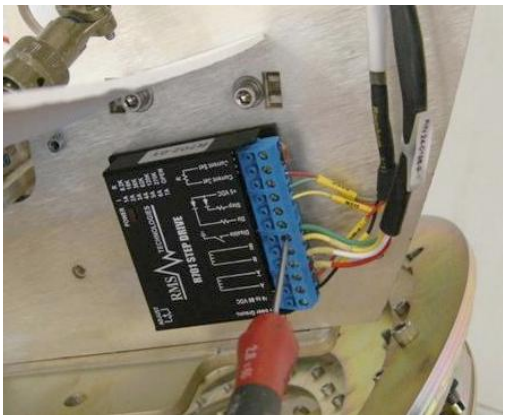
Cut the tie-wraps securing the cables to the `DISH ASSEMBLY`.

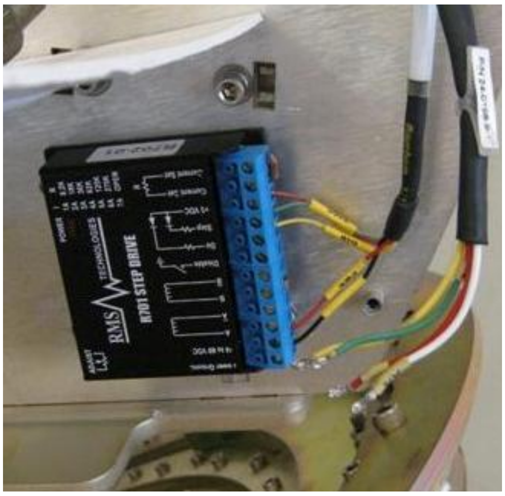


Step 3

Disconnect the cable wires from the `STEPPER MOTOR DRIVER`.

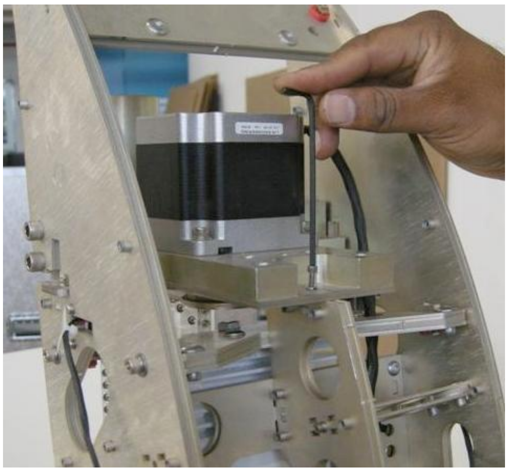
Do not disconnect the current-limit resistor from the terminal.

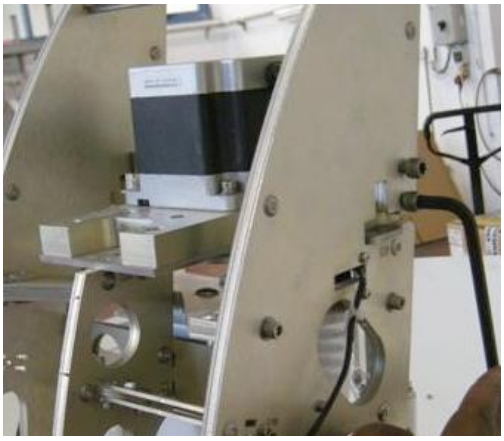




Step 4

Remove the 3 6/32” screws and the 4 5/16” screws securing the FEED SUBASSEMBLY to the DISH ASSEMBLY.

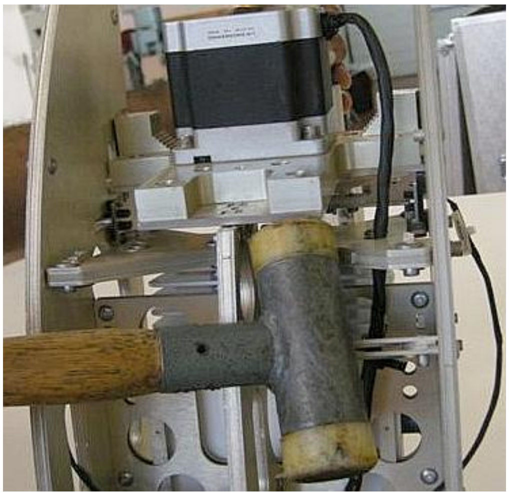


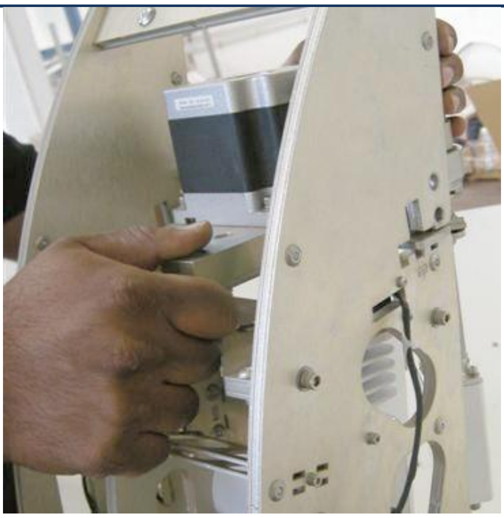


Step 5

Tap the FEED SUBASSEMBLY with a mallet to release it from the DISH ASSEMBLY.

Remove the FEED SUBASSEMBLY.

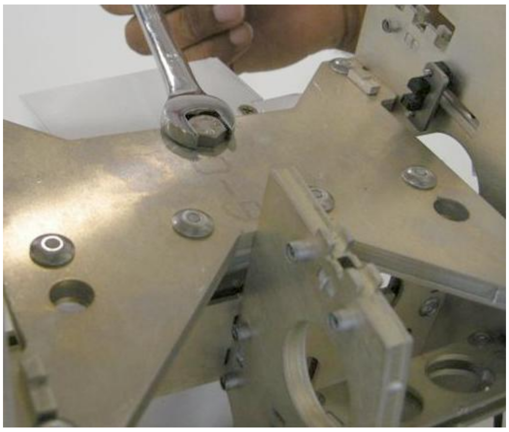


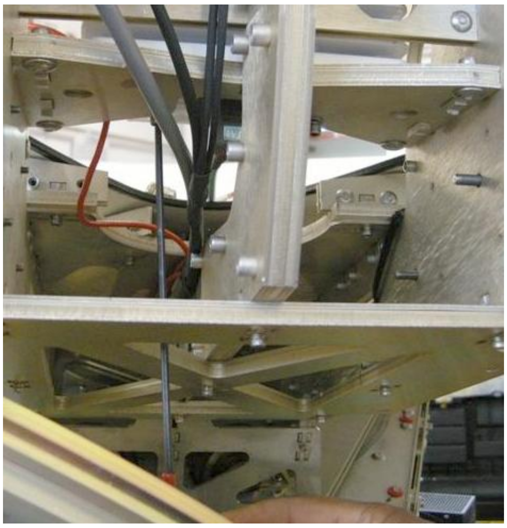


Step 6

Remove the 2 M-4 screws securing the `BUC` to the `DISH ASSEMBLY`.

Loosen the M-8 screw securing the `BUC` to the `DISH ASSEMBLY`.





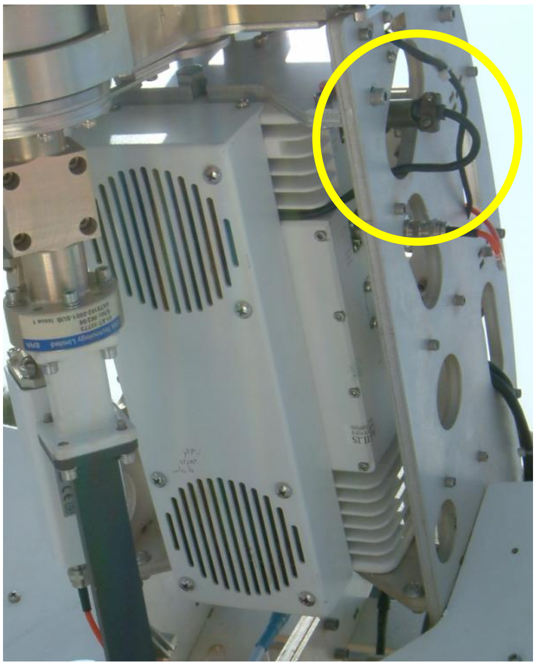
Step 7

Remove the `BUC`, reinstall the 2 M-4 screws, and fasten the M-8 screw.

➲ To Remove 8W Ku-Band BUC

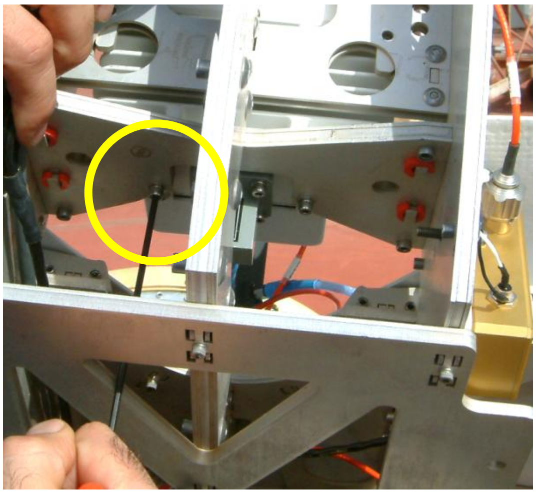
Step 1

Disconnect the cables from the BUC connectors.



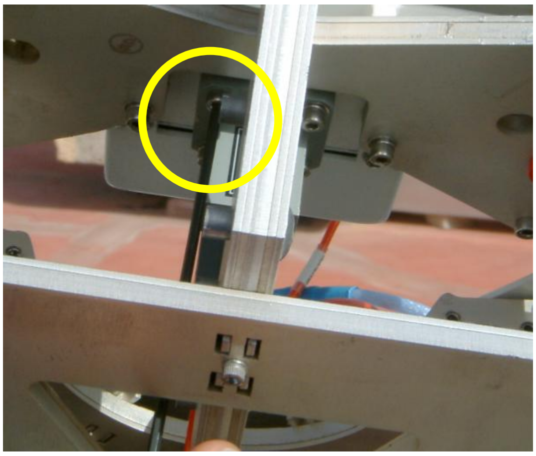
Step 2

Remove the two screws securing the BUC to the RF ASSEMBLY using a 13mm open wrench and 3mm Allen key.



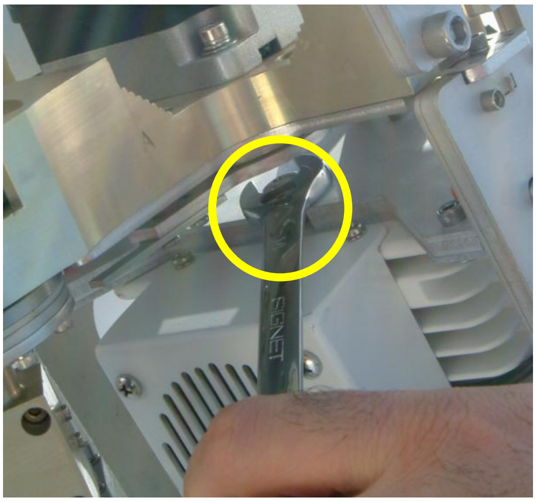
Step 3

Remove the 4 screws securing the BUC waveguide using a 3mm Allen key.



Step 4

Loosen the securing screws using a 13mm open wrench.



Step 5

Remove the BUC.

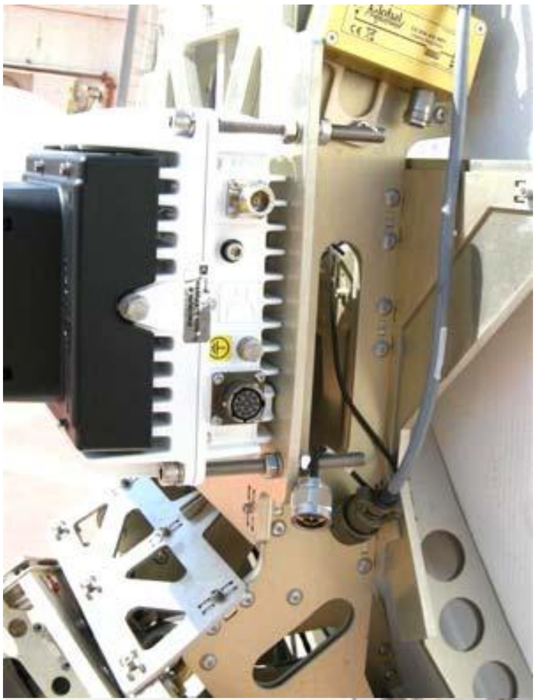
➲ To Remove 16W Ku-Band BUC

Step 1

Cut the tie-wraps binding the cables and remove them from the DISH ASSEMBLY.

Step 2

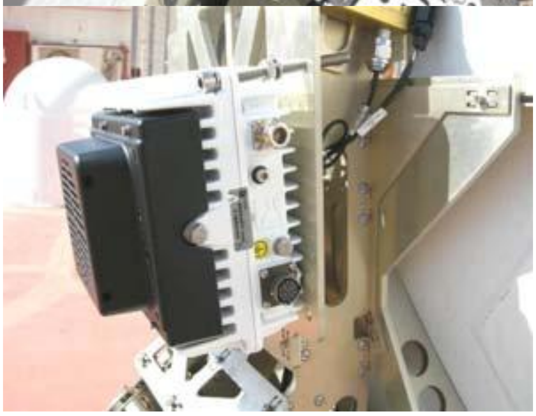
Disconnect the cables from the BUC connectors.

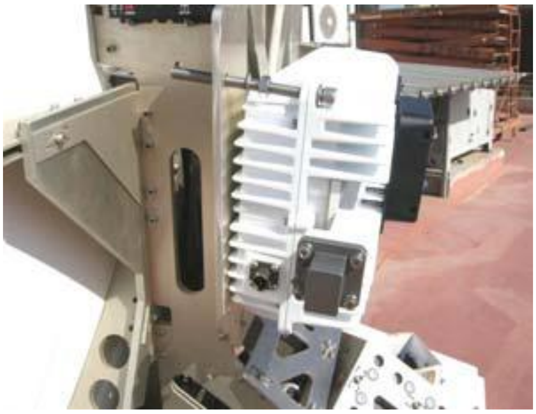


Step 3

Release the inner and outer nuts and remove the screws and washers.

Attach the nuts and washers to their screws and save them for the reinstallation procedure.





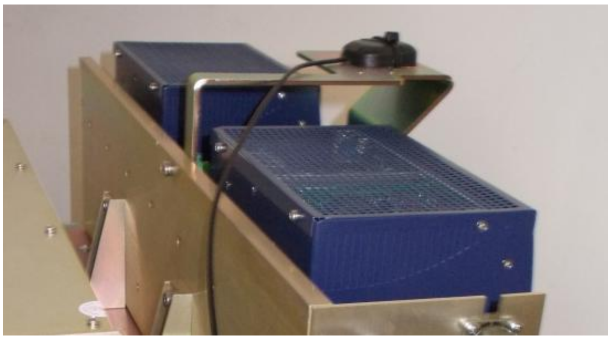
Step 4

Remove the `BUC` from the `RF ASSEMBLY`.

➲ To Remove PSU L00321001 - PSU ASSEMBLY FOR 4W and 8W BUC Systems

Step 1

Remove the `GPS ANTENNA` from the `PSU`.



Step 2

Disconnect the cables from the `PSU` connectors.

Step 3

Loosen the three screws securing the PSU to the BASE PLATE using a 5/32" Allen key.

Note: The screws remain attached to the **PSU** (Captives).

Step 4

Remove the **PSU**.

Installing the X-Band RF Kit

The X-Band RF Kit, ORBIT P/N KIT25-0097-10X-2 is shipped in a dedicated packing box.

Figure 15-9: X-Band RF Kit – Packing Box

The following image and table display the contents of the X-Band RF Kit.

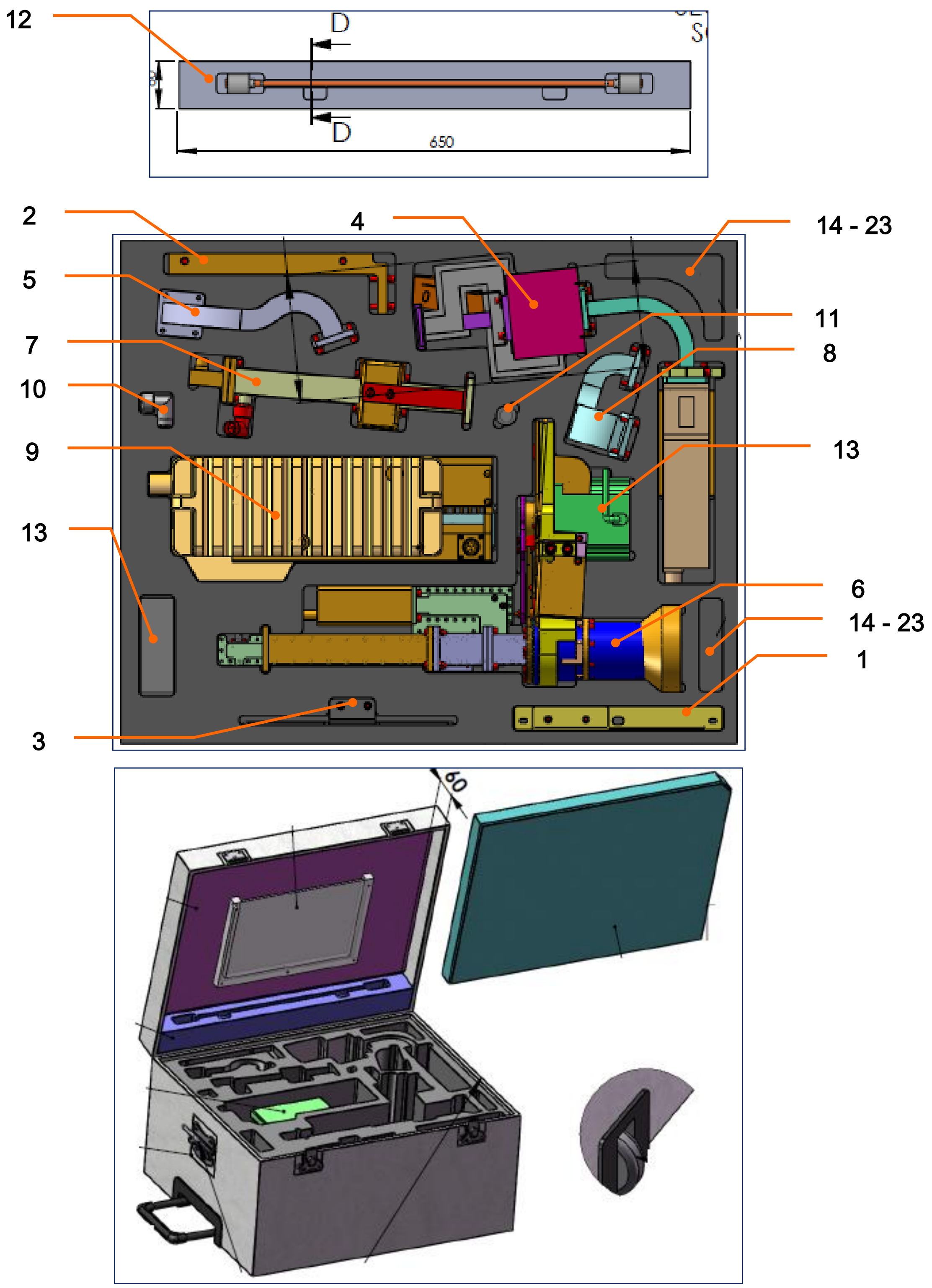


Figure 15-10: X-Band RF Kit – Packing Arrangement

Table 15-3: X-Band RF Kit – Packing List

Item	Description	Orbit Part No.	Qty
1.	TRF BRACKET	29-0676-4-1	1
2.	LNB BRACKET	29-0675-4-1	1
3.	RRF BRACKET	29-0642-4-1	1
4.	TRF+LNB SUB ASSY	29-0681-4-1	1
5.	FLEX WG #1	29-0644-4-1	1
6.	FEED SUB ASSY	29-0679-4-1	1
7.	RRF SUB ASSY	29-0678-4-1	1
8.	FLEX WG #2	29-0647-4-1	1
9.	BUC SUB ASSY	29-0648-4-1	1
10.	N-TYPE TO N-TYPE 90° ADAPTER	53N-50-0-4	1
11.	ATTENUATOR 15DB	E12000021	1
12.	RF CABLE	SF104-11NX2-0.5M	1
13.	DC INSERTER ASSEMBLY	25-0781-9-1	1
14.	RF CABLE 0.5m TX-BUC/DC.INS	26-1144-9-7	1
15.	DC BLOCK	CMH-F-M-DC BLOCK	1
16.	PHIL FH90 SCREW M3X8 ST.ST.	H00013040802	4
17.	N-MALE TO F-FEMALE ADAPTER	TC-666	2
18.	O- RING FOR FLEXIBLE WAVEGUIDES #1 & #2	K03000001	4
Fasteners Set for X-Band Feed Subassembly			
19.	ALLEN SOCKET CAP SCREW, #6-32X3/4	H06063271204	3
20.	LOCK WASHER, #6	MS35338-136	3
Fasteners Set for TRF + LNB Subassembly			
21.	ALLEN SOCKET CAP SCREW, #6-32X1"	H06063271604	5
22.	LOCK WASHER, #6	MS35338-136	5

Table 15-3: X-Band RF Kit – Packing List

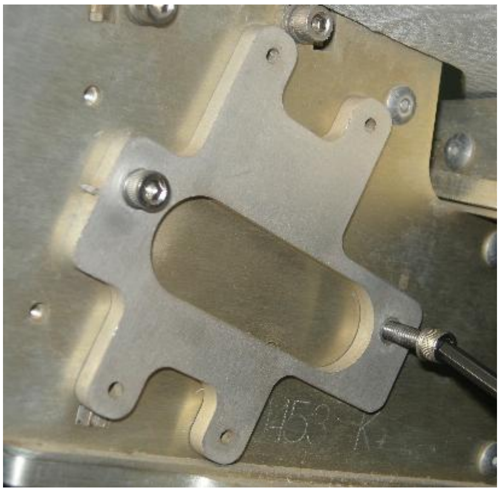
Item	Description	Orbit Part No.	Qty
23.	WASHER, #6	H20200691074	5

➲ To install the X-Band RF Kit:

Step 1

Remove the 2 screws securing the DC **INSERTER BRACKET** to the **DISH ASSEMBLY**.

Remove the **DC INSERTER BRACKET**.

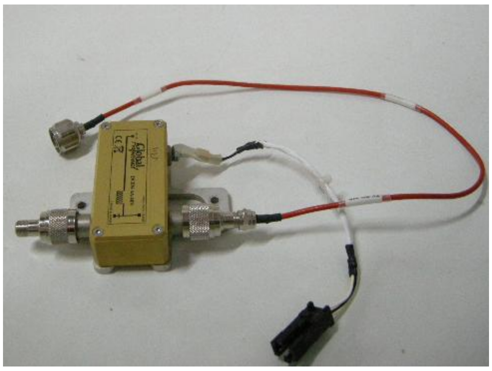


Step 2

Install the **2 N-MALE TO F-FEMALE ADAPTERS** on the **DC inserter N-**Type connectors.

Step 3

Connect the **RF CABLE** (14) to the L-Band 10 MHz and DC **CONNECTOR**.

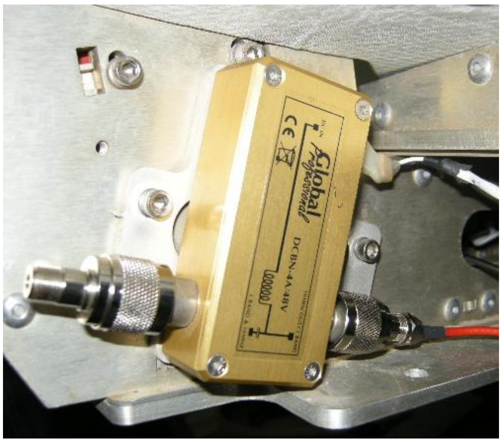


Step 4

Fasten the 4 screws (16) securing the DC INSERTER to its bracket.

Step 5

Mount the DC INSERTER and bracket on the **DISH ASSEMBLY** and fasten the 2 screws.

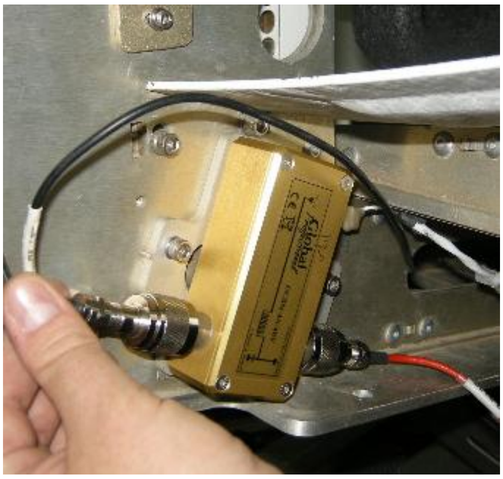


Step 6

Connect the system's DC cable to the DC INSERTER Mollex cable (DC IN).

Step 7

Connect the system's Rx cable to the **DC INSERTER L-BAND** and 10 MHz connector.



Step 8

If the **TX REJECT FILTER** (TRF) bracket (1) is already installed on the dish assembly, proceed to the next Step.

If not, mount the **TRF BRACKET** and secure it with 2 screws, lock washers, and washers (21, 22, and 23).

Step 9

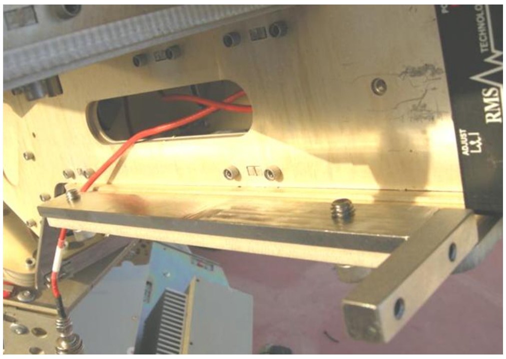
If the **RX REJECT FILTER** (RRF) **BRACKET** (1) is already installed on the **DISH ASSEMBLY**, proceed to the next step.

If not, mount the **RRF BRACKET** and secure it with 3 screws, lock washers, and washers (21, 22, and 23).

Step 10

If the LNB BRACKET (2) is already installed on the DISH ASSEMBLY, proceed to the next step.

If not, mount the LNB BRACKET and secure it with 2 5/16” screws (supplied with the bracket).



Step 11

Mount the BUC (9) on the DISH ASSEMBLY and secure it with the 2 M-4 screws (supplied with the bracket) and the M-8 screw (supplied with the BUC).

Step 11

Connect the following cables to the BUC cable connectors:

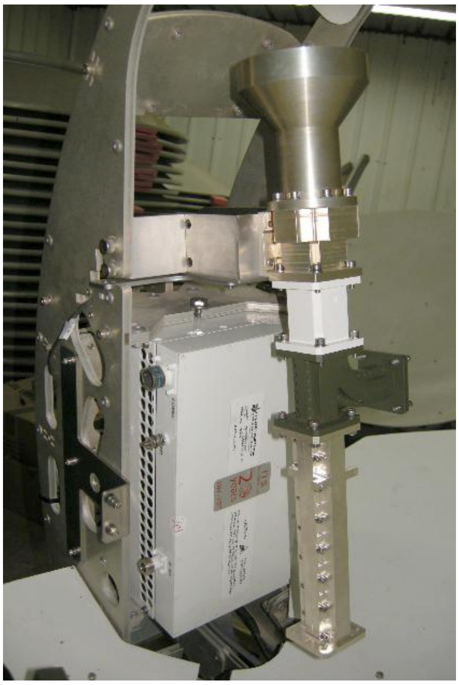
- The RF CABLE (12) to the RF OUT connector.
- The power cable to the DC/M&C connector.
- The N-TYPE TO N-TYPE 90° ADAPTER (10) to the RF INPUT connector.
- The 15DB ATTENUATOR (11) to the N-TYPE TO N-TYPE 90° ADAPTER (10).
- The system's Tx cable to the 15DB ATTENUATOR (11).

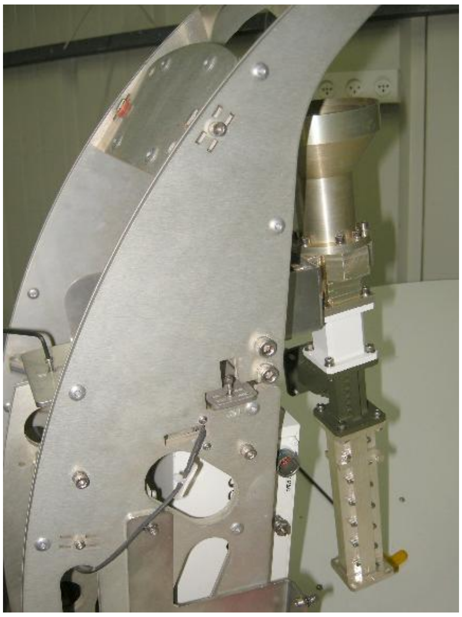
Step 12

Remove the 4 5/16” screws mounted on the FEED SUBASSEMBLY (6) BRACKET.

Mount the X-band FEED SUBASSEMBLY BRACKET on the DISH ASSEMBLY and secure it with 3 screws and lock washers (19, 20).

Fasten the 4 5/16” screws securing the bracket.

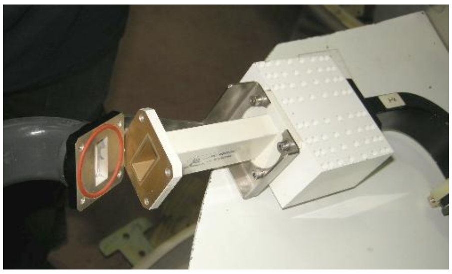


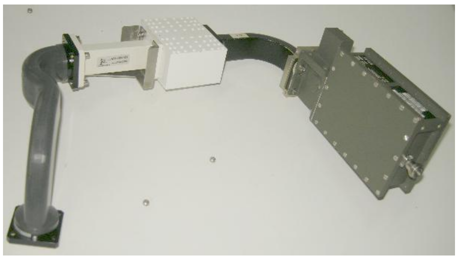


Step 13

Place an O-RING (13) on the FLEXIBLE WAVEGUIDE #1 (5).

Fasten the 4 screws (supplied with the WAVEGUIDE) securing the WAVEGUIDE to the TRF+LNB SUBASSEMBLY (4).





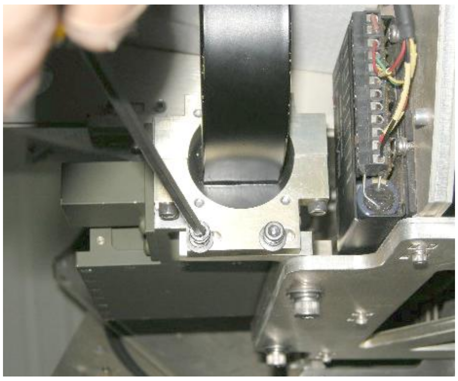
Step 14

Loosen the 2 screws, lock washers, and washers (21, 22, 23) securing the TX REJECT FILTER (TRF) BRACKET (1) to the DISH ASSEMBLY.

Remove the 2 screws from the TRF BRACKET.

Step 15

Place the combined FLEXIBLE WAVEGUIDE #1/TRF+LNB SUBASSEMBLY on the TX REJECT FILTER (TRF) BRACKET.



Install and loosely fasten the 2 screws securing the combined FLEXIBLE WAVEGUIDE #1/TRF+LNB SUBASSEMBLY on the TRF BRACKET.

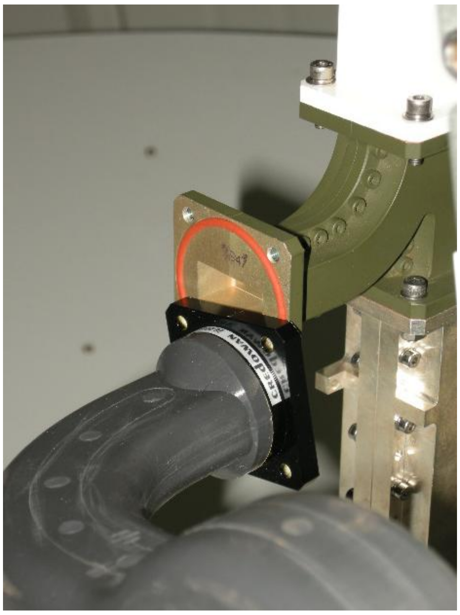
Remove the 2 screws from the LNB BRACKET (2).

Install and loosely fasten the 2 screws securing the combined FLEXIBLE WAVEGUIDE #1/TRF+LNB SUBASSEMBLY on the TRF BRACKET to the LNB BRACKET.

Step 16

Place an O-RING (13) on the X-BAND FEED SUBASSEMBLY (6).

Fasten the 4 screws (supplied with the X-BAND FEED SUBASSEMBLY) securing the FLEXIBLE WAVEGUIDE #1 (5) to the X-BAND FEED SUBASSEMBLY (6).



Step 17

Rotate the `15DB ATTENUATOR` (11) with the `N-TYPE TO N-TYPE 90° ADAPTER` (10) approximately 30° clockwise.

Step 18

Carefully fasten the following screws in a cross-wise manner:

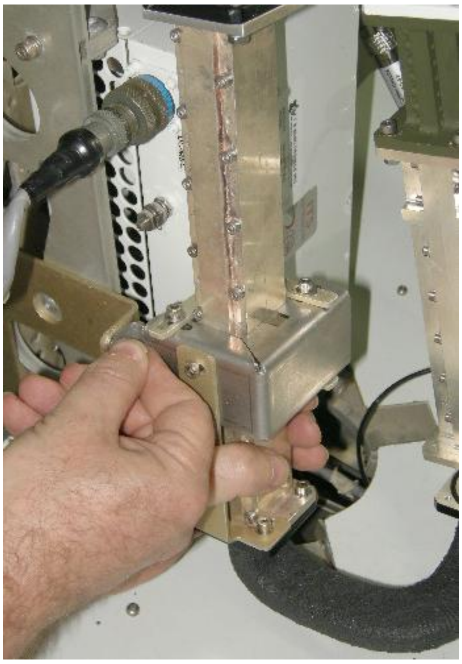
- 2 screws, lock washers, and washers (21, 22, 23) securing the `TX REJECT FILTER (TRF) BRACKET` (1) to the `DISH ASSEMBLY`.
- 2 screws securing the combined `FLEXIBLE WAVEGUIDE #1/TRF+LNB SUBASSEMBLY` on the `TX REJECT FILTER (TRF) BRACKET`.
- 2 screws securing the combined `FLEXIBLE WAVEGUIDE #1/TRF+LNB SUBASSEMBLY` on the `TX REJECT FILTER (TRF) BRACKET` to the `LNB BRACKET`.

Step 19

Place 2 O-RINGS (13) on the FLEXIBLE WAVEGUIDE #2 (8).

Fasten the 4 screws (supplied with the FLEXIBLE WAVEGUIDE #2) securing the WAVEGUIDE to the RRF SUBASSEMBLY (9).

Step 20



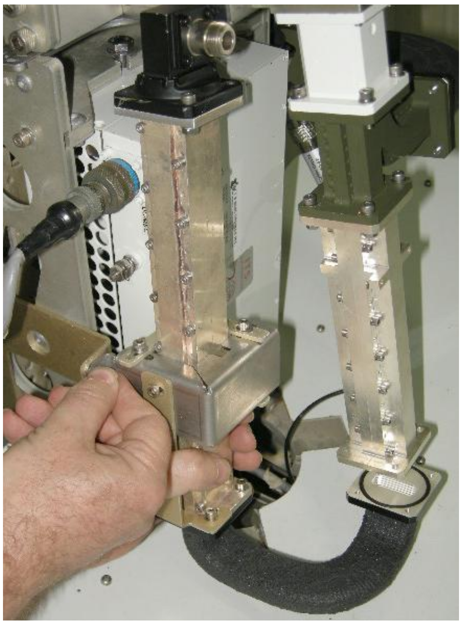
Place the combined FLEXIBLE WAVEGUIDE #2/RRF SUBASSEMBLY on the RX REJECT FILTER (RRF) BRACKET (3).

Loosely fasten the 2 screws (supplied with the RRF BRACKET) securing the combined FLEXIBLE WAVEGUIDE #2/RRF SUBASSEMBLY to the RX REJECT FILTER (RRF) BRACKET.

Step 21

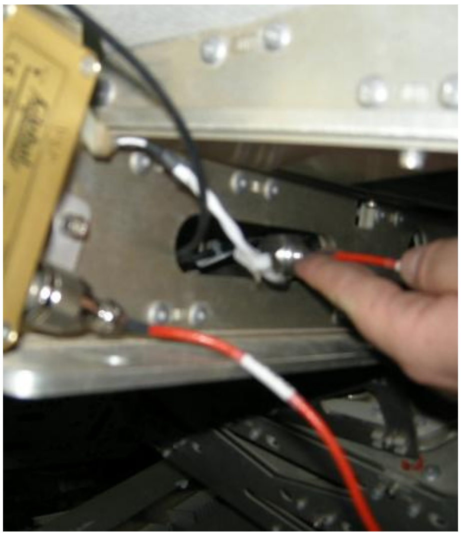
Fasten the 4 screws (supplied with the FLEXIBLE WAVEGUIDE #2) securing the WAVEGUIDE to the FEED SUBASSEMBLY (6).

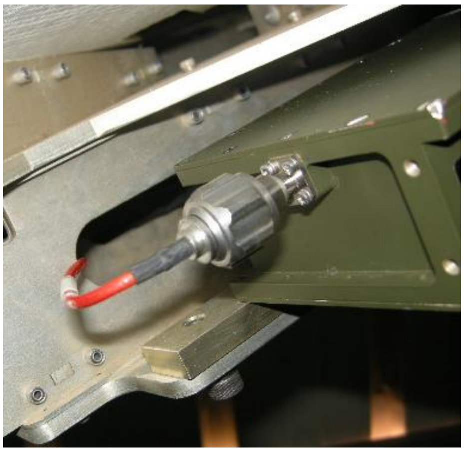
Fasten the 2 screws (supplied with the RX REJECT FILTER RRF BRACKET) securing the combined FLEXIBLE WAVEGUIDE #2/RRF SUBASSEMBLY to the RRF BRACKET.



Step 22

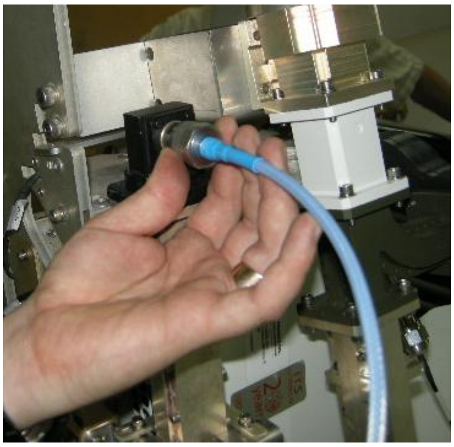
Pass the RF CABLE (14) through the DISH ASSEMBLY and connect it to the LNB connector.





Step 23

Connect the RF CABLE (12) to the Waveguide-to-Coax connector on the RRF ASSEMBLY.



Step 24

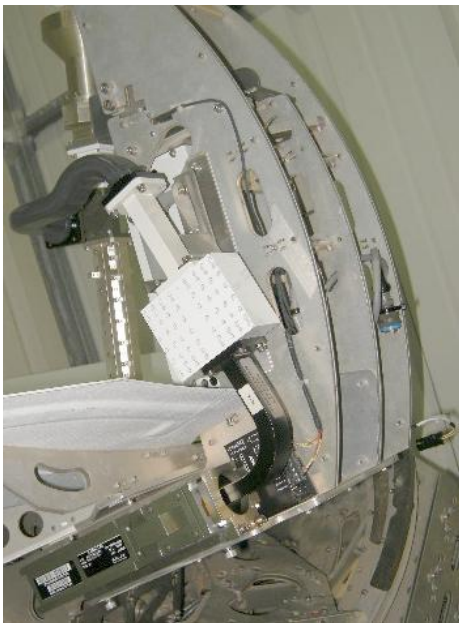
Disconnect the cable from the SBC AGC connector P8 and connect the DC BLOCK (15).

Re-connect the cable to the DC BLOCK.

Step 25

The `X-BAND RF KIT` is now installed.

Visually inspect that all screws are tightened and all cables connected and secured.



* In case you removed an 8W KU-BAND BUC and installed a 10W X-Band BUC – move to the section **To Install PSU L00321001 - PSU ASSEMBLY FOR 4W and 8W BUC Systems**.
* In case you removed an 8W KU-BAND BUC and installed a 16W X-Band BUC, follow the next section below.

➲ To Install PSU L00321002 - PSU ASSEMBLY FOR 16W BUC and up SYSTEMS

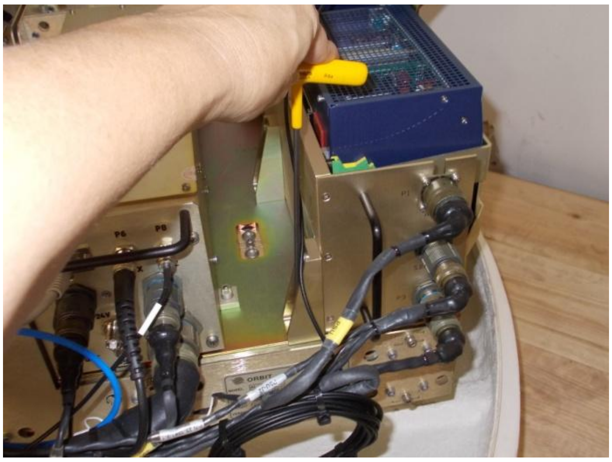
PSU 20W includes a 3rd Power supply in the middle of the assembly compare to the PSU 8W

Step 1

Mount the new PSU in its place on the ADE BASE.

Step 2

Tighten the three screws securing the PSU to the ADE BASE using a 5/32” Allen key.

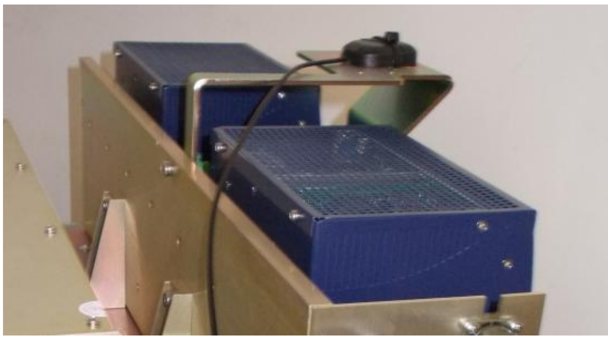


Step 3

Connect the cables to the `PSU` connectors.

Step 4

Mount the `GPS ANTENNA` in its place on the `PSU` and secure it with a tie-wrap.



Post-Assembly System Verification

After replacing the PSU, power up the system and activate Enc Init Mode several seconds after startup (see the *AL-7103 MKII Installation and Operation Manual* for instructions). Verify that the system functions properly.

Software Configuration Changes for Changing from Ku-Band to X-Band

Following installation of the X-Band RF Kit, perform the following procedure to change the software configuration from the Ku-Band to the X-Band configuration:

1. Power up the system.
2. In the `MTSLINK` **Operation Screen**, open the **InConfig** Menu and select **Step-Track**, then **X-Band**. The **X Step-Track Mode** dialog box opens.

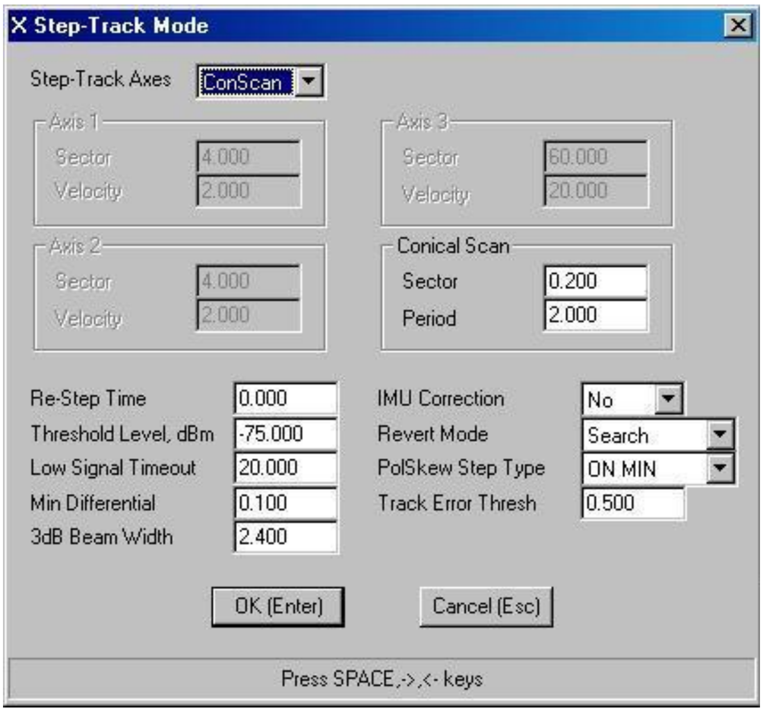


Figure 15-11: X Step-Track Mode dialog box

3. Verify that the settings match those displayed in the above figure.
4. Open the **Maintenance Screen**. In the **Receiver** window, click the **Band** button and select **X Circular**.

Figure 15-12: Receiver Window Band Menu

5. In the Tx Chain window, click the BUC Model button and select 10W X ITS M&C.

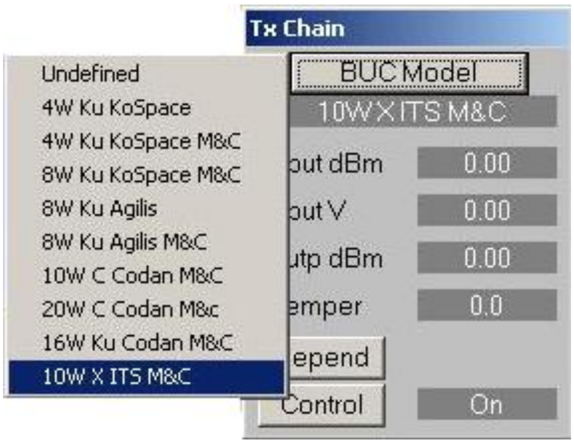


Figure 15-13: Tx Chain Window BUC Model Menu

6. Save the changes to non-volatile memory.

Change System Configuration from X-Band to Ku-Band

➲ To Remove X-Band RF Kit

In this section you will see a 16W X-Band BUC in pictures.

- In Case your system includes a 10W X-Band BUC – please follow the same section · of **To Remove X-Band RF Kit**, as both BUCs are the same.
- If you are changing from 10W X-Band to 8W Ku-Band BUC please follow section · **To Install 8W Ku-Band BUC** for installing 8W Ku-Band BUC, there is no need to replace PSU.
- If you are changing from 16W X-Band to 8W Ku-Band BUC please follow section **To Install 8W Ku-Band BUC** · for installing 8W Ku-Band BUC, and section **To Install PSU L00321001 - PSU ASSEMBLY FOR 4W and 8W BUC Systems** for replacing the PSU.
- If you are changing from 16W X-Band to 16W Ku-Band BUC please follow section **To Install 16W Ku-Band BUC** · for installing 16W Ku-Band BUC, there is no need to replace PSU.

Step 1

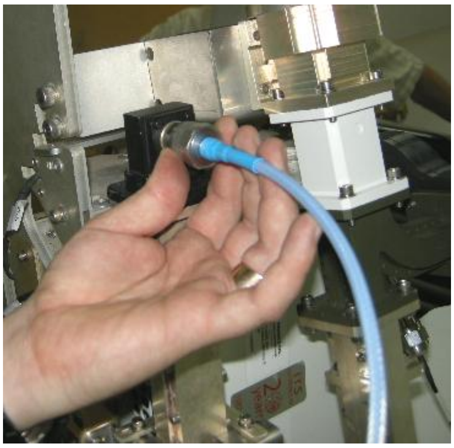
Disconnect the DC BLOCK cable from the SBC AGC connector P8.

Remove the DC BLOCK and re-connect the cable to the SBC AGC connector P8.

Step 2

Disconnect the RF cable (12) from the Waveguide-to-Coax connector on the `RRF ASSEMBLY`.

Disconnect the RF cable (12) from the RF OUT connector on the `BUC`.

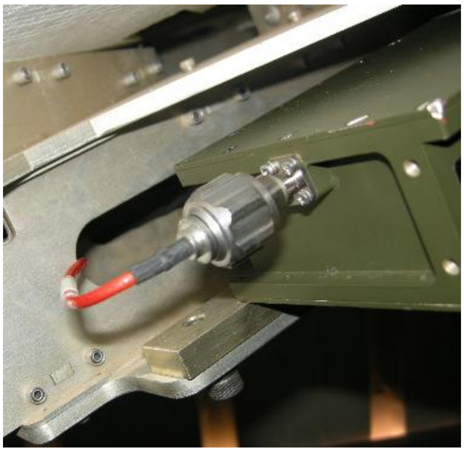


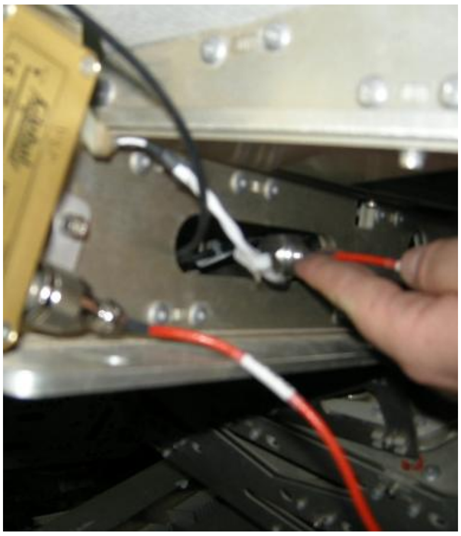
Step 3

Disconnect the RF cable (12) from the RF OUT connector on the `BUC`.

Step 4

Disconnect the RF cable (14) from the LNB connector and pass it through the DISH ASSEMBLY.

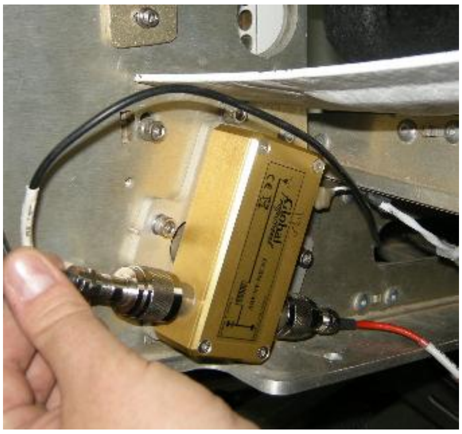




Step 5

Disconnect the system's DC cable from the DC INSERTER Mollex cable (DC IN).

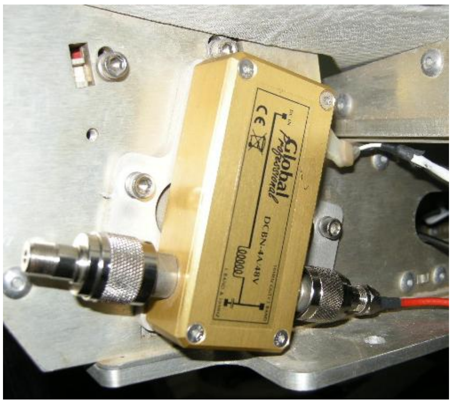
Disconnect the system's Rx cable from the DC INSERTER L-Band & 10 MHz connector.



Step 6

Remove the DC INSERTER and its bracket from the DISH ASSEMBLY.

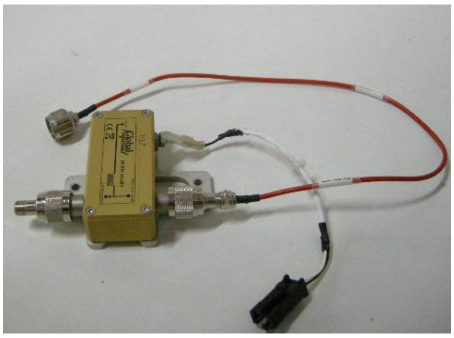
Remove the 4 screws (16) securing the DC INSERTER to its bracket.



Step 7

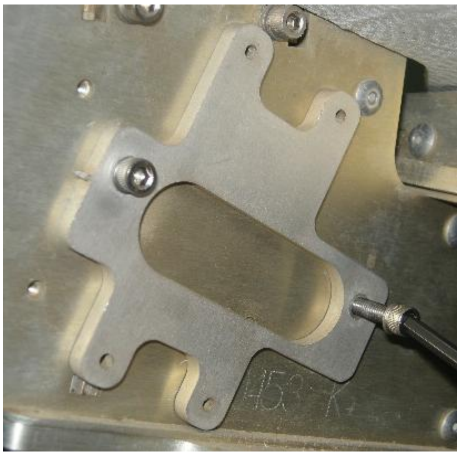
Disconnect the RF cable (14) from the L-Band 10 MHz & DC connector.

Remove the 2 N-MALE TO F-FEMALE ADAPTERS from the DC INSERTER N-Type connectors.



Step 8

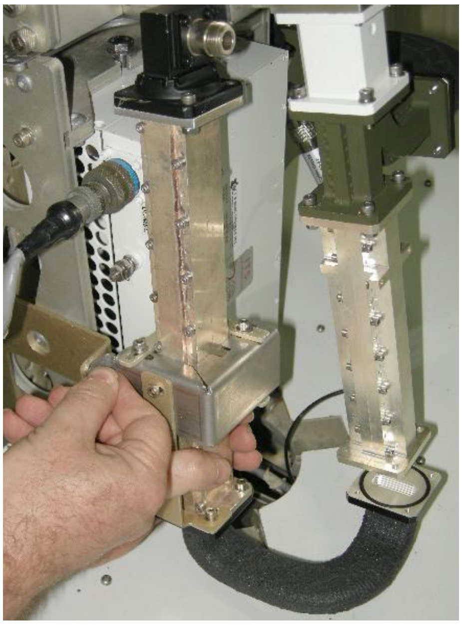
Mount the DC INSERTER bracket on the DISH ASSEMBLY and fasten the 2 screws.



Step 9

Remove the 2 screws securing the combined FLEXIBLE WAVEGUIDE #2/RRF SUBASSEMBLY to the RX REJECT FILTER (RRF) BRACKET.

Remove the 4 screws securing the FLEXIBLE WAVEGUIDE #2 to the FEED SUBASSEMBLY.



Step 10

Remove the 4 screws securing the FLEXIBLE WAVEGUIDE #2 to the RRF SUBASSEMBLY.

Fasten the 8 removed screws on both sides of the FLEXIBLE WAVEGUIDE #2.

Remove the two O-RINGS and put them into their plastic bag.

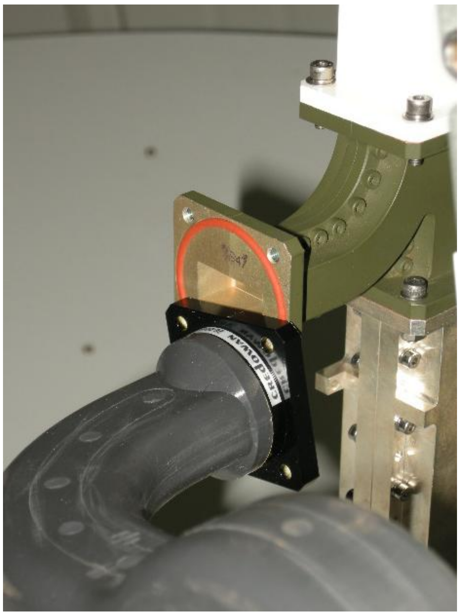
Step 11

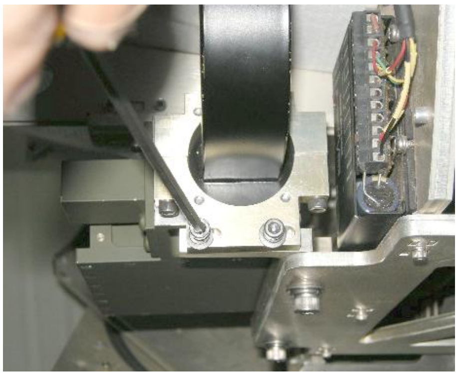
Loosen the 2 screws securing the combined FLEXIBLE WAVEGUIDE #1/TRF+LNB SUBASSEMBLY on the TX REJECT FILTER (TRF) BRACKET.

Step 12

Remove the 4 screws securing the FLEXIBLE WAVEGUIDE #1 (5) to the X-BAND FEED SUBASSEMBLY (6).

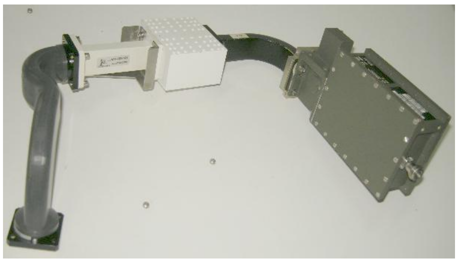
Remove the O-RING (13) from the X-BAND FEED SUBASSEMBLY (6).





Step 13

Remove the 2 screws securing the combined FLEXIBLE WAVEGUIDE #1/TRF+LNB SUBASSEMBLY to the LNB bracket.



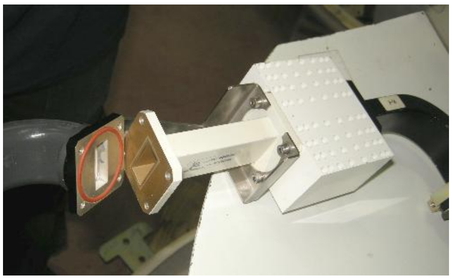
Step 14

Remove the 4 screws securing the FLEXIBLE WAVEGUIDE #1 (5) to the TRF+LNB SUBASSEMBLY (4).

Remove the O-RING (13) from the FLEXIBLE WAVEGUIDE #1 (5).

Fasten the 4 removed screws on both sides of the WAVEGUIDE.

Remove the 2 O-RINGS and put them into their plastic bag.



Step 15

Attach the removed screws to the LNB BRACKET and the TRF BRACKET.

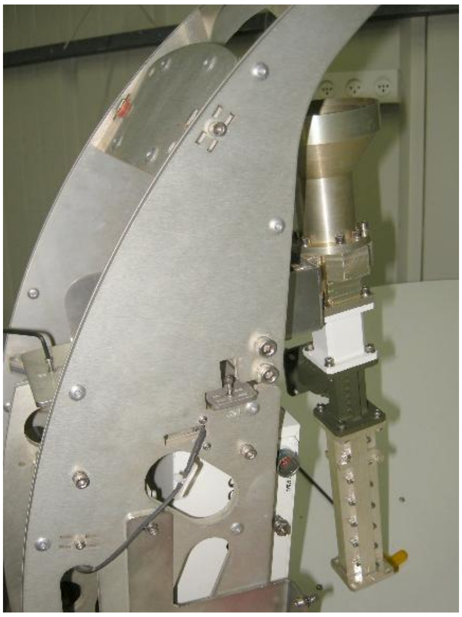
Step 16

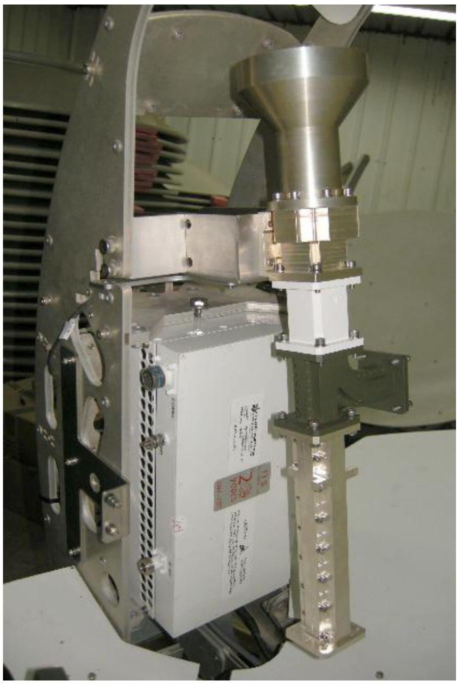
Remove the 4 5/16" screws securing the FEED SUBASSEMBLY (6) BRACKET to the DISH ASSEMBLY.

Remove the 3 screws and lock washers (19, 20) securing the X-BAND FEED SUBASSEMBLY (6) BRACKET to the DISH ASSEMBLY.

Remove the X-BAND FEED SUBASSEMBLY (6) from the DISH ASSEMBLY.

Attach the 4 four 5/16" screws mounted on the FEED SUBASSEMBLY (6) BRACKET.





Step 17

Disconnect the system's Tx cable from the 15DB ATTENUATOR (11).

Disconnect the ATTENUATOR (11) from the N-TYPE TO N-TYPE 90° ADAPTER (10).

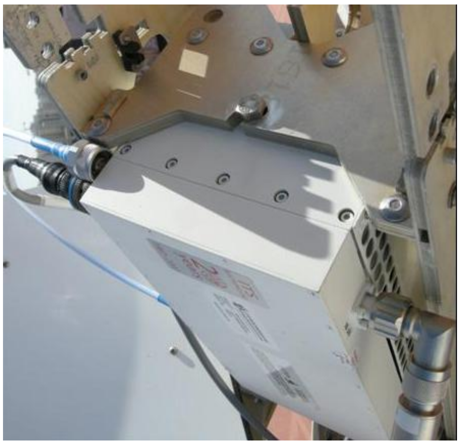
Disconnect the N-TYPE TO N-TYPE 90° ADAPTER (10) from the RF INPUT connector on the BUC.

Disconnect the power cable from the DC/M&C connector on the BUC.

Remove 2 M-4 screws securing the BUC to the DISH ASSEMBLY.

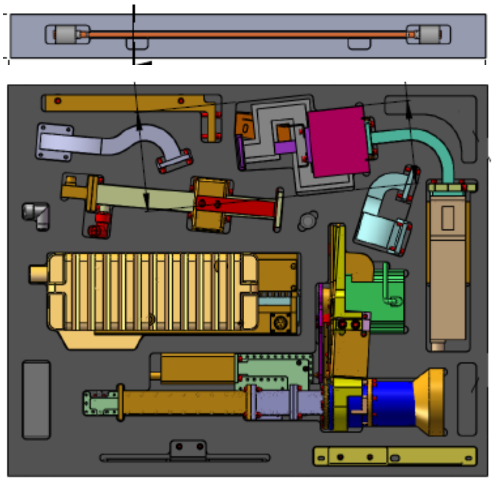
Remove the M-8 screw securing the BUC to the DISH ASSEMBLY.

Remove the BUC (9).



Step 18

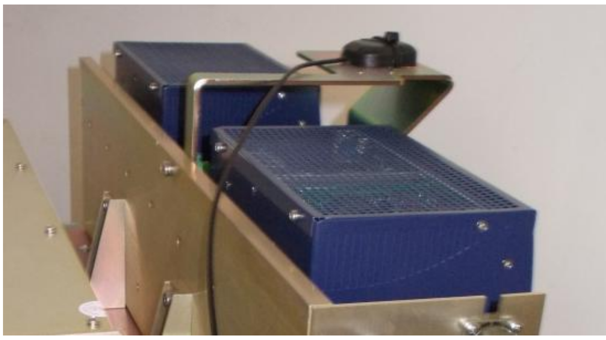
Verify that all the X-Band RF Kit components are inserted in their designated locations in the packing box.



➲ To Remove PSU L00321002 - PSU ASSEMBLY FOR 16W BUC and up Systems

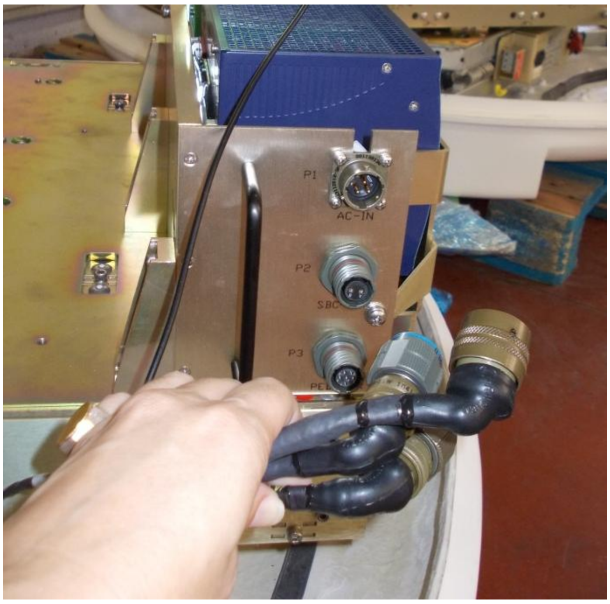
Step 1

Remove the `GPS ANTENNA` from the `PSU`.



Step 2

Disconnect the cables from the `PSU` connectors.



Step 3

Loosen the three screws securing the PSU to the BASE PLATE using a 5/32" Allen key.

Note: The screws remain attached to the PSU (Captives).

Step 4

Remove the **PSU.**

Installing the Ku-Band RF Kit

The Ku-Band RF Kit ORBIT P/N KIT25-0097-8W-KU is shipped in a dedicated packing box.

Figure 15-14: Ku-Band RF Kit – Packing Box

The following figure and table display the contents of the Ku-Band RF Kit.

Figure 15-15: Ku-Band RF Kit – Packing Arrangement

Table G-3. Ku-Band RF Kit – Packing List

ITEM	DESCRIPTION	ORBIT P/N	QTY
1.	FEED SUBASSEMBLY	29-0683-4-1	1
2.	BUC SUBASSEMBLY	29-0684-4-1	1
3.	RF CABLE	CF-210-51CM-SMSM	1
Fasteners Set for Ku-Band Feed Subassembly			
4.	ALLEN SOCKET CAP SCREW, #6 32 × 3/4	H06063271204	3
5.	LOCK WASHER, #6	MS35338-136	3
6.	ALLEN SOCKET CAP SCREW, #5/16-18 × 5/8	H06051671004	4

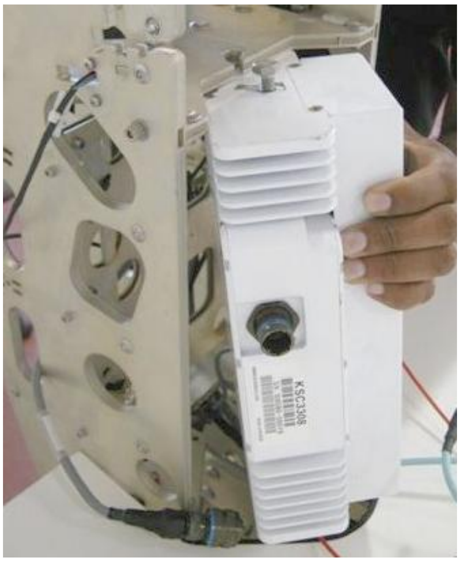
➲ To install the Ku-Band RF Kit:

Step 1

Loosen the M-8 screw on the `BUC` (2).

Remove the 2 M-4 screws from the `BUC`.

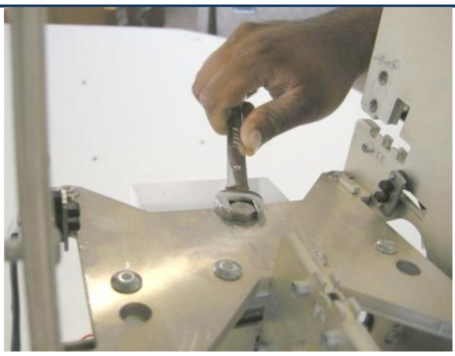
Install the `BUC` on the `DISH ASSEMBLY`.



Step 2

Fasten the 2 M-4 screws securing the `BUC` to the `DISH ASSEMBLY`.

Fasten the M-8 screw securing the `BUC` to the `DISH ASSEMBLY`.

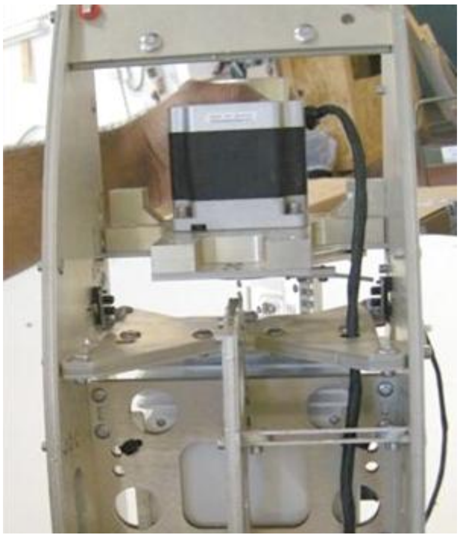


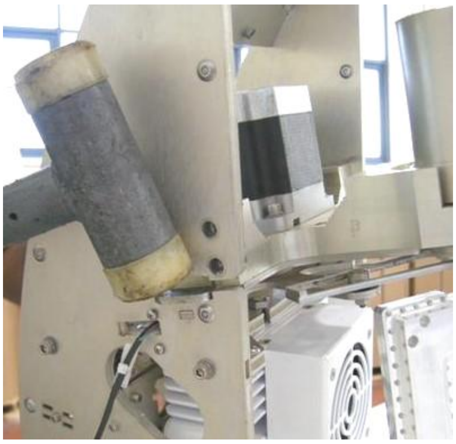
Step 3

Install the FEED SUBASSEMBLY (1) on the DISH ASSEMBLY.

Using a plastic hammer, tap on the FEED ABSSEMBLY to secure it to the DISH ASSEMBLY.

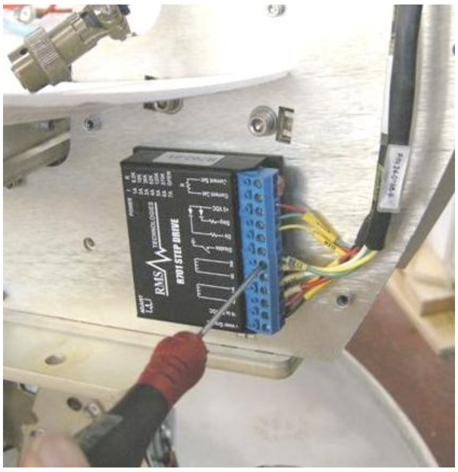
Fasten the 3 6/32" screws and 4 5/16" screws securing the FEED SUBASSEMBLY to the DISH ASSEMBLY.

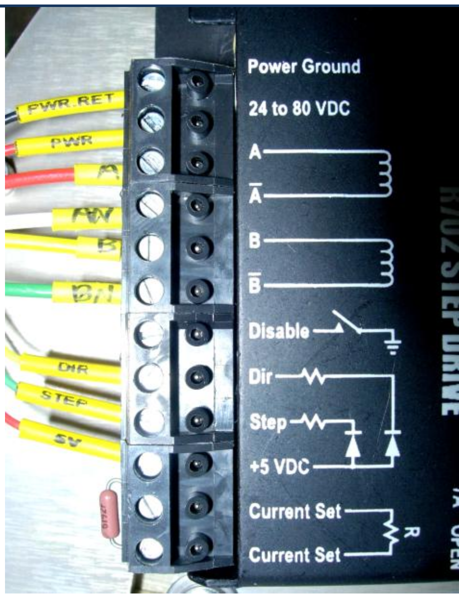




Step 4

Connect the motor cable wires to the STEPPER MOTOR DRIVER.



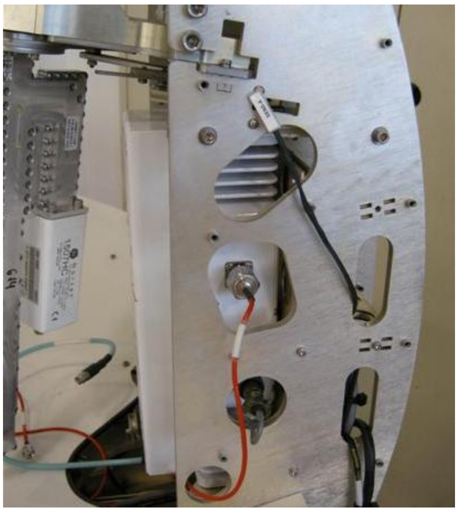


Step 5

Secure the cables to the `DISH ASSEMBLY` with tie-wraps.

Step 6

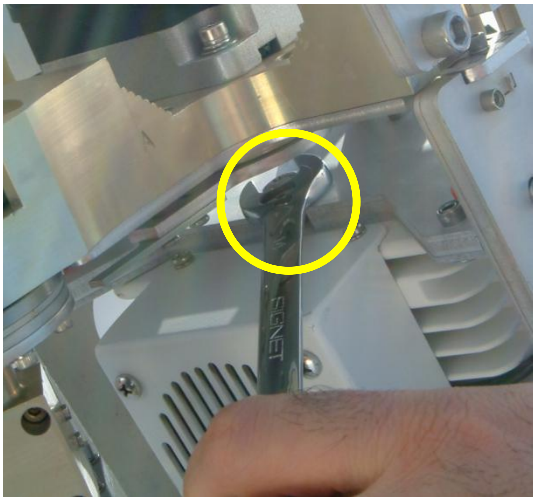
Connect the cables to the `BUC` and `LNB` connectors.



➲ To Install 8W Ku-Band BUC

Step 1

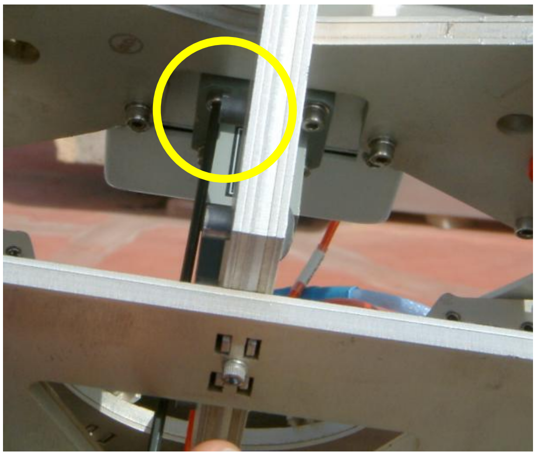
Mount the new BUC in its place and use a 13mm open wrench to tighten the securing screws.



Step 2

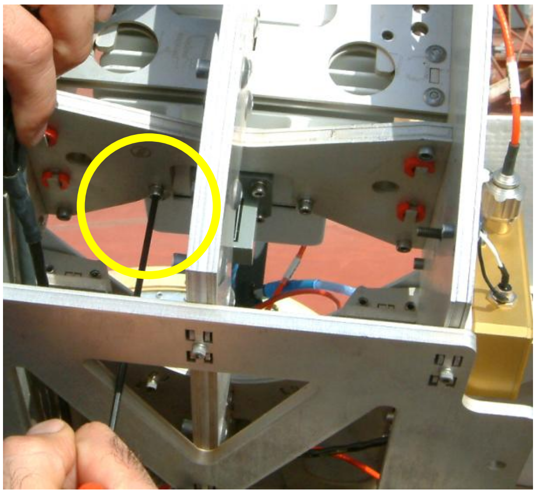
Use a 3mm Allen key to secure the BUC WAVEGUIDE.

Attention: Make sure to replace the rubber O-Ring that seals the WAVEGUIDE to the BUC.



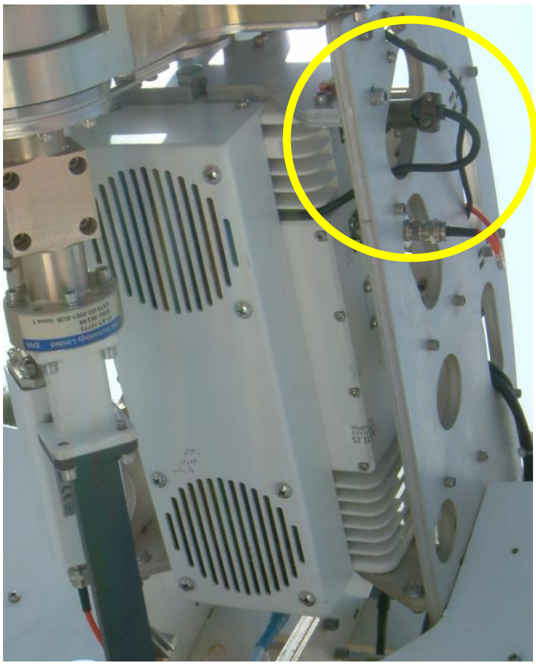
Step 3

Use a 13mm open wrench and 3mm Allen key to secure the BUC to the RF ASSEMBLY.



Step 4

Connect the cables to the BUC connectors.



Post-Installation System Verification

After replacing the BUC, power up the system and drive the BUC to 1dB compression (see the *AL-7103 MKII Installation and Operation Manual* for instructions). Verify that the EB/N0 is exactly as defined in the link budget.

➲ To Install 16W Ku-Band BUC

Step 1

Connect the WAVEGUIDE-TO-SMA adapter to the BUC with M4 fasteners and an EMI O-RING.

Use a 3mm Allen key and a 7mm open wrench.

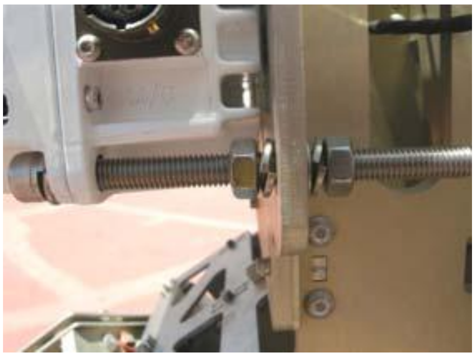
Step 2

Use a 2.5mm Allen key to remove the screws holding the safety caps in place. Remove the caps and replace the screws.

Step 3

Use a 6mm Allen key and a 13mm open wrench to loosely attach the BUC to the DISH ASSEMBLY with M8 fasteners.

Attention: Make sure the spring washers and flat washers are correctly positioned.



Step 4

Tighten the nuts and screws.

Attention: The distance between the `BUC` and the `DISH ASSEMBLY` should not exceed 3mm.

Step 5

Connect the cables to the `BUC` connectors.

Use an SMA torque wrench for the SMA connectors.

Step 6

Bind the cables to the `DISH ASSEMBLY` with tie-wraps.

Post-Installation System Verification

After replacing the BUC, power up the system and drive the BUC to 1dB compression (see the *AL-7103 MKII Installation and Operation Manual* for instructions). Verify that the EB/N0 is exactly as defined in the link budget.

➲ To Install PSU L00321001 - PSU ASSEMBLY FOR 4W and 8W BUC Systems

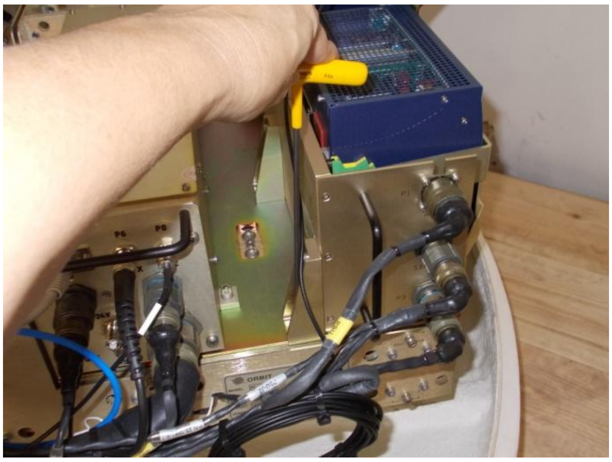
PSU 8W includes 2 Power supplies compare to 3 units in PSU 20W

Step 1

Mount the new PSU in its place on the ADE Base.

Step 2

Tighten the three screws securing the PSU to the ADE BASE using a 5/32" Allen key.

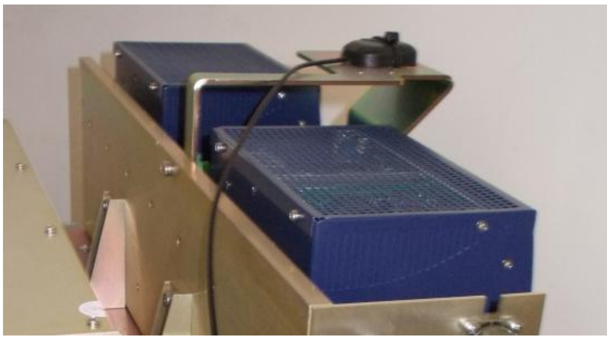


Step 3

Connect the cables to the PSU connectors.

Step 4

Mount the GPS ANTENNA in its place on the PSU and secure it with a tie-wrap.



Post-Assembly System Verification

After replacing the PSU, power up the system and activate Enc Init Mode several seconds after startup (see the *AL-7103 MKII Installation and Operation Manual* for instructions). Verify that the system functions properly.

➲ To change the software configuration from X-Band to Ku-Band:

Following the installation of the Ku-Band RF Kit, perform the following procedure to change the software configuration from X-Band to Ku-Band configuration:

1. Apply power to the system.
2. In the MTSLINK **Operation Screen**, open the **InConfig** Menu, select **Step-Track**, and then **Ku-Band**. The **Ku Step-Track Mode** dialog box opens.

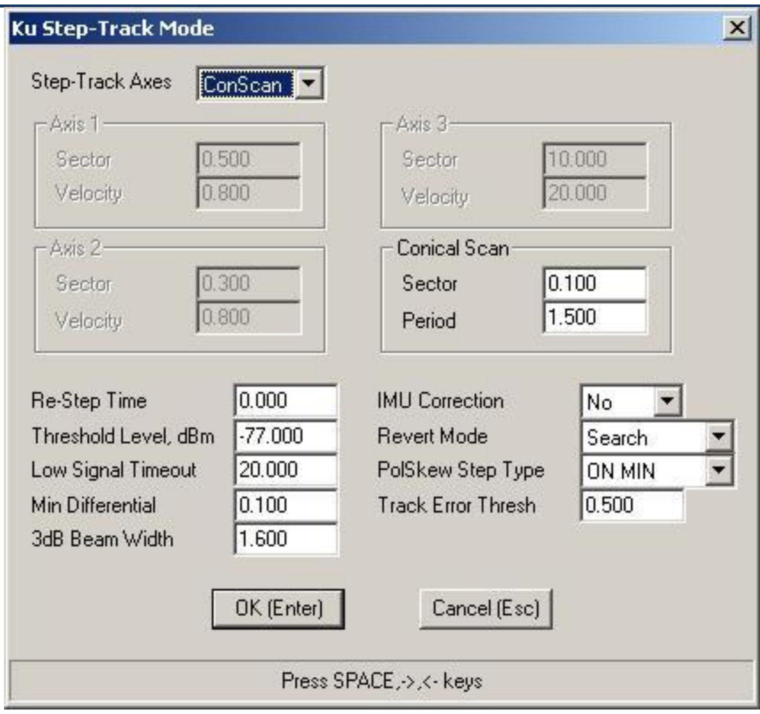


Figure 15-16: Ku Step-Track Mode dialog box

3. Verify that the settings match those displayed in the above figure.
4. Open the **Maintenance Screen**. In the **Receiver** window, click the **Band** button and select **Ku Linear Circular**.

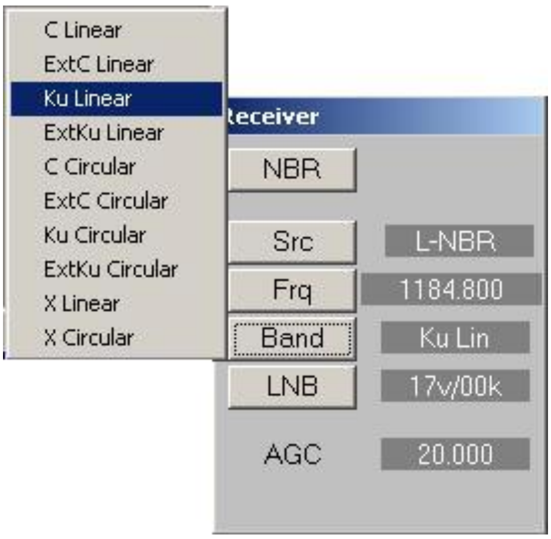


Figure 15-17: Receiver Window Band Menu

5. In the **Tx Chain** window, click the **BUC Model** button and select 8W Ku Agilis M&C.

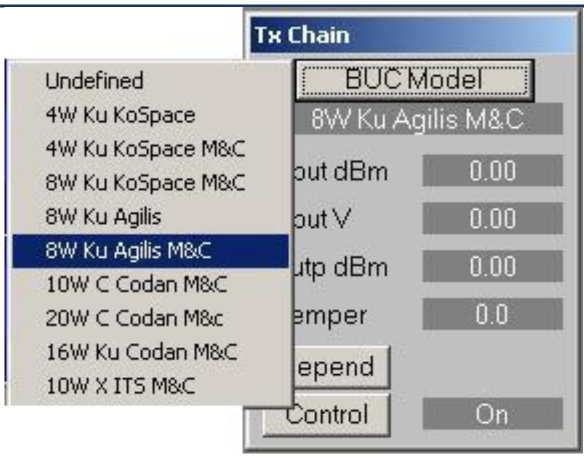


Figure 15-18: Tx Chain Window BUC Model Menu

6. Save the changes to non-volatile memory.

16 Appendix I: Ku-Band CO-CROSS Polarization Feed

This chapter provides information and instructions for switching the OrSat™ AL-7103 system from CROSS to CO-CROSS polarization. This procedure requires the following steps:

- Removing the CROSS polarization feed
- Installing the CO-CROSS polarization feed
- Configuring the related software
- Performing noise-floor calibration

Only authorized Orbit technicians should perform the following procedure.

The CO-CROSS Polarization Kit

The following section contains images and descriptions of the major components of the CO-CROSS polarization kit as well as a table listing the kit's part list.

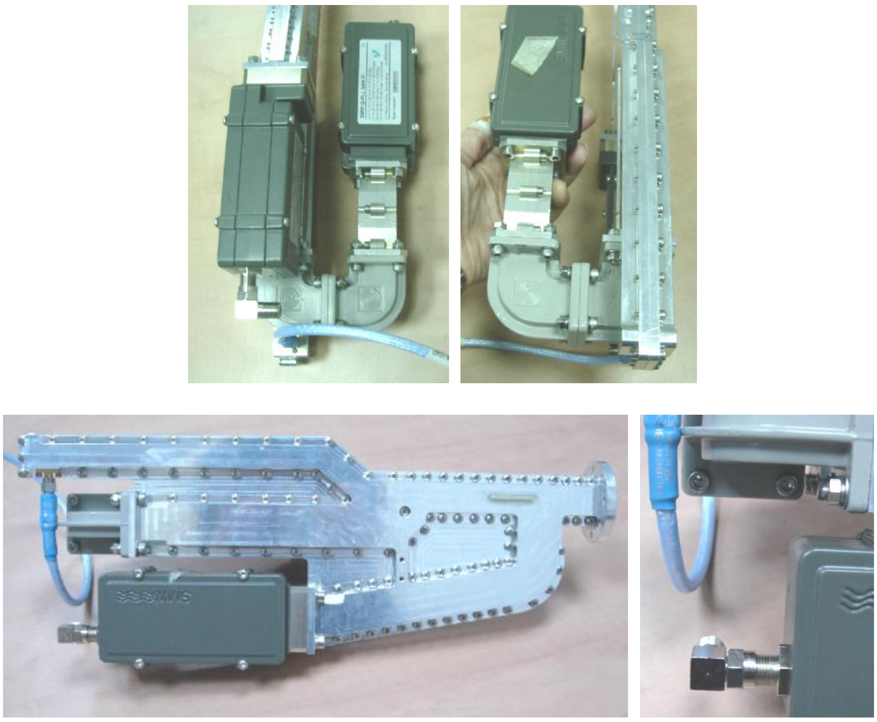


Figure 16-1: CO-CROSS polarization feed with LNB

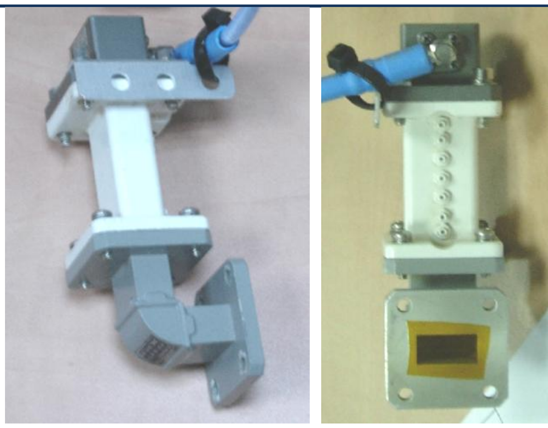


Figure 16-2: Waveguide adapters to be connected to the BUC waveguide output

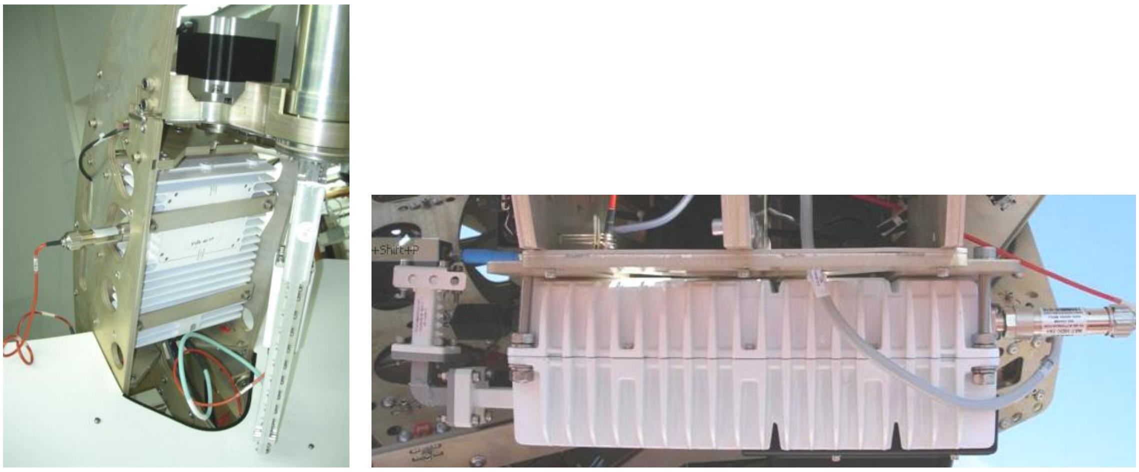


Figure 16-3: 4W, 8W, and 16W BUCs

The location of the RF Input connector location differs for each BUC type

Table 16-1: Co-Cross Polarization RF Kit – Packing List

Item	Description	Orbit P/N	Quantity
1	FEED SUBASSEMBLY (INC. LNBS)	Part of KIT29-0733	1
2	RRF SUBASSEMBLY INC. SPACER 29-0308)	Part of KIT29-0733	1
3	EMI O-RING FOR FEED	K03000016	1
4	EMI O-RING FOR BUC	K03000015	1

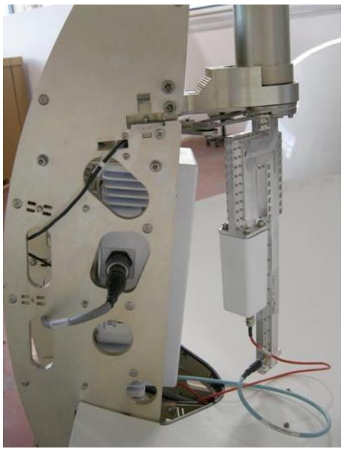
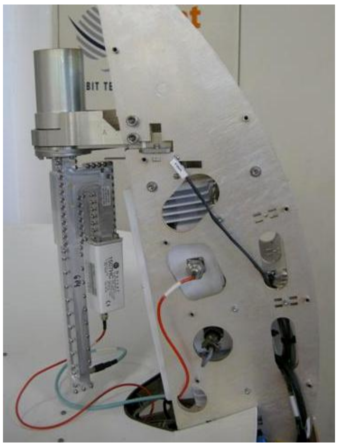
5	F-TYPE TO F-TYPE ADAPTER	SF-81-HP	1
6	LINE AMPLIFIER	E12000054	1
7	COPOL SWITCH HARNESS	28-1271-9-1	1
8	CABLE SF 11SMA/11SMA 50R 90CM (FOR 16W OPTION)	E11000024	1
Fastener set for feed subassembly			
9	SCKT CAP SCR M4X12 STST	H06014071202	6
10	FLAT RD WASHER M4 STST	H20214091001	6
11	HELIC SPR WASHER M4 ST.ST.	H28214091002	6
Fastener set for RRF subassembly			
12	SCKT CAP SCR M4X16 ST.ST.	H06014071601	4
13	FLAT RD WASHER M4 STST	H20214091001	4
14	HELIC SPR WASHER M4 ST.ST.	H28214091002	4

Installation Procedures

➲ To remove the Ku-Band RF kit:

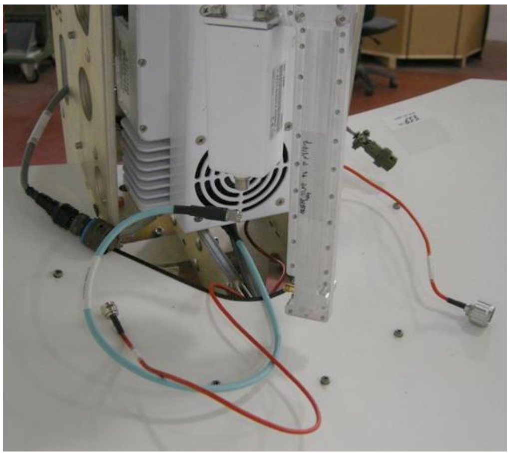
Step 1

Disconnect the cables from the BUC and LNB connectors. Remove the RF cable (not used with the CO-CROSS FEED).

Step 2

Remove the 6 screws securing the RF CHAIN to the FEED SUBASSEMBLY (not used with the CO-CROSS FEED) and set them aside for future installation of the CROSS POL FEED.



Step 3

Cut the tie-wraps securing the cables to the DISH ASSEMBLY.

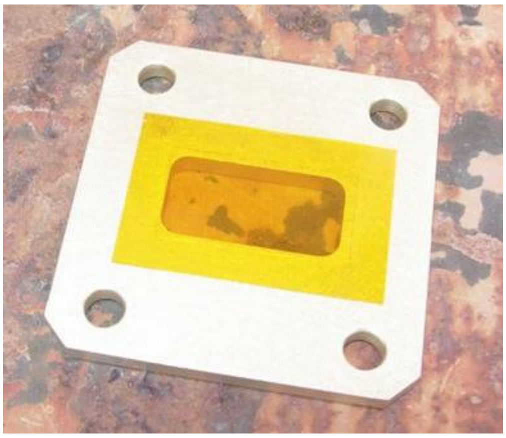
➲ **To install the Co-CROSS polarization kit with a 4W or 8W BUC:**

Step 1

The RX REJECT FILTER (RRF) SUBASSEMBLY (2) connects to the BUC output in the following order:

BUC > SPACER > 90° WG ADAPTER > STRAIGHT WG ADAPTER > WG-TO-SMA ADAPTER.

Place the SPACER (29-0308) between the BUC output and 90° WAVEGUIDE ADAPTER and connect it to the ADAPTER without connecting it to the BUC.



Step 2

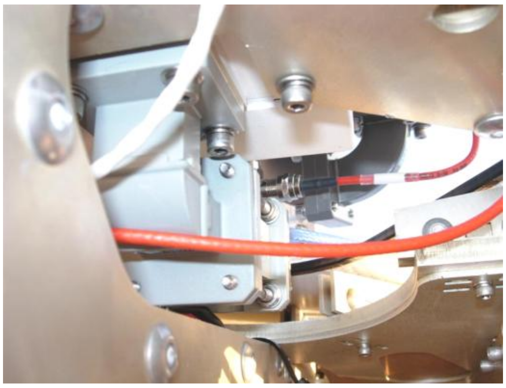
Install the conductive EMI O-RING (4) between the BUC output and the SPACER (29-0308).

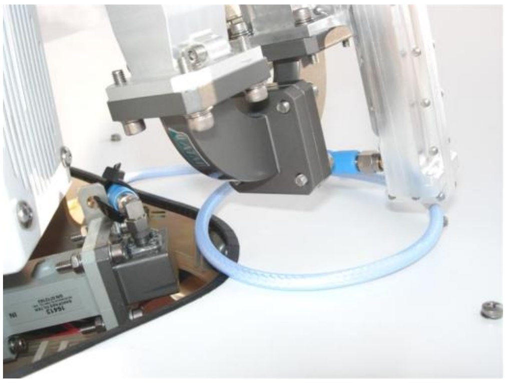
Connect the SPACER and WAVEGUIDE to the BUC output.

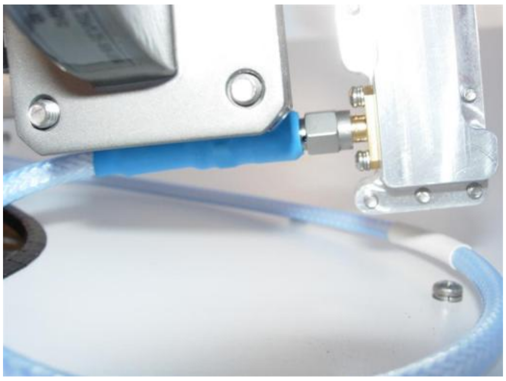
Step 3

Connect the Ku-Band RF cable between the WAVEGUIDE-TO-COAX ADAPTER and the FEED SUBASSEMBLY using an SMA torque wrench, making a smooth loop of the cable.

Secure the cable to the ADAPTER with tie-wrap.



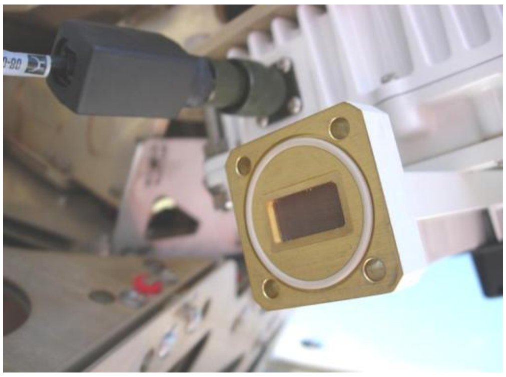


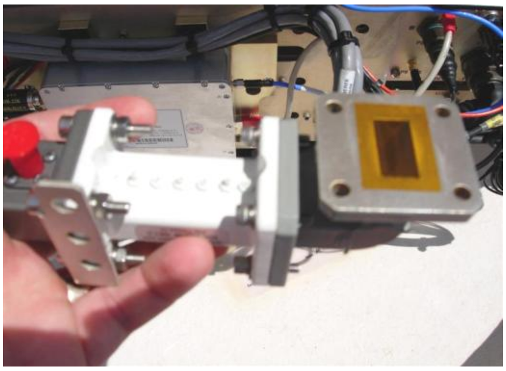


➲ To install the Co-CROSS polarization kit with a 16W BUC:

Step 1

Install the CONDUCTIVE EMI O-RING between the BUC output and the WAVEGUIDE ADAPTERS.



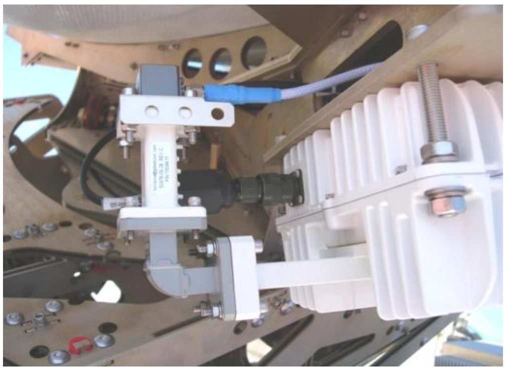


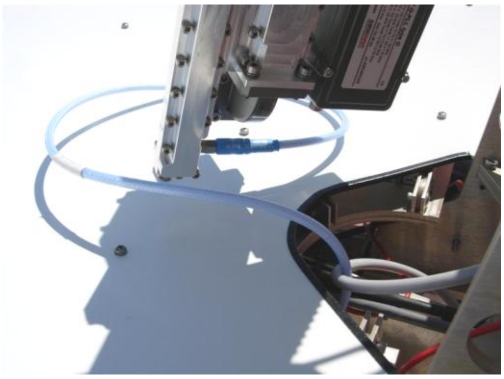
Step 2

The RX REJECT FILTER (RRF) SUBASSEMBLY connects to the BUC output in the following order:

BUC > SPACER > 90° WG ADAPTER > STRAIGHT WG ADAPTER > WG-TO-SMA ADAPTER.

Connect the Ku-Band RF cable between the WAVEGUIDE-TO-COAX ADAPTER and the FEED SUBASSEMBLY using an SMA torque wrench, making a smooth loop of the cable.

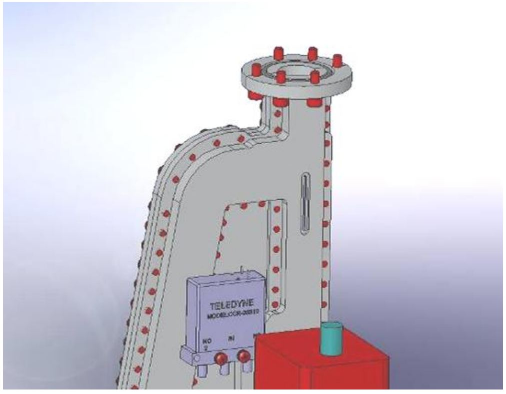




➲ To install the Co-CROSS polarization feed (all BUCs):

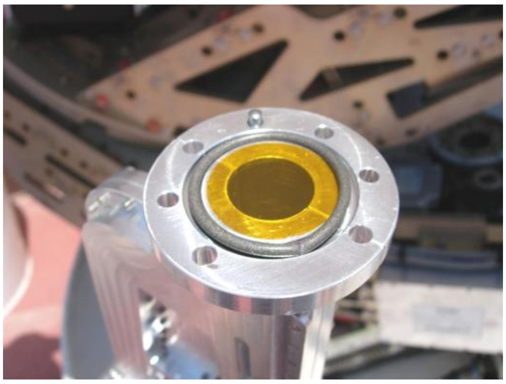
Step 1

Connect the FEED SUBASSEMBLY to the ANTENNA ASSEMBLY using the 6 fasteners.



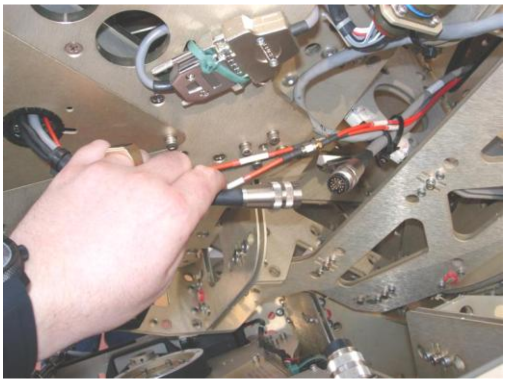
Step 2

Install the CONDUCTIVE EMI O-RING.



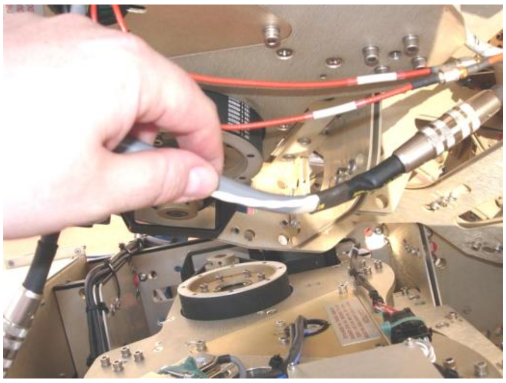
Step 3

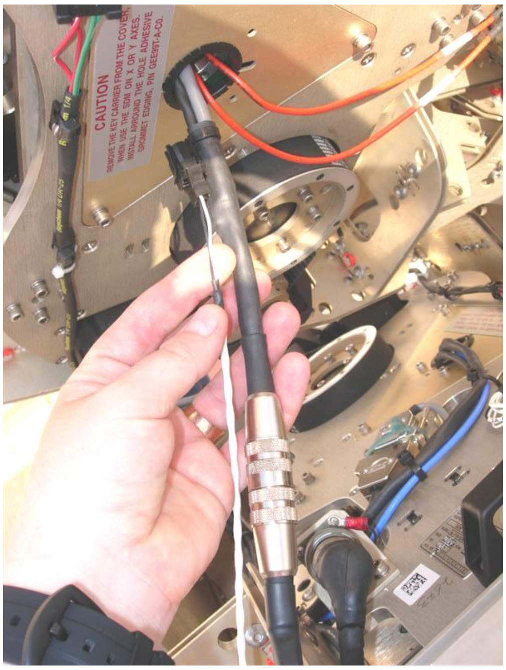
Untie the BUC M&C cable from the Y-AXIS SDM.



Step 4

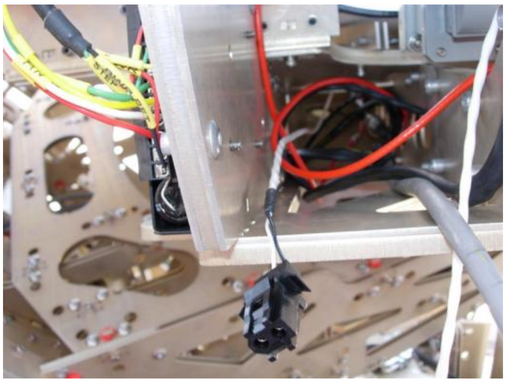
Attach the COPOL SWITCH HARNESS (7) to the BUC cable.

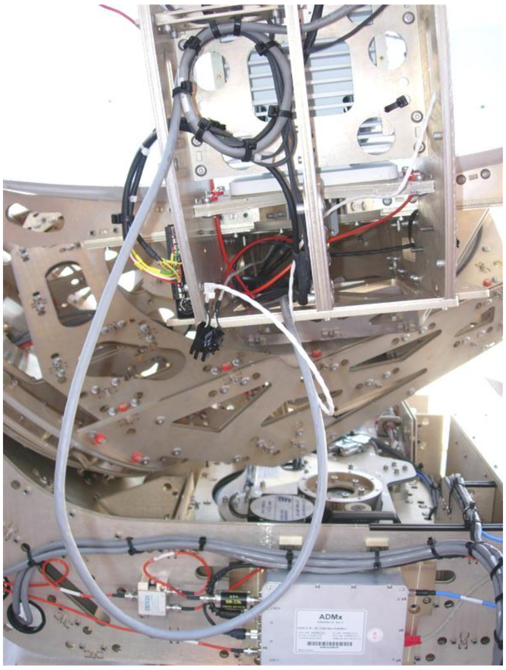




Step 5

Pull the cable up through the DISH ASSEMBLY.





Step 5

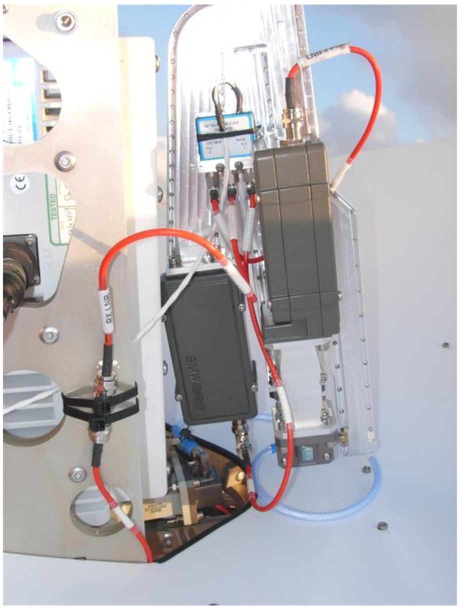
The CO-CROSS POL FEED contains a switch connected to a DC harness with a dual-pin connector at its end.

Connect the DC harness (28-1271-9-1) provided in the kit to the DC harness attached to the SBC. Then connect its female dual-pin connector to the male connector of the DC harness attached to the switch (29-0151-9-1).

Secure the cables to the DISH ASSEMBLY with tie-wraps.

Step 6

Connect the Rx LNB cable attached to the Switch IN to the Rx LNB cable attached to the system using the F-TYPE TO F-TYPE ADAPTER (5).



Step 7

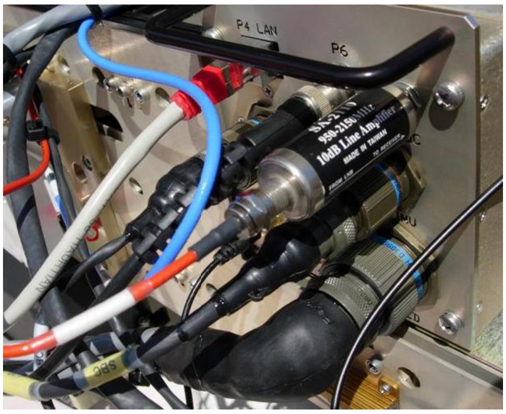
Reconnect all BUC connections and secure all cables with tie-wraps as needed.

Step 8

Install the SBC LNBR GR (L00322001), running the software version 4.53 or higher.

Step 9

Connect the LINE AMPLIFIER (6) to the AGC input on the SBC connector panel.



➲ To configure MtsLink for Co-CROSS polarization:

1. Enter the **Maintenance** screen and click the **LNB** button on the **Receiver** window.

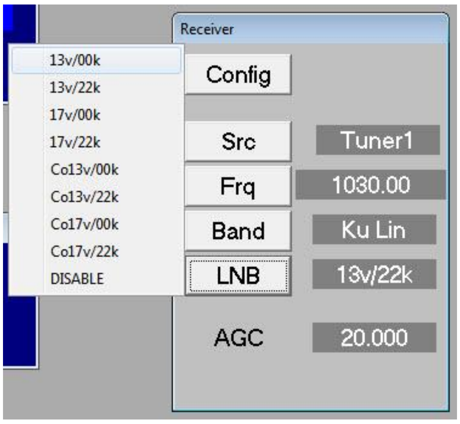


Figure 16-4: Receiver Window

Altogether the following controls are available:

- **13V/00K** – RF Switch is activated so that the `X-POL LNB` is connected. 10.7-11.2 GHz (9.75 GHz LO) range is selected by providing `LNB` voltage of 13 VDC and no tone.
- **13V/22K** – RF Switch is activated so that the `X-POL LNB` is connected. 11.2-11.7 GHz (10.25 GHz LO) range is selected by providing `LNB` voltage of 13 VDC and 22 KHz tone.
- **17V/00K** – RF Switch is activated so that the `X-POL LNB` is connected. 11.7-12.2 GHz (10.75 GHz LO) range is selected by providing `LNB` voltage of 17 VDC and no tone.
- **17V/22K** – RF Switch is activated so that the `X-POL LNB` is connected. 12.2-12.75 GHz (11.25 GHz LO) range is selected by providing `LNB` voltage of 13 VDC and 22 KHz tone.
- **Co13V/00K** – RF Switch is activated so that the `CO-POL LNB` is connected. 10.7-11.2 GHz (9.75 GHz LO) range is selected by providing `LNB` voltage of 13 VDC and no tone.
- **Co13V/22K** – RF Switch is activated so that the `CO-POL LNB` is connected. 11.2-11.7 GHz (10.25 GHz LO) range is selected by providing `LNB` voltage of 13 VDC and 22 KHz tone.
- **Co17V/00K** – RF Switch is activated so that the `CO-POL LNB` is connected. 11.7-12.2 GHz (10.75 GHz LO) range is selected by providing `LNB` voltage of 17 VDC and no tone.

- **Co17V/22K** – RF Switch is activated so that the `CO-POL LNB` is connected. 12.2-12.75 GHz (11.25 GHz LO) range is selected by providing `LNB` voltage of 13 VDC and 22 KHz tone.
- **DISABLE** – `LNB` voltage is switched off.

2. Point the `ANTENNA` away from any radiating source.

If you are not on the Equator you can activate Stow-up Mode.

---

3. Click the **Spectrum** control on the **MtsLink** Menu Bar to open the **Spectrum Analyzer Screen**.

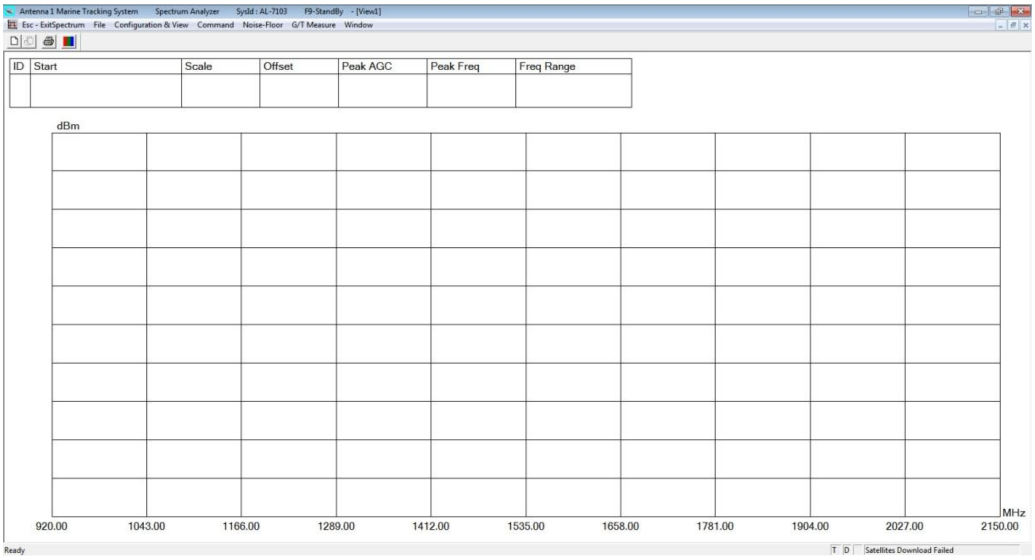


Figure 16-5: Spectrum Analyzer Screen

4. Open the **Noise-Floor** menu and select **Start Calibration**. The **Start Noise-Floor Calibration** dialog box appears.

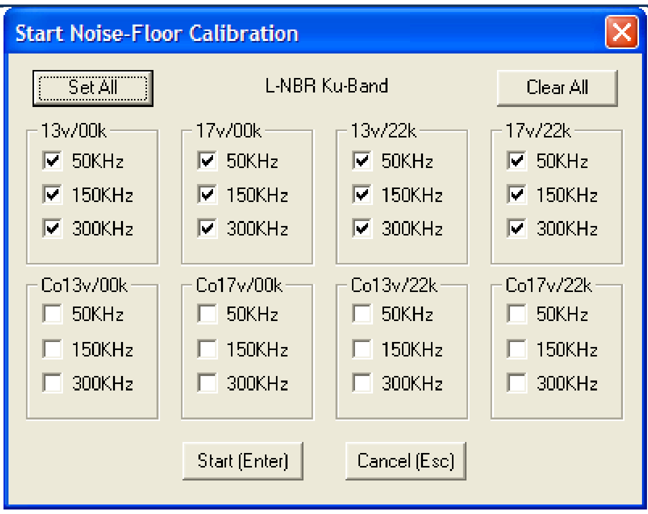


Figure 16-6: Start Noise-Floor Calibration dialog box

5. Check the relevant calibration lines as listed below:

- For a single-band LNB (for example: Norsat 1000HA/B/C):
  - 17v/00 KHz – 50 KHz
  - 17v/00 KHz – 150 KHz
  - 17v/00 KHz – 300 KHz
- For a dual-band LNB (for example: SMW Q-pll Type-C):
  - 13v/00 KHz – 50 KHz
  - 13v/00 KHz – 150 KHz
  - 13v/00 KHz – 300 KHz
  - 17v/00 KHz – 50 KHz
  - 17v/00 KHz – 150 KHz
  - 17v/00 KHz – 300 KHz
- For a quad-band LNB (for example: SMW Q-pll Type-O):
  - 13v/00 KHz – 50 KHz
  - 13v/00 KHz – 150 KHz
  - 13v/00 KHz – 300 KHz
  - 17v/00 KHz – 50 KHz
  - 17v/00 KHz – 150 KHz
  - 17v/00 KHz – 300 KHz

- 13v/22 KHz – 50 KHz
- 13v/22 KHz – 150 KHz
- 13v/22 KHz – 300 KHz
- 17v/22 KHz – 50 KHz
- 17v/22 KHz – 150 KHz
- 17v/22 KHz – 300 KHz

In the case of a CoPol/Xpol ANTENNA feed all of the above should be repeated for CoPol. For example, for a CoPol/Xpol feed equipped with two quad-band LNBs, select all 24 lines.

Calibrating an excess number of lines (for example: all 24 lines for a single-band LNB) does not affect the system adversely. Any surplus information is ignored.

6. Press the **Start (Enter)** button.

   The calibration process runs in a fully automatic manner, scanning the calibration lines one by one. Each line takes approximately 20 seconds. The interim scan results are displayed in the **Write Noise-Floor Calibration** dialog box and may be compared to the examples displayed in the section **Typical Noise Floor Curves** on page 116.

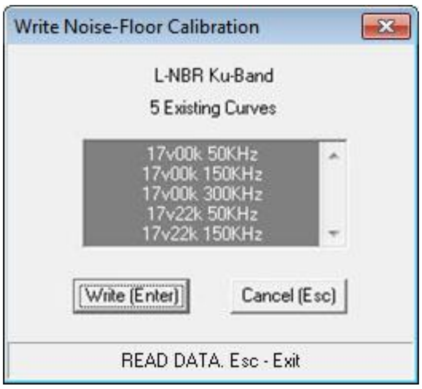


Figure 16-7: Write Noise-Floor Calibration dialog box

7. After the process is completed the final results are displayed. Click **Write (Enter)**.
8. To review the measured data open the **Noise-Floor** menu and select **Read Calibration**.
   The **Read Noise-Floor Calibration** dialog box appears.

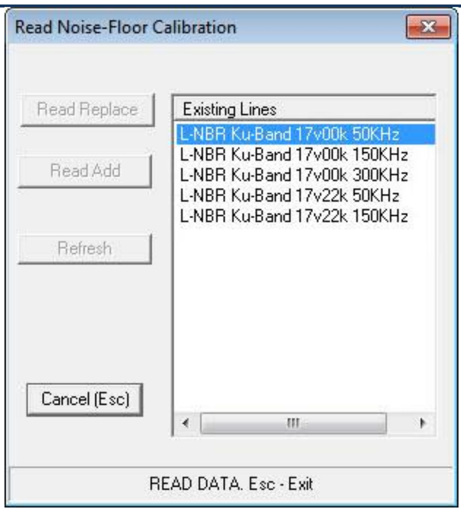


Figure 16-8: Read Noise-Floor Calibration dialog box

The curves may be presented in pairs. You can click the **Read Replace** button to view a single curve, and the **Read Add** button to add a second curve.

It is recommended to review all the lines and compare them to the relevant example displayed in the section **Typical Noise Floor Curves** on page 116. The curves do not have to be identical with the examples, but should attain a reasonable level of correlation.

9. Enter the **Maintenance Screen** and click the **Config** button in the **Receiver** window. The **Receiver Configuration** dialog box appears.

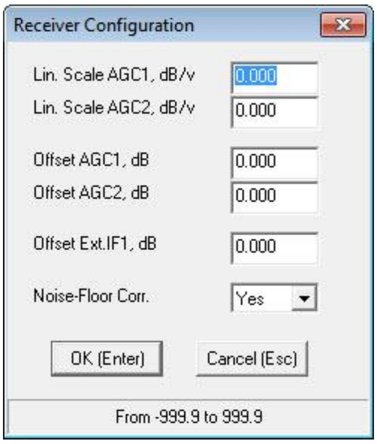


Figure 16-9: Receiver Configuration dialog box

10. Verify that the **Noise-Floor Corr.** field is set to ‘Yes’.

- The **Noise-Floor Corr.** setting is not important during the calibration process. It is handled automatically by the calibration program.
- If there are no calibration files in the `SBC` memory when the process is activated, the warning message `WRN 180: No Noise Floor Table` is displayed.

11. Return to the **Operations Screen**, open the **InConfig** menu, and select **Display**. The **Display Configuration** dialog box appears.

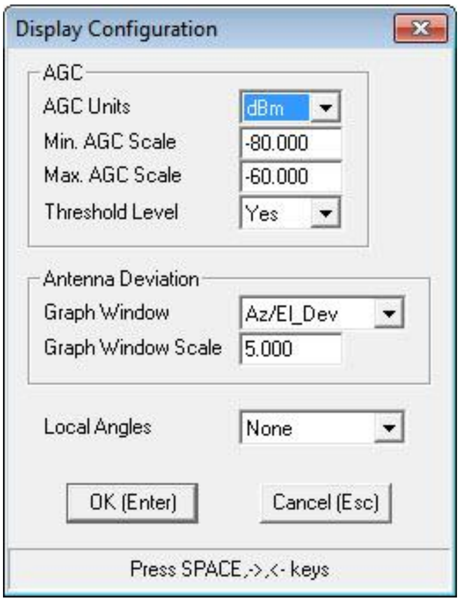


Figure 16-10: Display Configuration dialog box

12. Set the **Min. AGC Scale** value to '-80.000' and the **Max. AGC Scale** value to '-60.000'.

13. Open the **Commands** menu and select **Set Threshold**. The **Set Threshold Level** dialog box appears.

Figure 16-11: Set Threshold Level dialog box

14. Set the **Threshold Level, dBm** value to '-75.000'.

15. Click OK (Enter).

16. Click Save on the Operation Screen Menu Bar and save the settings.

17 Appendix J: OrSat™ GILAT Configuration

In order to use GILAT configuration (i.e. a GILAT SkyEdge1 modem and a GILAT BUC), a dedicated model of the OrSat™ system is available upon request.

Switching between BUC configurations

The OrSat™ AL-7103 system can be set up for any of the following BUC configurations:

- Standard 4W BUC configuration
- AL-7103-KU4W-GLT - GILAT configuration, supporting a SkyEdge1 modem and GILAT 4W BUC.
- AL-7103-KU12W-GLT - GILAT configuration

Switching between these configurations involves the following two steps:

- Changing the BUC in the ADE assembly.
- Changing the position of an RF jumper cable on the CCU rear panel.

Only authorized Orbit technicians should perform these procedures.

Before switching the BUC configuration, make sure you are familiar with the *AL-7103 Installation & Operations Manual* and with the appropriate mechanical drawings, as well as the instructions in this chapter.

This procedure must be performed with all power OFF.

Installing the Standard Ku-Band 4W BUC

Install the Standard Ku-Band 4W BUC on the OrSat™ AL-7103 system as shown in the following figures. Refer to the following table for a description of the numbered parts.

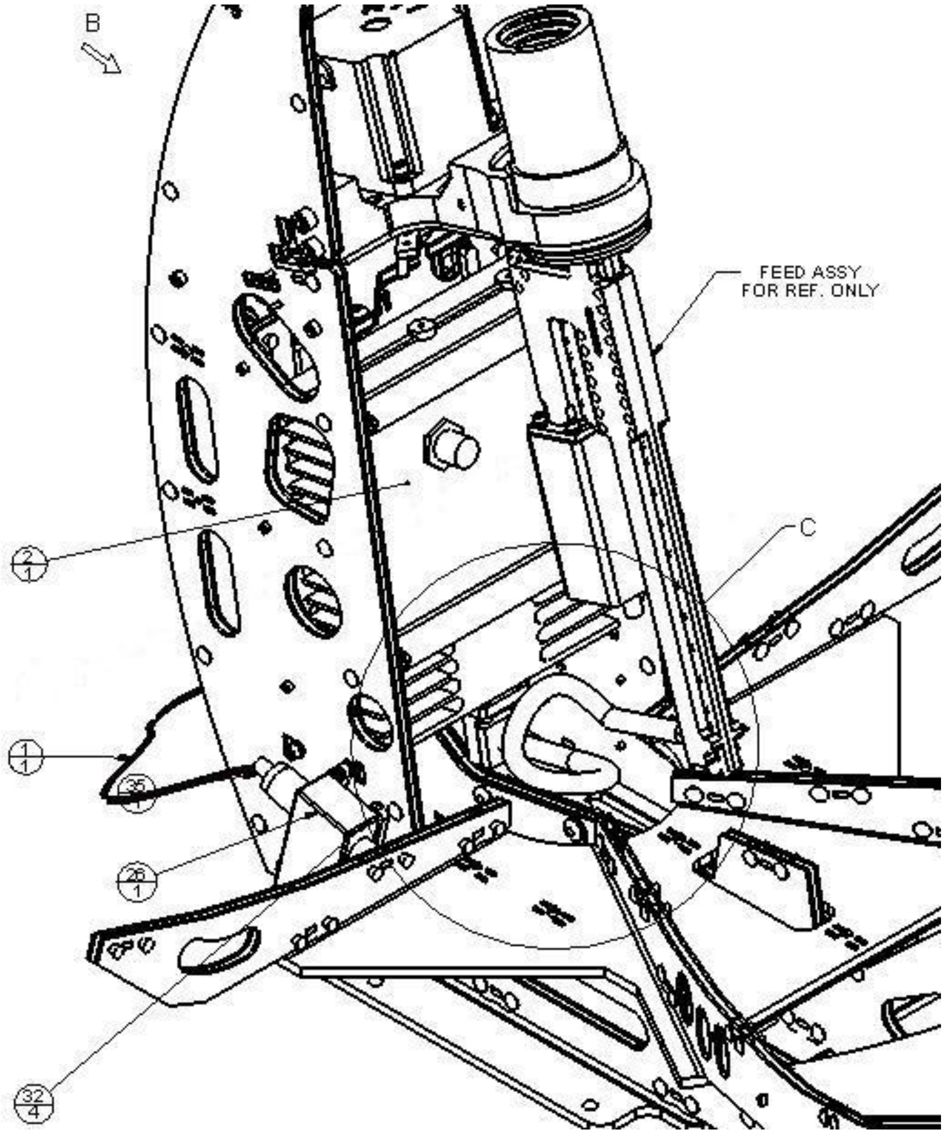


Figure 17-1: Standard Ku-Band 4W ODU (BUC) Assembly

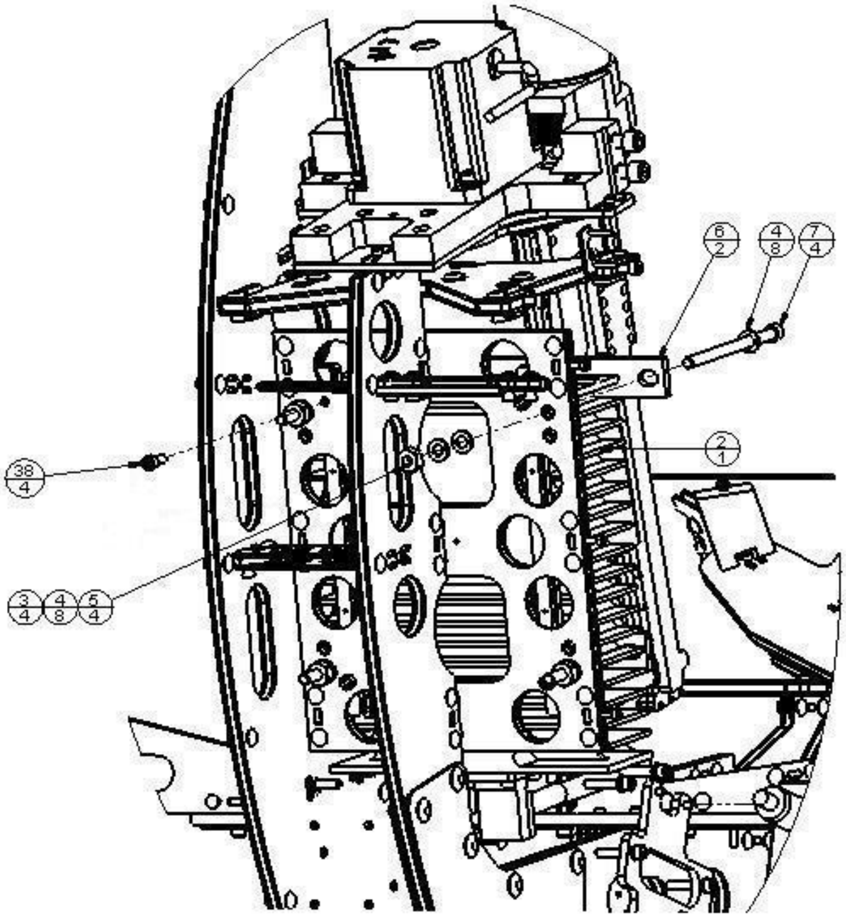


Figure 17-2: Standard Ku-Band 4W ODU (BUC) Assembly – Detail B

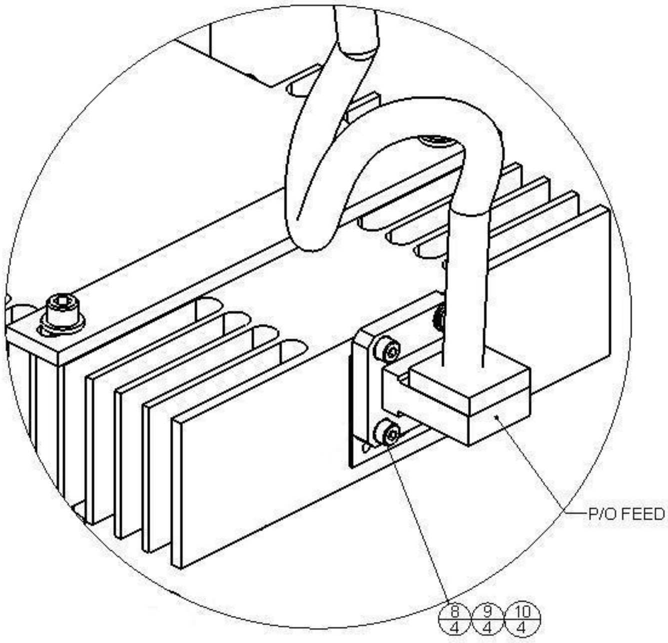


Figure 17-3: Standard Ku-Band 4W ODU (BUC) Assembly – Detail C

The following table lists the numbered parts in the above figures and their descriptions.

Table 17-1: Standard Ku-Band 4W BUC Kit Part List

Ref. No.	Description
1	RF CABLE 0.5mTX-BUC/TX-DC.INS.
10	HELIC SPR WASHER M4 ST.ST.
2	BUC 4W KU BAND
26	DC INSERTER ASSY AL-7103-SYS
3	HELIC SPR WASHER 1/4 ST.ST.
32	PHIL FH90 SCR M3X8 ST.ST.
35	ADAPTER N-MALE TO F-FEMALE
4	FLAT RD WASHER #1/4 ST.ST 316
5	PLAIN HEX NUT 1/4-20 STST
6	HOLDER FOR BUC 4W AL-7103
7	SCKT CAP SCR 1/4-20X3.75 STST
8	SCKT CAP SCR M4X12 STST
9	FLAT RD WASHER M4 STST

Installing the RF Jumper-Cable on the CCU

Connect the RF jumper-cable between the AUX TX and AUX OUT 10 MHz connectors on the `CCU` rear panel as shown in the following figure.

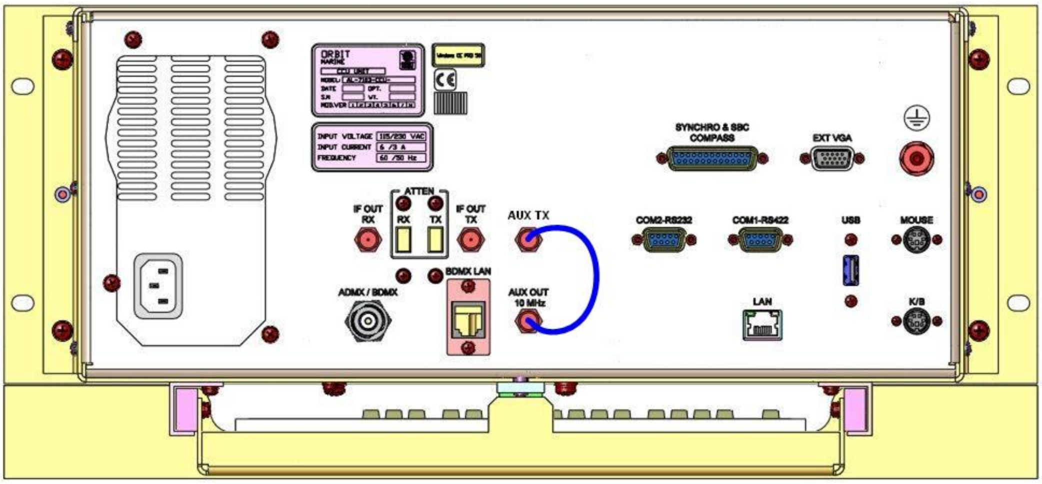


Figure 17-4: Standard Ku-Band Configuration – RF Jumper Cable Connection

Installing the GILAT 4W BUC

1. Assemble the brackets on the GILAT Ku-Band ODU (`BUC`) as shown in the following figure.

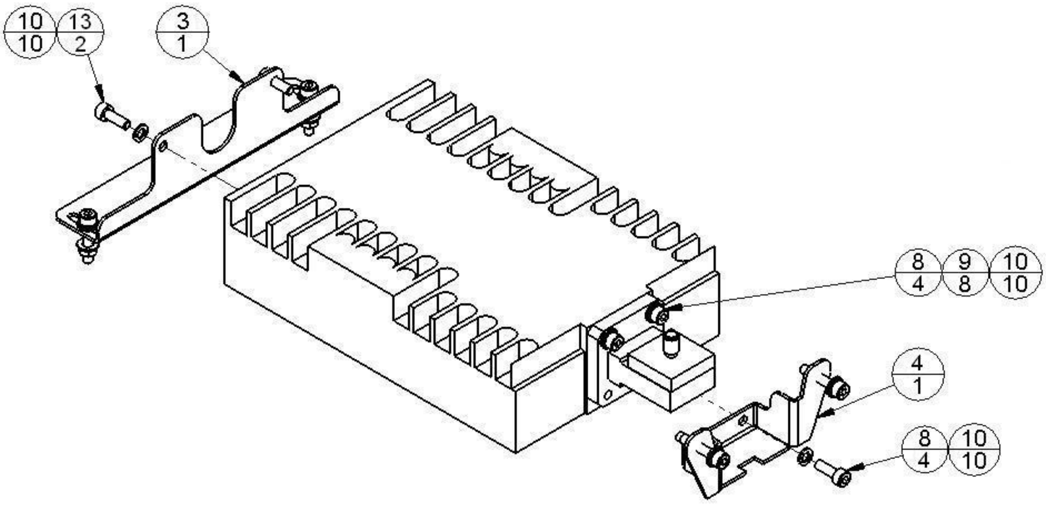


Figure 17-5: GILAT Ku-Band ODU (BUC) Assembly (with Brackets)

2. Install the GILAT Ku-Band 12W `BUC` on the OrSat™ AL-7103 system as shown in the following figures.

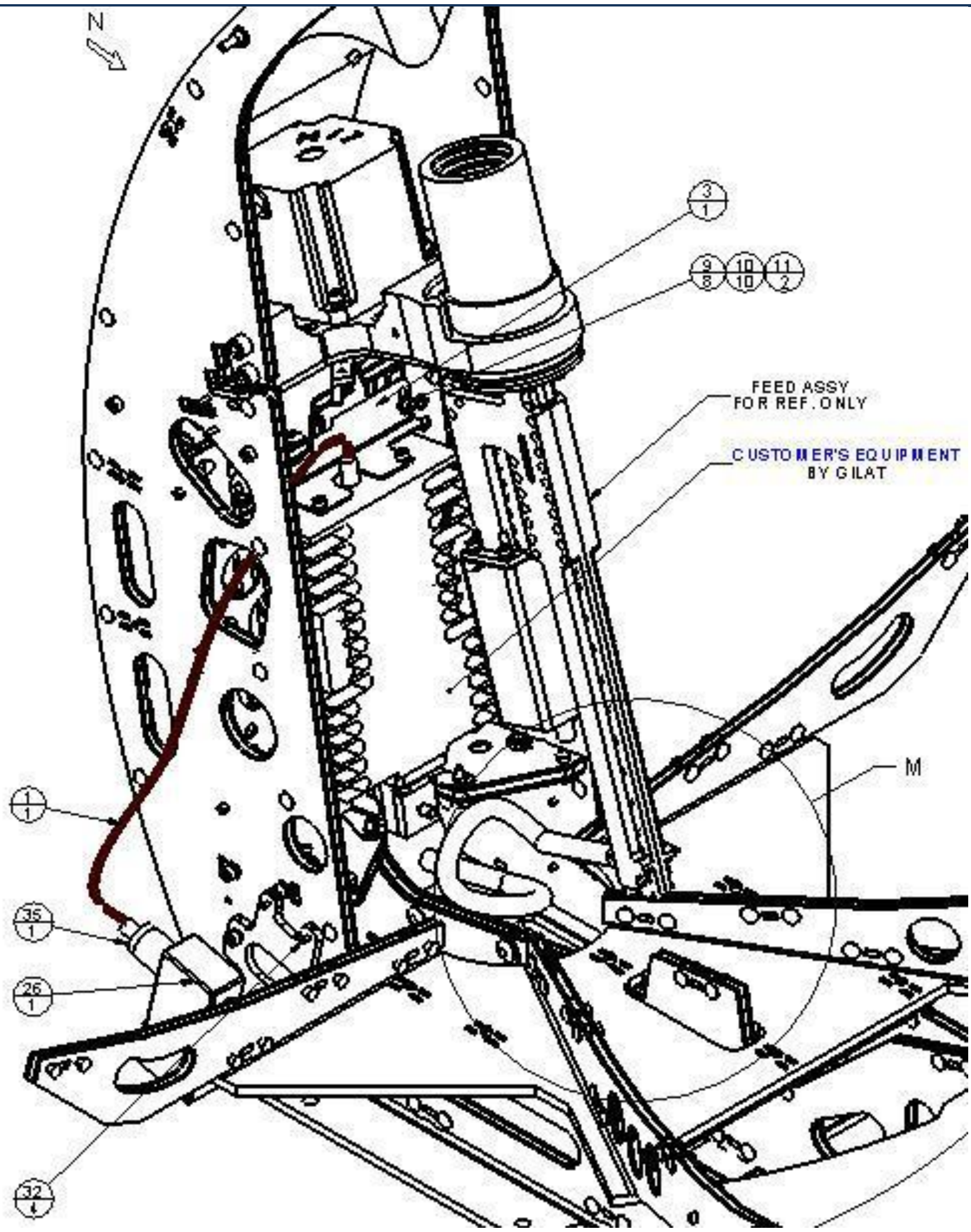


Figure 17-6: GILAT Ku-Band 4W ODU (BUC) Assembly

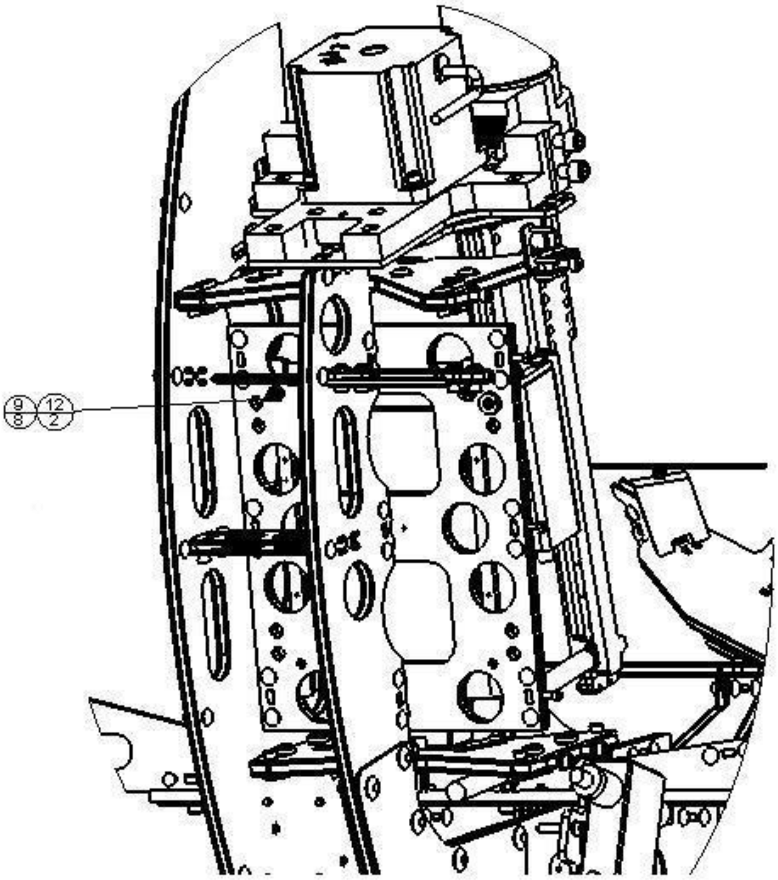


Figure 17-7: GILAT Ku-Band 4W ODU (BUC) Assembly – Detail N

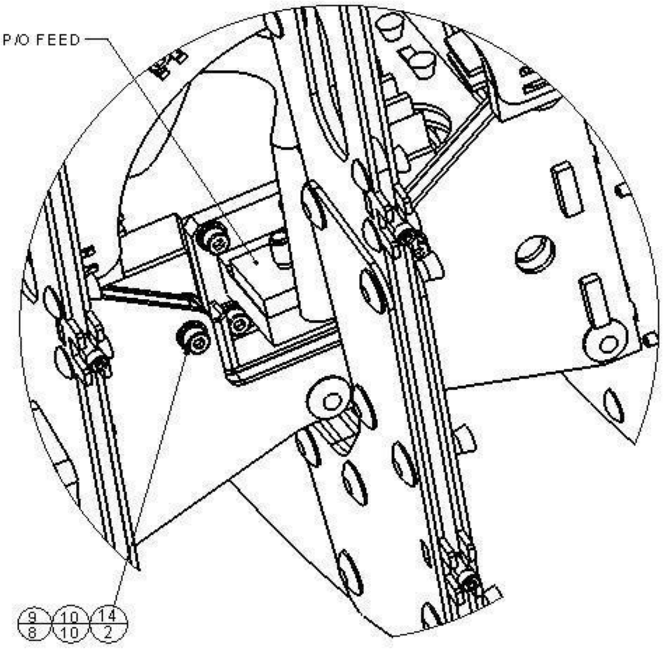


Figure 17-8: GILAT Ku-Band 4W ODU (BUC) Assembly – Detail M

The following table lists the numbered parts in the above figures and their descriptions.

Table 17-2: GILAT Ku-Band 4W BUC Kit Part List

Ref. No.	Description
1	RF CABLE 0.5mTX-BUC/TX-DC.INS.
10	HELIC SPR WASHER M4 ST.ST.
11	SCKT CAP SCR M4X20 STST
12	PLAIN HEX NUT M4 STST
3	BRACKET #1 BUC GILAT AL-7103
13	SCKT CAP SCR M4X8 ST.ST
4	BRACKET #2 BUC GILAT AL-7103
14	SCKT CAP SCR M4X16 STST
26	DC INSERTER ASSY AL-7103-SYS
32	PHIL FH90 SCR M3X8 ST.ST.
35	ADAPTER N-MALE TO F-FEMALE
8	SCKT CAP SCR M4X12 STST
9	FLAT RD WASHER M4 STST

Installing the RF Jumper-Cable on the CCU

Connect the RF jumper cable between the IF OUT TX and AUX OUT 10 MHz connectors as shown in the following figure.

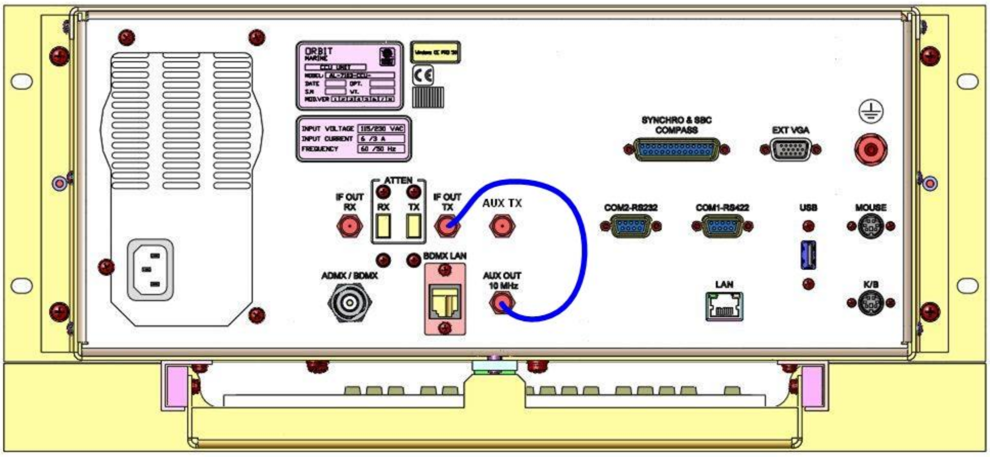


Figure 17-9: GILAT 4W BUC Configuration – RF Jumper Cable Connection

Installing the GILAT 12W BUC

1. Assemble brackets on the GILAT Ku-Band ODU (`BUC`) as shown in the following figure.

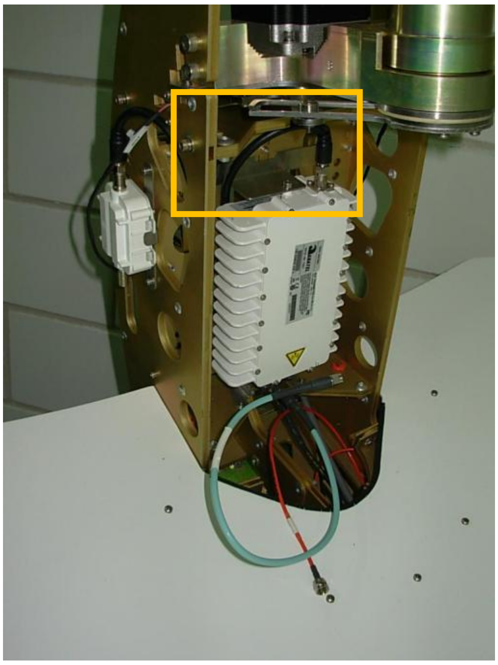


Figure 17-10: GILAT Ku-Band ODU (BUC) Assembly (with Brackets)

2. Install the GILAT Ku-Band ODU (BUC) on the OrSat™ AL-7103 system as shown in the following figures.

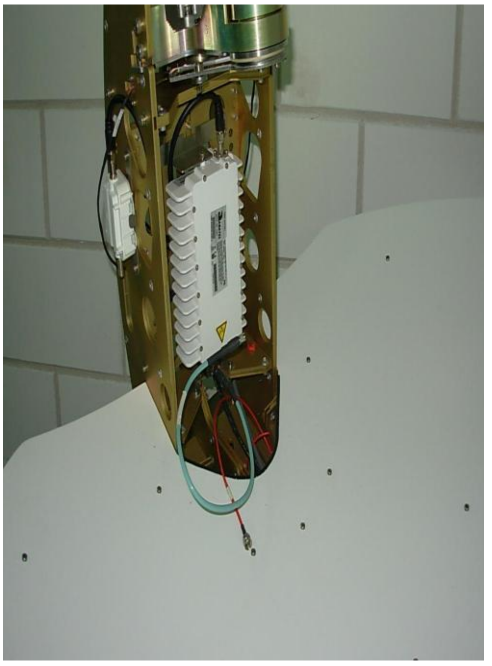
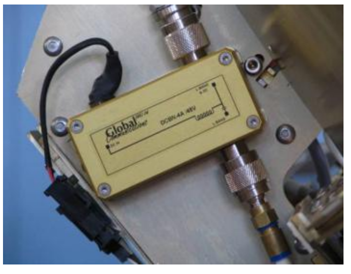
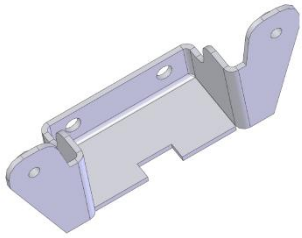
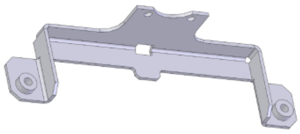
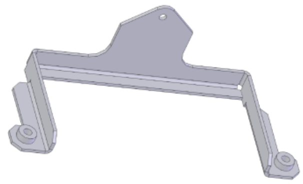


Figure 17-11: Installing the GILAT Ku-Band 12W BUC

The following table lists the part numbers and descriptions of the various components of the 12W BUC displayed in the above figure.

Table 17-3: GILAT Ku-Band 12W BUC Kit Part List

Part No.	Description	Picture
25-0781-9-1	DC INSERTER ASSY AL-7103-SYS	
26-1144-9-7	RF CABLE 0.5mTX-BUC/TX-DC.INS.	

Part No.	Description	Picture
29-0549	BRACKET #2 BUC GILAT AL-7103	
30-0769	BRACKET #2 BUC 12W AL-7103 SYS-GLT	
30-0770	BRACKET #1 BUC 12W AL-7103 SYS-GLT	
H00013040802	PHIL FH90 SCR M3X8 ST.ST.	
H06010471404	SCKT CAP SCR 1/4-20X7/8 STST	
H06014070802	SCKT CAP SCR M4X8 ST.ST	
H06014071202	SCKT CAP SCR M4X12 STST	
H20201691004	FLAT RD WASHER 1/4 ST.ST.	
H20214091001	SCKT CAP SCR 1/4-20X3.75 STST	
H28201691004	SCKT CAP SCR M4X12 STST	
H28214091002	FLAT RD WASHER M4 STST	
TC-666	ADAPTER N-MALE TO F-FEMALE	

Installing the RF Jumper Cable on the CCU

Connect the RF jumper cable between the IF OUT TX and AUX OUT 10 MHz connectors as shown in the following figure.

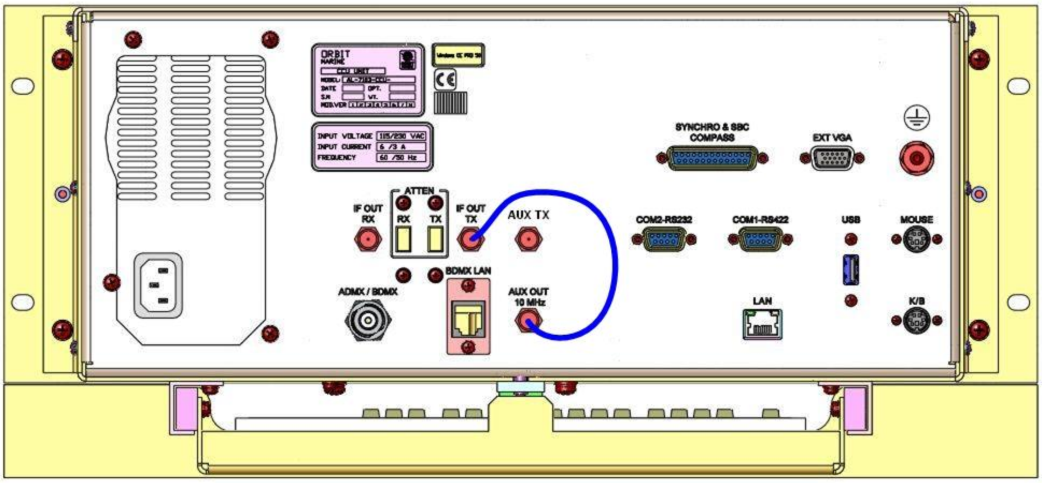


Figure 17-12: GILAT 12W BUC Configuration – RF Jumper Cable Connection