# AL-7205-R

## 1.5m (59”) Ku-Band Linear and C-Band Circular Maritime Stabilized TVRO System


## Installation and Operation Manual

**Document: MAN30-0700 Revision: C**


Orbit Communication Ltd. 8D Hatzoran St. P.O.B. 8657, Netanya 42504, Israel, Tel: +(972) 9 892 2777, Fax: +(972) 9 885 5944 www.orbit-cs.com

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# Certifications

Orbit Communication Systems Ltd. is an ISO 9001:2008 registered company. Registration License No. 58908, issued 15.8.2010

ORBIT AL-7205R Stabilized Maritime Satellite Communication System is in conformity with the appropriate standards:
EN60645:2002, SECTION 9 AND 10 ;

EN606950-1:06+A11:09+A1:10;

EN60950-2:06+A11:08;

EN60945:2002 SECTION6

The system components are RoHS compliant

# Revision History & Control

## Revision History

| Revision # | Date | Description |
|---|---|---|
| Rev: - | 2002 | Initial version |
| Rev: A | March 2007 | Updated version |
| Rev B | October 2010 | Updated version |
| Rev C | Jan 2018 | Updated version |
| | | |

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## SAFETY PRECAUTIONS

The following list of safety precautions should be observed when installing, operating and maintaining the TVRO System. Specific warnings and cautions, appearing as applicable throughout the manual may not appear in this summary.

**⚠WARNING**

*The antenna pedestal is equipped with high torque DC motors that develop considerable force. This force can be harmful.*

*The ADE power switch on the SDU will be powered from the antenna drive motors and should be used appropriately.*

**⚠WARNING**

*This equipment has potentially harmful voltages when connected to the designated power sources. Never remove equipment covers except for maintenance or internal adjustments.*

**⚠WARNING**

*Verify that the main POWER switch is in the OFF position, and that the power cable is disconnected from the unit before removing the covers of any unit. Note: The ACU receives voltage from two sources: the vessel's power network and the compass gyro.*

**⚠CAUTION**

*Metal parts accessible to the operator are connected to the chassis ground to prevent fire hazards from lightning, shocks, or similar hazards. The chassis ground conductor must not be removed. Ensure the enclosure is bonded to ground potential.*

**⚠CAUTION**

*Only qualified and trained personnel should perform installation, operation and maintenance of the equipment.*

**⚠CAUTION**

*Although the Kevlar radome is light, two to three people are needed to lift it with care during installation since the radome is bulky and will act as a sail in wind.*

**⚠CAUTION**

*To prevent shock or fire hazard, when sub-units are open or cables are disconnected, do not expose the equipment (with the exception of the radome) to rain or moisture.*

**⚠CAUTION**

*Avoid making unauthorized modifications to the system. Any such changes to the system will void the warranty.*

**⚠CAUTION**

*Do not disconnect cables from the equipment while the system is powered-on.*

**NOTE**

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

# ACRONYMS & ABBREVIATIONS

| | |
|---|---|
| ACU | Antenna Control Unit |
| ACW | Anti Clockwise |
| ADE | Above Deck Equipment |
| BDE | Below Deck Equipment |
| BIT | Built-In Test |
| CONT | Controller |
| CW | Clockwise |
| DiSEqC | Digital Satellite Equipment Control |
| GND | Ground |
| HDD | Hard Disk Drive |
| IMU | Inertial Measurement Unit |
| IRD | Integrated Receiver-Decoder |
| LAT | Latitude |
| LONG | Longitude |
| LNB | Low Noise Block Downconverter |
| MMI | Man-Machine Interface |
| NMEA | National Marine Electronics Association |
| OVRD | Override |
| RCU | Remote Control Unit |
| SBC | Single Board Control |
| CCU | Communication Control Unit |
| SAS | Spectrum Analyser Screen |
| SDU | Servo Drive Unit |
| TVRO | TV Receive Only |

# ABOUT THIS MANUAL

This Manual provides the shipboard system's operator with the system description, operational instructions, maintenance procedures and troubleshooting guidelines. The Manual is divided into the following chapters:

**Chapter 1. General Description**

Provides a general description of the system, including the following main topics:

- Introduction
- System Structure and Units
- Theory of Operation

**Chapter 2. Basic Operation**

Provides detailed basic operational information and instructions.

**Chapter 3. Advanced Operation**

Provides a brief description of advanced operation modes, usually not used by the system operator.

**Chapter 4. Installation Guide**

Provides installation guidelines, and detailed setup, configuration and installation procedures.

**Chapter 5. Installation of Feed Assemblies**

Provides installation instructions for feeds on the Universal Feed Mount.

**Chapter 6. Maintenance**

Provides maintenance instructions for both preventive and corrective on-board vessel maintenance, and a detailed troubleshooting guide.

# 1. GENERAL DESCRIPTION

## 1.1. Introduction

### 1.1.1. AL-7205-R 1.5 m (59") TVRO System

The state-of-the art high performance and cost–effective AL-7205 system is designed to receive high quality digital TV transmissions from Ku-band satellites, and to distribute the TV signal to any desired location on the vessel. The system is suitable for installation on all types of vessels

The 7205 can support Different type of ADE BDE communication and control to allow long distance communication:

1. ADE & BDE RCU/CCU OPTION (According figure 2)
2. ADE & BDE ACU OPTION AL-7205-SYSTEM-4R U (According figure 3)
3. ADE & BDE SBC OPTION AL-7205-SYSTEM-5R (According Figure 4)

### 1.1.2. Main Features of AL-7205-

- Highly efficient 1.5m (59") prime focus antenna
- Supports analogue and digital reception
- Fully stabilized 3-axis antenna
- X-over-Y-over-POL (X/Y) pedestal configuration, no gimbal lock during zenith pass, continuous azimuth rotation
- Does not require system balancing
- User-friendly Man-Machine Interface (MMI), high-resolution LCD screen
- Built-in satellite database
- Powerful diagnostic and analysis tools
- Real time data logger
- Built-in spectrum analyser
- Interface to vessel's gyro compass (synchro, National Marine Electronics Association [NMEA], step-by-step)
- Built-in GPS receiver and antenna
- Narrowband tracking receiver included
- Light weight: 180 kg (396 lb.), including radome
- Fast and easy installation
- Proven reliability (via Mean Time Between Failures [MTBF])
- Optional: remote support access for monitoring and control

#### 1.1.2.1. 1.5m (59") TVRO System Specifications

***Table 1. Technical Specifications***

| Parameter | Specification |
|---|---|
| ***RF System:*** | |
| Antenna type | Prime focus |
| Antenna diameter | 1.5 m (59”) |
| Operating frequency | Ku-band: 10.7-12.75 GHz<br>C-band: 3.7-4.2 GHz |
| Antenna polarity | Linear (V/H), circular (L/R) |
| Antenna gain, typical | 43 dB @ 12.75 GHz<br>34 dB @ 4.2 GHz |
| Equivalent Isotopically Radiated Power (EIRP) level (min.) | 32 dBW @ 4.2 dBW<br>40 dBW @ 12.75 dBW |
| Radome size | 1.95 m (77") |
| ADE weight | 180 kg (396 lb) |
| ***Tracking System:*** | |
| Pedestal type | AL-7205-1R |
| Axis configuration | X/Y |
| Tracking controller | AL-7205-SBC-R<br>AL-7204-RCU-4R<br>AL-7204-CONT4R |
| Polarisation unit | AL-7204-POLB-R |
| Servo Drive Unit (SDU) | AL-7200-SDU-08-R |
| Pitch/roll sensors - IMU | L00123006 |
| Vessel gyro compass interface<br>*Note: Please consult Orbit for a list of additional interfaces supported by the system.* | Typical interfaces:<br>Synchro 1:1, 36:1, 360:1, 60:1, or 90:1<br>Step-by-step<br>(both common polarities)<br>NMEA-0183 (RS-422) |
| Narrowband tracking receiver | Yes |
| GPS | Yes |

| | |
|---|---|
| ***Vessel Motion:*** | |
| Roll | 30° @ 8 sec |
| Pitch | 15° @ 8 sec |
| Yaw | 80° @ 50 sec |
| Surge | 0.2g |
| Sway | 0.2g |
| Heave | 0.5g |
| Turning rate | 10°/ sec |
| ***Environmental (Above Deck Equipment):*** | |
| Temperature, operational | -25°C +55°C with radome,<br>as per IEC 60945:<br>2002 dry heat, low temp |
| Temperature, storage | -25°C to 75°C |
| Humidity | 95% @ 40°C |
| Spray | Radome-protected |
| Icing | Radome-protected |
| Rain | Radome-protected |
| Wind speed, operational | 100 knots |
| Wind speed, survival | 130 knots |
| Power requirements | 115/230 VAC (± 5%),<br>50/60 Hz (+0, -3%)<br>• ADE – 660 W, max.<br>• BDE – 150 W, max. |
| ***Fibre Optic*** | |
| Parameter | Specification |
| Card type | P/N: 855-13732<br>McPC/ISA-MediaLinX-MM1300-ST |
| Distance | 5 km |
| Data rate | IEEE 802.3 10Base-T twisted pair |
| | IEEE 802.3u 100Base-TX twisted pair |

| | |
|---|---|
| | IEEE 802.3ab 1000Base-T twisted pair |
| | IEEE 802.3z 1000Base-LX or SX fiber |
| ***C Band LNB Parameters*** | |
| Parameter | Specification |
| Input frequency | 3.4-4.2 GHz |
| Output frequency | 950-1750 GHz |
| LO frequency | 5.15 GHz |
| DC power | 11-20 / 75 vdc/Ma |
| ***KU Band LNB Parameters*** | |
| Parameter | Specification |
| Low band I/P frequency range | 10.7~11.7 GHz |
| O/P frequency range | 950~1950 MHz |
| L0 frequency | 9.75 GHz |
| Hi Band I/P frequency range | 11.7~12.75 GHz |
| O/P frequency range | 1100~2150 MHz |
| L0 frequency | 10.6 GHz |
| Output impedance | 75 Ohm (F-Type) |
| DC power | 10~20/210 vdc/Ma |
| ***DiSEqC Switch Parameters*** | |
| Parameter | Specification |
| Frequency range | 950-2150 MHz |
| Switching Outputs | DiSEqC 2.0 13 vdc/17 vdc<br>0/22 KHz |
| Power supply of Low-Noise Block Downconverter (LNB) | 230VAC to 200mA/18 vdc |
| Consumption from receiver | 50 ±2.0 (12…20 vdc) |
| ***Ip Rating*** | |
| IP 65 | Dust protected, water jets |

### 1.1.3. System Description

The 1.5m (59") TVRO system components consist of two sections:

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

**The following figures provide general views and outline drawings of the ADE.**

***Figure 1. ADE General View (Radome Installed)***

**The following figure is a block/interconnection diagram of the TVRO Default system.**

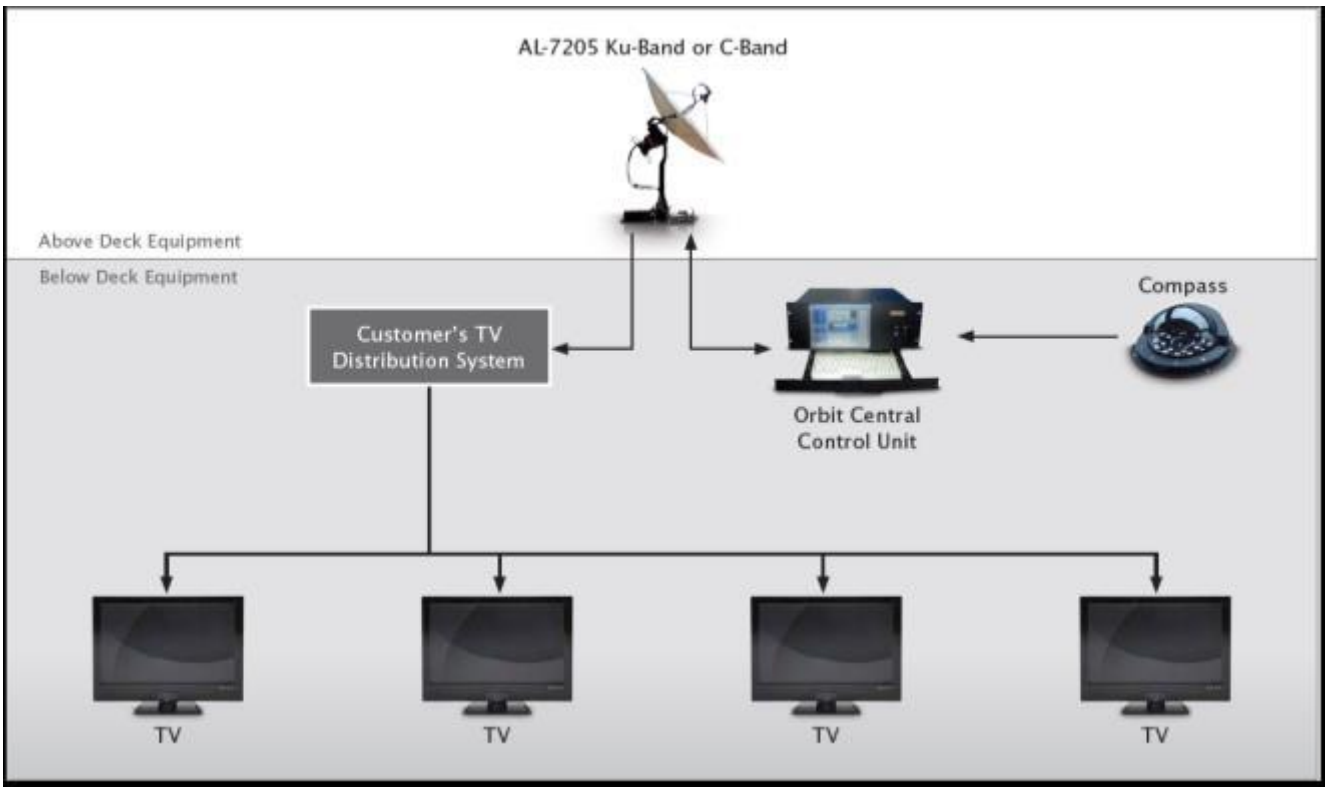



Figure 2. TVRO System – General Functional Block Diagram

### *1.1.3.1. AL-7205-R ADE BDE OPTION'S*

#### *1. ADE & BDE RCU/CCU OPTION*

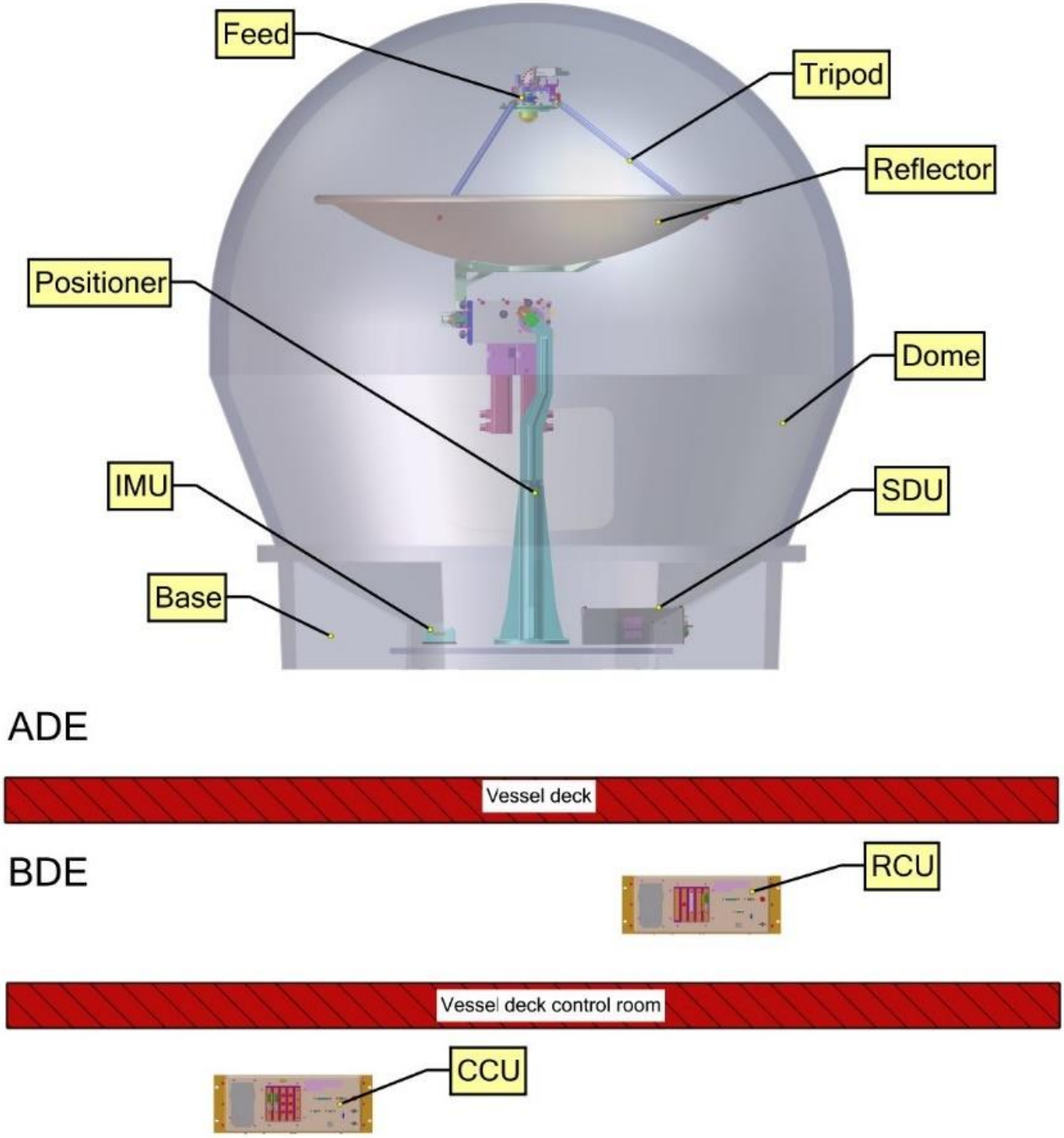



*Figure 3. ADE & BDE RCU/CCU OPTION*

## 2. ADE & BDE ACU OPTION AL-7205-SYSTEM-4R

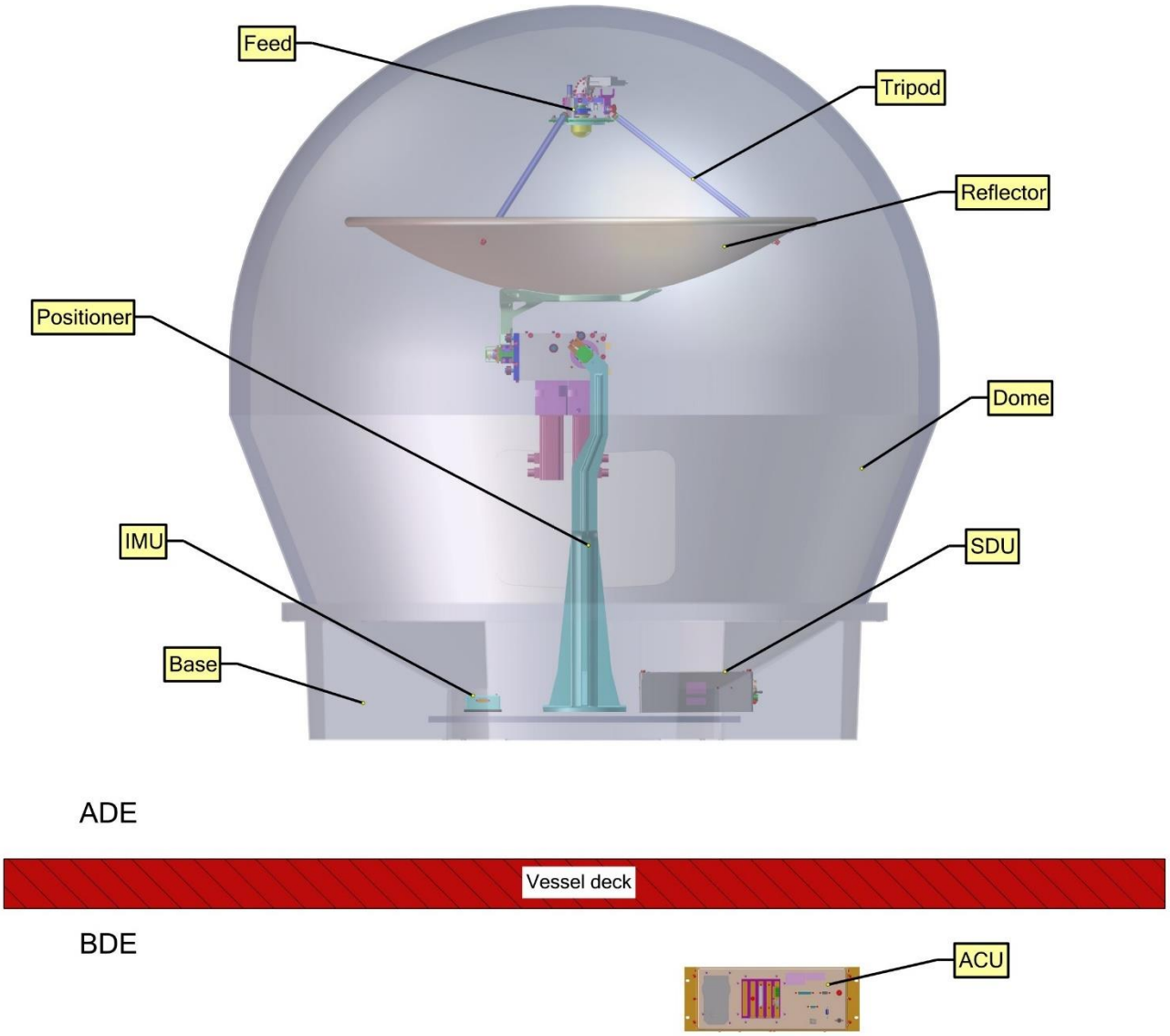



*Figure 4. ADE & BDE ACU OPTION*

## 3. ADE & BDE SBC OPTION AL-7205-SYSTEM-5R

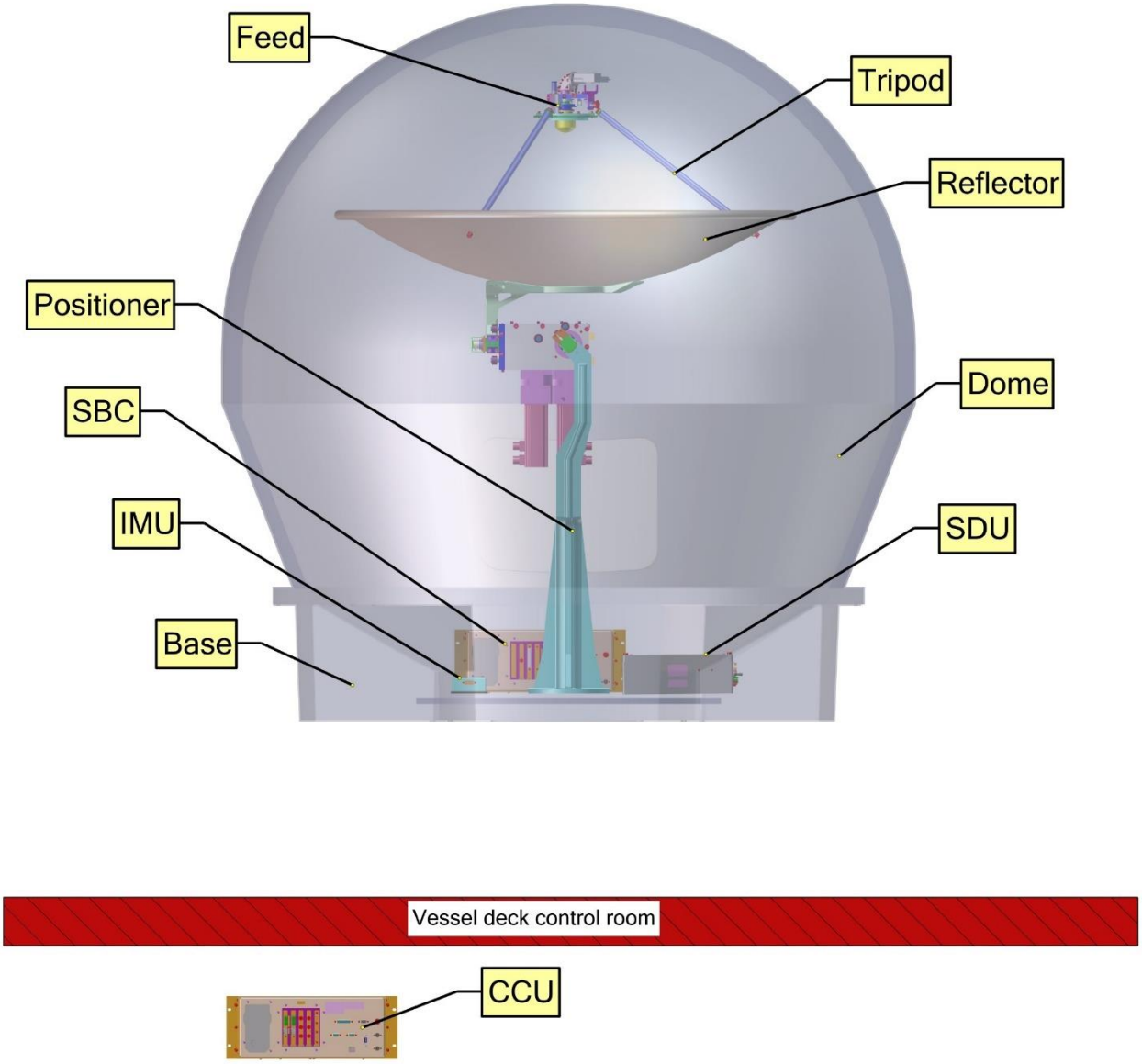



*Figure 5. ADE & BDE General View Layout SBC/CCU OPTION*

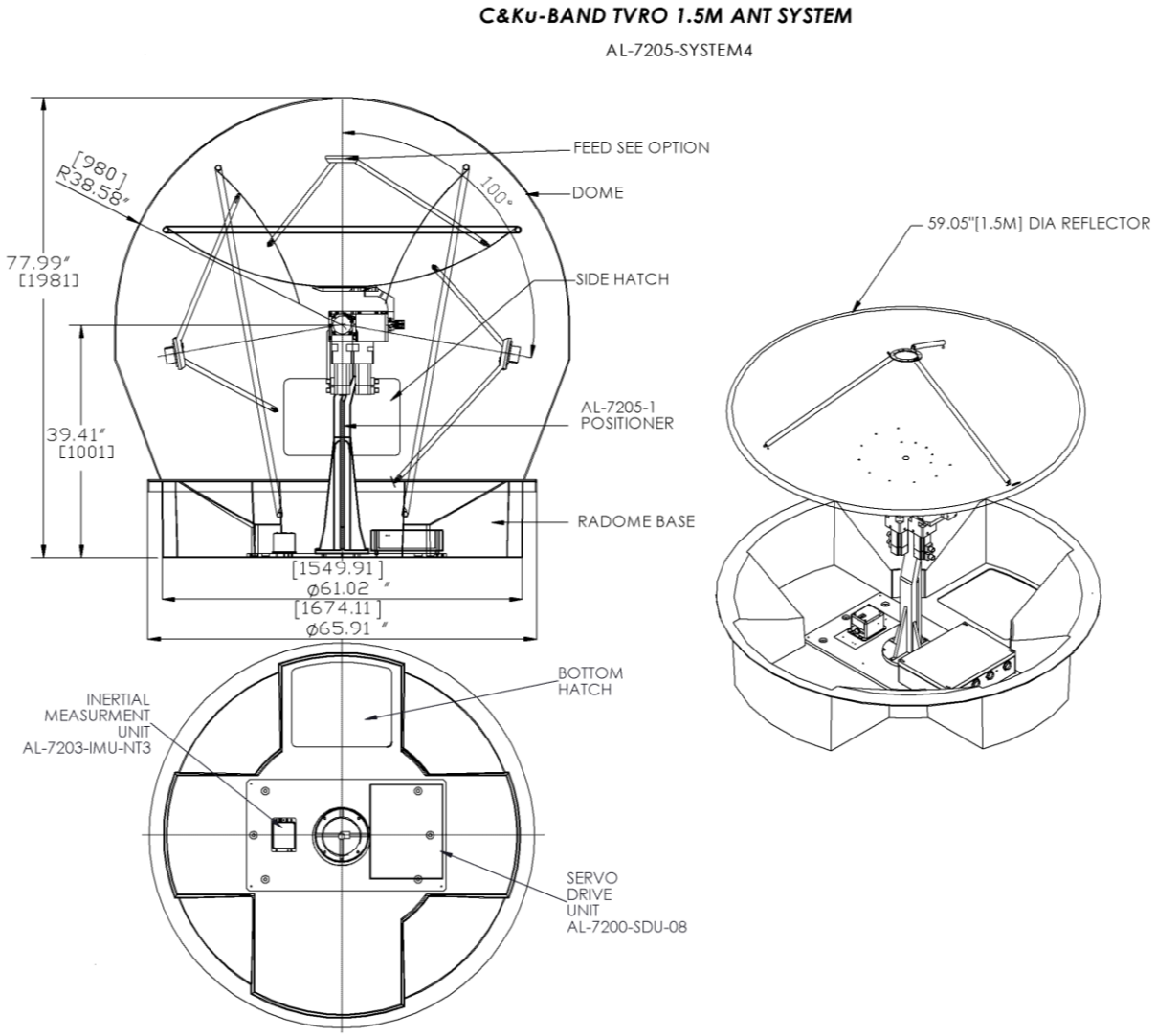



***Figure 6. ADE – Units Location, Identification and Dimensions***

*Figure 7. ADE – General View (Radome Removed)*

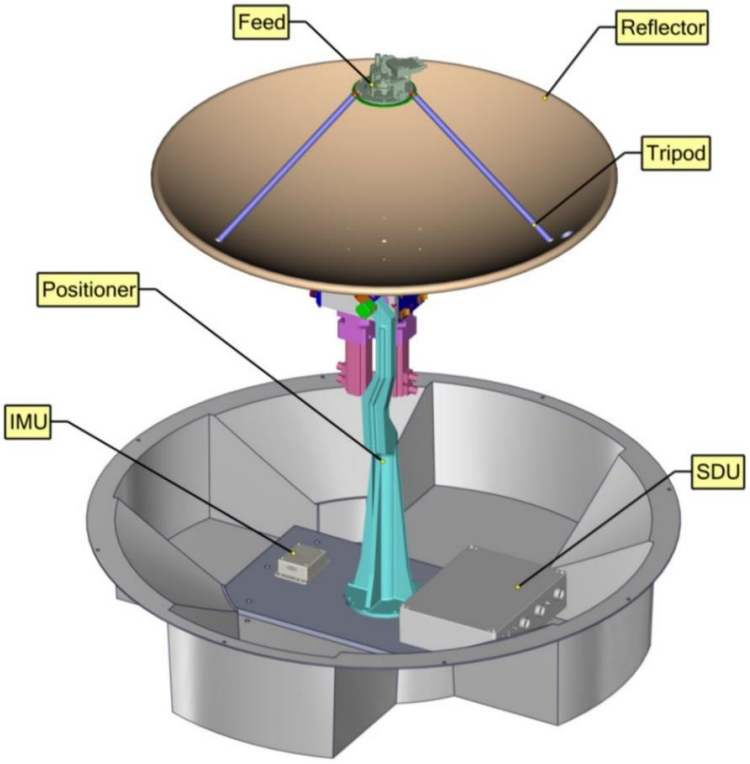



*Figure 8. ADE – Unit Location and Identification AL-7205-R ACU OPTION*

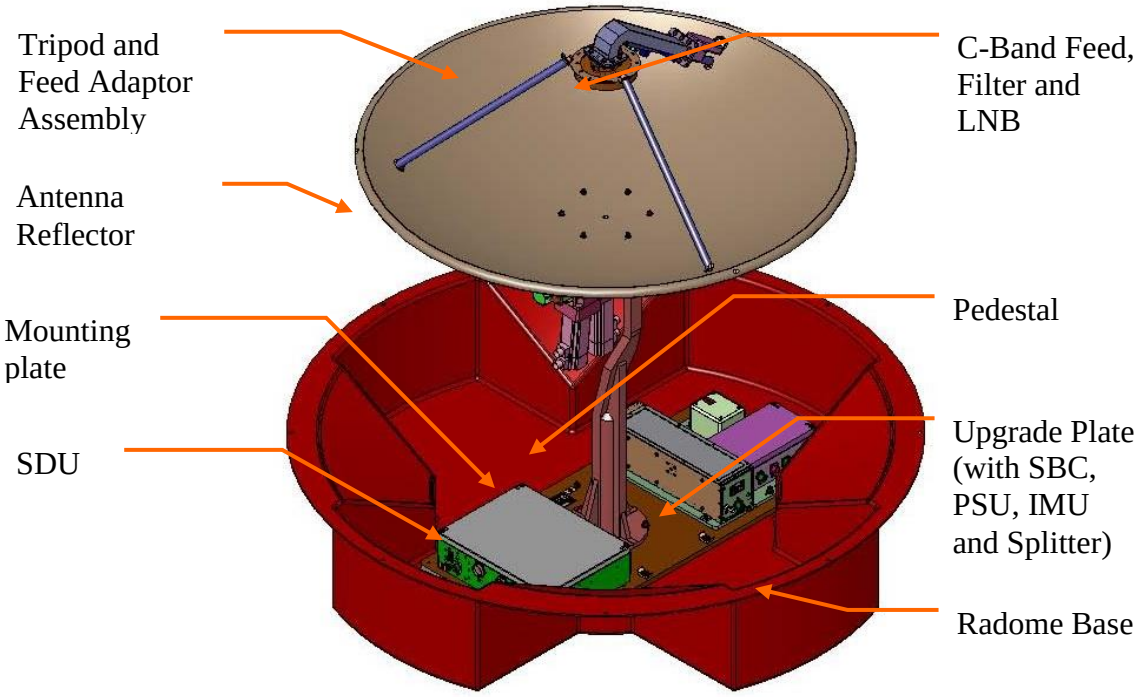



***Figure 9. ADE – Unit Location and Identification AL-7205-R SBC OPTION***

***Figure 10. ADE – Base Hatch***

### *1.1.3.1. Below Deck Equipment (BDE)*

The Below Deck Equipment (BDE) comprises an AL-7204-CONT4 Antenna Control Unit (ACU) or AL-7204-RCU4, which controls the operation of the TVRO system.

The ACU/RCU includes a narrow band-tracking receiver and is able to interface with a vessel gyrocompass.

The AL-7204-CONT4R RCU and AL-7204-RCU4 is a 19" 4U, with a 1U screen kb with a USB interface

***The differences between ACU and RCU are the fiber optic card option***

The Below Deck Equipment (BDE) comprises an AL-7108-CCU Communication Control Unit (CCU )

The CCU includes LAN OR FIBER OPTIC to communicate with the RCU /SBC

AL-7108-CCU- Central Control Unit (CCU), which controls the operation of the 7205-R system.

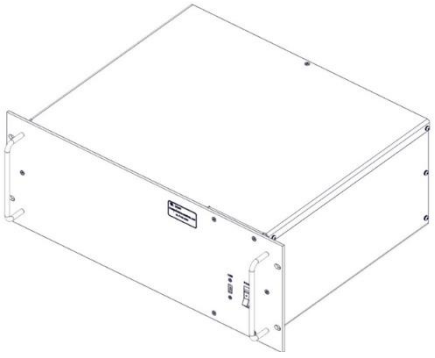
The main features of the BDE eqwwipement:

- "On screen" user-friendly man-machine interface
- Digital control loop interface to the servo drivers for X/Y axes, DC driver for poll axis and GPS receiver
- Interface to the vessel gyro compass
- Advanced stabilization algorithm which processes the IMU roll & pitch sensor data, as well as the GPS readout into real time antenna pointing commands
- Satellite coverage database
- Powerful diagnostic tools (Built-In Test [BIT])
- Real time data logger
- Built-in spectrum analyser
- Enhanced maintenance functions
- Fully automatic operation
- Power: 110 or 230 VAC, 50 or 60 Hz
- Built-in narrowband receiver

***Figure 11. 1U KVM***

**AMK701** general dimensions: 442.4 x 44 x 480 mm (W x H x D)

**RCU/ACU** general dimensions: 483 x 177 x 386 mm (W x H x D)



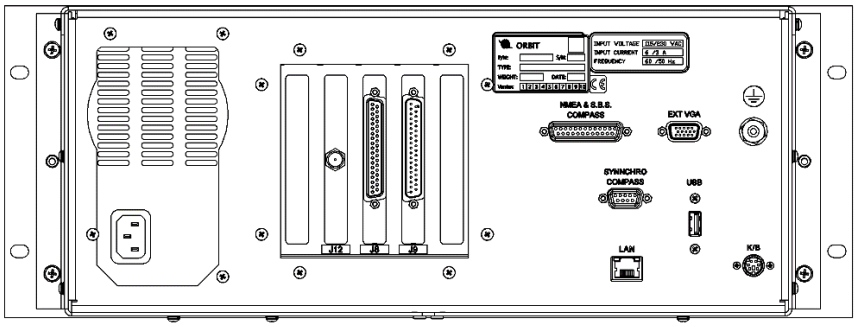



***Figure 12. ACU – Rear Panel General View***

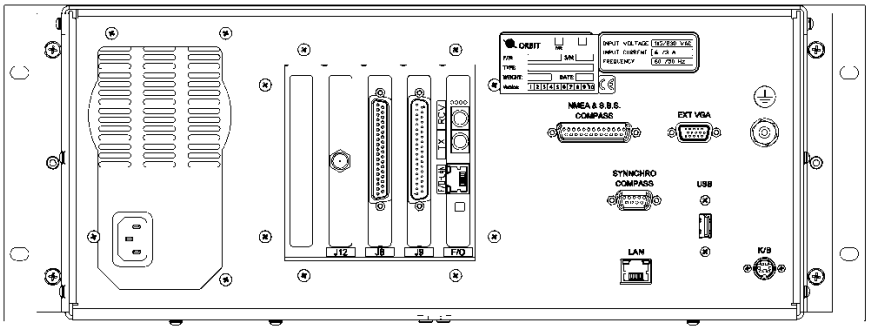



***Figure 13. RCU – Rear Panel  View***

**NOTE**

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

### *1.1.3.2. Central Control Unit (CCU) AL-7108-ccu*

The Below Deck Equipment (BDE) comprises an AL-7108-CCU Central Control Unit (CCU), which can be used as a controller for a single-antenna or dual-antenna system, using fiber-optic communication links.

The CCU serves both as the AL-7205-R System Man-machine terminal as well as the interface to the ships Gyrocompass and the customer's modem.

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

The CCU is based on a 19" rack-mounted 4U industrial PC (including a 1U keyboard-and-mouse drawer), and it is usually located in the Radio Room or the TV Distribution Room.

Man-Machine Interface (MMI) with the CCU. The front panel also includes a power switch, and a USB connector that allows software updates and data downloads, using a memory stick.

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

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

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

The CCU contains the following cards:

- CPU Card
- Receiver Card
- 2 Ethernet-to-Fiber converter cards (optional)
- Ethernet Hub.
- L-Band switch card.(optional)
- Power Supply

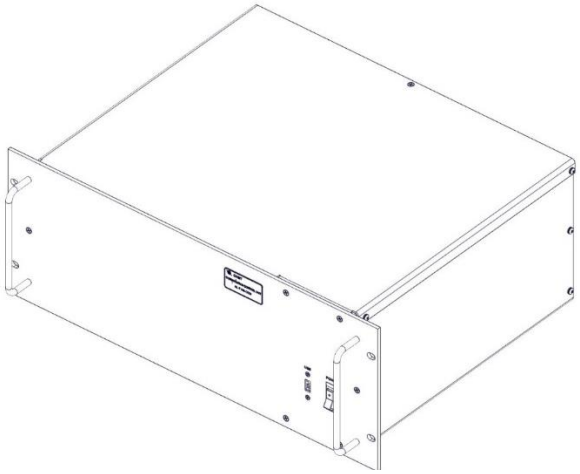


*Figure 14. CCU General View*


*Figure 15. CCU Front Panel*


*Figure 16. CCU Rear Panel*

### *1.1.3.3. Above Deck Equipment (ADE)*

## *1.2. Servo Driver Unit (SDU) AL-7200-SDU-08R*

The AL-7200-SDU-08R Servo Driver Unit is an outdoor, compact sized box which includes brushless motors, servo drivers and a GPS Receiver. The SDU also provides power to the ADE.

The AL-7200-SDU-08R includes the following:

- GPS receiver
- EMI/RFI protection
- Servo drivers for 2 brushless motor axes (pedestal axes X and Y)
- DC driver for polarizer skew motor
- Power supply for brakes (for pedestal axes X and Y)
- Power: 115/230V, 50/60 Hz
- ADE power indicator
- 24 vdc power supply for brake release
- Fuses

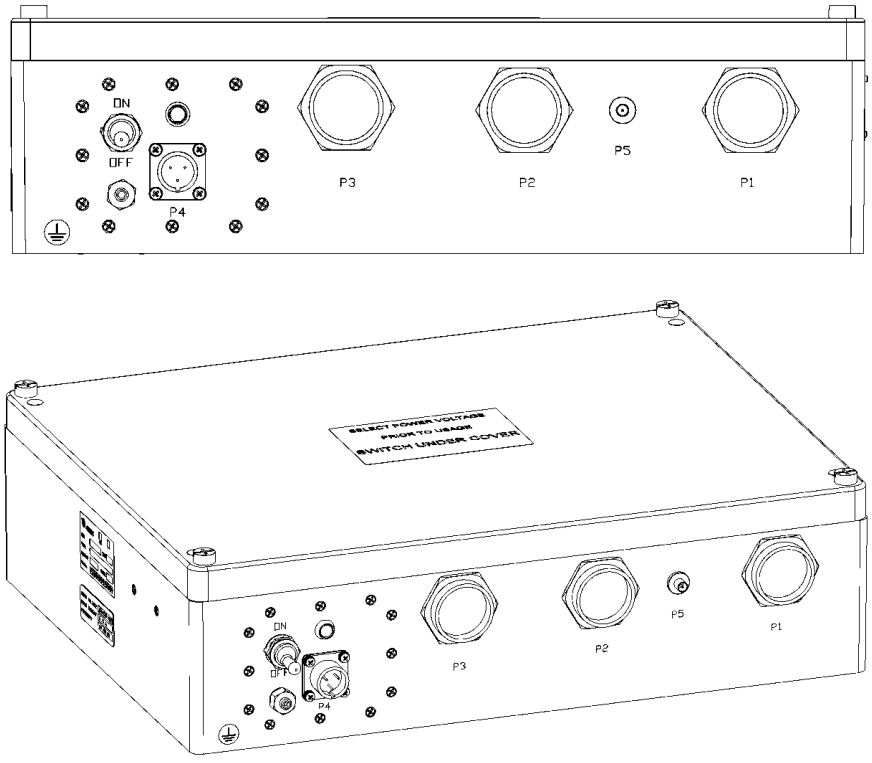



*Figure 17. SDU AL-7200-SDU-08R - General View*

## SDU Front View, Controls and Indicators

The SDU front panel includes the following items:

- IMU Power Connector P1 – supplies power and control signals to the IMU, and receives control signals from the IMU.
- Pedestal Power Connector P2 – supplies power to the pedestal motors.
- Control Connector P3 – receives motion control (azimuth and elevation) signals from the ACU. These signals are used to position the antenna for optimal reception of the satellite signals.
- Power In Connector P4 – mains power inlet (115/230V, 50/60 Hz).
- GPS Antenna Connector P5 – the Omni-Directional GPS Antenna is connected to the GPS receiver located in the SDU via this connector.
- Grounding Jack
- SDU Power Switch and Indicator – the SDU's ON/OFF switch. When in the ON position, the green LED is illuminated.

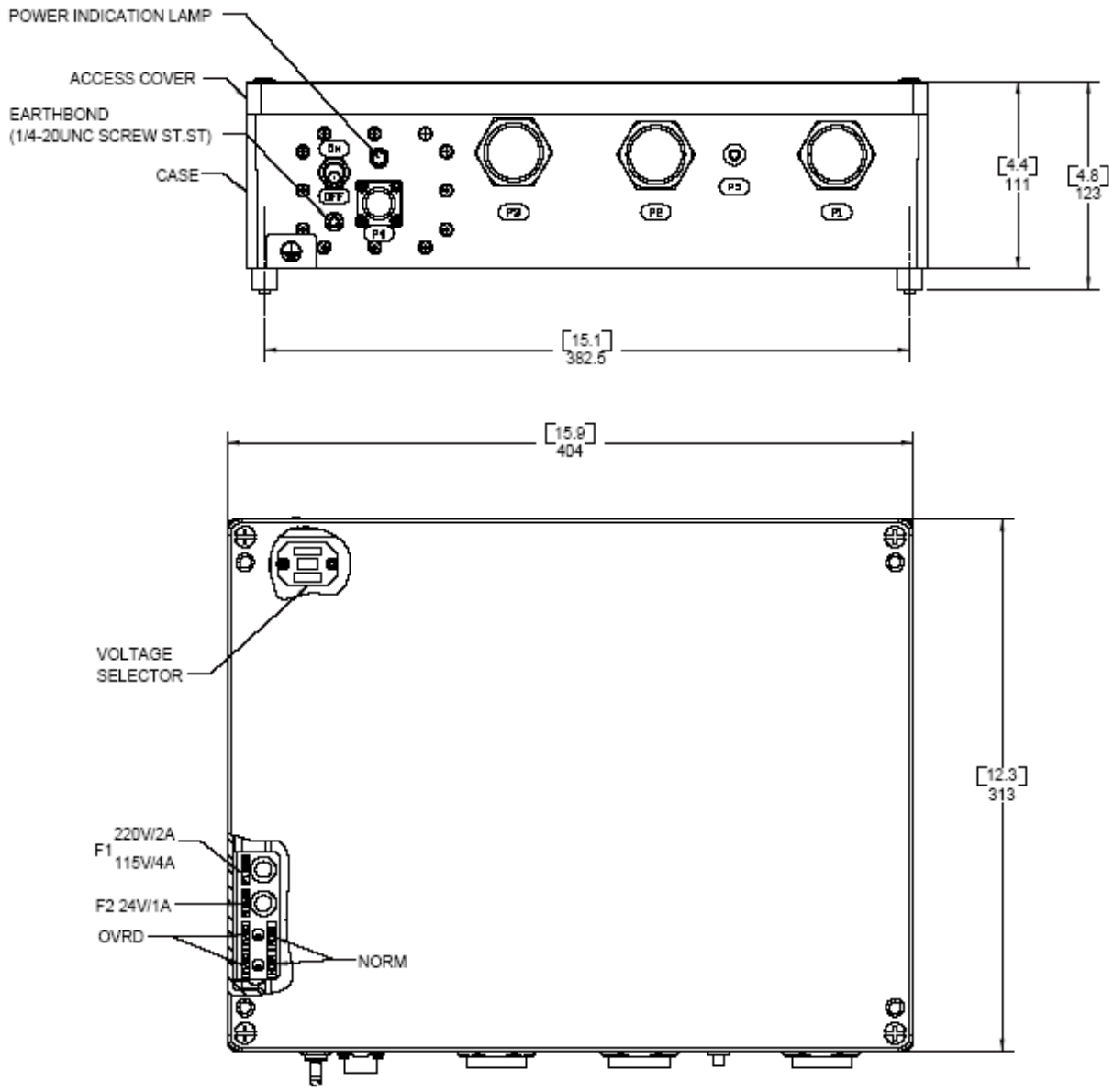



*Figure 18. SDU Outline Drawing*

## *1.3. Single Board Controller (SBC) AL-7204-SBC*

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

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

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

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

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

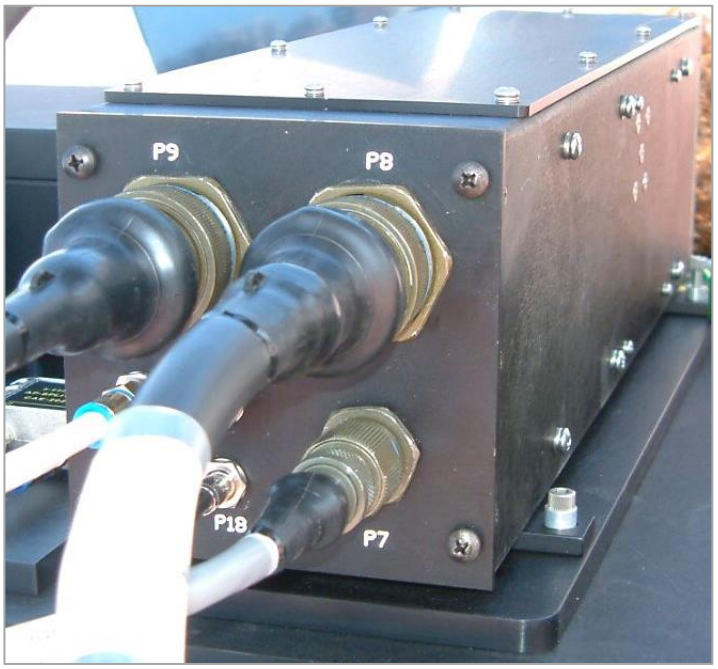



***Figure 19. Single Board Controller (SBC) AL-7204-SBC General View***

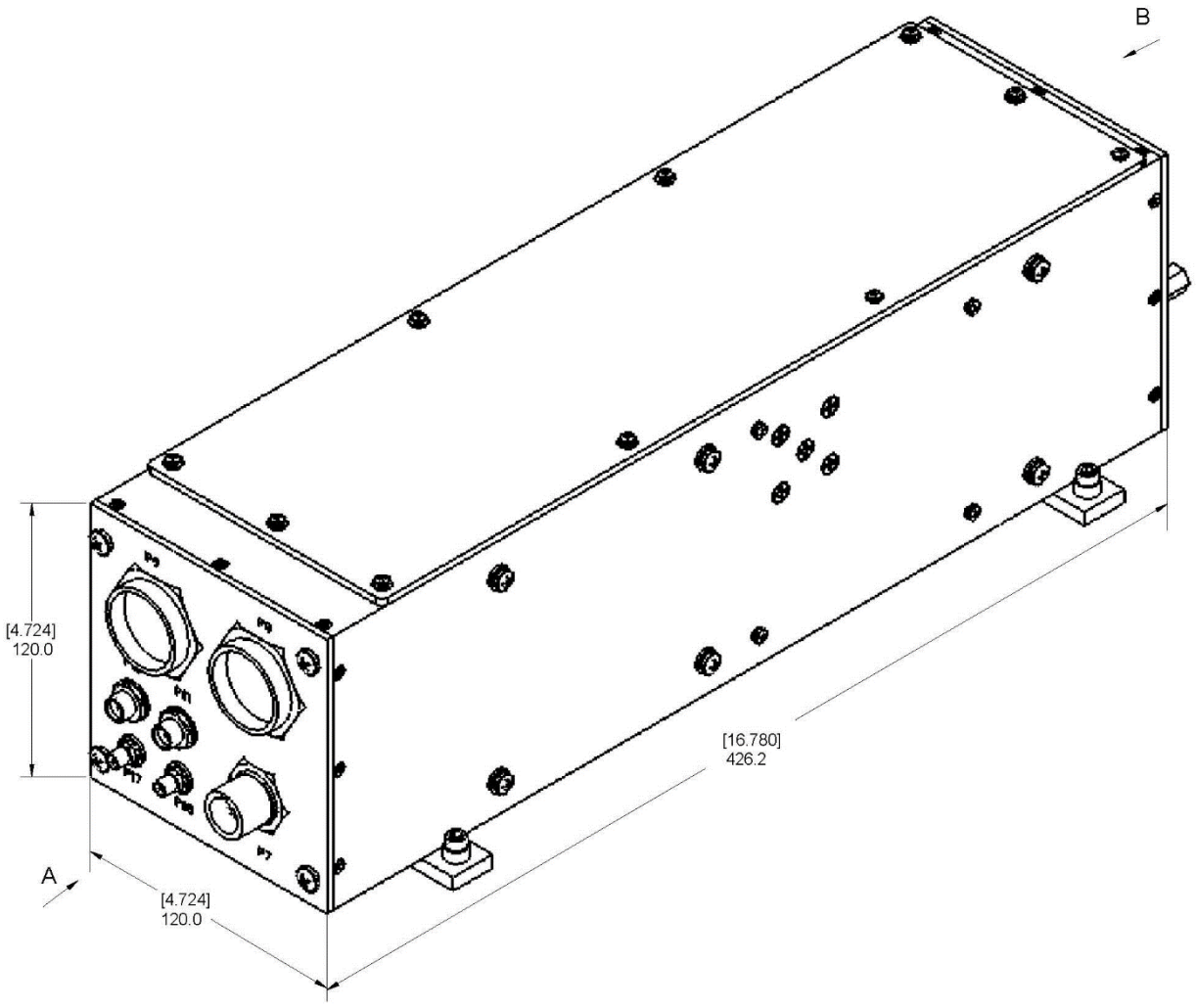
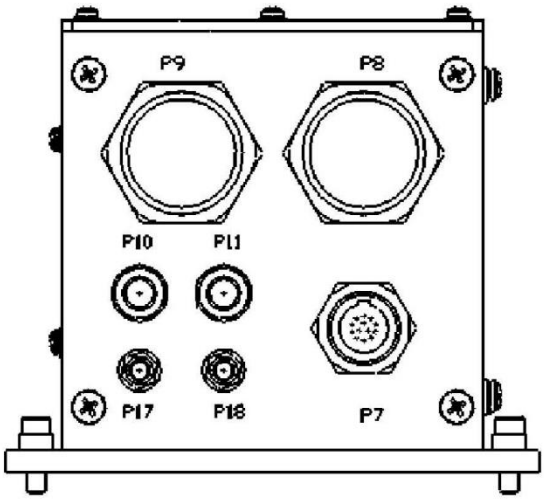
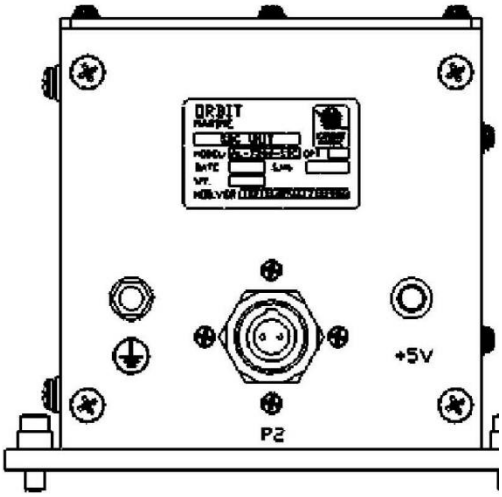



*Figure 20. SBC Outline Drawing*




VIEW A




VIEW B

| NAME | PURPOSE | TYPE |
|---|---|---|
| P7 | IMU | D38999/24WB35SN |
| P8 | SDU | MS3474W20-41SX |
| P9 | PEDESTAL | MS3474W20-41P |
| P10 | IF1 | BNC |
| P11 | IF2 | BNC |
| P17 | TxLAN | ST |
| P18 | RxLAN | ST |

| NAME | PURPOSE | TYPE |
|---|---|---|
| P2 | +24v | D38999/24WB02SN |
| +5v | LED | |
| GND | GROUND | |

***Figure 21. SBC Connectors***

### 1.3.1. Power Supply Unit (PSU) AL-7204-PSU

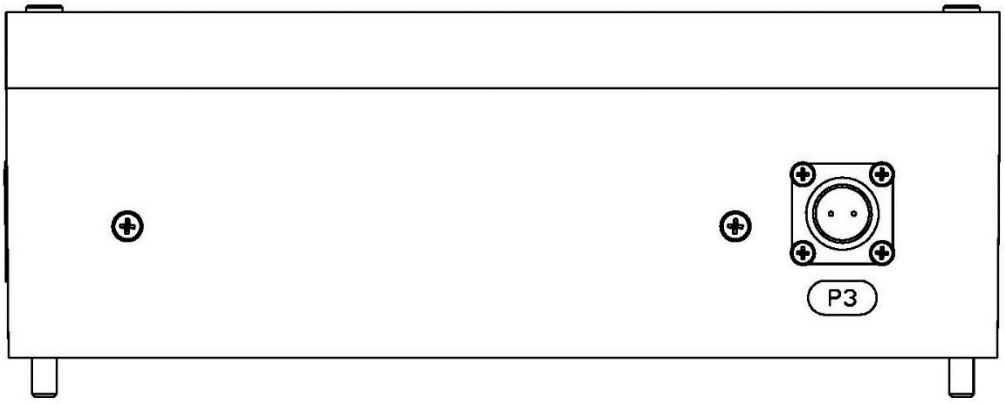
The AL-7204-PSU Power Supply Unit serves as the ADE power supply and distribution unit. The PSU distributes the mains voltage to the SDU, and produces 22VDC voltage for the SBC and for auxiliary future equipment.

***Figure 22. Power Supply Unit (PSU) AL-7204-PSU General Views***

PSU Connectors

The PSU panels include the following items:

- AC IN Connector P1 – Mains power inlet – from the ship's power source (115/230V, 50/60 Hz).
- DC OUT Connector P2 – Supplies 22 VDC voltage to the SBC.
- AUX OUT Connector P3 – Supplies 22 VDC voltage. Not used in this system.
- AC OUT Connector P4 – Supplies mains voltage to the SDU.
- Grounding Jack.



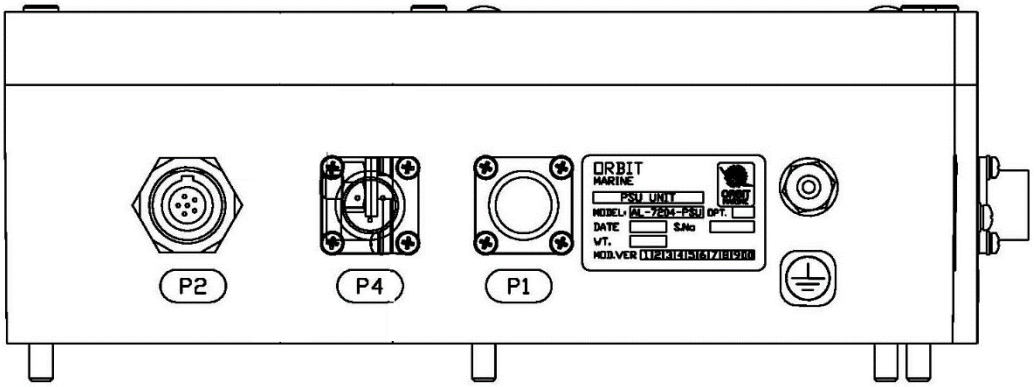



*Figure 23. PSU Connectors*

### 1.3.2. Inertial Measurement Unit (IMU)

The Inertial Measurement Unit (IMU) is the “heart” of the antenna-stabilized TVRO system. The IMU provides accurate dynamic readings of the antenna platform’s roll, pitch and yaw angles at all times. To produce a true yaw angle, the IMU relies on a long-term reference feedback from the vessel’s gyro.

The solid-state (static sensor platform) inertial measurement unit, designed to stabilize a Ku antenna on a small vessel, using the vessel’s gyro as a heading long-term reference. The IMU provides extremely accurate information on a vessel’s motion in pitch, roll and yaw axes.

The controller software uses a 3D-calibration algorithm to correct the individual sensor readings in real-time, thus producing an over-all pitch-roll-yaw angle accuracy better than 0.5 degree.

The L00123006 is an accurate and agile device suitable for operation in the harsh dynamics of a relatively small vessel, such as a yacht.

**Specifications need to updated according to new IMU**

- Dimensions: 104 x 145 x 88 mm
- Weight: 1 Kg
- Power Consumption: 7 Watt
- Accuracy: 1° envelope
- Dynamics: 30°/s in pitch & roll
  10°/s rate of turn in heading
- Output: Digital (high rate serial comm. link)

**NOTE**

*Each IMU is individually pre-calibrated at the factory. The calibration data resides on the controller’s non-volatile memory, and is also supplied with the IMU (on a floppy disk).*

*If an IMU needs to be replaced, its individual set of calibration-parameters must be copied into the controller’s memory.*

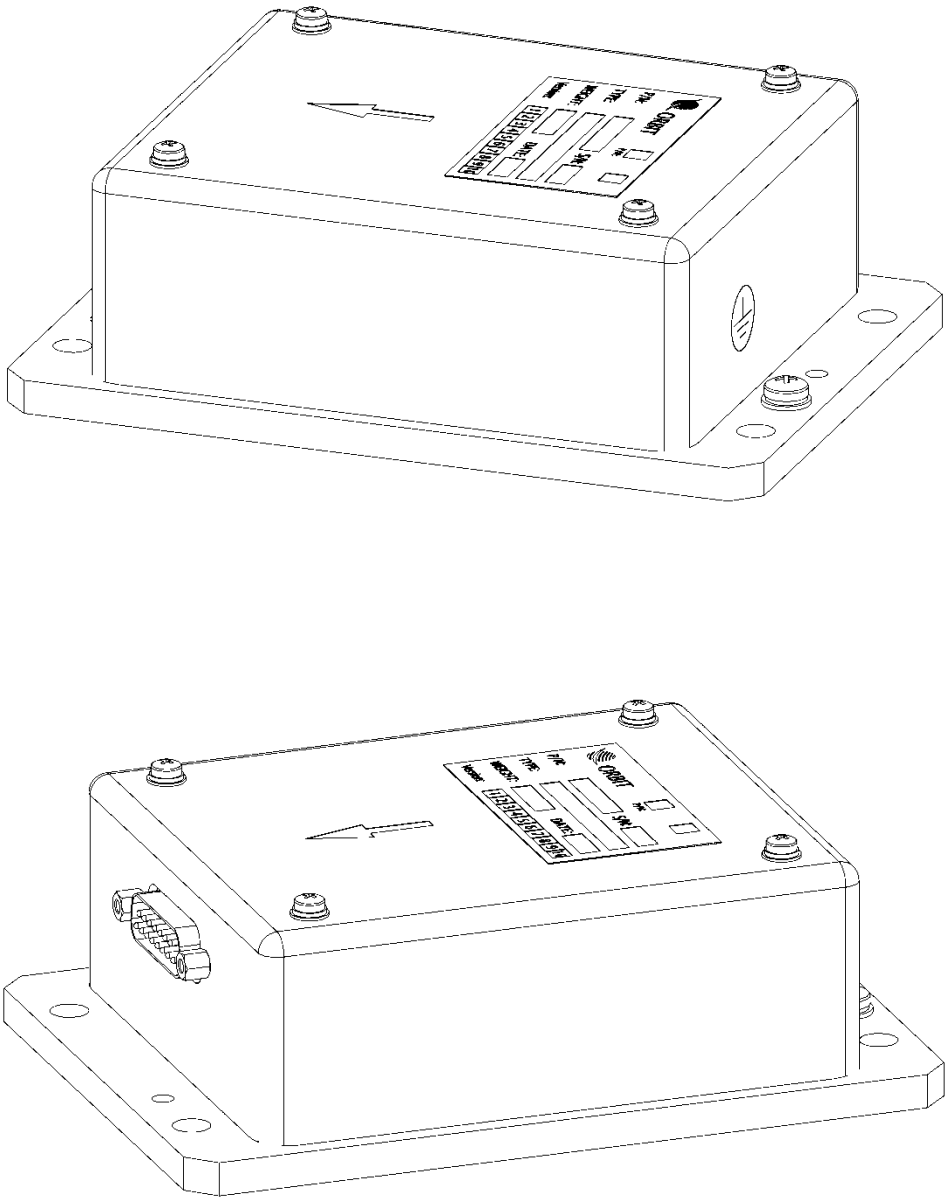


*Figure 24. IMU - General View*

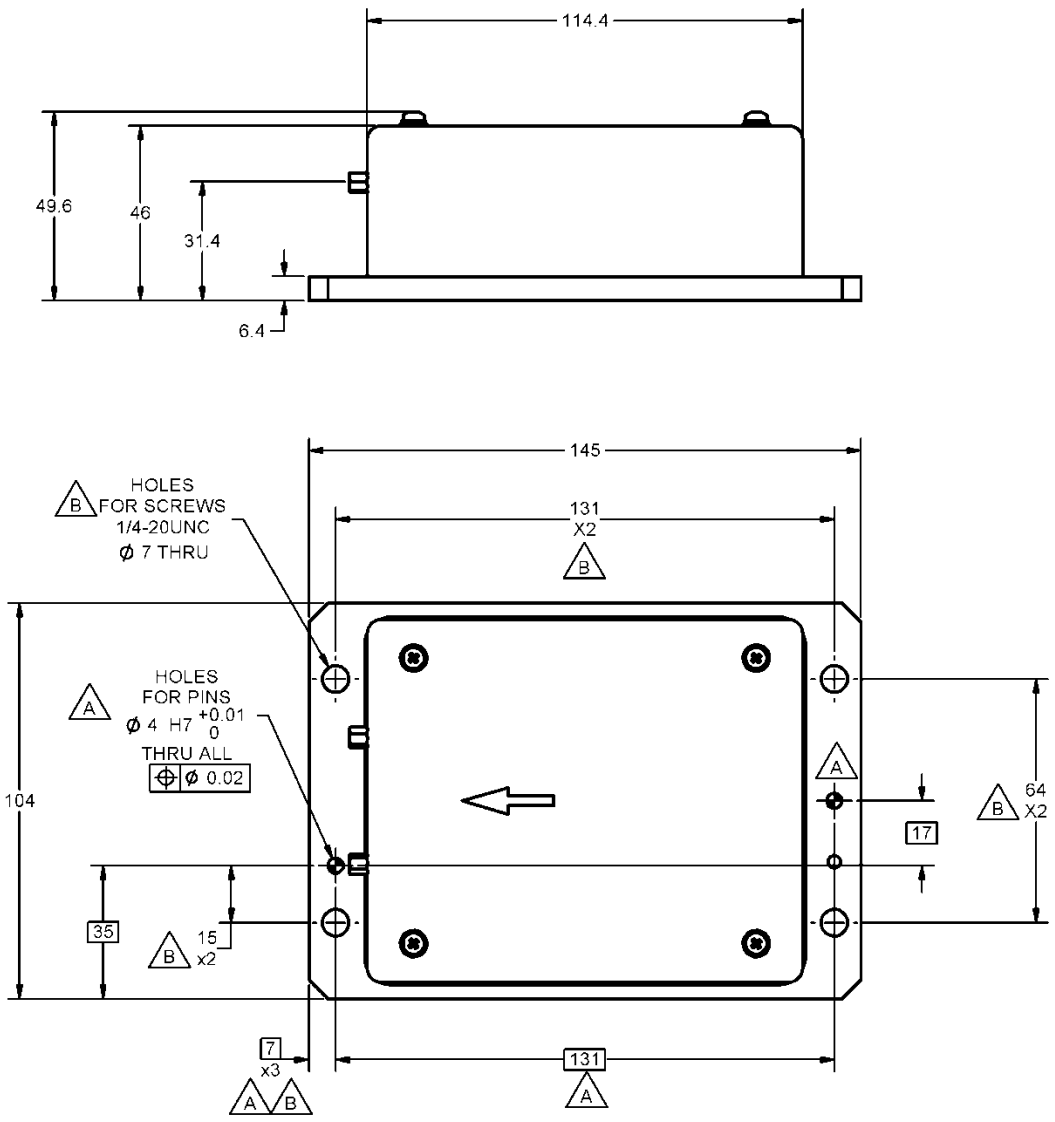



***Figure 25. IMU - Outline Drawing***

### 1.3.3. X/Y Pedestal AL-7205-1R

The X/Y pedestal can carry the antenna to any required angle, at a high speed and accuracy with continuous axis movement (no azimuth limits), without the need for slip-rings or rotary joints. The X/Y configuration also eliminates the zenith pass problem. The X/Y pedestal uses brushless motors that contribute to high reliability.

The elevation axis is capable of continuous movement from -10° to 190°, providing a total of 200° of uninterrupted movement. In addition, the system has no cable wrap (unlimited azimuth).

**NOTE**

- *The dish is mounted on the Y axis.*
- *The system should be installed with the X axis pointed toward an entity which is obstructing satellite visibility to improve operation. The X axis direction is indicated by an arrow on the IMU..,. This arrow also indicates the "0" reference of the azimuth axis.*

The pedestal consists of the following sub-assemblies, as shown in the following figure:

- Pedestal leg and base
- Two axes, each equipped with a motor, gear and encoder, and a fail-safe brake
- Antenna adapter
- Interconnection cables

The Main Features of the AL-7205-1R Pedestal are:

- High torque brushless motors
- High accuracy planetary gear
- No azimuth slip rings, rotary joints or cable wraps are needed
- Continuous rotation
- High accuracy at extreme tactical dynamics
- Exceptional reliability through use of brushless motors and encoders
- Unique and clean design
- Simple installation and maintenance

**NOTE**

*The pedestal nameplate indicates the factory-measured encoder offset values of the X and Y axes. These values must be entered into the ACU, via the Maintenance screen, as the pedestal X and Y axis offsets when replacing the pedestal.*

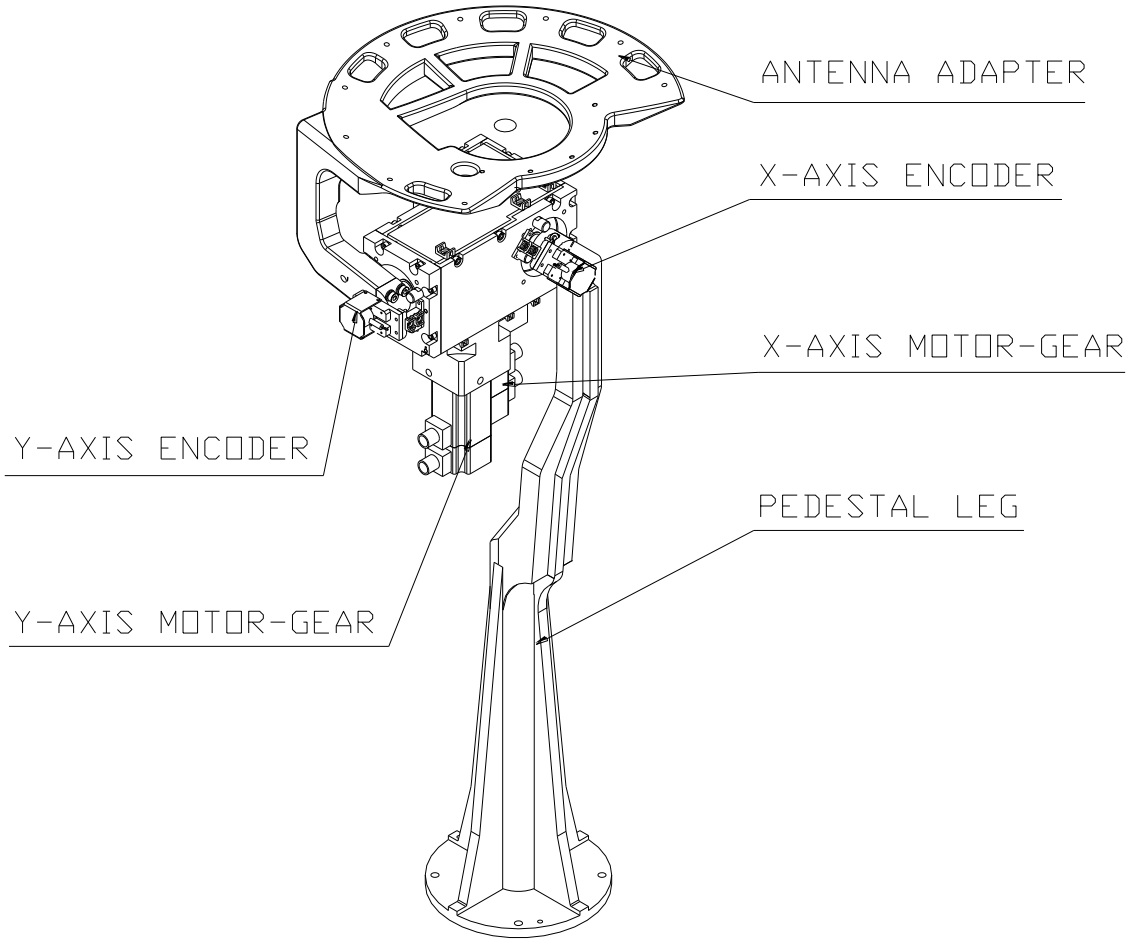



***Figure 26. Pedestal - General View***

## 1.3.4. Antenna and Feed Assembly AL-7205-R

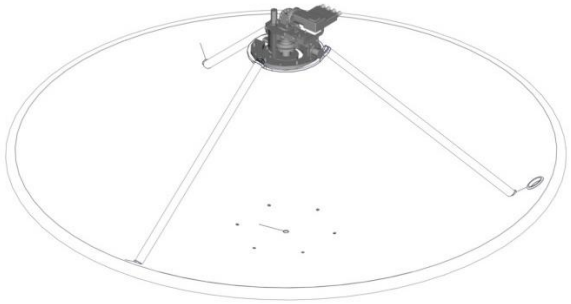
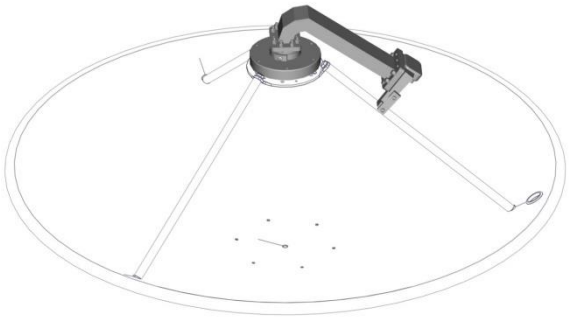
### *1.3.4.1. Universal Feed Mount*

The System's antenna reflector is equipped with a universal feed mount, which facilitates the quick and easy installation of a variety of feed assemblies, thus providing worldwide coverage.

***Figure 27. Universal Feed Mount and Available Feed Assemblies***

### 1.3.4.2. Available Feed Assemblies

The following feed assemblies can be installed on the universal feed mount:

| Feed | ORBIT P/N | Notes |
|---|---|---|
|  Linear Ku motorized feed assembly | KIT25-0445-1 | Global linear Ku coverage |
|  | 25-0446-4-1R<br>25-0446-4-2R | C band left or right feed with filter |

### 1.3.4.3. Installation of Feed Assemblies

Chapter 5 in this manual provides installation guidelines for each feed, and describes the required software configuration changes.

### 1.3.5. DiSECqC Switch (optional)

The Digital Satellite Equipment Control (DiSEqC) is a special communication protocol used between a satellite receiver and a device, such as a multi-dish switch.

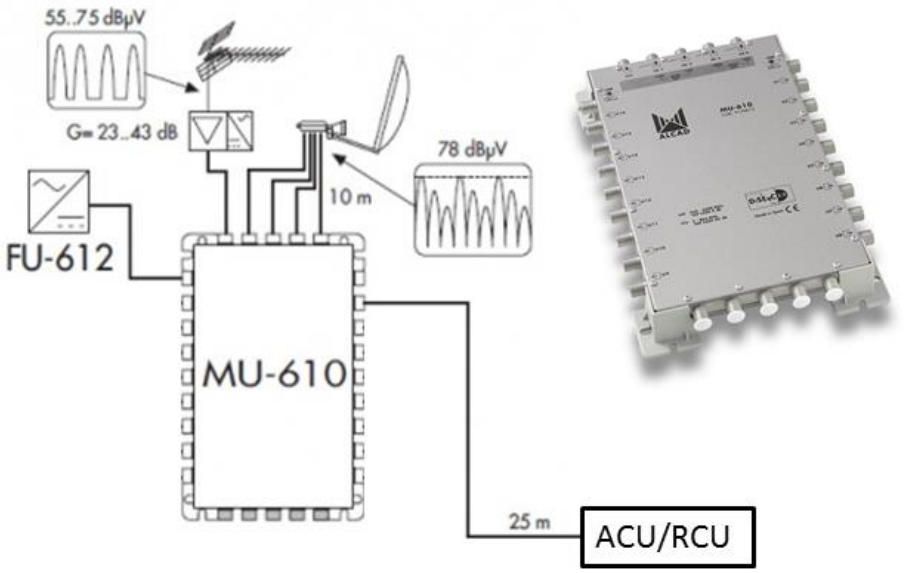



***Figure 28. Single System Interconnection Diagram***

**NOTE**

*The unused terminal may be left disconnected.*

## 1.3.6. Antenna and Feed Assembly AL-7205-R

### *1.3.6.1.Tripod and Feed Adaptor Ring AL-7205-R*

The System's antenna reflector is equipped with a tripod and feed adaptor ring, which facilitates easy and quick installation of a variety of feed assemblies, thus providing worldwide coverage.

The system is supplied with a C-Band Feed, LNB and Filter Assembly, which can be replaced with an optional DBS LNBF (Ku-Band feed) Assembly for USA DBS coverage.

***Figure 29. Antenna Reflector, Tripod and Feed Adaptor (with C-Band Feed Mounted)***

#### *1.3.6.1.1. C-Band Feed*

*Radio Frequencies*

*The system is supplied with a C-Band feed and LNB. The system operates in the C-Band receive band between 3900 MHz-4200 MHz.*

*Polarization*

*C-Band signals: Left Hand Circular Polarized (LHCP)*

*Pointing Accuracy*

*The TV-DTS antenna system is not degraded more than 0.5 dB RMS sampled over any 2-hour time period due to ship's motion at C-Band.*

*IF Interface*

*The C-Band LNB provides L-Band output (950-1450 MHz) to provide the proper signal levels for the IRDs and receiver via the TV distribution system.*

*C-Band Feed/LNB Characteristics*

| Parameter | Specification |
|---|---|
| Type | Integral Feed and LNB |
| Frequency Range | 3.9 GHz - 4.2 GHz |
| Output Frequency | 975 MHz - 1750 MHz |
| Local Oscillator | 5150 MHz |
| L.O. Stability | 500 kHz to 1 MHz |
| Noise Temp | 20°K |
| Output Connector | F-type |
| Cross Pole Isolation | 32 dB |
| DC Voltage | 13V – 18V |

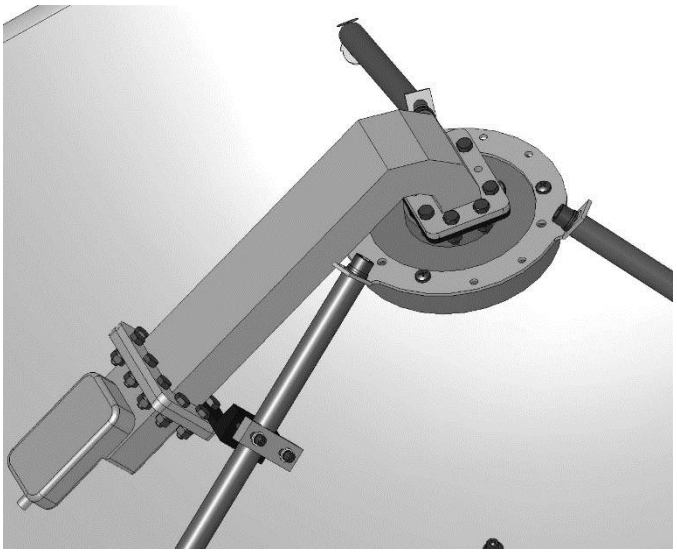


*Figure 30. C-Band Feed, LNB and Filter Assembly*

## 1.3.7. Theory of Operation

### *1.3.7.1. Block Diagram Description AL-7205-R*

The operation of the TVRO system is fully controlled from the AL-7204-CONT4R ACU Or The AL-7204-RUC4 (installed below the deck). Using the ACU, the operator can select the desired satellite and channel from a list displayed on the ACU/RCU monitor.

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

**ACU/RCU Principle of Operation**

The AL-7204-CONT4R ACU Or AL-7204-RCU4 is fed by 115/230 VAC, 50/60 Hz single-phase power supply (from the vessel's power system), receives the following data:

- Vessel's gyro compass signals - the ACU/RCU is able to interface to most standard vessel gyro compass types.
  - The following are typical gyro compass types:

  Synchro compass 1:1, 36:1, 60:1, 90:1 or 360:1 [115 VAC, 50 Hz or 400 Hz]

  NMEA-0183 (RS-422 interface) - default configuration

  Step-by-step

  - GPS data (from the SDU internal receiver)

The ACU/RCU receives the following data from the ADE:

- Antenna position signals from the pedestal encoders (via the pedestal encoder cable).
- Vessel's roll, pitch and yaw positions taken from the IMU.
- L-band RF signals from the antenna's LNB output.

The ACU/RCU analyses the above data to produce control signals that are sent to the pedestal (via the control cable). These control signals provide antenna azimuth and elevation direction to position the antenna correctly in order to optimally receive the satellite signals continuously.

## SDU Principle of Operation

The SDU is fed by a 115/230 VAC, 50/60 Hz single-phase power supply (from the vessel's power system), and provides power to the IMU and the pedestal. The SDU contains servo cards, which drive the pedestal.

## IMU Principle of Operation

When the system is in use, the IMU provides the ACU/RCU with the following vessel's position information:

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

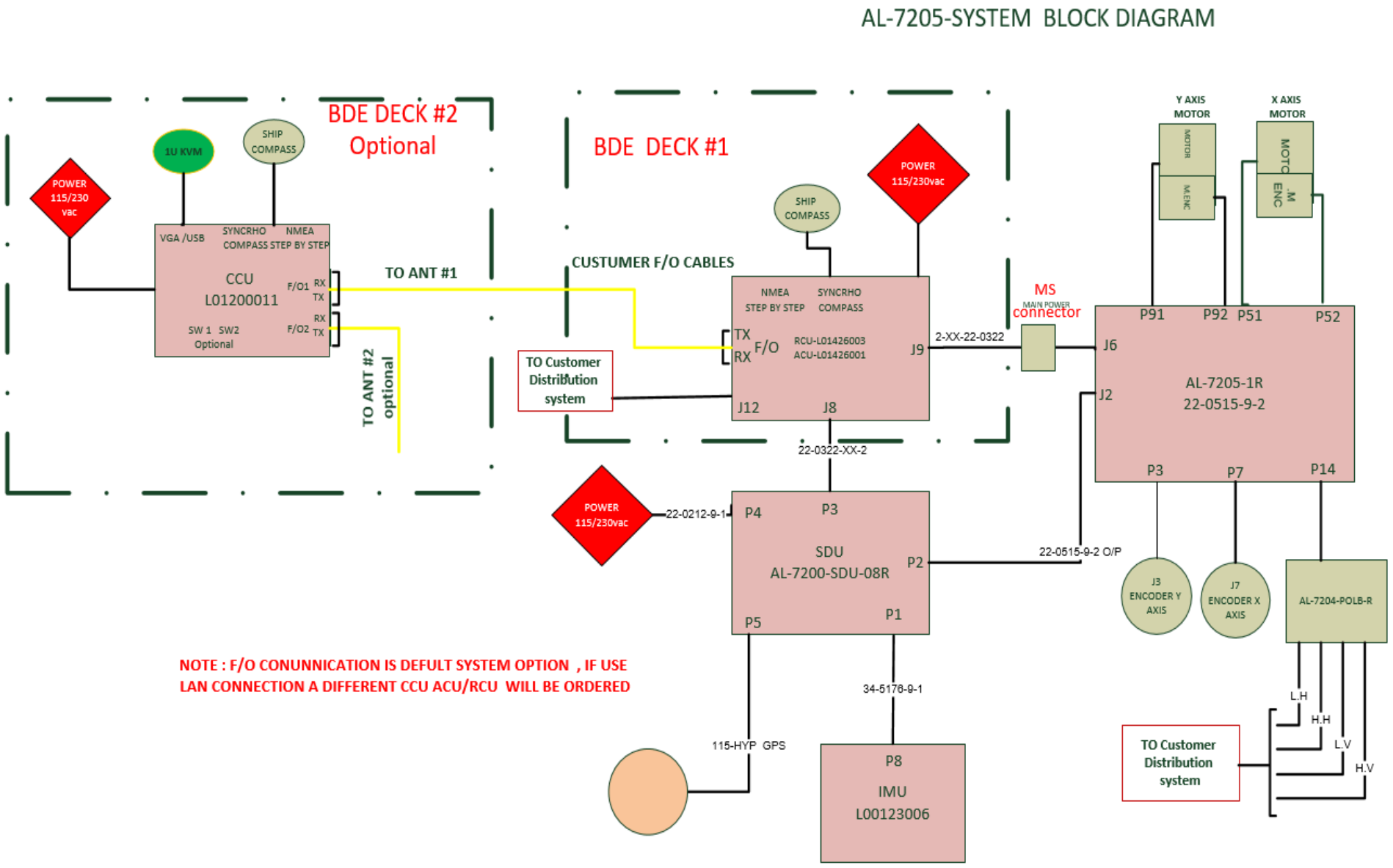



*Figure 31. TVRO System - Block/Interconnection Diagram RCU/ACU OPTION*

### *1.3.7.2. Block Diagram Description AL-7205-R SBC OPTION*

The operation of the 7205-R system is fully controlled from the AL-7108-CCU (installed below the deck). Using the CCU, the operator may select the desired satellite and channel from a list displayed on the CCU monitor.

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

**CCU Operation**

The AL-7108, which is fed by 115/230 VAC, 50/60 Hz single-phase power supply (from the ship's power system), receives the following data:

- Ship's gyro compass signals - The CCU can be connected to most standard ship gyro compass types. The following are typical gyro compass types:
  - Synchro compass 1:1, 36:1, 60:1, 90:1 or 360:1 [115VAC, 50Hz or 400 Hz]
  - NMEA-0183 (RS-422 interface) - default configuration
  - Step-by-Step.
- GPS data (from the SDU internal receiver).
- Antenna position signals from the pedestal encoders.
- Ship's angular position signals from the IMU.
- L-band RF signals from the antenna's LNB output.
- Fiber optic communication with the ADE SBC.

The CCU uses the above data to produce control signals that are sent to the pedestal via the SBC. These control signals provide antenna azimuth and elevation direction to position the antenna correctly in order to optimally receive the satellite signals.

**CCU-SBC Operational Concept:**

The SBC and CCU are connected by a fiber-optic communication link, and provide distributed control concept – SBC running real-time software for stabilization and control, while the CCU presents the man-machine interface to the operator.

The CCU and the SBC are connected by two multi-mode fiber-optic cables (Rx and Tx), utilizing LAN communication channel between the two units.

## SDU Operation

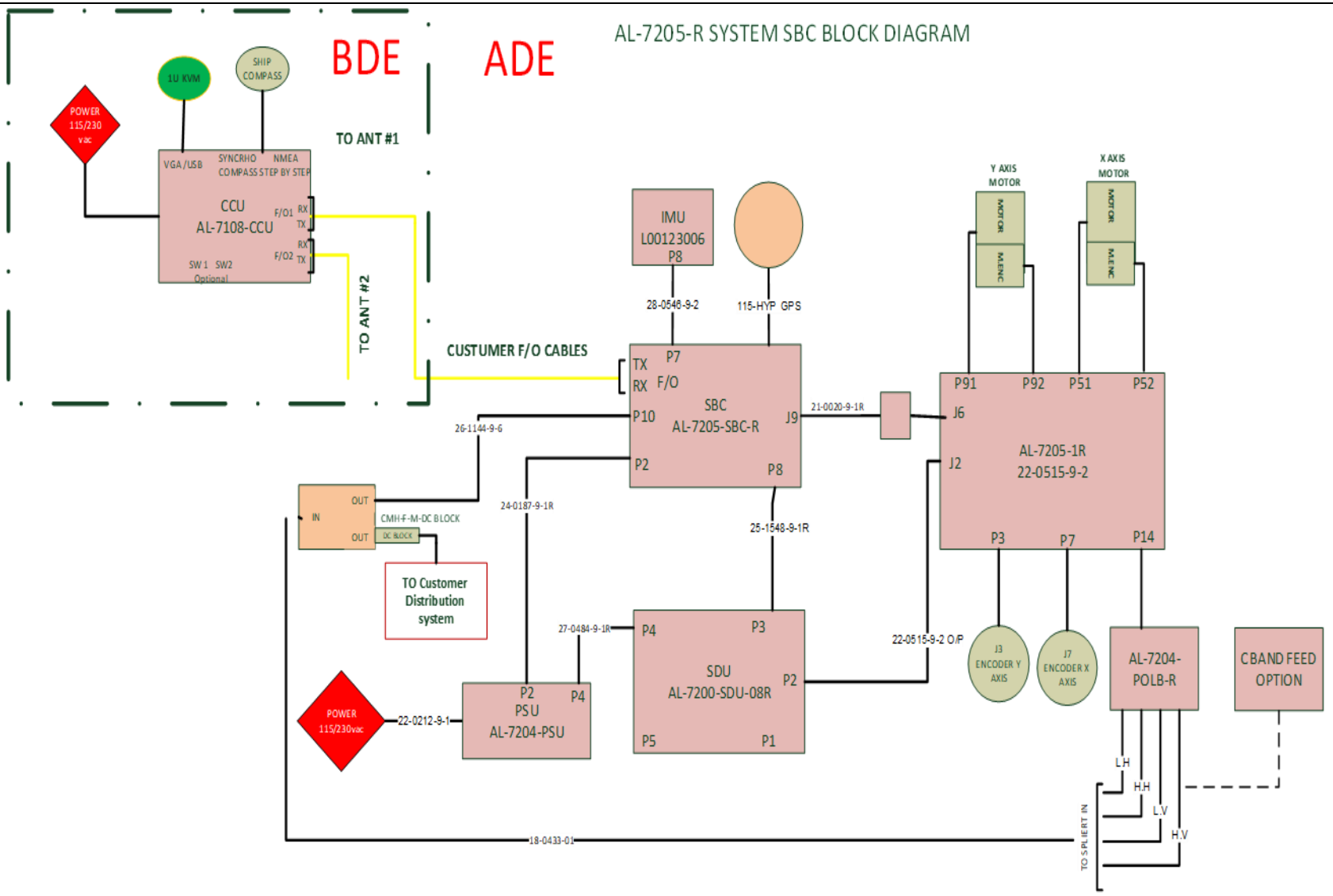
See page 52

## PSU Operation

The PSU is fed by 115/230 VAC, 50/60 Hz single-phase power supply (from the ship's power system) and provides power to the SDU and the SBC.

## IMU Operation

see page 53




NOTE : F/O IS COMUNICATION SYSTEM DEFULT OPTION , IF USE LAN CONNECTION A DIFFERENT CCU SBC WILL BE ORDERED

***Figure 32. 72505-R System – SBC OPTIO***

# 2. BASIC OPERATION

## 2.1. Introduction

This section describes the basic operating procedures of the system to be carried out by the system operator on the vessel.

## 2.2. ACU MMI Principles

The below deck AL-7204-CONT4R ACU/RCU controls, monitors and configures the system. Using the ACU 1U screen/K/B, the operator can monitor system status, while using the built-in keyboard, menus and functions can be selected, and operational parameters changed.

The up and down arrow keys (not the right and left arrow keys) are used to select a particular item in any screen. The selected item appears under the blue highlighted bar. The “Enter” key is used to activate the selection.

Additional controls and utility items located on the ACU include:

- Power ON/OFF switch
- USB port
- Keyboard & mouse connector

**NOTE**

*The password is factory-set and cannot be altered.*

## 2.3. Getting Started – Power-Up Sequence

1. To power-up the ACU/RCU, turn on the ACU's / RCU's power switch located on the rear panel. This initiates an automatic restart procedure.
2. After a number of operating system messages appear, the Banner/Self-Test screen appears (as shown in the following figure), indicating that the ACU/RCU is performing the self-test procedure. This screen is shown for a period of 10 seconds, during which time a 10-to-0 countdown is displayed.

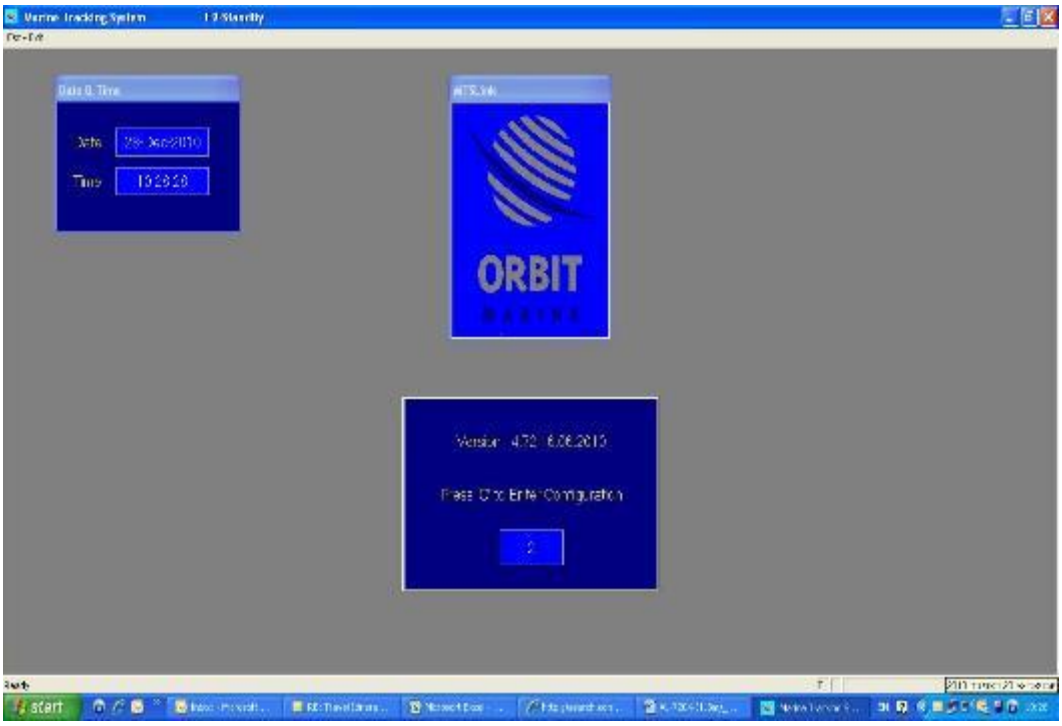
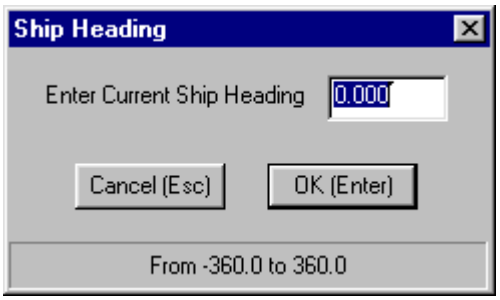



***Figure 33. Banner/Self-Test Screen***

**NOTE**

*If the ACU is configured with the vessel's gyro compass for an incremental interface, an on-screen message, requesting the operator to enter the current vessel's heading, will appear after the self-test:*




*A typical vessel's gyro compass with an incremental interface:*

- *Step-by-Step*
- *36:1 Synchro*
- *60:1 Synchro*
- *90:1 Synchro*
- *360:1 Synchro*

3. After the self-test procedure is successfully complete, the display switches automatically to the Basic Operation screen:
4. During the automatic restart procedure, the Basic Operation screen displays the following message: "Auto-Restart In Progress". The automatic restart procedure includes the following steps:
    - Encoder Initiation procedure. Throughout this procedure, the Mode field on the Basic Operation screen indicates "ENC Init". At the end of this procedure, the antenna is moved to the zenith position - where both the X and Y axes are positioned at 0°.

- When the Encoder Init procedure is complete, the system starts the IMU Initiation procedure, which lasts up to 360 seconds. During this procedure, the IMU field on the Basic Operation screen indicates “Unlocked”. At the end of this procedure, the IMU is “Locked”, and the system initiates the Satellite Acquisition (Point-to-SAT) Mode.
- During the Point-to-SAT Mode, the antenna is pointed to the best-estimated direction of the last-selected satellite, and then searches for the required satellite within a pre-defined sector. When the received AGC signal exceeds the acquired level, the system automatically reverts to Step-Track Mode, in order to lock on to the signal.
- In the Step-Track Mode, the ACU implements periodic step-movement of the antenna pedestal in the elevation axis, and in the azimuth axis for repositioning to the point of the maximal reception level.

## 2.4. Basic Operation Screen Description

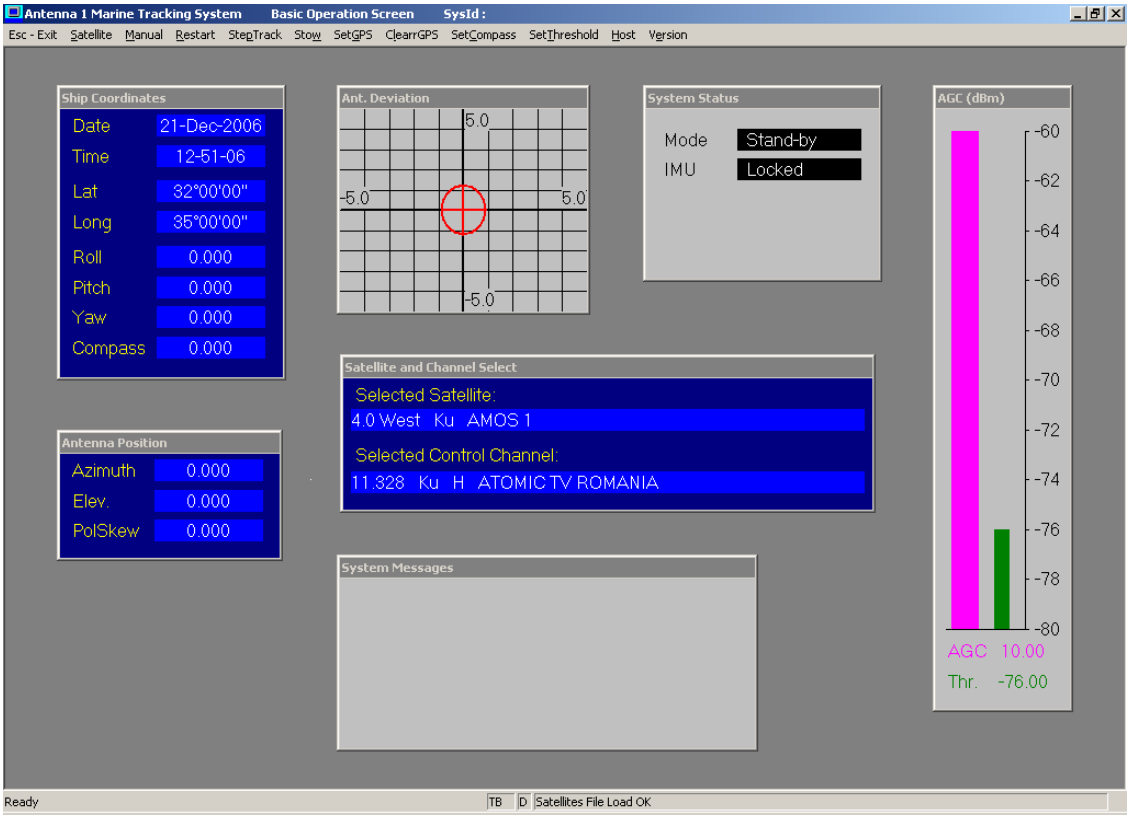



***Figure 34. Basic Operation Screen***

The operator monitors the system parameters using the Basic Operation screen, and can select a new satellite and/or tracking channel.

The Basic Operation screen is divided into several display fields that present the parameters and information required for the system's operation.

The following table describes the Basic Operation screen fields.

**NOTE**

*The underlined letters of menu options denote the fast activation keys (shortcuts) for the same functions.*

***Table 2 - Basic Operation Screen – Fields:***

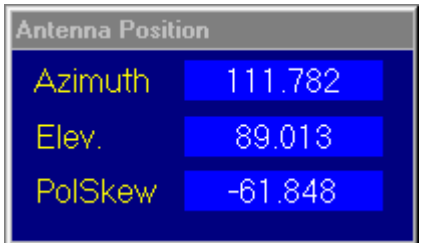
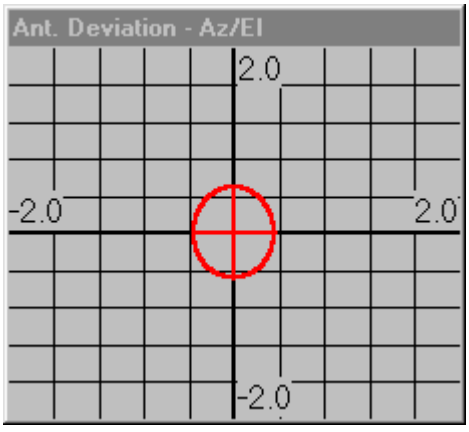
| | |
|---|---|
| | |
|  | **Ship Coordinates Field:**<br>• **Date -** From the internal CPU card<br>• **Time-** From the internal CPU card<br>• **Lat** - Ship's latitude- from the GPS receiver<br>• **Long** - Ship's longitude - from the GPS receiver<br>• **Yaw -** IMU yaw<br>• **Pitch -** IMU pitch<br>• **Roll –** IMU roll<br>• **Comps** - Ship's heading (as read from the vessel's compass, or as entered manually) |
|  | **Antenna Position Field:**<br>The ACU constantly calculates and presents the following parameters:<br>• **Azimuth** - Azimuth axis angle<br>• **Elev.** - Elevation axis angle<br>• **PolSkew** - Polarization skew axis angle. |
|  | **Antenna Deviation Field:**<br>This field graphically depicts the tracking error of the antenna (the error between true boresight as calculated by each step-track, and the mechanical boresight to which the antenna is pointed), presented in a two-dimensional cross-hair type error display. The deviation is presented in degrees of AZ/EL. |

***Table 2 - Basic Operation Screen – Fields:***

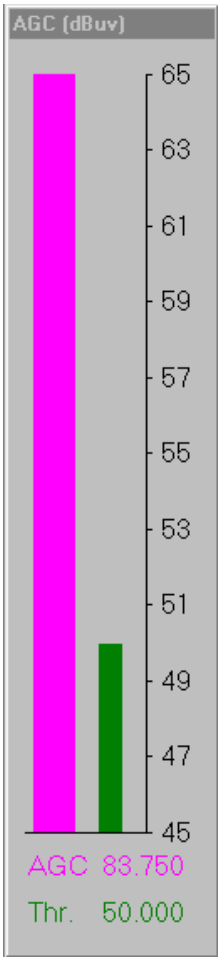
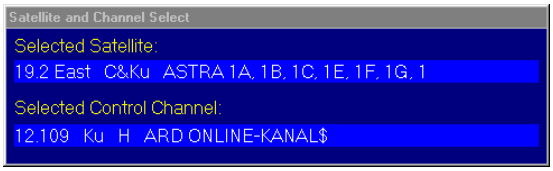
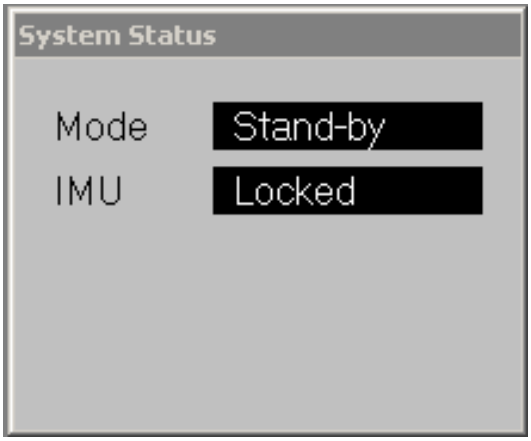
| | |
|---|---|
|  | **AGC Field:**<br>This field presents (both graphically and numerically) the AGC signal level, which represents the strength of the satellite's signal that is received by the antenna.<br>A threshold level is also shown for reference. |
|  | **Satellite and Channel Select Field:**<br>This field presents the following information:<br>• **Selected Satellite** - current selected satellite (e.g. 19.2 East C&Ku ASTRA 1A 1B 1C 1E 1F 1G.1)<br>• **Selected Control Channel** - current selected channel (e.g. 12.109 Ku H ARD ONLINE-KANAL$) |

***Table 2 - Basic Operation Screen – Fields:***

| | |
|---|---|
|  | **System Status Field:**<br>This field presents the following information:<br>• **Mode –** Current operational mode (Stand-by, Step-track, etc.)<br>• **IMU -** IMU status (Locked, Unlocked, Init, Pre-set). |
|  | **System Messages Field:**<br>The System Messages field displays the following types of indications:<br>• Messages (green and without a preamble) - Such as “Auto-restart in progress” or “Acquiring a satellite”…<br>• Warnings (blue and with a “Wrn:” preamble) - Such as “No GPS position updates” or “Synchro compass fault”…<br>• Errors (flashing-red and with an “Err:” preamble) - Such as “Auto-restart failed” or “Pedestal Axis X mech fault”… |

## 2.5. Satellite and Channel Selection

### 2.5.1. Guidelines for Satellite and Tracking Frequency Selection

Satellites transmit to limited areas. In order to receive any given satellite signal, the vessel must be within the satellite's footprint (the area to which it is transmitting), and have an appropriate receiver system. For example, a 2.4 meter antenna will generally receive a signal over a greater area than a 1.3 meter antenna.

In addition, some satellites transmit to two or three areas of the world (multiple footprints) at the same time. Pas 1 @ 45 deg W (Pan-American satellite 1 - located at 45 degrees over the equator) transmits to North America, Europe and South America, but not to the oceans (and surrounding areas) in between.

Not only must the system be inside the satellite's footprint, but the operator must also select a tracking frequency which is transmitted inside the footprint. The system will not be able to receive a channel transmitted to South America, if the vessel is located in Europe.

A channel with the closest frequency to the desired received frequency should be selected. In cases when multiple channels are to be viewed, a channel at a middle frequency should be selected.

As some satellites transmit to multiple areas, and some channels are only available in a single area, care should be taken to select only those channels that are transmitted to the area where the vessel is located.

The following information is provided for each channel: Frequency (GHz), Polarization (H-Horizontal, V-Vertical, L-Left hand Circular, R-Right hand Circular), channel name.

### 2.5.2. Selecting Satellite and Tracking Frequency

To select a new satellite, perform the following procedure:

**⚠CAUTION**

*Do not select a satellite until the auto-restart sequence has been completed, and the IMU status is "Locked".*

1. Press the "S" key or click the Satellite option. The following window with a drop down list of the available satellites appears:

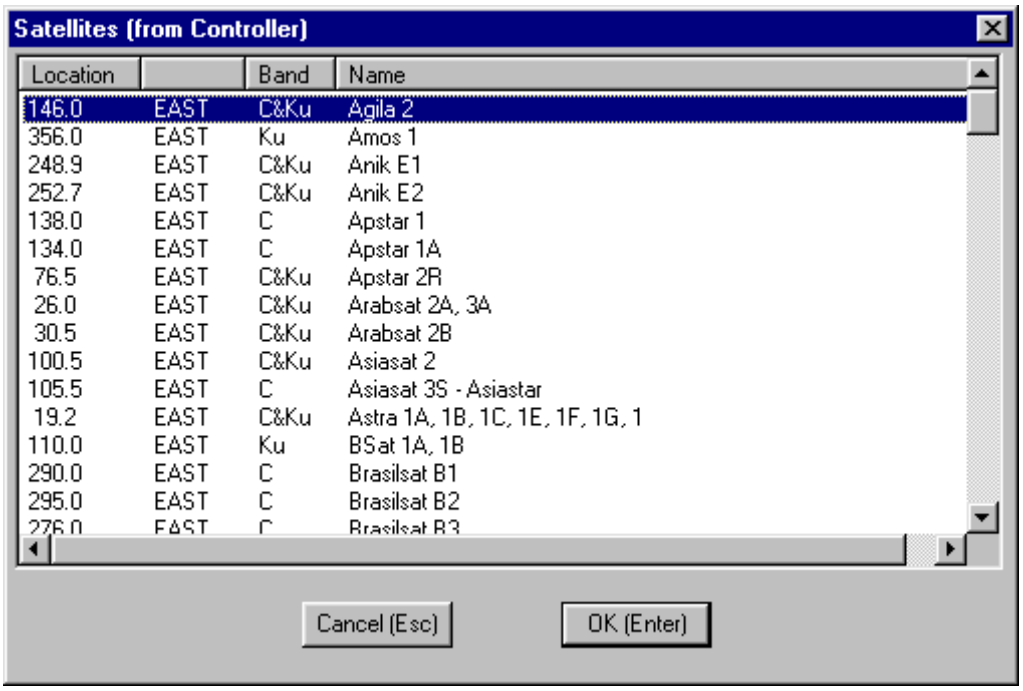



***Figure 35. Satellites Listing Window***

If the required satellite is not listed, this may be because the vessel's current location is not within the satellite footprint.

2. Use the up or down arrow keys to highlight the desired satellite.
3. Select the desired satellite by pressing the ENTER key. A new window appears, with a drop down list of the available selected-satellite channels (transponders - satellite frequencies):

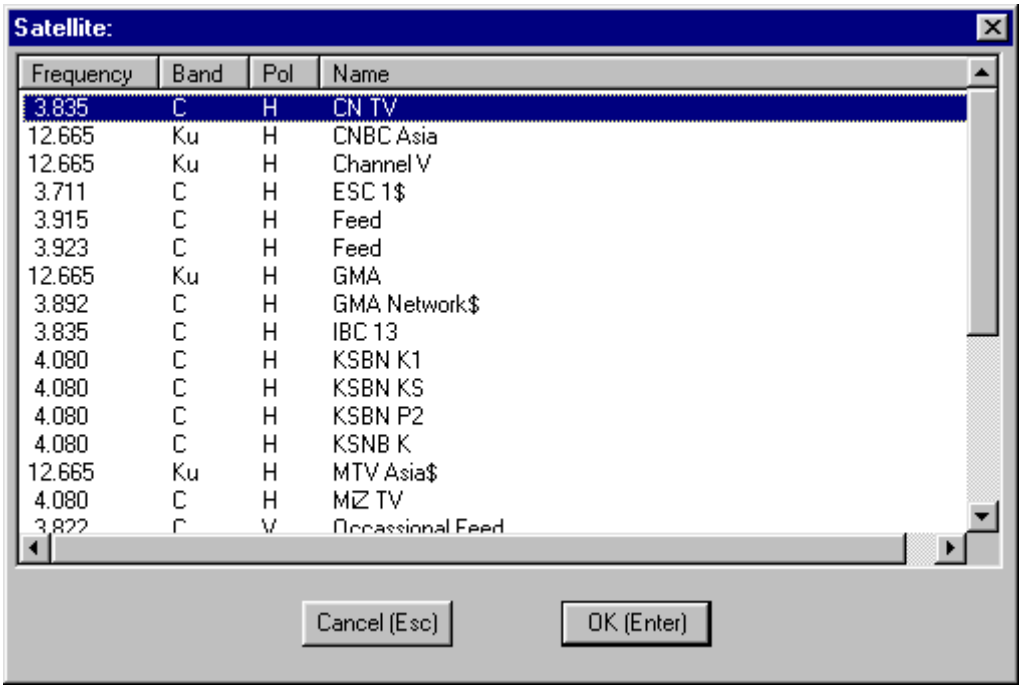



***Figure 36. Satellite Channel Listing Window***

4. **Ignore this window-by clicking OK (ENTER).** Proceed with the Spectrum Analyser Screen (SAS) selection as described below.

## 2.5.3. Selecting Tracking Frequency Using the Spectrum Analyser Screen (SAS)

### *2.5.3.1. Introduction*

Use the Spectrum Analyser screen to select the optimal tracking frequency,

The Spectrum Analyser screen is used for viewing wide-band satellite spectrum. The Spectrum Analyser screen will only work with the selected wide-band tracking receiver.

To open the Spectrum Analyser screen, press “R” in the “Operation screen” or “Maintenance screen”.

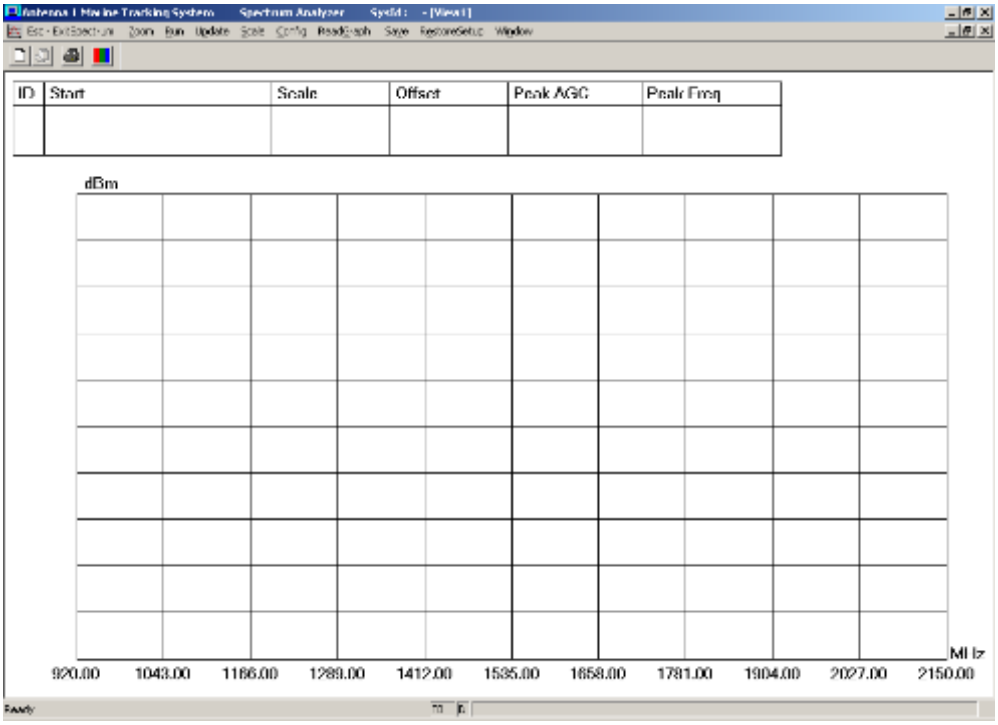



***Figure 37. Spectrum Analyser Screen (SAS)***

Press “C” to configure the spectrum analyser measurement: The Configuration window opens.

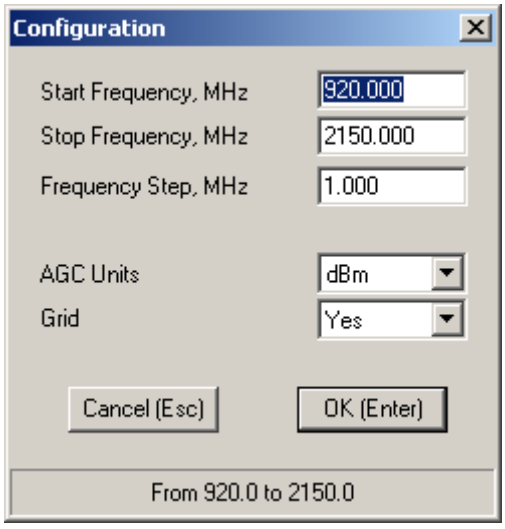



***Figure 38. Configuration Window***

**Start** and **Stop** frequency values can be used to setup a full or partial range of measurement.

- Ku-Band full range: 920 to 2150 MHz
- C-Band full range: 950 to 1450 MHz

**Frequency Step** can be setup from as low as 0.125 MHz, but it should be noted that the measurement time increases, as the number of steps increase.

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

1. Verify that the system is not in “Step-track” before taking a measurement, as “Step-track” uses the tracking receiver resource. If the system is currently in “Step-track” – turn it to “Peak”.
2. To run the spectrum analyser measurement, press “R”.
3. To store a recorded pattern, press “W”, then select a filename and save.

Examples of satellite spectrum recordings are shown below.

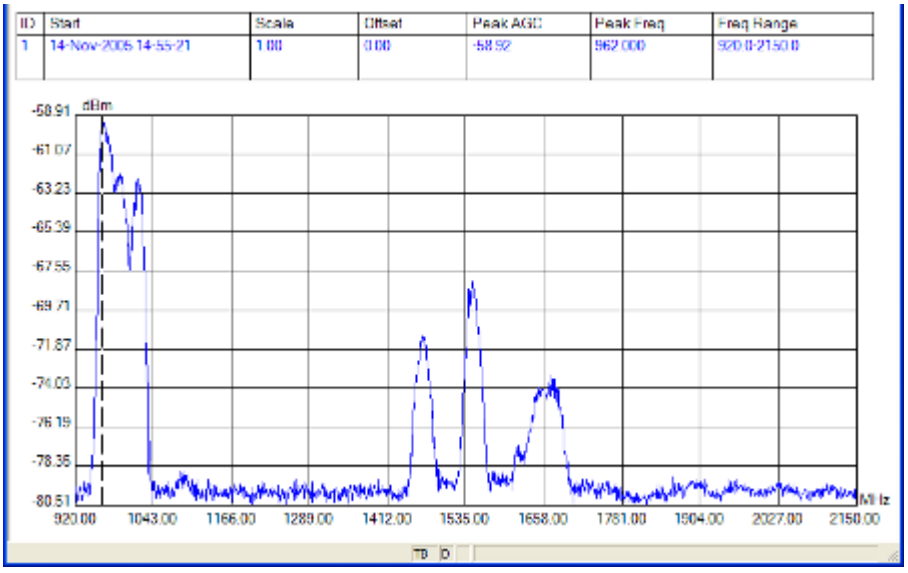



***Figure 39. Example: Satellite: Amos 4.0 West, Horizontal Pol, Ku-Band, LNB LO 10.0 GHz***

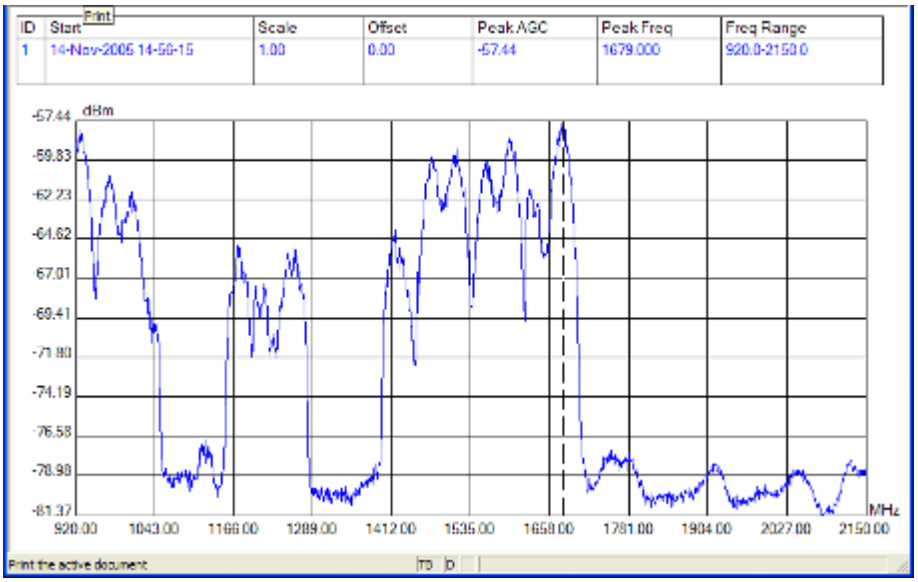



***Figure 40. Example Satellite: Amos 4.0 West, Vertical Pol, Ku-Band, LNB LO 10.0 GHz,***

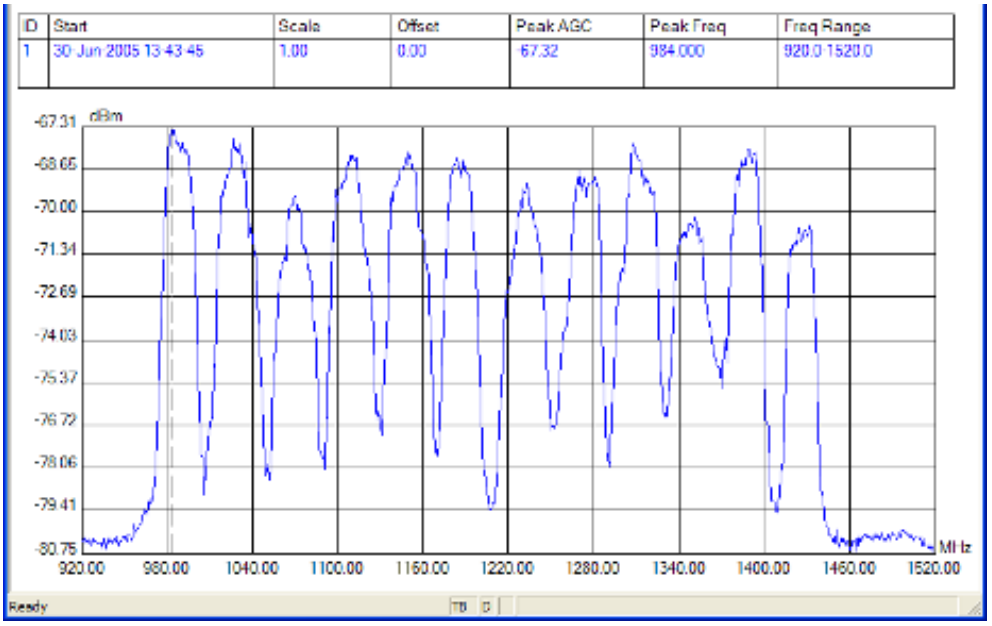



***Figure 41. Example Satellite: Arabsat 26.0 East, C-Band, Linear Pol Satellite - as Seen with Circular Pol Antenna***

### *2.5.3.2. Using SAS to Select Optimal Tracking Frequency for Wide-Band Receiver*

After a satellite spectrum is presented on the Spectrum Analyser screen, a vertical dotted line indicates the highest-level frequency:

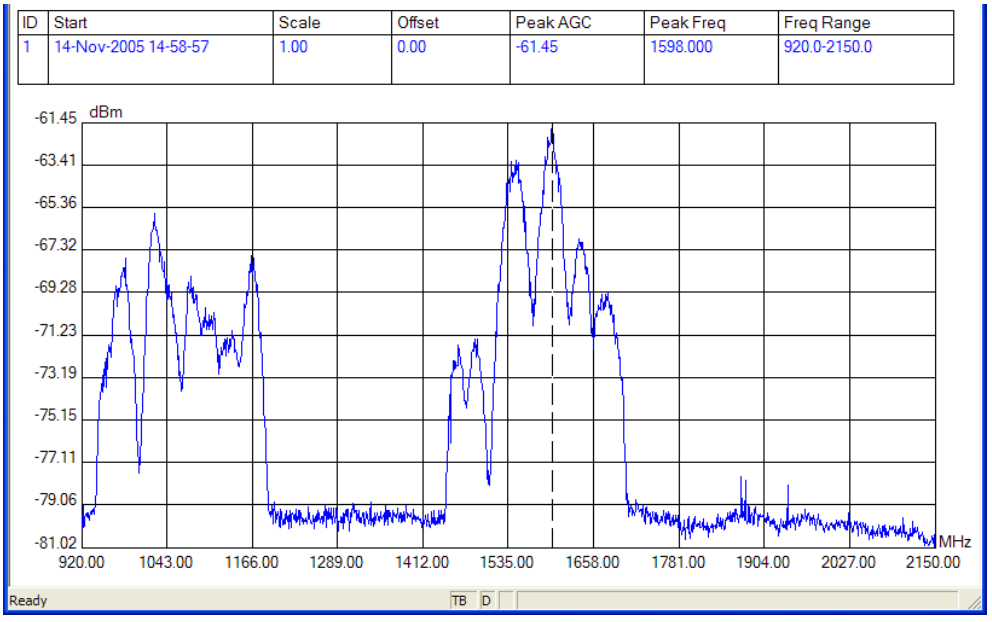



***Figure 42. Example: Satellite: NSS6 95.0 East, Vertical Pol, Ku-Band, LNB LO 10.0 GHz***

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

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

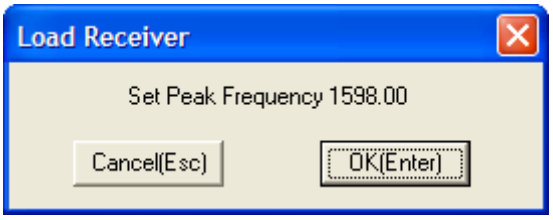



***Figure 43. Load Receiver Confirmation***

Press ENTER to confirm your selection, then verify the action by exiting the Spectrum Analyser screen, and check the “Receiver” sub-window in the Maintenance screen. The selected “Freq” will be: 1598.000 MHz.

### *2.5.3.3. Using SAS for Satellite Identification*

The Spectrum Analyser screen can also be used to help identify a satellite. This is done by comparing a measured pattern with a stored reference pattern.

Measure the current satellite pattern:

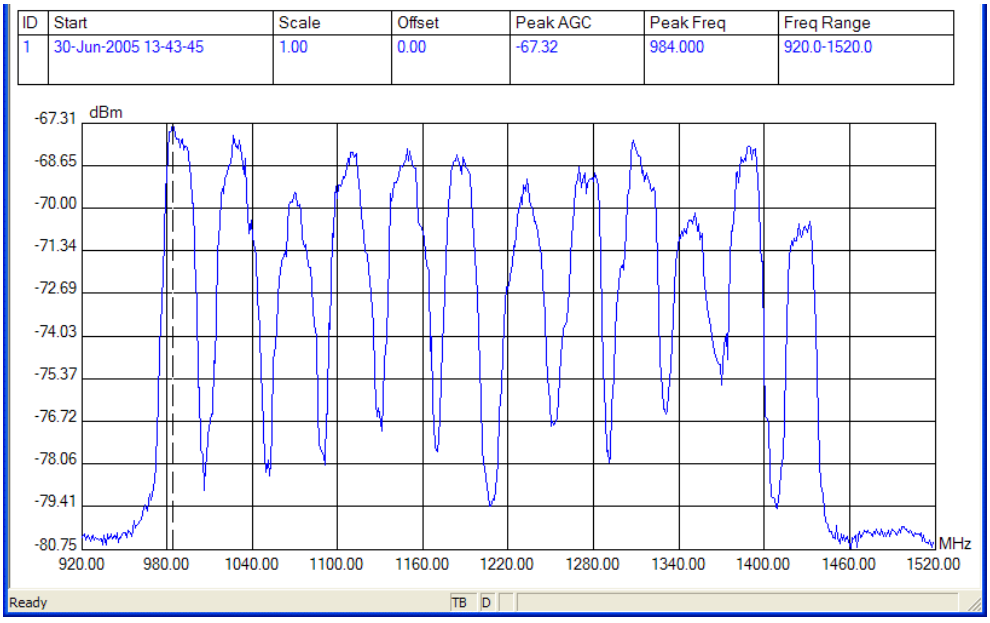



***Figure 44. Measuring the Current Satellite Pattern***

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


***Figure 45. ReadyGraph > Selected File > Add Menu***

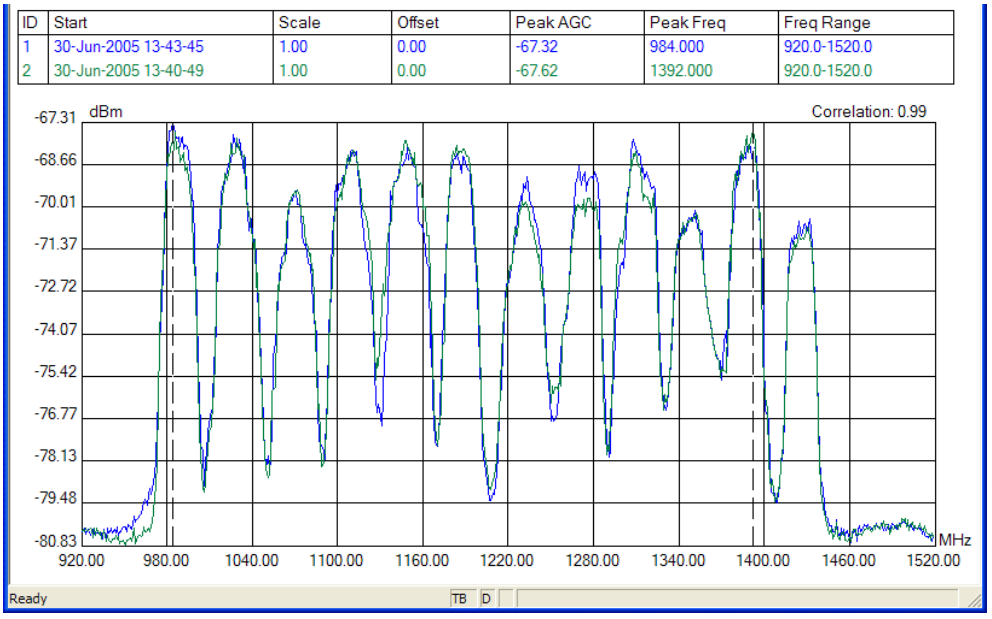



***Figure 46. Graph Depicting Added Satellite Pattern***

In the above depicted example, it is obvious that the measured satellite is identical to the satellite whose pattern was saved as a reference.

In cases when the two curves are not too notably similar, it is possible to use the “Correlation” number, which is calculated and presented in the upper right corner. In this example, the correlation is 0.99 out of 1.00.

Usually a correlation of over 0.8 indicates positive satellite identification

## 2.6.Using the Manual Mode to Move the Antenna

**NOTE**

*The following function is only available when the Basic Operation screen menu includes the appropriate command. Otherwise, this function may only be accessed from the pertaining Advanced Operation screen.*

The Manual Mode enables to manually move the antenna axes.

Invoking the Manual Mode:

1. In the Basic Operation screen, press the “M” key. The following confirmation window appears:

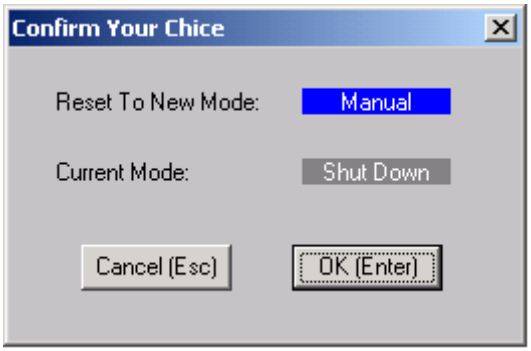



***Figure 47. Confirmation Window***

2. Click ENTER twice to confirm your selection. A Manual Mode window is added to the bottom left corner of the Basic Operation screen.

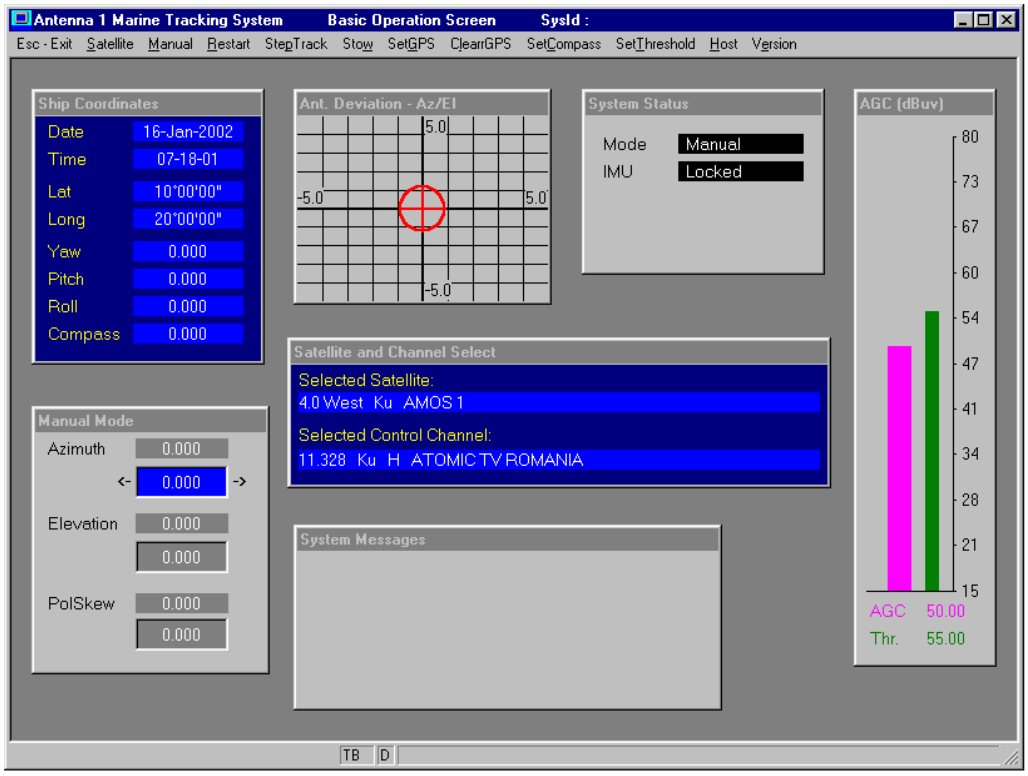



***Figure 48. Manual Mode Window in Basic Operation Screen***

4. For each axis (Azimuth, Elevation and PolSkew [if applicable]), the Manual Mode window provides two display fields: the upper field displays the current angle of the axis, and the bottom field shows the new manually modified angle.

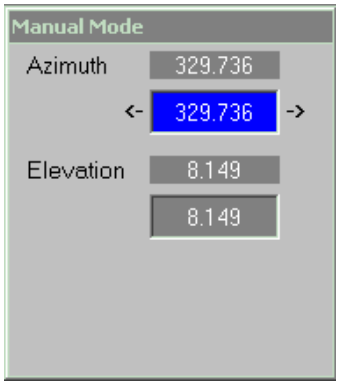



***Figure 49. Manual Mode Window showing Current and Manually Modified Values***

5. To move the antenna to a different direction, use the up/down arrow keys to highlight the bottom-field of the appropriate axis, and use the right/left arrows to increase/decrease the angle in step increments. The increment size can be defined in the appropriate configuration screen (password-protected). The default setting is 0.1-degree steps.

## 2.7. Restarting the System

**NOTE**

*The following function is available only if the Basic Operation screen menu includes the appropriate command. Otherwise, this function can only be accessed from the pertaining Advanced Operation screen.*

To restart the system:

1. In the Basic Operation screen, press the “R” key. The following confirmation window appears:

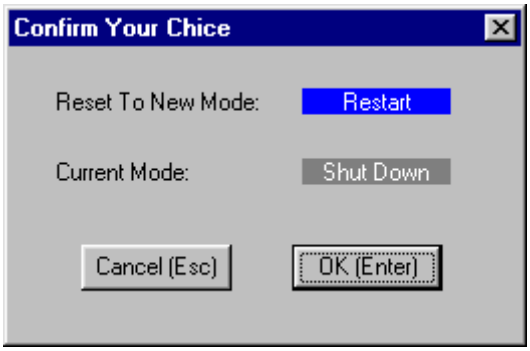



***Figure 50. Confirmation Window***

2. Press ENTER to confirm your selection. The system will initialize the restart/initialization sequence.

## 2.8. Activating the Step-Track Mode

**NOTE**

*The following function is available only if the Basic Operation screen menu includes the appropriate command. Otherwise, this function can only be accessed from the pertaining Advanced Operation screen.*

To invoke the Step Track Mode:

1. On the Basic Operation screen, press the “P” key. The following confirmation window appears:

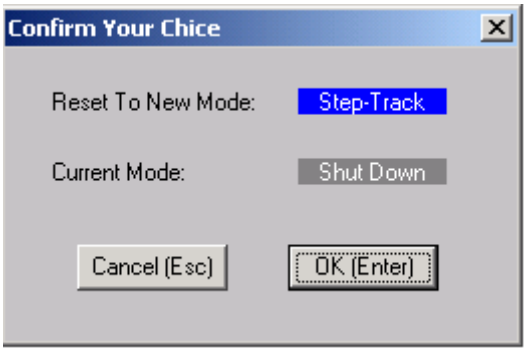



***Figure 51. Confirmation Window***

2. Press ENTER to confirm your selection. The system will switch to Step-Track Mode.

### 2.8.0.1. Satellite Acquisition and Tracking Principles

**NOTE**

*Total time required to acquire a satellite, during normal operation is less than 1 minute. After power-up, acquisition time is approximately 7 minutes.*

**Auto-Restart**

When the system is turned-on, an auto-restart sequence is initiated. The sequence includes the following steps:

- Encoder Initiation procedure - lasts up to 40 seconds. At the end of this procedure, the antenna is positioned at the 0, 0 position (zenith).
- IMU Initiation procedure - lasts up to 360 seconds. On completion of this procedure, the IMU is "locked", i.e., the antenna is slaved to, and stabilized by, information supplied by the IMU.
- Satellite acquisition (point-to-SAT) - during this period, the antenna moves to the estimated position of the last-selected satellite. When the satellite is found, the system diverts to the Step-Track Mode, maintaining the antenna boresight directed towards the satellite.

**⚠CAUTION**

*A satellite should not be selected until the auto-restart sequence has terminated, and the IMU status is "Locked".*

**Manual Satellite Selection**

When the operator activates the Satellite Selection Mode, the system automatically identifies all satellites that are within the parameters set in the ACU configuration, and displays a menu listing them. The operator selects a satellite, and thus activates the Acquisition Mode.

**Acquisition Mode**

In this mode, the system automatically acquires the desired satellite according to the following parameters:

- *Satellite position selected by operator from the ACU monitor, or the last-selected satellite before shut-down*
- *Vessel's position (given by the GPS)*
- *Vessel's heading (given by the vessel's gyro compass, or manual pier-side input)*
- *Vessel's pitch and roll (given by the IMU pitch and roll sensors)*

The ACU calculates the satellite direction relative to the vessel and antenna positioner, and points the antenna towards the best-estimated satellite direction. The system then reverts to step-track (Acquisition Steps feature).

## Step-Track Mode

This mode is intended for tracking low angular dynamic targets, such as geostationary satellites with inclination. In this mode, the system maintains the antenna boresight directed towards the satellite.

The ACU/RCU implements periodic step-track of the antenna positioner in the elevation axis (up/down), and in the azimuth axis (Clockwise {CW} and Anti Clockwise {ACW}) for repositioning to the point of maximal reception level.

Step-Track Features:

- *Minimal Signal Threshold Level*

If most of the AGC samples gathered during step-track are below the minimal level, the step is defined as a “low signal step”, and disregarded - previous peak point prevails.

This improves cases where the system does not see a signal due to temporary blockage/s, and just wanders off.

- *Acquisition Steps*

The first steps, after step-track is invoked, are referred to as “acquisition steps”. These steps differ from the normal operation steps, which are performed to improve system capability to quickly lock onto a target:

The span of the first two steps is double the size of the normal steps (as set in operator setup).

The first five steps do not have any delay between them (continuous steps), even if the Step-Track setup specifies a “re-step time” other than 0 seconds.

- *Low Signal Timeout*

When a “low signal step” situation (see above) is identified, a clock count-down is initiated. Meanwhile, the step-track keeps step-tracking around the same position. If the count-down of the predefined timeout elapses, the step-track reverts to one of the following pre-defined modes:

Peak, Search, Box-Scan, Pnt-to-Sat, Acquire, Pre-set, Stand-by, Step-Track, Restart

## Search Mode

In this mode, the ACU/RCU/sbc performs a spiral-type search around the current positioner's location, within a pre-defined Az/El sector for initial target acquisition.

The Search Mode moves the antenna in an expanding and contracting spiral trajectory, which is not necessarily circular.

The purpose of this mode is to acquire a satellite signal whose strength is slightly above the step-track threshold level. When this is the case, the Search Mode automatically reverts to step-track, in order to lock on to the signal.

If during the pre-defined number of seconds, a signal is not acquired, the Search Mode times out, and reverts to a pre-defined mode.

Available revert modes are:

Peak, Search, Pnt-to-Sat, Acquire, Pre-set, Stand-by, Step-Track, Restart.

## 2.9.Setting GPS Coordinates

**NOTE**

*The following function is available only if the Basic Operation screen menu includes the appropriate command. Otherwise, this function can only be accessed from the pertaining Advanced Operation screen.*

To set new GPS longitude and latitude coordinates:

1. In the Basic Operation screen, press the "G" key. The following Set GPS window appears:

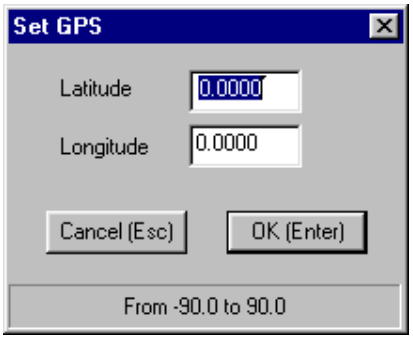



***Figure 52. Set GPS Window***

2. The Set GPS window displays the current GPS longitude and latitude coordinates. Type new values into the longitude and latitude fields, and press ENTER to confirm your selection.

**NOTE**

*The longitude and latitude values should be entered in their decimal representation, e.g.:*

- *Latitude of 34° 30' 00" north should be entered as +34.5000*
- *Latitude of 28° 45' 00" south should be entered as -28.7500*
- *Longitude of 68° 15' 00" east should be entered as +68.2500*
- *Longitude of 91° 20' 00" west should be entered as –91.3333*

## 2.10. Clear GPS

**NOTE**

*The following function is available only if the Basic Operation screen menu includes the appropriate command. Otherwise, this function can only be accessed from the pertaining Advanced Operation screen.*

This command is used to initialize GPS data when a GPS-related error message is displayed.

To invoke the Clear GPS function:

1. In the Basic Operation screen, select the ClearGPS menu option. The following confirmation window appears:


***Figure 53. GPS Reading Warning***

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

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

## 2.11. Setting Compass

**NOTE**

*The following function is available only if the Basic Operation screen menu includes the appropriate command. Otherwise, this function can only be accessed from the pertaining Advanced Operation screen.*

To set a new Compass angle:

1. In the Basic Operation screen, press the “C” key. The following Ship Heading window appears:

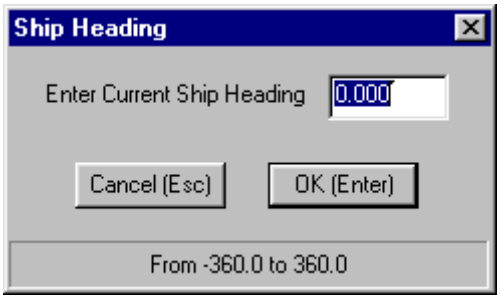



***Figure 54. Ship Heading Window***

**NOTE**

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

*For absolute types, (NMEA-0183, Synchro 1:1, 60:1, 90:1), a default compass value may be set by the operator. This value will prevail until a valid compass update is received.*

2. Type a new value into the window, and press ENTER to confirm your selection.

## 2.12. Setting AGC Threshold

**NOTE**

*The following function is available only if the Basic Operation screen menu includes the appropriate command. Otherwise, this function can only be accessed from the pertaining Advanced Operation screen.*

To set a new threshold level:

1. In the Basic Operation screen, press the “T” key. The following window appears:


***Figure 55. Set Threshold Window***

2. Key in a new value in the window, and press ENTER to confirm your selection.

## 2.13. Stow and Shut-Down Sequence

**NOTE**

*The following function is available only if the Basic Operation screen menu includes the appropriate command. Otherwise, this function can only be accessed from the pertaining Advanced Operation screen.*

To shut-down the system:

1. In the Basic Operation screen, press the “W” key. The following confirmation window appears:

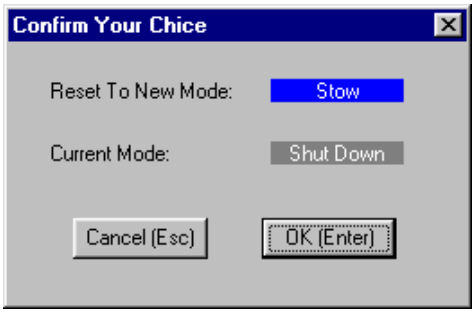



***Figure 56. Confirmation Window***

2. Press ENTER to confirm your selection\.
3. The antenna moves to the pre-defined Stow position and then halts. In this setting, the IMU is unlocked and the antenna is not stabilized.
4. Press ESC and then ENTER to shut-down the controller.
5. Turn off the power switch.

**NOTE**

*To define a new Stow position, use the Maintenance screen (Advanced-Operation Mode) to shut down the axes, move the dish manually to the new position, read the X and Y values, and feed them into the Maintenance screen as the new stow parameters.*

*Alternatively, the Stow-up Mode may be used to stow the dish at its zenith position (x=y=0 degrees).*

# 3. ADVANCED OPERATION

## 3.1. Introduction

This section describes the advanced control functions of the controller software.

> ⚠CAUTION *Only authorized and qualified (installation and service) personnel are allowed to use the advanced functions. System operators are not authorized to perform advanced functions.*

## 3.2. Access to Advanced Control Functions

1. While in the Basic Operation screen, press the "O" key. The password window appears:


***Figure 57. Password window***

2. Enter the password. The Operation screen is opens.

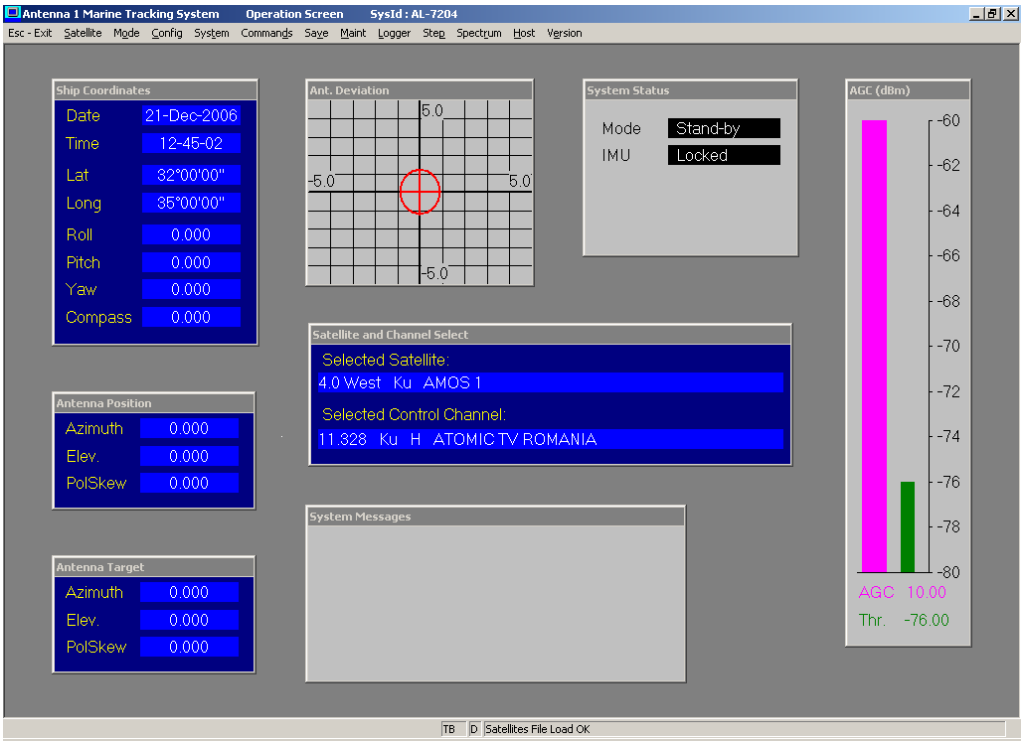



***Figure 58. Operation Screen***

3. The Operation screen menu presents the available advanced functions. Each function can be accessed by selecting the option, or by pressing the appropriate shortcut key. Refer to the following table for details on the advanced operation modes.

**NOTE**

*To return to the Operation screen from any one of the advanced screens, press the "Esc" key; to revert to the Basic Operation screen, press the "U" key.*

***Table 3. Advanced Operation Modes***

| Menu Option | Shortcut Key | Function | Description |
|---|---|---|---|
| **Esc-Exit** | <ESC> | Exit | Terminates the application. |
| Satellite | S | Satellite Selection | Invokes the satellite selection procedures in the Basic Operation screen. |
| Mode | O | Operation Modes | Enables changing the current operating mode of the system, by selecting an available mode from a list:<br>Standby – Places the system in the Standby Mode and stops all current operations<br>Manual – Allows operator to move the antenna in azimuth and elevation (operates by left and right arrow keys selection)<br>Restart – Manually restarts system<br>Pre-set – Sends antenna to a pre-defined position. Allows entering settings for: Azimuth (-180 - 180°), Elevation (0.0 - 90.0°), Polarization<br>Search – Starts system search for a satellite in a round spiral trajectory<br>Peak – Tells the system to go to the peak received signal determined by the step-track<br>Step Track – This is the system's normal operating mode. Starts the system step-track function to determine peak receive signal<br>Pnt to Sat – Sends the antenna to the last calculated position in the current satellite selection<br>Encoder init – Initializes all system encoders<br>Test Traj – Starts the positioner on a pre-determined test program<br>Acquire – Initiates the Pnt-to-Sat and then Step-Track Mode<br>Satellite Pre-set – Sends the antenna to a satellite according to its location on the geo-synchronic arc<br>Stow – Sends the antenna to a stow position |

***Table 3. Advanced Operation Modes***

| Menu Option | Shortcut Key | Function | Description |
|---|---|---|---|
| | | | Stow Up - Sends the antenna to its zenith position (x=y=0 degrees) |
| **Commands** | **D** | Commands | Provides quick access to several commands, such as SetGPS, IMU Init, etc. |
| Maintenance | M | Maintenance | Presents detailed system information and technical data relating to the pedestal axes, receiver, GPS and SDU power.<br>The maintenance screen enables the following for each axis: monitoring and changing of operational parameters, changing individual axis modes, and enabling system calibration and alignment. |
| Logger | L | Data Logger | The data logger is a data recorder, which can monitor and record information from over 200 points in the system. Up to 4 different tracks can be recorded and viewed at any one time. The overall sample time can be varied, as can the scale of the display. In addition, the data logger can be setup in advance to be triggered by a specific change in system performance. |
| Save | V | Save Configuration | Allows saving various system configuration changes that have been made. |
| --- | **U** | Basic Operation | Reverts to the Basic Operation screen. |

## *3.3. Troubleshooting Guide*

### 3.3.1. Introduction

Use The following troubleshooting guide may be used to help resolve a problem or malfunction detected during operation.

The troubleshooting guide consists of the following columns:

- **Symptom**: Describes problems and malfunctions that might be detected during operation.
- **Possible Cause**: Describes the most likely reasons for the malfunction symptoms.
- **Recommended Action**: Details the maintenance procedures recommended to repair the system.

### 3.3.2. Using the Troubleshooting Guide

1. When a malfunction symptom is detected, start with the first possible cause and perform the first appropriate recommended action. If the symptom persists, perform the next recommended action, and so on, until the problem is solved.
2. If after performing all recommended actions for a specific possible cause the symptom persists, proceed with the next possible cause.
3. Repeat step (2.) until the malfunction symptom disappears.
4. In cases when the malfunction is not eliminated by the troubleshooting procedure, consult ORBIT.

### 3.3.3. Error Messages

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

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

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

The following table lists all the messages.

*Table 4. Troubleshooting Guide- CCU Messages*

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

| Message | Possible Cause |
|---|---|
| **"Error: Satellite File Read Error"** | The SBC could not read the Satellite database file from its flash memory (disk C:\) during operation. |
| **"Pedestal X Axis Encoder Fault"** | X-axis encoder communication failure. |
| **"Pedestal Y Axis Encoder Fault"** | Y-axis encoder communication failure. |
| **"Error: SBC Pwr/Tmpr out of Tolerance"** | One of the SBC power indications (+5v, +/-12v, +2.5v etc.) exceeded the predefined tolerance limits. This error will also appear if the SBC internal temperature exceeded its tolerance limits. |
| **Warning Messages** | |
| **"Warning: LNB Power Over-Current"** | The controller 13/18vdc power supply, feeding the LNB is overloaded |
| **"Warning: Compass Communication Failed"** | No valid communication frames were received on the NMEA-0183 compass com port in over 1.5 seconds. |
| **"Warning: GPS Communication Failed"** | No valid communication frames were received on the GPS Com port in over 5 seconds. |
| **"Warning: No GPS Position Updates"** | No GPS position-fix frames were received on the GPS Com port in over 30 seconds. |
| **"Warning: System not initialized"** | The AL-7103 did not undergo the process of initialization - which includes all axes encoder init, as well as IMU init. |
| **"Warning: LNB Voltage out of Tolerance"** | The controller 13/18vdc power supply, feeding the LNB, is exceeding its predefined tolerance levels |

| Message | Possible Cause |
|---|---|
| **"Warning: Antenna View Blocked"** | The antenna has moved into one of the predefined blockage areas |
| **"Warning: No Communication with Host"** | Communications with the host computer, identified by a predefined IP address, have timed-out (10 seconds). |
| **"Warning: Signal below Threshold"** | The controller signal strength indication (AGC) on the selected frequency is lower than the predefined threshold level. |
| **"Warning: IMU-ACU Communication Fault"** | Communications between IMU and the controller have timed-out. |
| **"Warning: 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. |
| **"Warning: X-Axis Forward Limit"** | The position encoder readout of the X-axis exceeded its Forward Limit configuration definition. |
| **"Warning: X-Axis Reverse Limit"** | The position encoder readout of the X-axis exceeded its Reverse Limit configuration definition. |
| **"Warning: Y-Axis Forward Limit"** | The position encoder readout of the Y-axis exceeded its Forward Limit configuration definition. |
| **"Warning: Y-Axis Reverse Limit"** | The position encoder readout of the Y-axis exceeded its Reverse Limit configuration definition. |
| **"Warning: Tracking Error Exceeds Limit"** | Tracking error exceeded limit. |
| **Messages (Information)** | |

| Message | Possible Cause |
|---|---|
| **"Auto-Restart in progress"** | System is going thru initialization stage including – IMU init, Encoder init and optionally, Satellite acquisition |
| **"Acquiring a Satellite"** | System is currently acquiring a satellite |
| **"System no initialized"** | Encoder and IMU have not yet been initialized. |
| **"System Shutdown"** | System was shut-down |
| **"System Shutdown, Ped-X Jammed"** | System was shut-down due to "Pedestal-X Jammed" fault (No. 36) |
| **"System Shutdown, Ped-Y Jammed"** | System was shut-down due to "Pedestal-Y Jammed" fault (No. 37) |
| **"System Shutdown, Ped-X Encoder"** | System was shut-down due to "Pedestal-X Encoder Fault" (No. 8), or "Pedestal-X NE2 Encoder Fault" (No. 104), or "Pedestal-X NE2 Enc Init Fault" (No. 111) |
| **"System Shutdown, Ped-Y Encoder"** | System was shut-down due to "Pedestal-Y Encoder Fault" (No. 9), or "Pedestal-Y NE2 Encoder Fault" (No. 105) or "Pedestal-Y NE2 Enc Init Fault" (No. 112) |
| **"System Shutdown, Power Loss"** | System was shut-down due to "SDU/IMU power Out of Tolerance" (No. 15) |
| **"System Shutdown, Restart Time"** | System was shut-down due to "Restart Time-out" (No. 17) |
| **"System Shutdown, SBC Power/Tempr"** | System was shut-down due to "SBC Pwr/Tmpr Out of Tolerance" (No. 121) |

| Message | Possible Cause |
|---|---|
| **"System Halted, Axes Jammed"** | System has experienced multiple jammed-axis faults. More than 6 occurred in two minutes – the system therefore halted. |

***Table 5. Troubleshooting Guide***

| *Symptom* | *Possible Cause* | *Corrective Action* |
|---|---|---|
| Missing picture; AGC signal is present. | Faulty cables or receivers. | Check cable connections to the TV distribution system. |
| Loss of signal (no picture or AGC reading) | LNB power supply failure. | Check for 13V/17V voltage on coax cable (between centre and shield) at the LNB input.<br>Check for 13V/17V voltage on coax cable (between centre and shield) at the ACU output.<br>NOTE: In Ku-band, if only one polarity is missing, only perform the above checks on that specific polarity path. |
| | Faulty Ku-band LNB. | **For Ku-band**:<br>Replace Feed & LNB assembly |
| System is unable to acquire a satellite; AGC reading is present. | Satellite out of range. | Try to acquire another satellite. |
| | Faulty SDU. | Verify that the power indicator on the SDU front panel is on (green light).<br>Open the Maintenance screen, and check SDU 5V supply, +12V supply, and GPS updates.<br>On the Maintenance screen, press "P" for power parameter and check all valid voltages in I/O Card, Receiver Card, IMU and SDU. |

***Table 5. Troubleshooting Guide***

| *Symptom* | *Possible Cause* | *Corrective Action* |
|---|---|---|
| | | **Turn off the ADE power**, and check cables, connectors and power supply in the AL-7204-SDU. |
| | Faulty pedestal axis.<br>To verify, use the Maintenance screen to move the axes. | If all axes fail, check cables, connectors and power supply. |
| ***The ACU displays an Error, Warning or a Message:***<br>*The messages are classified into three categories, each identified by a different colour:*<br>• *Message - green*<br>• *Warning - blue*<br>• *Error –red.*<br>*Errors may be configured to shut-down system operation upon their occurrence.* | | |
| **Pedestal X Axis Jammed**<br>**Pedestal Y Axis Jammed**<br>**Polarizer Axis Jammed**<br>**Accompanied with the following messages, respectively:**<br>**System Shut-Down, Ped-X Jammed**<br>**System Shut-Down, Ped-Y Jammed** | A situation occurred when a 100% command was initiated to a particular axis, which didn't move as expected.<br>Note: For polarizer axis, this error is applicable only if the AL-7204-POL feed is installed.<br>Note that the "System Shut-Down…" messages will appear if the above errors are configured to shut-down the system upon their occurrence. | Check for mechanical obstructions and interference.<br>Restart system. If problem persists, consult Orbit. |

*Table 5. Troubleshooting Guide*

| *Symptom* | *Possible Cause* | *Corrective Action* |
|---|---|---|
| **Restart timed out** | The system is not able to complete the initialization process in the allocated time (usually) due to mechanical shaft jam or inability to find encoder zero mark. | Check for mechanical obstructions and interference.<br>Restart the system, if the fault persists, consult Orbit. |
| **SDU/IMU Power out of Tolerance**<br>**I/O Power out of Tolerance**<br>**LNB Voltage out of Tolerance**<br>**RCVR Power out of Tolerance** | The power voltage test point is out of tolerance, as defined in the controller maintenance configuration. | Replace the suspected sub-assembly. If replacement is not available, consult Orbit. |
| **I/O Card not Recognized**<br>**Receiver 2 Card not Recognized**<br>**Receiver Card not Recognized** | The specific card is not recognized by the ACU on its bus. | Replace the suspected sub-assembly. If replacement is not available, consult Orbit. |
| **Compass Communication Failed**<br>(Applicable when a RS-422 compass is used, e.g. NMEA-0183) | Disconnected cable; Inactive compass; Disconnected compass. | Check and connect compass cable; Check and connect compass. |
| **GPS Communication Failed** | Communication failure with GPS receiver. | Open the Maintenance screen and verify that the GPS window presents a blinking “Updated” message, and that at least 3 space vehicles are present.<br>If these conditions do not exist, check the cable between the ADE and the controller. |

***Table 5. Troubleshooting Guide***

| *Symptom* | *Possible Cause* | *Corrective Action* |
|---|---|---|
| **No GPS Position Updates** | The GPS position updates rate, normally an update per second, is interrupted for more than 30 seconds.<br>**NOTE**<br>*This message is displayed in addition to the "GPS Communication Failure" which is displayed whenever all communication with the GPS receiver is lost.* | Verify that the GPS antenna is not obstructed by the ADE.<br>Check GPS antenna cable and connector. |
| **Illegal Step-by-Step Compass Data**<br>(Applicable when using a step-by-step compass) | Disconnected cable; Inactive compass; Disconnected compass | Check and connect compass cable; Check and connect compass. |
| **Synchro Compass Fault**<br>(Applicable when a synchro-type compass interface is selected (1:1, 36:1, 60:1, 90:1 or 360:1) | No. 115 VAC Reference<br>- or -<br>There is a tracking error inside the S/D converter which is too large<br>- or -<br>The synchro S1, S2, S3 signals are not present.<br>- or -<br>The compass is inactive or disconnected<br>**NOTE**<br>*When a Synchro fault is identified, the synchro readout is forced to the last valid update, which may then be overwritten by the "Set Compass" function.* | Verify that the compass functions properly.<br>Check compass harness and connector.<br>**NOTE**<br>*When the compass is inactive or disconnected and the vessel is static (for example, when the vessel is in the dock), activate the Set Compass function and enter the vessel's heading.* |

*Table 5. Troubleshooting Guide*

| *Symptom* | *Possible Cause* | *Corrective Action* |
|---|---|---|
| **System not Initialized** | Power to the ADE was disconnected and connected again.<br>This message alerts the operator that after ADE power loss, all the mechanical axes, incremental encoders, and the IMU filters must be initialized. | Restart the System by turning the ADE and controller power switches off, wait for approximately one minute, and then execute the full start-up procedure. |
| **Auto-Restart in Progress** | The ACU performs Auto-Restart. | Wait until Auto-Restart is complete. |
| **Acquiring a Satellite** | The system is acquiring a satellite. | Wait until the Acquire procedure is complete. |

# 4. INSTALLATION GUIDE

## 4.1. Introduction

The purpose of this chapter is to establish the plan, guidelines and procedures for installation of a typical AL-7205 Marine Stabilized TVRO System aboard a designated ship/vessel.

The processes and procedures outlined provide the basic step-by-step structure necessary to successfully accomplish system installation and checkout.

The procedures provided in this chapter are intended for implementation by personnel with a background in electronics, standard shipboard installations, and in-depth familiarity with the operation of the AL-7204 system. Installation personnel should be totally familiar with the content of this AL-7204 Technical Manual.

## 4.2. Sequence of Installation

Regardless of the varying installation requirements and working conditions on board different vessels, the following sequence of installation is recommended.

3. **Vessel Survey and Installation Planning** - vessel survey and installation planning, including selecting the mounting sites, and preparing an installation plan.

**NOTE**

*Preliminary activities, such as system site preparation and installation planning, must be pursued before installation operations may be started.*

4. **On-Site Unpacking and Inspection** – unpacking and inspection of the system components at the installation site (harbour or shipyard).
5. **On-Board Installation** – mounting the ADE and BDE on the vessel; laying and connecting system cables and wiring (between the system units); connecting the system to vessel's power supply and gyro compass.
6. **System Power-Up and Setup** - power-up, setup, and testing.
7. **System Commissioning** – commissioning and acceptance of the system.

**NOTE**

*System installation involves the deployment of several units, components and cables on the vessel. As working conditions are strenuous, the process must be properly coordinated among the installation staff and vessel crew.*

## *4.3. Vessel Survey*

### 4.3.1. Introduction

A pre-installation site/vessel survey should be conducted. The site survey provides an opportunity to collect valuable information on vessel facilities, and the parameters affecting installation decisions. This site survey should be conducted with a representative from the vessel's personnel in attendance.

### 4.3.2. Survey Report

During the site survey, particular attention should be given to requirements for cable runs available, interfaces to the vessel systems (power, gyro, etc.), intended locations for equipment placement, etc.

After completion of the site survey, data should be incorporated into a Site Survey Report which will detail specific installation processes and include "red-lined' drawings to document, pending changes to vessels configuration.

During the site survey, particular attention should be given to the location of both equipment groups associated with the system. These groups are the Above Deck Equipment (ADE) and the Below Deck Equipment (BDE).

## 4.4. Installation Planning

### 4.4.1. Introduction

Installation planning is one of the most important stages in any installation procedure. Correct planning will result in successful installation with minimum issues before and throughout system operation.

Verify the following before starting installation\:

1. The vessel has been visited and the vessel layout was recorded, or a filled-out Survey Report is available.
2. Existing vessel layouts have been received, as may be available:
    - Vessel's construction plan
    - Vessel's electric mains layout and UPS access (if available)
    - Vessel's gyro compass interface type, wiring and availability.
3. The following are identified: the vessel's power supply voltage, gyro compass (standard and voltage), and gyro repeater output (standard and voltage).

**⚠CAUTION**

*The vessel's gyro repeaters may convert the original signals received from the compass. Therefore, verify that the appropriate signal is supplied to the system.*

Use this data to prepare the installation plan, which should include equipment locations, installation details, cable runs, etc.

### 4.4.2. Installation by Location

Typically, the system installation is divided into two stages, in respect to the installation locations:

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

### 4.4.3. Selecting the Best ADE Location

Special care must be taken when selecting installation locations for the ADE. The following parameters should be taken into consideration when selecting installation sites for the equipment:

- Mechanical stability
- Radome outline dimensions
- Line Of Site (LOS)
- Distance between ADE and BDE
- Maintenance access
- Other considerations for proper location.

#### *4.4.3.1. Mechanical Stability*

Verify that the mounting surface intended for the ADE is rigid, flat, free of vibration, levelled and has a stable surface.

The mounting surface should be capable of supporting the total equipment weight (about 200 kg).

In addition, the mounting surface should be able to withstand lateral wind loading forces, and should be stable with a natural resonance frequency of above 30 Hz.

#### *4.4.3.2. Line Of Site (LOS) Considerations*

Line Of Site (LOS) is a straight line between the antenna and the satellite. Obstructions to the LOS will typically be the vessel's funnels and masts.

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

### 4.4.3.3. Radome Outline Dimensions

When selecting the ADE location, be sure to account for the radome envelope dimensions, as illustrated in the following figure:

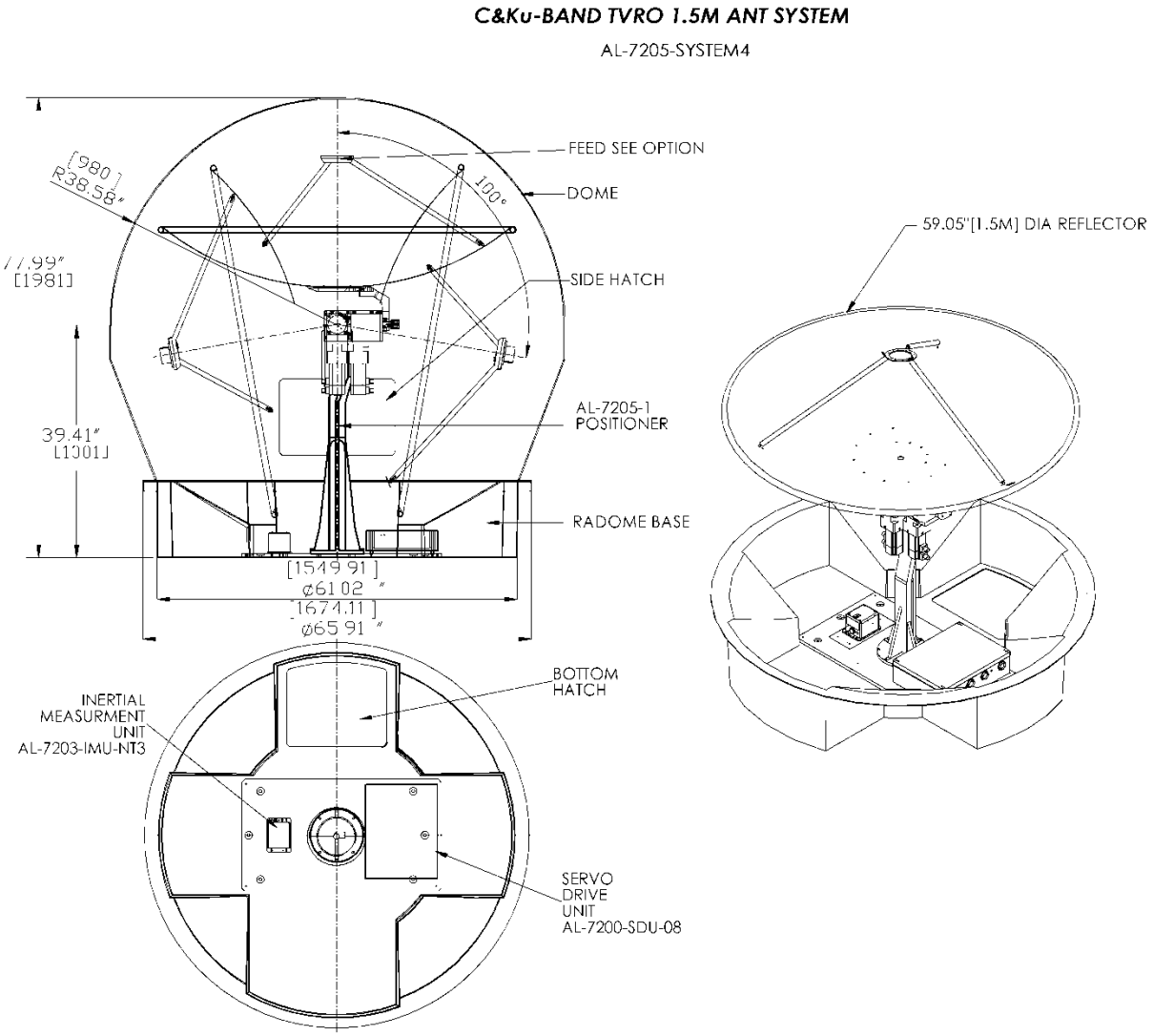



***Figure 59. Radome Outline Drawing***

### 4.4.3.4. Distance between ADE and BDE

The system is supplied with two ADE-BDE control cables. The length of the cables depends on the cable-run distance between the ADE and the BDE, as measured during the site survey.

The system supports ADE-BDE cables length of up to 100 meter (328.1 feet) On Acu Option.

On Rcu Option the recommendation is to use the minimum ADE-BDE cables length Between the ADE and the BDE, The Run the F/o Cable To The second Control room Max length 2KM.

On Sbc Option The Run the F/o Cable To The Control room Max length 2KM.

### 4.4.3.5. Maintenance Access

An obstacle-free space is necessary below the ADE support construction to allow sufficient maintenance access for technical staff.

### 4.4.3.6. Other Considerations (for Location Selection)

The below general guidelines for installation aboard vessels should be followed:

- The mounting location should not be immediately adjacent to high-power radars or other communication equipment.
- The installation location should have maximum non-blocked hemispheric view down to 10 degrees visibility.
- The mounting location should be as far away as possible, and on a different plane from high-power radar systems or other radiating devices.
- The minimum distance should be 10 meters from the radar beam width
- If there is a blockage in any direction, the x-axis orientation should point toward it. To improve operation, the system should be installed with the X axis (horizontal keyhole) pointed toward an obstruction to satellite visibility. The X axis direction is marked by a pointed arrow on the IMU chassis.

### *4.4.3.7. Power Supply Considerations*

The power supplies to both ADE and BDE must be fed through an Uninterruptible Power Supply (UPS).

## 4.4.4. Mounting Surface (Foundation)

The mounting surface intended for the ADE should be a stable (with a natural resonance frequency of above 30 Hz) flat surface, capable of supporting the total equipment weight (radome with all units installed in it).

The following figures show the layouts and mounting-holes location of the recommended mounting surface (foundation), and of the ADE mounting plate.

The foundation and ADE mounting plate holes should line up, allowing to insert the bolts and to secure the ADE to the foundation.

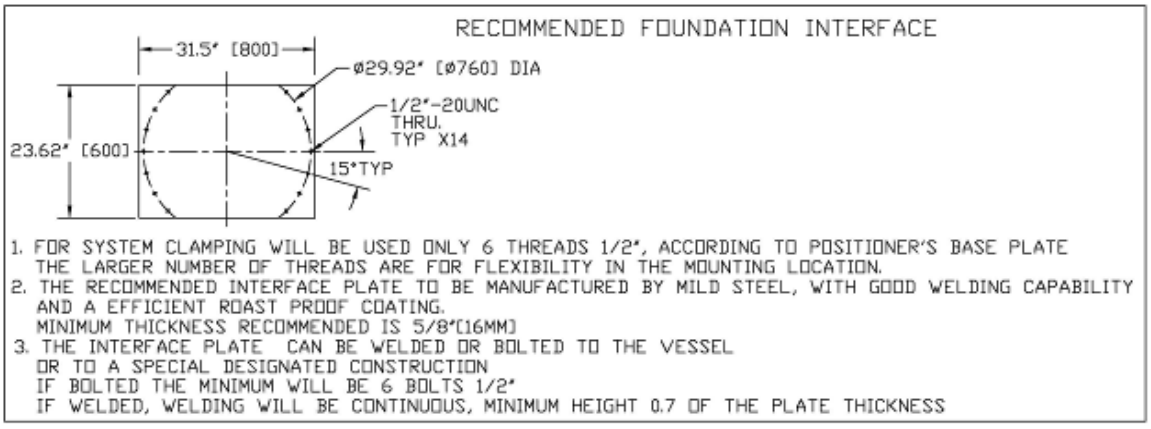



***Figure 60. Recommended Mounting Surface (Foundation) Layout***

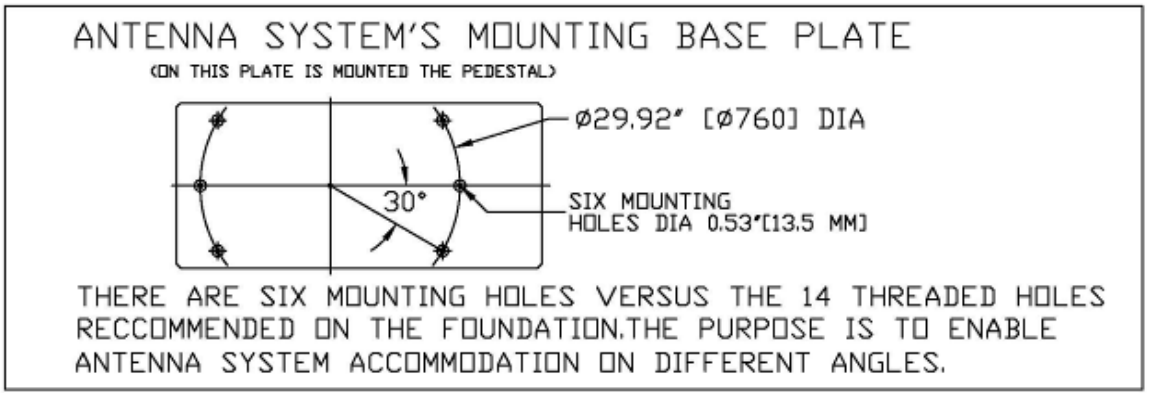



***Figure 61. ADE Mounting Base Plate Layout***

### *4.4.4.1. ADE Support Construction*

If the ADE ever needs to be elevated, the radome can be mounted on an optional structure, which will support the radome with the ADE units installed in it.

The following figures are outline drawings of the recommended support construction and base plate designed to carry the
AL-7205 system on board the vessel.

**NOTE**

*The holes on the support plate are intended for the bolts securing the Base Ring to the support construction.*

It is advisable to use the recommended support device, however, any other construction capable of supporting the weight of the system and with the required space to fit the radome base dimensions, can be used.

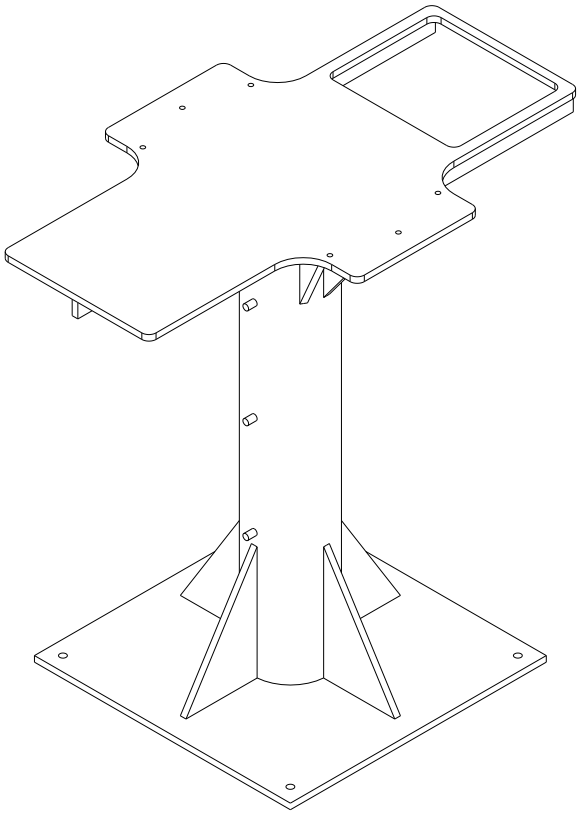


***Figure 62. Recommended Support – General View***

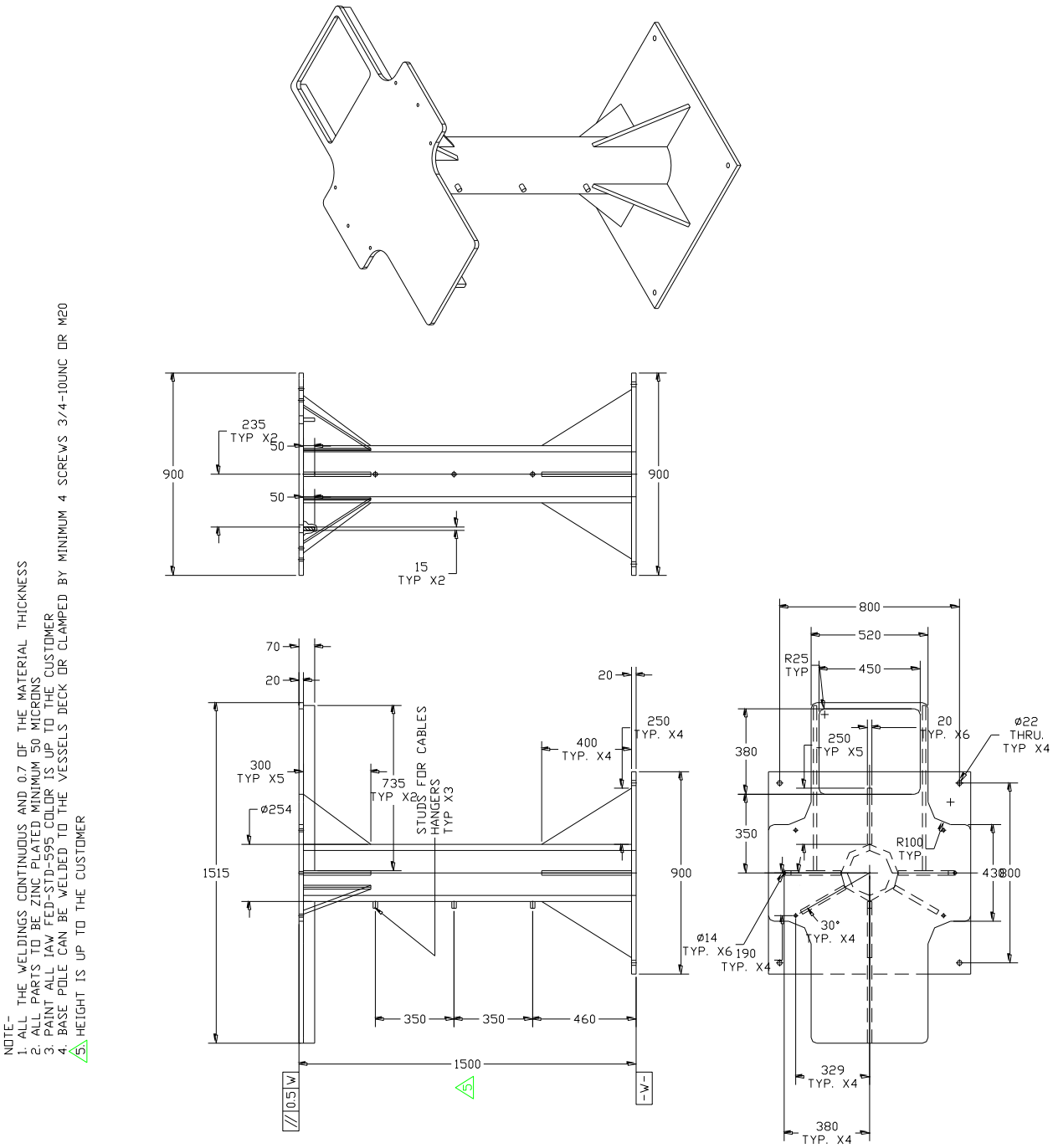



***Figure 63. Recommended Support Structure***

## 4.4.5. BDE Location Considerations

### *4.4.5.1. Installation Method*

The BDE units should be mounted on, and secured to, solid surfaces.

**NOTE**

*The BDE environment should be climate-controlled.*

### *4.4.5.2. BDE Cables Length Considerations*

When planning the BDE units' location, verify that the distance between the ACU and the display is suitable for the length of the supplied 8-m controller-display cable.

### *4.4.5.3. Operator/Maintenance Accessibility*

The BDE operation is mainly automatic, but it should be monitored periodically. Therefore, it should be placed at a location with easy operator access.

An obstacle-free space should be maintained around the equipment to allow maintenance access for technical staff to the rear panel, where cables are connected to the equipment.

**⚠CAUTION**

*Verify that the ACU is installed at a distance of at least 5 meters from the vessel's compass.*

### 4.4.6. Packing List

**NOTE**

*This section presents a typical shipping configuration.*

Typically, the AL-7205 (without the radome) and installation tools/materials are sent to the installation site packed in a single shipping crate.

The radome is sent to the installation site in a separate shipping crate.

**System crate specifications**:

- Crate dimensions (L x W x H) - 136cm [53.5”] x 136cm [53.5”] x 122cm [48”]
- Crate Weight – 250 kg (550 lb).

**Radome crate specifications:**

- Crate dimensions (L x W x H) - 180cm [70”] x 180cm [70”] x 180cm [70”]
- Crate Weight – 150 kg (330 lb).

***Figure 64. AL-7205 System4R Shipping Crate***

The shipping crate contains the following items (for a typical installation):

***Table 6. AL-7205 System4R - Packing List / Bill of Materials***

| Component | ORBIT P/N | Notes | Equipment Verification | |
|---|---|---|---|---|
| | | | Check | Record S/N… |
| Reflector 1.5 m for AL-7205-1R | 22-0346 | | | |
| Positioner | AL-7205-1R | | | |
| IMU | L00123006 | | | |
| SDU | AL-7200-SDU-08R | | | |
| Controller | AL-7204-CONT4R<br>L01426001 | | | |
| Remote Controller | AL-7204-RCU4<br>L01426003 | | | |
| 1U SCREEN/K.B<br>(PART OF ACU /RCU) | | | | |
| KIT ANT to POS AL-7205 | KIT23-0219 | | | |
| KIT B.Plate Ship AL-7205 | KIT19-0984 | | | |
| Hard copies of:<br>Interface Control DWG | DCD 25-0444-4 | | | |
| C-Band & KU-Band Installation Manual | MAN30-0700-BAE | | | |
| Options | | | | |
| Universal 220V Power Utility Kit | KIT20-0418 | | | |
| 115V Power Utility Kit | KIT20-0419 | | | |

*Table 6. AL-7205 System4R - Packing List / Bill of Materials*

| Component | ORBIT P/N | Notes | Equipment Verification | |
|---|---|---|---|---|
| | | | Check | Record S/N… |
| ADE-to-BDE Cables, __M Set | 22-0322-9-2__M | __M - required length per installation | | |
| KU-band Liner Motorized Feed | KIT25-0445-1 | | | |
| C-Band Left Feed | 25-0446-4-2R | | | |

### 4.4.7. Unpacking and Inspection Guide (at Installation Site)

**NOTE**

*Before unpacking, check the contents of the shipping crate, and verify that all components are present.*

*Where applicable, record the components' serial numbers. The serial numbers are marked on the components' nameplates. These numbers will be requested by the service department when ORBIT is contacted for technical assistance.*

1. Contact the Client Representative and Site Foreman to locate the crate supplied to the site by the Installation Contractor.
2. Find a suitable build area according to the pre-install checklist.
3. Locate the packing manifest on the side of the crate.
4. Inspect all contents and ensure all items are accounted for.
5. Place the shipment crate on a robust, levelled surface.
6. Open the crate with care to avoid damaging the contents.
7. Carefully remove all packages, and place them at a designated storage area in an orderly manner.
8. Visually inspect the exterior of the equipment for evidence of any physical damage that might have occurred during shipment/storage.
9. Tighten any loose mounting screws and terminal board screws.
10. Clean the exterior of the equipment.

**⚠CAUTION**

*Check all components for shipping damage, and report all damage to shippers immediately, as units damaged in shipping will not be replaced under Warranty terms and conditions.*

## 4.5. On-Board Installation

### 4.5.1. ADE-BDE Cables Routing

Lay and route the cables connecting between the ADE and BDE (control, pedestal, power supply, RF). Use standard practice - bending diameter 10 - 12 cm/min.

**⚠CAUTION**

*The control and pedestal cables are supplied with the BDE-side connector disconnected, and should be routed from the ADE-side towards the BDE-side.*

*When routing these cables, verify that the BDE-side pins are not damaged.*

### 4.5.2. Placing the ADE on the Vessel

Using a crane and slings, in accordance with the ADE weight and shape, lift the ADE and place it on the designated mounting surface.

***Figure 65. Lifting the ADE***

### 4.5.3. Mounting and Securing the ADE Radome Base

Place the ADE on the mounting surface, with the arrow on the IMU pointing forward or toward an obstruction.

Install and fasten the bolts, securing the ADE Base to the mounting surface.

Seal the mounting screws protruding below the mounting surface. Use a silicon sealing compound.

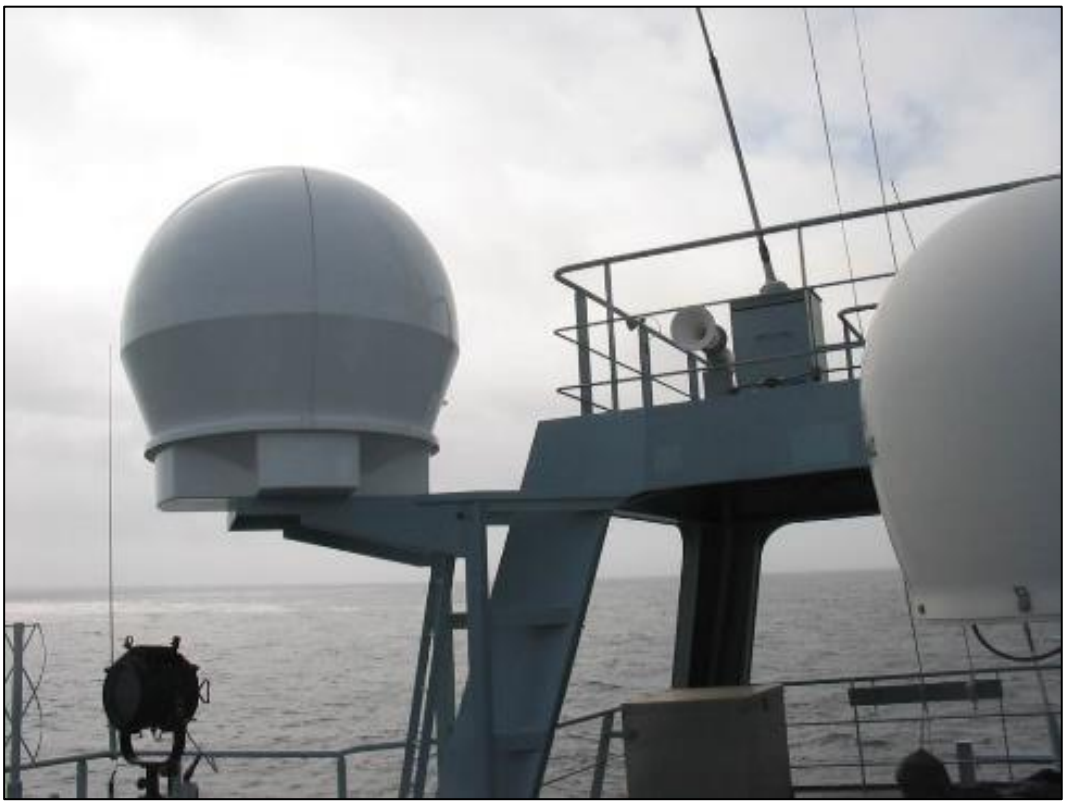


***Figure 66. Mounting and Securing the ADE***

#### 4.5.3.1. ADE Installation

To mount the ADE on the support / mounting surface, perform the following procedure:

1. Place the Radome Base on the support, with the base hatch above the support's opening. Verify that the Radome Base mounting holes match those of the support.
2. Remove the PSU from the Plate in the following manner:
    a. Remove four caps from the PSU cover.
    b. Insert a screwdriver through the holes, and loosen four screws securing the PSU to the Mounting plate.
    c. Remove the PSU.

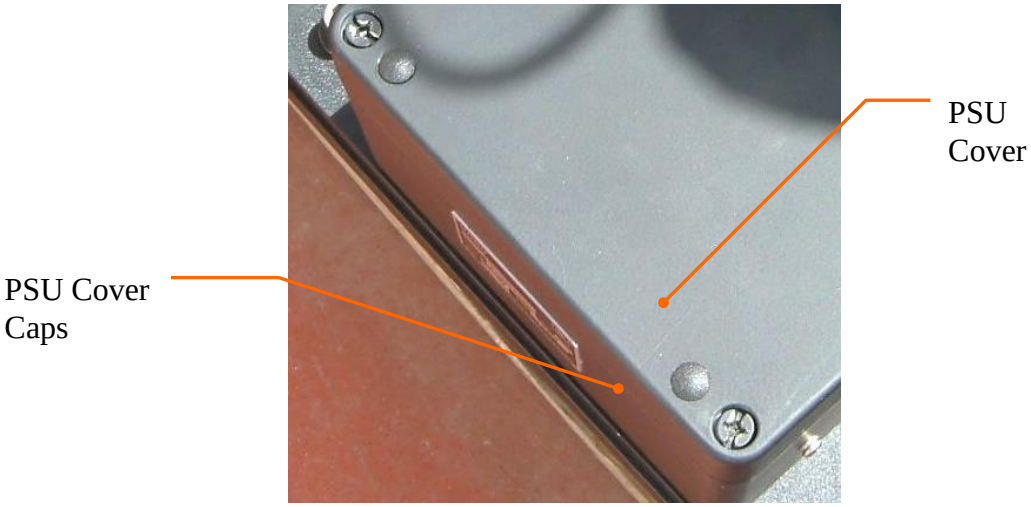



***Figure 67. PSU Cover Caps***

3. Lift and place the Pedestal (Mounting plate with ADE) on the Radome Base in the proper orientation.

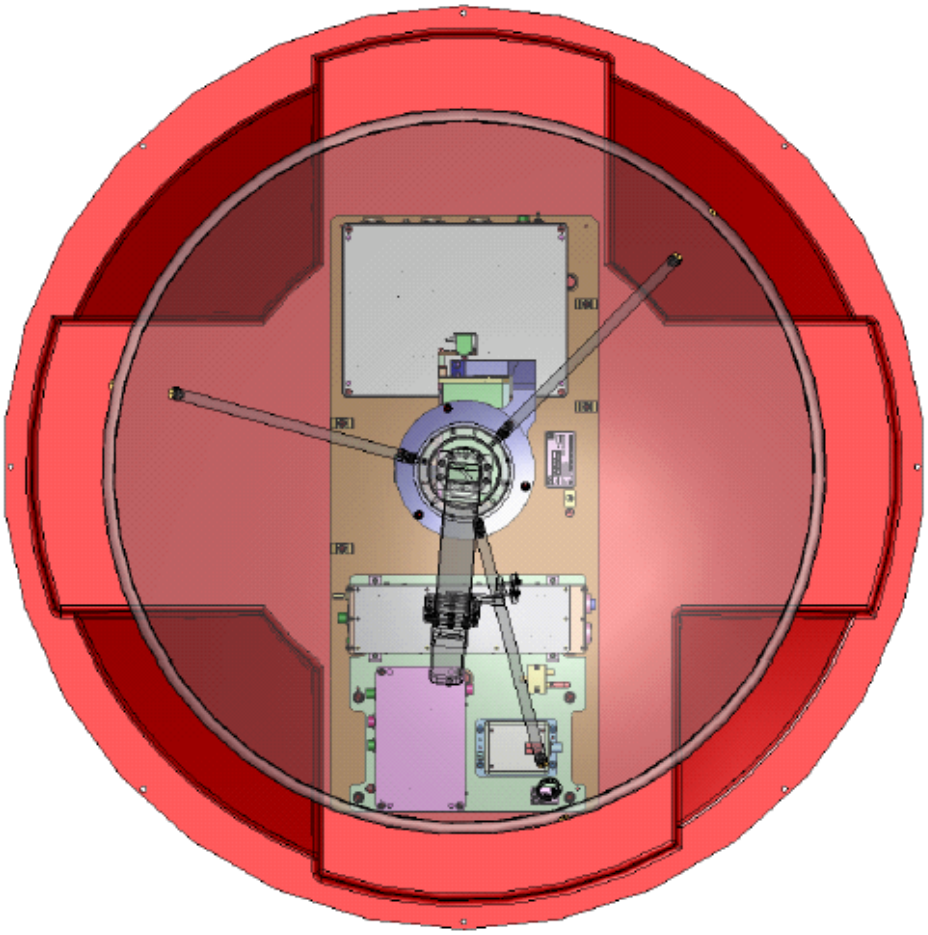


***Figure 68. ADE Base Plate Mounting Orientation***

4. Insert and fasten six ½" bolts through the Mounting plate, Raome Base and mounting surface holed. Seal the mounting screws protruding below mounting surface. Use silicon sealing compound.
5. Install the SDU to the Mounting Plate in the following manner:
    a. Place the SDU on the Mounting Plate.
    b. Remove four caps from the SDU cover.
    c. Insert a screwdriver through the holes, and fasten four screws securing the SDU screws to the Mounting Plate.
    d. Connect cables to the SDU connectors. refer to **Error! Reference source not found.**

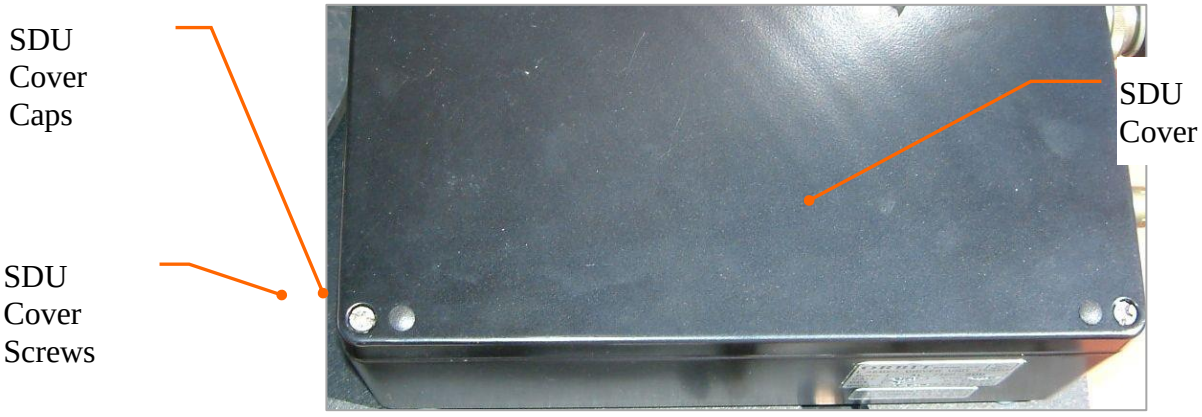



***Figure 69. SDU Cover Caps***

**NOTE**

*If the SDU cover is already removed (for setting the input power voltage, the SDU screws can be accessed directly.*

6. Install the SBC on the Upgrade Plate in the following manner:
    a. Place the SBC on the Mounting Plate.
    b. Fasten the four SBC captive screws.
    c. Connect cables to the SBC connectors. refer to **Error! Reference source not found.**

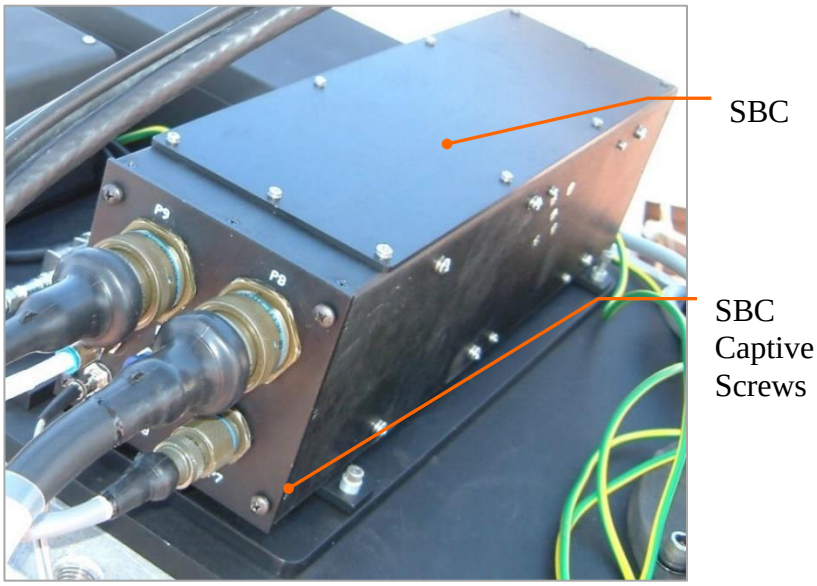



***Figure 70. SBC Installation***

7. Reinstall the PSU on the Mounting Plate, and connect cables to the PSU connectors. refer to **Error! Reference source not found.**.
8. Install the antenna assembly (reflector with feed) on the positioner in the following manner:
    a. Place the antenna assembly on the positioner antenna adaptor, verify that the arrow marked on the antenna is aligned with the one marked on the adaptor.
    b. Fasten six screws securing the antenna reflector to the positioner's antenna adaptor.

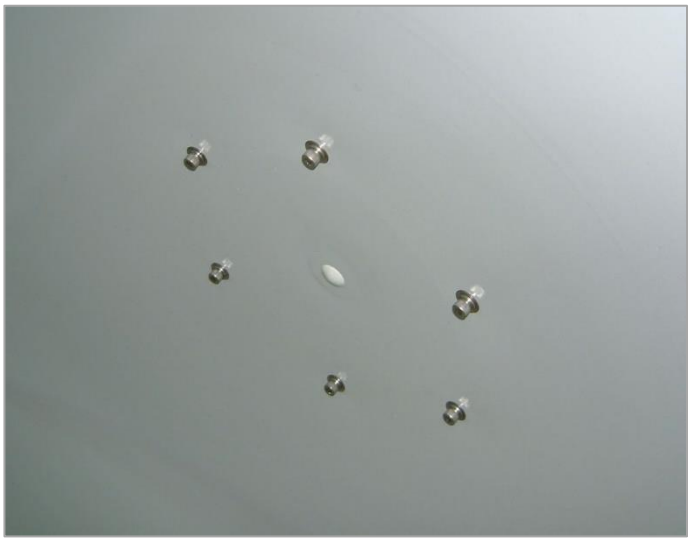


***Figure 71. Antenna Assembly Installation***

9. Mount and secure the dome to the radome base. Verify that access to the side hatch is clear of obstacles.

***Figure 72. Typical ADE Installation***

## 4.5.4. Connecting Cables to ADE

### *4.5.4.1. SDU Connectors*

The following figure shows the SDU front panel connectors and the connected cables.

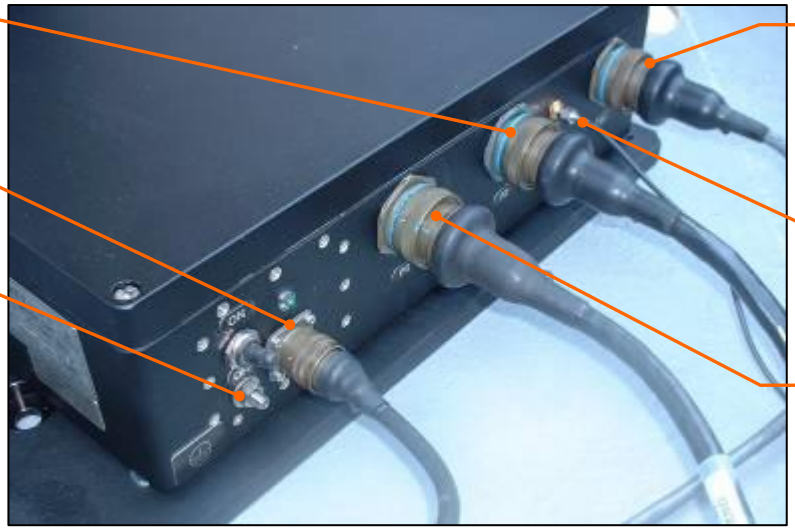



***Figure 73. SDU Connectors and Connected Cables***

### 4.5.4.1. Connecting the mains Power cable to the PSU

PSU Power Cable Termination

The PSU POWER cable is supplied by ORBIT, without the utility-side plug.

***Figure 74. PSU Power Cable***

**WARNING**

*Terminating the Power cable with a pertaining plug should be performed only by a certified electrician.*

**CAUTION**

*When connecting a utility plug to the POWER cable, pay special attention to the wire labels (phase, neutral, ground).*

*Connect a utility plug to the POWER cable, in the following manner:*

- *Phase wire (~) to pin A*
- *Neutral wire (∅) to pin C*
- *Ground wire to pin B.*

*Use a DVM to check and verify the above connections.*

Connecting the PSU Power Cable

Connect the POWER cable to connector P1 on the PSU or to P4 on the SDU for systems with below deck ACU.


*Figure 75. PSU Power Input*

### 4.5.4.2. RF Cables Connection

Insert the RF cables via the hole in the antenna reflector.

Connect the RF cables to the feed assembly connectors.

Use tie-wraps to secure the RF cables to the reflector's tripod leg.


*Figure 76. Routing and Securing the RF Cables*

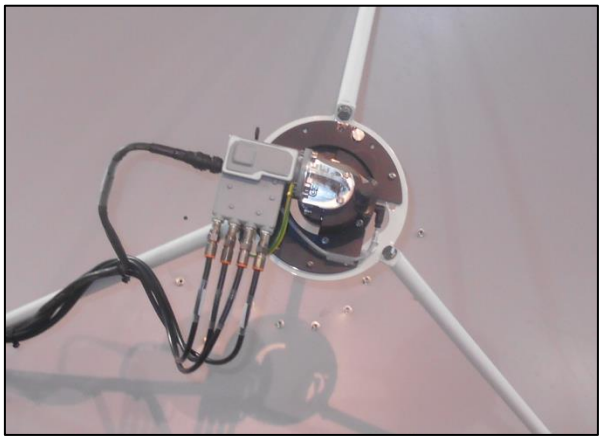


*Figure 77. Connecting the RF Cables to the Feed*

### *4.5.4.3. Feed RF cable connection*

Insert the RF cable (connected on the other end to the RF splitter) via the hole in the antenna reflector.

Connect the RF cable to the Feed Assembly connector.

Use tie-wraps to secure the RF cable to the reflector's tripod leg.



*Figure 78. Routing, Securing and Connecting the RF Cable*

#### 4.5.4.4. GPS Antenna Connection

Secure the GPS antenna cable and route it down the positioner towards the SDU together with the other cables.

Connect the GPS antenna cable to the SDU connector P5.

Place the antenna on the SDU cover and glue it in place.

*Figure 79. GPS Antenna*

#### 4.5.4.5. Control Cable Connection

Connect connector J3 of the ADE-BDE control cable to connector P3 on the SDU.

#### 4.5.4.6. Pedestal Cable Connection

Connect the pedestal harness power cable J2 to connector P2 on the SDU.

Connect connector J6 of the pedestal harness to the ADE-BDE control cable P6.

#### 4.5.4.7. IMU Connector

The following figure shows the IMU connector and the connected cable.

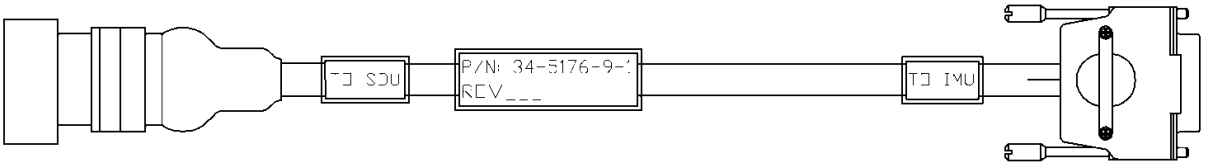
*Figure 80. IMU Connector and Connected Cable*

### 4.5.4.8. SDU-to-IMU Harness Connection

Connect the SDU-to-IMU Harness between the IMU connector P8 and the SDU connector P1.

The following figure shows the general view and wiring diagram of the SDU-to-IMU Harness:

*The IMU connector be changed according to the IMU Version.



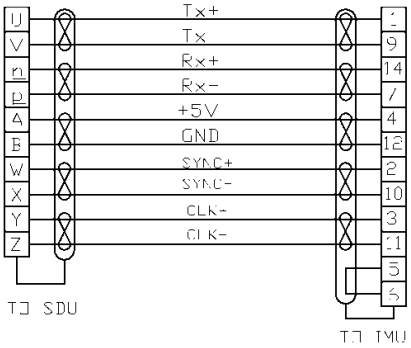




*Figure 81. SDU-to-IMU Harness*

### 4.5.4.9. ADE-BDE Fiber Optic Cables Connection

The SBC or RCU is connected to the CCU by a multi-mode fiber optic cable with two connectors type “ST”

Connect the fiber optic cable coming from SBC 1 to F/O 1 Card connectors RCV and TX.

If a dual system is used, connect the fiber optic cable coming from SBC 2 to F/O 2 Card connectors RCV and TX.

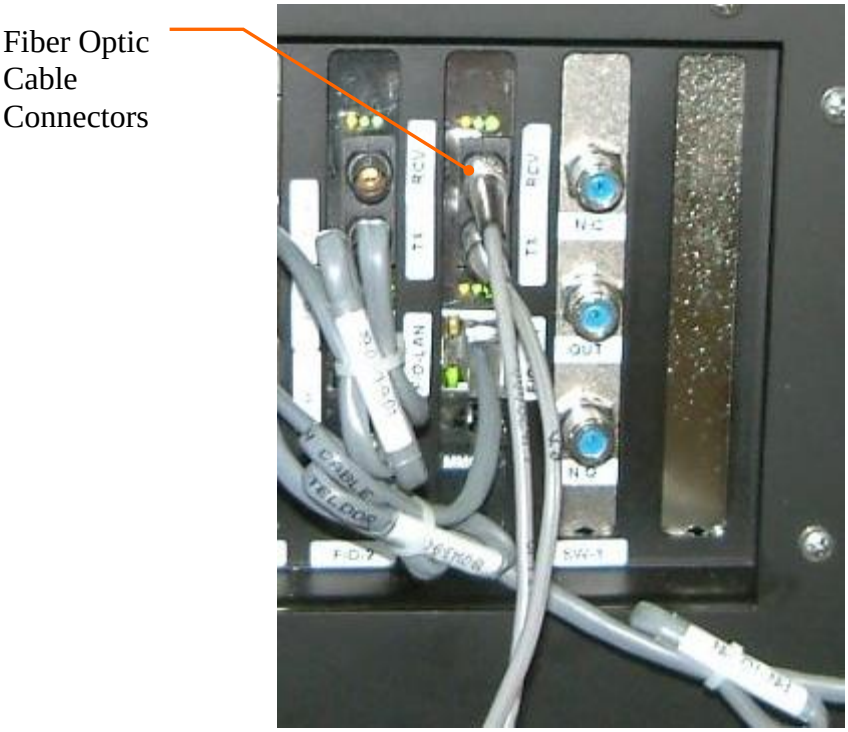



*Figure 82. CCU Rear Panel – Fiber Optic Connectors*

### 4.5.4.10. ADE-BDE RF Cable Connection (RF Switch Connections)

When a single system is used:

The RF output from the feed's LNB is connected directly to the distribution system, and the RF switch is not used.

When a dual system is used:

The RF outputs from both systems are connected to the CCU's RF switch, in the following manner:

- Connect the RF cable of System 1 to the N.C. connector of the switch.
- Connect the RF cable of System 2 to the N.O. connector of the switch.

### 4.5.4.11. CCU-Distribution System RF Cable Connection

When a single system is used:

The RF output from the feed's LNB is connected directly to the distribution system, and the RF switch is not used.

When a dual system is used:

Connect the RF cable from the distribution system to the OUT connector of the switch.

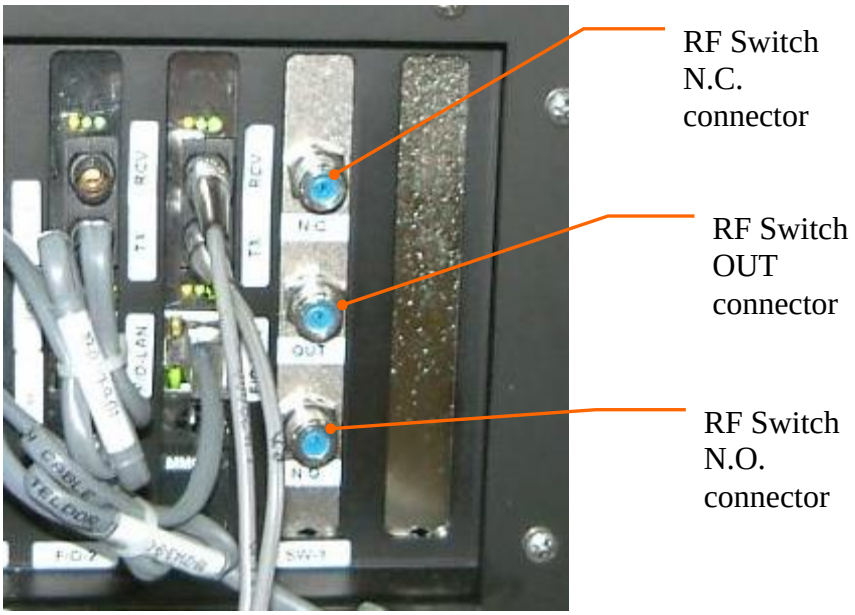



*Figure 83. CCU Rear Panel – Switch Connectors*

### *4.5.4.12. Serial Communication and Compass Connectors*

The CCU rear panel includes three communication connectors, which are used as follows:

When a single system is used:

- COM1 – RS-422 - Connects CCU to customer's Compass (RS-422 port).
- COM2 – RS-422 – Not used.
- Synchro and SBS Compass – connecting to synchro and step-by-step compass.

When a dual system is used:

- COM1 – RS-422 - Connects CCU to customer's Compass (RS-422 port) – for System 1 in a dual system configuration.
- COM2 – RS-422 - Connects CCU to customer's Compass (RS-422 port) - for System 2 in a dual system configuration.
- Synchro and SBS Compass - Not used in this system.

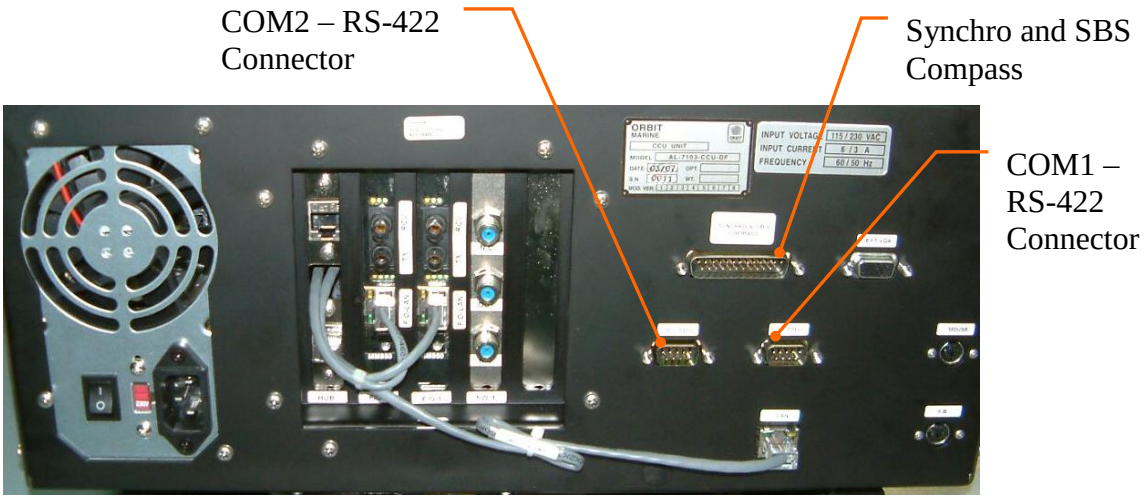



***Figure 84. CCU Rear Panel – Serial and Compass Connectors***

The following Table specifies the communication connector pin-out.

The subsequent paragraphs describe how to use each connector.

### *Table 7. CCU 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 | 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 |

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

### 4.5.4.13. Connecting ADE-BDE Fiber-Optic cables to the SBC

The SBC is connected to the CCU by a multi-mode fiber optic cable with two ST connectors.

Connect the Fiber optic cable to SBC connectors P17 and P18.

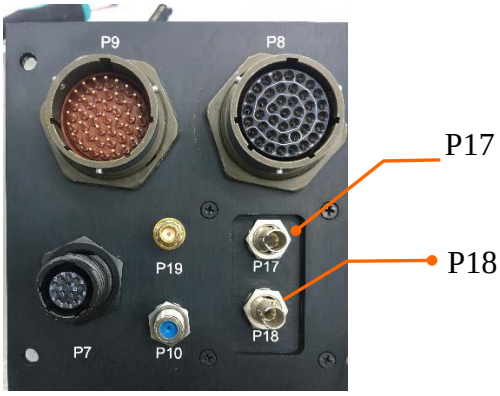



*Figure 85. SBC Fiber Optic Connectors*

### 4.5.4.14. Connecting ADE-BDE RF Coax Cable to the Splitter

The RF output from the feed's LNB is fed via the RF splitter to the BDE CCU, which in turn feeds the signal to the distribution system.

Connect the ADE-BDE RF cable to the OUT connector of the RF splitter.

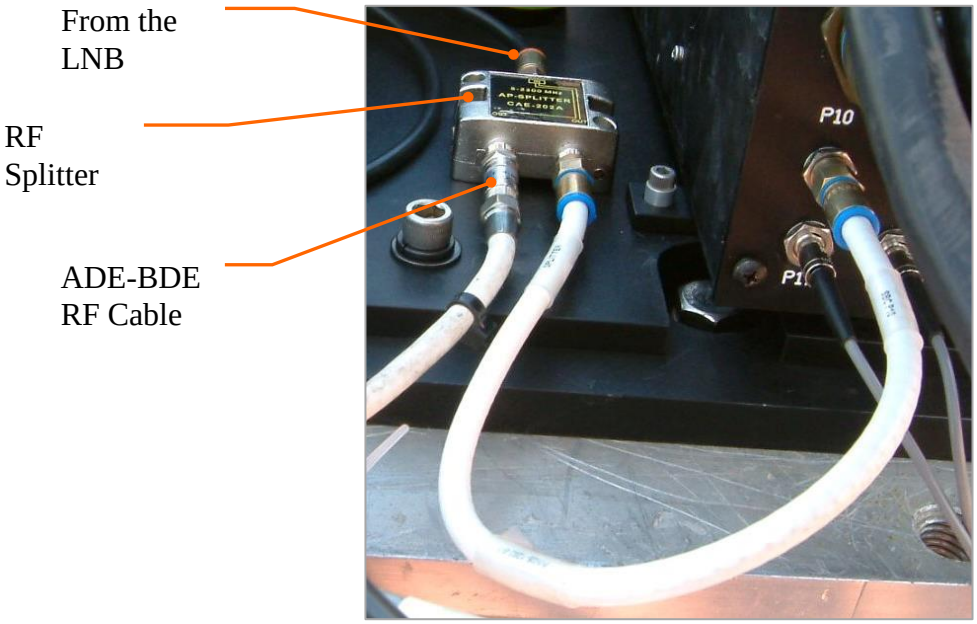



*Figure 86. SBC Fiber Optic Connectors*

### *4.5.4.15. Setting the SDU Power Supply Voltage*

**⚠ DANGER**

*DANGER – HIGH VOLTAGE*

*The SDU has potentially harmful voltages when connected to the designated power source.*

**⚠ CAUTION**

*Setting the SDU voltage selector S2 to an incompatible AC voltage will cause damage to the equipment.*

1. Disconnect P4 if connected
2. Unfasten the 4 screws securing the SDU top cover to the chassis. Remove the top cover.
3. Verify that the internal SDU voltage selector S2 is set to the correct AC voltage (115 VAC or 220 VAC).
4. Verify the SDU fuse F1 rating is compatible with the input voltage: 4 amp slow blow fuse for 115V systems, and a 2 amp slow blow fuse for 220V systems. Replace the fuse if necessary.
5. Install the SDU top cover and fasten the 4 screws to secure it to the chassis.

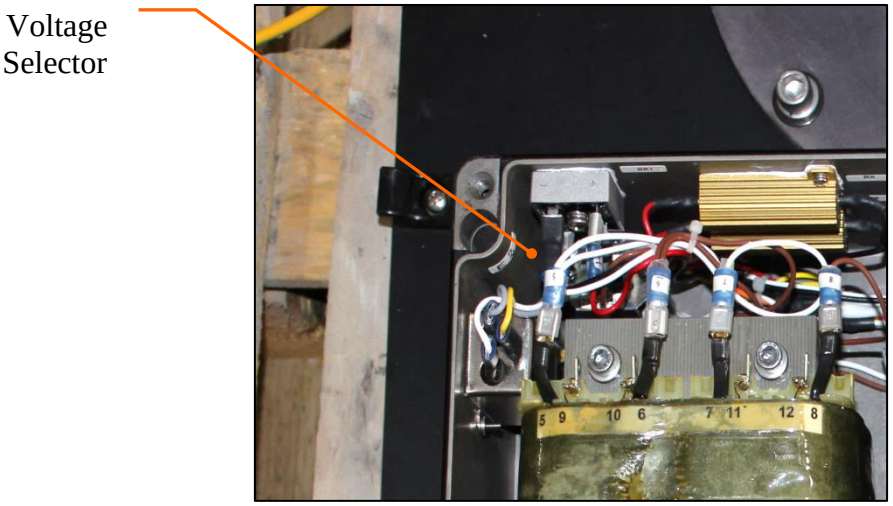



***Figure 87. SDU Voltage Selector S2***


***Figure 88. SDU Voltage Fuse F1***

**⚠CAUTION**

*Before starting the following procedures, remove the power and control cables from the ADE. Reinstall the caps on the ADE MS connectors. This procedure will prevent short-circuiting exposed BDE-side leads.*

### *4.5.4.16. SDU Power Cable Termination and Connection*

The SDU power cable is supplied by ORBIT without the utility-side plug.

**⚠WARNING**

*The termination of the power cable with a compatible plug should only be performed by a certified electrician.*

**⚠CAUTION**

*When connecting a utility plug to the power cable, special attention should be paid to the wire labels (phase, neutral, ground).*

A utility plug should be connected to the power cable in the following manner:

- Phase wire (~) to pin A
- Neutral wire (∅) to pin C
- Ground wire to pin B.

Use a DVM to check and verify the above connections.

Connect the power cable to connector P4 on the SDU.

***Figure 89. SDU Power Cable***

### *4.5.4.17. Ground Wire Connection*

Use a 16# GND wire, terminated with a terminal lug, to connect the grounding cable to the mounting plate GND jack.

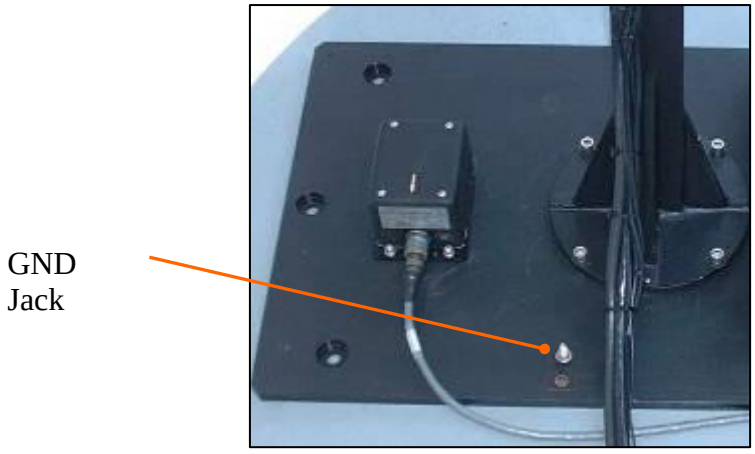



***Figure 90. Mounting Plate GND Jack***

## 4.5.5. BDE Installation

Mount the controller (ACU CONT-4 or CCU F/O) on the mounting rack and verify it is secured to prevent it from moving when sailing.

**⚠CAUTION**

*Verify that the ACU/CCU is installed at a distance of at least 5 meters from the vessel's compass.*

## 4.5.6. Connecting Cables to BDE

### *4.5.6.1. CCU /ACU Power Cable*

The power cable for the CCU/ACU is supplied by ORBIT with NEMA 5-15P plug

If required you can cut the plug and install different type according to the ship infrastructure

**⚠WARNING**

*Replacement of the Power Plug should only be performed by a certified electrician.*

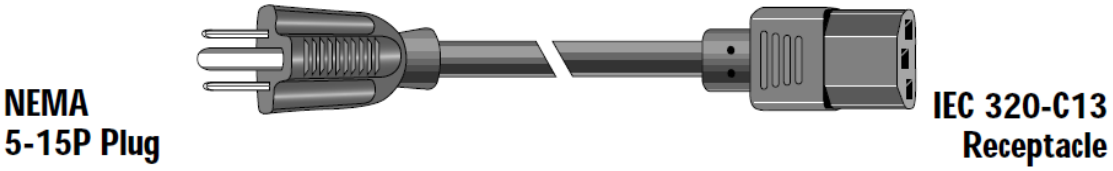



***Figure 91. CCU/ACU Power Cable***

### *4.5.6.2. Compass Cable Termination*

The gyro feed cable from the vessel should be routed to the BDE location. Its armour shield should be stripped (at least 2m), and terminated at the connector appropriate for the gyro signal in question.

Use the following wiring diagram to prepare and connect the compass cable to the relevant connector.

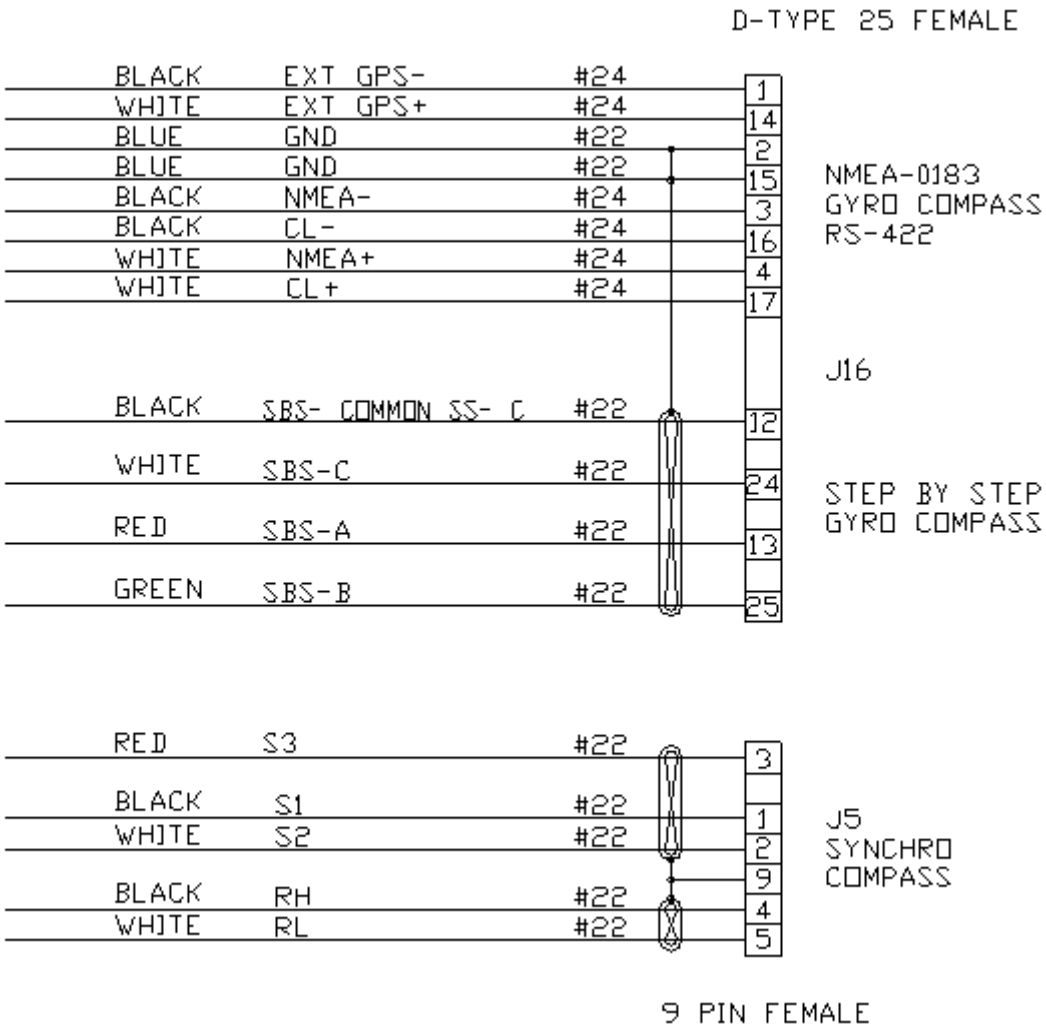



***Figure 92. Compass Harness Interface***

## *4.5.6.3. ADE-BDE Cables Termination*

### 4.5.6.3.1. General

The system is supplied with two cables (control and pedestal) that connect between the ADE and BDE, and should be laid via the vessel's designated cable guides/ducts.

The cables can be supplied in various lengths, depending on the specific installation. The following table provides the ordering information.

***Table 8 ADE-BDE Cables – Ordering Information***

| Item P/N | Parts List | Length |
|---|---|---|
| 22-0322-9-30M-2 | 22-0322-9-30M-2 | 30 ±0.5m |
| 22-0322-9-40M-2 | 22-0322-9-40M-2 | 40 ±0.5m |
| 22-0322-9-55M-2 | 22-0322-9-55M-2 | 55 ±0.5m |

### 4.5.6.3.2. Termination Procedure

Both the control and pedestal cables are supplied with the BDE-side connector disconnected, to allow easy routing and to prevent the connectors from being damaged during installation. After the cables are laid, the connectors should be connected to the cables.

Each cable is supplied with d type pins crimped to the cable wires. The wires are labelled with pin numbers, and protected with transparent shrinkable tubing at the cable end.

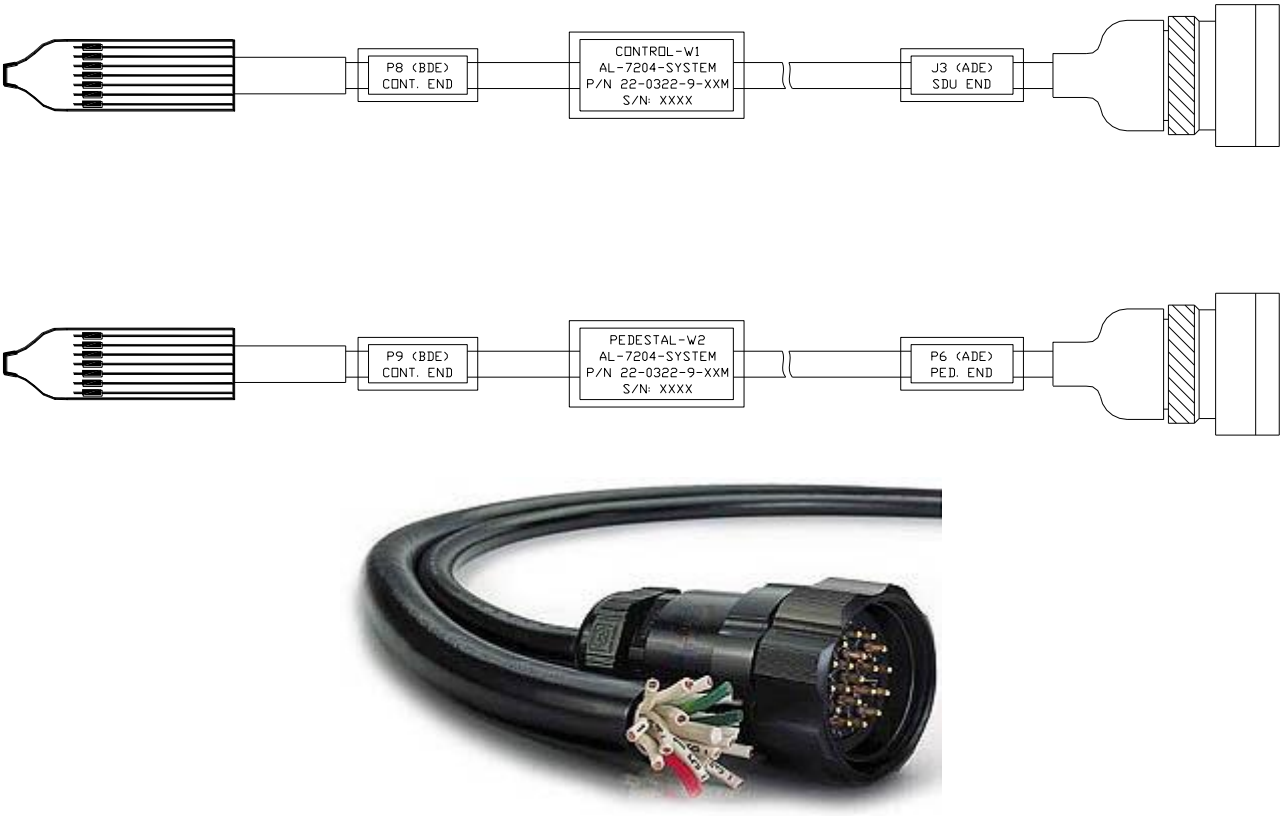



***Figure 93. ADE-BDE Cables - General View***

To terminate the control/pedestal cable with the connector, perform the following procedure. Installation details and a wiring diagram of the control/pedestal cable are shown in the following figures:

1. Carefully remove the transparent shrinkable tubing at the BDE-end of the cable.
2. Separate and arrange the pins in an ascending order to match the d type connector layout. Verify that the wires are not crossed.
3. Connect the cable pins to the d type connector.
4. Use appropriate equipment to check for current leakage, short circuits and continuity.
5. Fit the DB37 shells to the cable ensuring that the wires are not pressed or stressed.
6. Secure the shells, ensuring that the drain wire is wrapped around the cable clamping grommet in such a way that electrical continuity is maintained with the shell body.

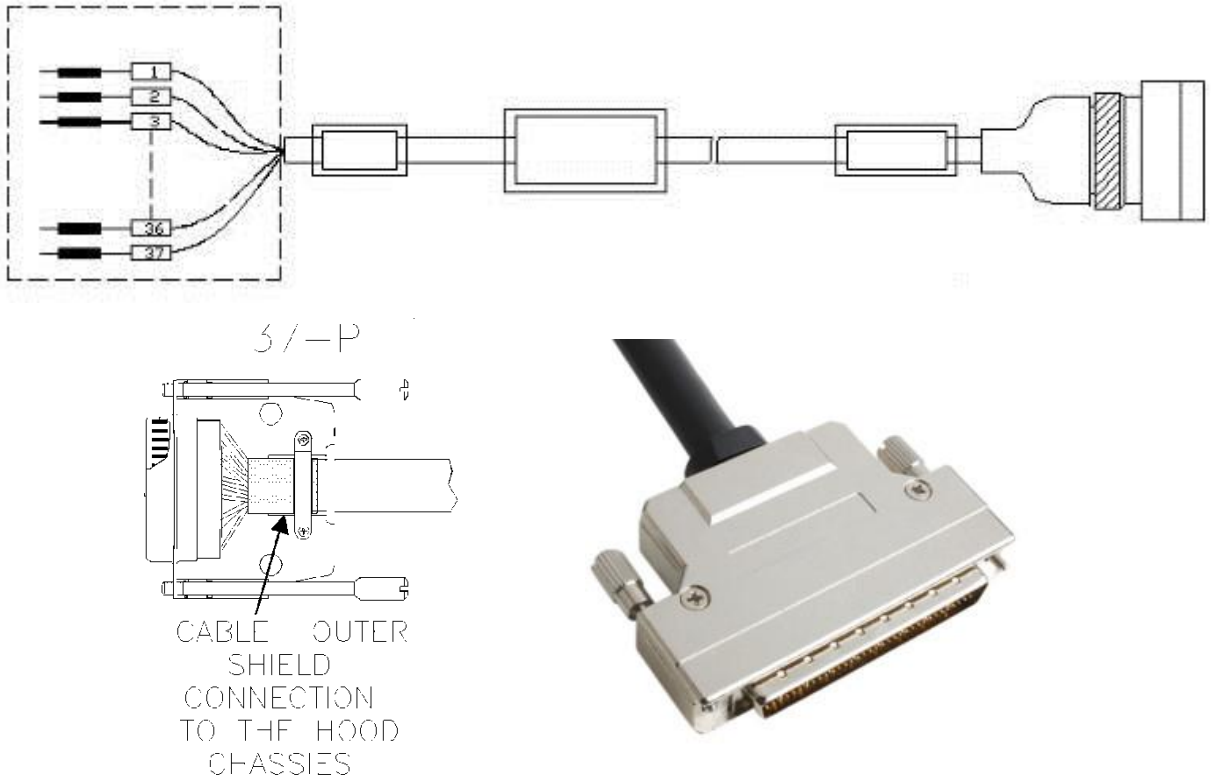



*Figure 94. Control/Pedestal Cables - Installation Details*

Controller (CONT-4) SDU Pedestal

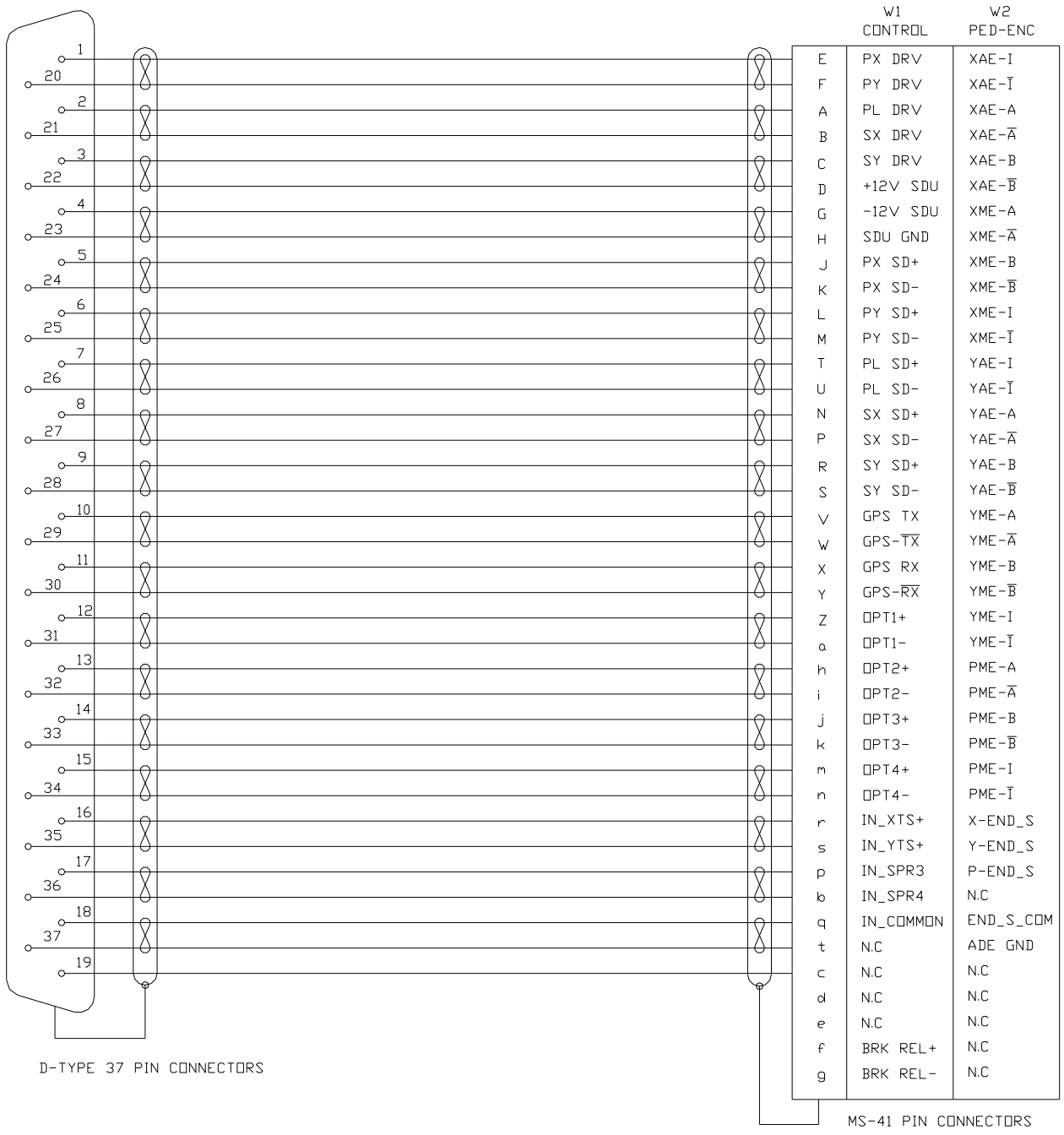



***Figure 95. ADE-BDE Cables - Wiring Diagram***

### 4.5.6.4. Connecting Control Cables to the ACU/RCU Controllers

Connect cables to the controller as described in the following procedure, and as depicted in the below figure.

1. Connect the RF cable to J12 connector.
2. Connect the compass cable to SYNCHRO COMPASS.
3. Connect control and pedestal cables to J8 and J9, respectively.
4. Secure the cable connectors to the controller's connectors by fastening the screws.
5. Connect the power cable to the controller.
6. Reconnect the power and control cables to the ADE.
7. Connect the VGA cable to EXT VGA and to USB.
8. On RCU option connect the TX and RCU respectively to the CCU on the control room deck.

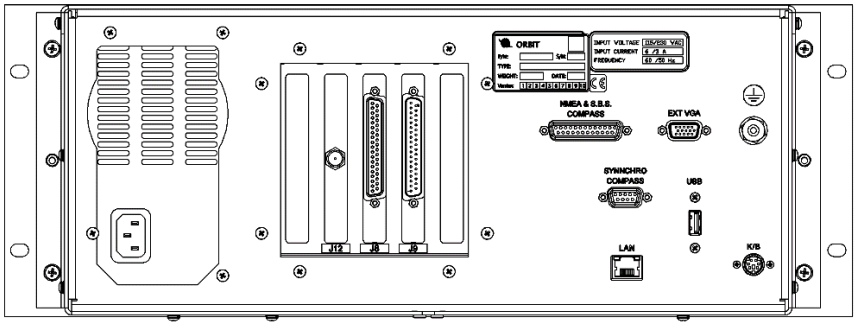



*Figure 96. AL-7204-CONT4R - ACU*

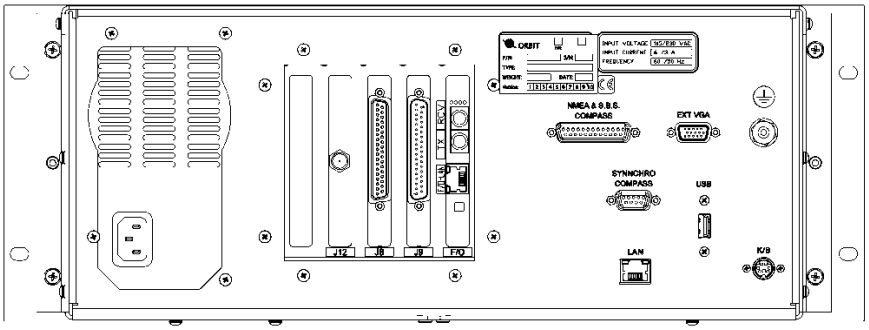



*Figure 97. AL-7204-RCU4 - RCU*

## 4.6. System Power-up and Setup

When installation is complete, the system should be powered up and system setup, functional tests and operability verification (satellite tracking/acquisition and RF aspects of system operation) should be performed.

System power-up and setup include the following procedures:

- Initial Inspections
- System Power-Up and Setup Procedure
- Pre-Commissioning Checks
- System Commissioning and Acceptance

## 4.7. Initial Inspections

Perform the following visual inspections before starting up the system:

1. **Rack Wiring** - Inspect all internal wiring terminations and labelling
2. **Mechanical Completion** - Inspect all metalwork and moving parts, ensure all edges are smooth, and that moving parts are operating properly.
3. **Labelling** - Inspect all equipment labels and equipment tag numbers, verify their correctness, and also the proper identification of power supplies.

## *4.8. System Power-up and Setup Procedure*

### 4.8.1. Introduction

The following procedures should be used to set up the system and verify the ability of the stabilised pedestal to track a carrier under normal operating conditions prior to Final Commissioning and Acceptance.

**⚠CAUTION**

*Verify that the radome is closed and secured before the system is powered-up.*

### 4.8.2. Initial Setup

1. Using the relevant termination detail drawings, ensure that all interconnection cables are correctly terminated between BDE and the ADE.
2. Carry out verification checks of the shipboard mains supply to ensure that it is suitably conditioned.
3. Apply power to the BDE/ADE equipment and observe the following:-
    - BDE Equipment:
        a. The tracking controller has powered up and the control software has been loaded.
        b. The monitor displays the manufacturer's logo while it carries out a self-test routine. During self-test countdown, press the 'C' key, and then enter the password to prevent auto-restart.
    - ADE Equipment:-
        c. The SDU front-panel power LED is illuminating.

### 4.8.3. Status and Indications Check

**Operation Screen**

1. If the Basic Operation screen is displayed, enter the password to enter the Operation screen (AL-7200).
2. Enter the System Configuration Mode and then under General, verify that the Auto-Restart option is set to No.

**NOTE**

*It is recommended to keep the Auto-Restart disabled throughout the tests and pre-commissioning procedures.*

3. On the Operational screen check the following:-
   - If error/warning messages appear in the message window - refer to each as appropriate.
   - Verify that the system ID is displayed (AL-7205).
   - Verify that the time and date are displayed.

*Compass Selection*

4. Press 'I' and 'C' to select compass type, and set the compass offset to 0. Check that the vessel's heading is displayed, and that it corresponds to the vessel's compass reading.

*Satellite Selection*

5. Press 'S' to select the required satellite and known channel with a high signal (within the band and polarity of the installed system feed).

**NOTE**

*It is recommended that a known accessible satellite be selected to perform tests and commissioning.*

6. Press 'D' and set the receiver. Press ENTER twice.

**Maintenance Screen**

1. Press ‘M’ to enter the Maintenance screen.
2. Monitor the SDU Power indicators, and verify a reading of 4.9-5.0V on the 5V indicator, and 12V on the 12V indicator. Press ‘P’ and monitor the Power Parameters. Verify that there are no red-coloured parameters.
3. Check for GPS updates. Verify that the X, Y, Z coordinates are displayed, and that the PDOP, HDOP, VDOP, TDOP fields display valid values.

**NOTE**

*It is recommended to compare the GPS readings with a reference GPS unit.*

### 4.8.4. Setting the AGC Feedback when Using a Multiswitch

When using a multi-switch box to distribute the 4 LNB outputs, one of the outputs is connected to the ACU/RCU’s AGC connector.

To configure the controller to address the desired line, perform the following procedure:

1. In the Operation screen, Press ‘T’ to enter System Configuration, and select ‘Lower Tuner’.
2. Enter LNB-V dual polarization.
3. Perform the following per each Band/Pol: Press the SPACE bar twice, and select 13V/00Hz, 13V/22Hz, 17V/00Hz, or 13V/22Hz (depending on the line connected to the multi-switch).

## 4.9. Pre-Commissioning Checks

### 4.9.1. Checking Axes of Movement

1. Press 'M' for Maintenance, then 'S' for Select Window then select 'Pedestal X'.
2. Select 'Mode', press ENTER and select 'Slew'. Then perform the following tests:
    a. Use the '↓' key to move the cursor to the velocity readout.
    b. Use the '←' and '→' keys to change the velocity to 1 or –1, and slew the axis by no more than 15 degrees in either direction from the starting position.

       Monitor the axis' position and velocity displays, and verify that the position tracking is smooth and consistent, and that the actual axis velocity is within ±0.2 deg/sec of the velocity command.

**⚠CAUTION**

*If any problem arises while slewing the axis, shut-down the axis immediately.*

    a. Use the '↓' key to move the cursor to 'Mode' and select 'Halt' to stop the axis movement
    b. Use the '↓' key to move the cursor to 'Mode' and select 'Enc Init'.
    c. Ensure the velocity remains steady, and that the encoder position varies steadily, and does not jump. If this is the case, disregard any warnings appearing in the axis window (Jmm, Rlm, Flm).
    d. Verify that the red Init flag is turned off, when the axis movement has completed.
    e. Select the 'slew' Mode again, and slew the axis 60 degrees in either direction around the zero position.
3. Repeat steps (1.) to (2.) for the 'Pedestal Y' axis.
4. Perform the Enc Init test for all axes: Select 'O' in the Operation screen, and select 'Enc Init'. Verify that all axes are moving properly, and zeroing.
5. Perform the IMU Init test: Select 'D' in the Operation screen, select 'IMU Init', and confirm your selection by pressing ENTER twice.
6. Monitor the pitch and roll, taking into consideration the levelling degree of the ADE mounting plate with the vessel's deck.

**NOTE**

*Visually inspect the pedestal's levelling within the radome.*

*The IMU Initiation procedure lasts for about 4 minutes. At the end of this procedure, the System Status field indicates that the IMU is "locked", i.e., the antenna is slaved to, and stabilized by, the information supplied by the IMU.*

### 4.9.2. Restart Initiation

1. In the Operation screen, press "O" for Operation mode, press "Restart", and then press ENTER twice. The system will perform a full restart procedure, point to the selected satellite, and then step-track on the selected channel.
2. In cases when there is no AGC level, perform the following procedure:
    a. Press "M" on the Operation screen for manual, and press ENTER twice.
    b. Move in the azimuth axis until the AGC level rises.
    c. Verify that the system is pointed towards the correct satellite, and press "O". Select step-track, and press ENTER twice.

### 4.9.3. Finding and Setting of Heading (Compass) Offset

When the system is installed on a vessel, it is not aligned with the bow of the vessel. This means that the compass offset will need to be set to align the system with the vessel's gyro compass:

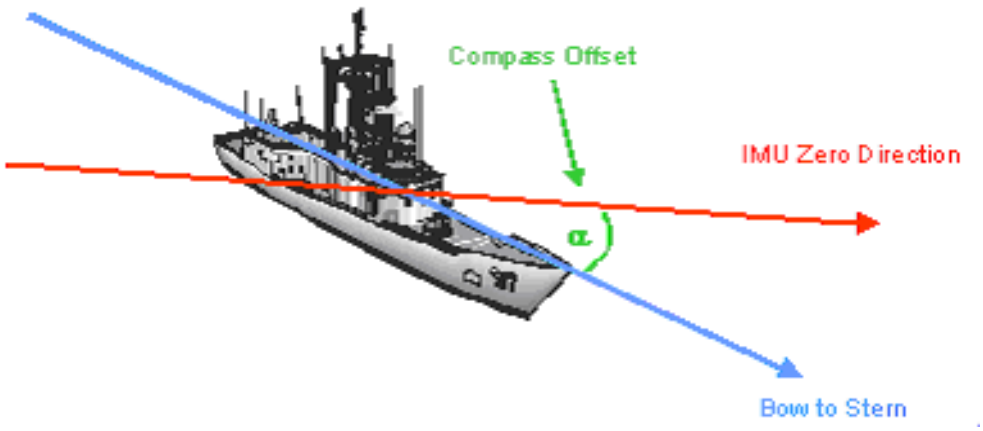



***Figure 98. Compass Offset***

As shown in the figure above, the compass offset is the angle between the vessel's compass direction, represented by the bow-to-stern line and the IMU direction, represented by a black arrow marking on the exterior of the AL-7204 radome.

To establish the exact offset angle:

1. Make a rough estimate of the offset angle. The drawing above shows an offset of -30 degrees (the negative value is due to the fact that the offset is counter-clockwise from the vessel's bow).
2. Set the estimate into the controller (as shown below).
3. Point the antenna toward the satellite. Record the antenna azimuth as "Nominal Azimuth".
4. Use Manual Mode to move the antenna azimuth orientation and point it toward the satellite. The amount of expected movement depends on the accuracy of the initial estimate. Most people can estimate the direction within +/-10 degrees.
5. Once the satellite is acquired (beacon receiver locked or, sat modem has locked on the downstream data channel or, spectrum analyser screen shows a recognizable signal pattern or any other way of validating that it is the correct satellite) set the antenna to step-track.
6. Find the "Azimuth Deviation", which is how far away the actual antenna azimuth is from the expected one.

To do so, use the graphical cross hair display, which is calibrated in degrees, showing a total of +/- 5 degrees:

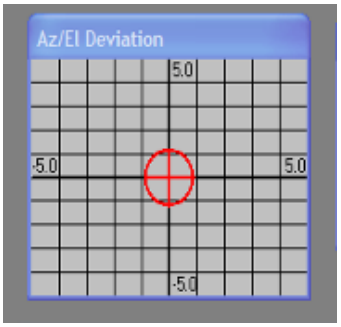



***Figure 99. Deviation Cross-Hairs)***

Or use the graphical logger, recording the azimuth deviation:

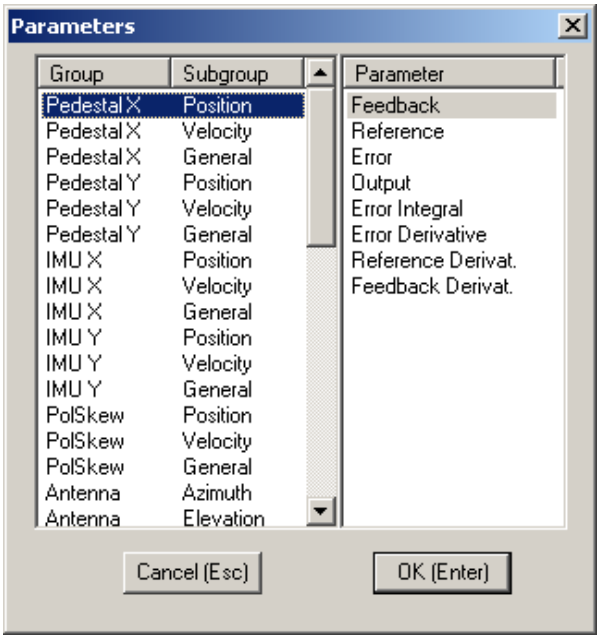



***Figure 100. Logger Parameters***

Or put the antenna in “Peak” Mode and find the “Azimuth Deviation” by calculating the difference between the current antenna azimuth and the “Nominal Azimuth” as described above.

7. The “Azimuth Deviation” obtained in one of the methods shown above will be used to refine the offset estimate. This will be calculated according to:
   Compass Offset Correction = Azimuth Deviation / Cosine (Antenna Elevation).

   For example, the satellite was located with the cross-hair mark three notches right of centre (+3 degrees), while the antenna elevation is 41.4 degrees.

   This means that the initial estimate of –30 degrees needs to be corrected by: 3/Cos (41.4) = 4.0 degrees, resulting in an overall compass offset of –26.0 degrees

**To set the offset to the controller**-

1. From “Operation screen” press “I” then select “Compass”:

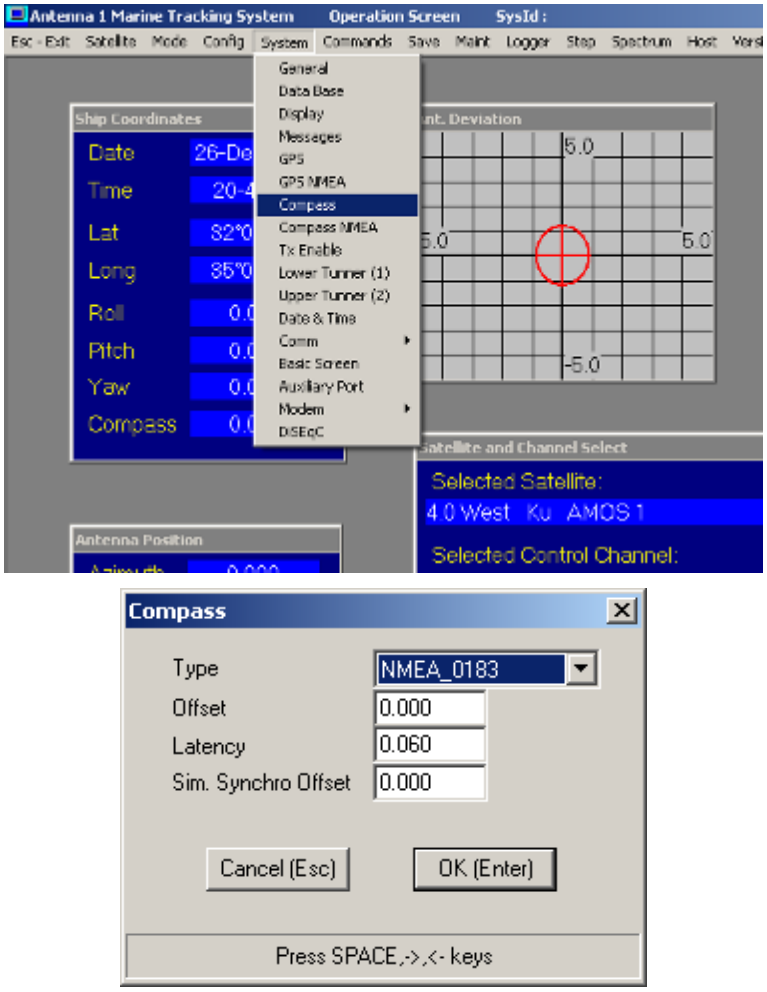
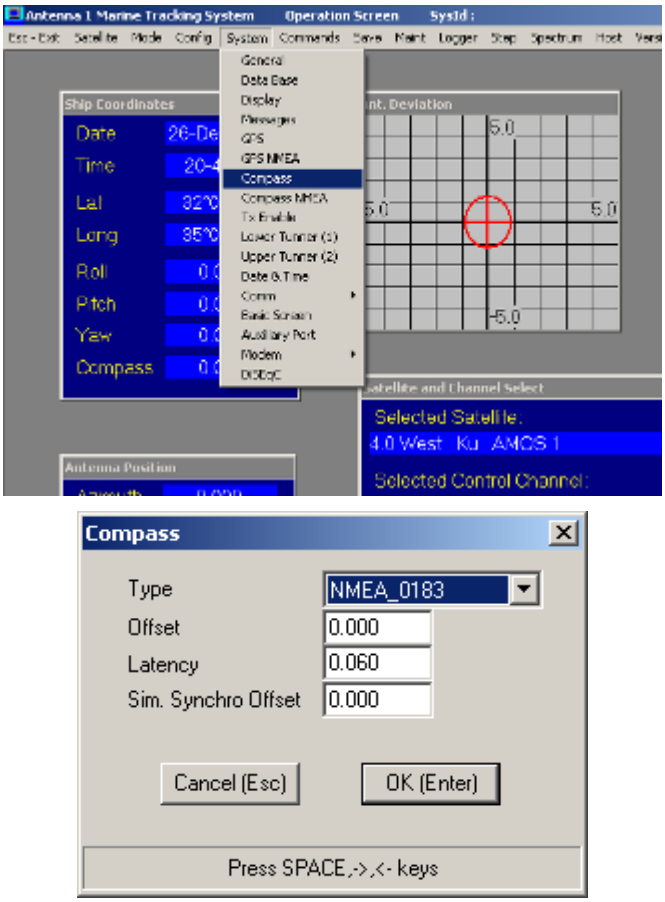



***Figure 101. Compass Window***

2. Enter the offset (second line from the top), click on OK and save in the ACU non-volatile memory.

### 4.9.4. Setting the Interface to Vessel's Compass

1. From "Operation screen" press "I", then select "Compass":




2. Select the relevant compass type:

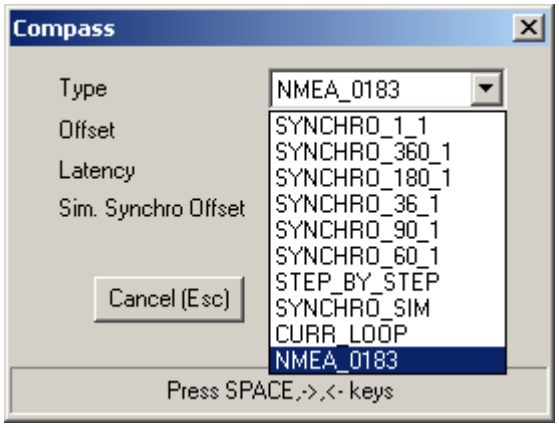



***Figure 102. Compass Selection***

**Supported interface types**:

- Synchro, Step-by-Step and NMEA-0183
- ("Current-loop" – although listed is not supported)
- The default setting is NMEA-0183
- For Synchro or Step-by-Step – please contact the factory

**Synchro hardware setup**: 115 VAC 50-400 Hz reference, 90 VAC S1, S2, S3 phases

Synchro 1 to 1:

1 degree of vessel rotation corresponds to 1-degree displacement of compass readout

Synchro 360 to 1:

1 degree of vessel rotation corresponds to 360 degrees displacement of compass readout

Synchro 180 to 1:

1 degree of vessel rotation corresponds to 180 degrees displacement of compass readout

Synchro 90 to 1:

1 degree of vessel rotation corresponds to 90 degrees displacement of compass readout

Synchro 60 to 1:

1 degree of vessel rotation corresponds to 60 degrees displacement of compass readout

Synchro 36 to 1:

1 degree of vessel rotation corresponds to 36 degrees displacement of compass readout

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

- Both types of step-by-step are supported: Common GND, and Common Hot
- Maximal voltage level allowed for active line in case of common GND: 20 to 70vdc
- Maximal voltage level allowed for common hot: 20 to 70vdc.

### 4.9.5. Changing the Default NMEA-0183 Compass Sentence

When connecting an NMEA-0183 compass, change the default sentence as follows:

1. In the “Operation screen”, press “I”, and then select “Compass NMEA”:

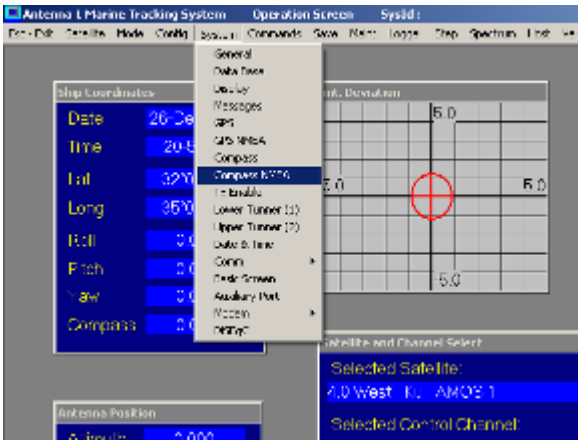



*Figure 103. Selecting Compass NMEA*

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

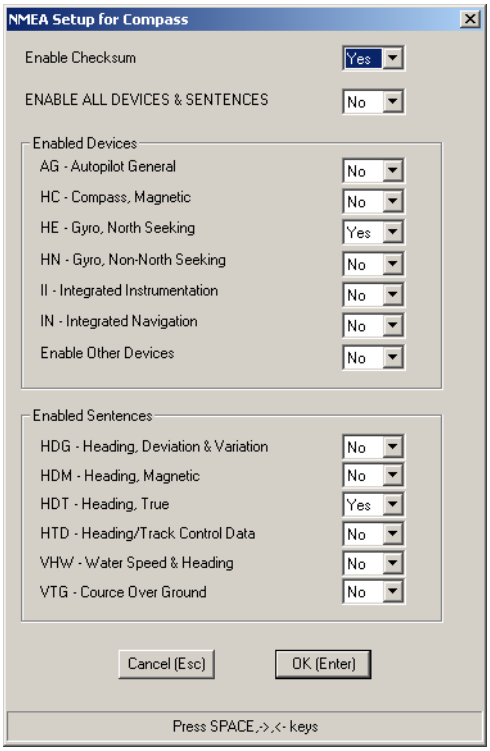



*Figure 104. NMEA Setup*

### 4.9.6. Setting Noise Floor and Threshold Values

1. Note the ‘On Satellite’ received signal strength in dBμV.
2. Note the ‘Off Satellite’ received signal strength in dBμV. This can be obtained by pressing ‘O’ for Mode in the Operation screen, selecting ‘Manual’, and then using the arrow keys to move the antenna off satellite.
3. Press ‘D’ for system configuration, select ‘Set Threshold’ and enter the Off Satellite AGC value.

### 4.9.7. Saving the Configuration Settings

**⚠CAUTION**

*The pre-commissioning procedures may take time due to the unstable power supply on vessels. Therefore, it is recommended to save the configuration parameters frequently, using the Save Configuration function.*

1. Press ‘V’ for Save, and select ‘All’, or the desired option.

# 5. INSTALLATION OF FEED ASSEMBLIES

## 5.1. C-Band Feed, LNB and Filter Assembly Installation

The following procedure should be performed to install the C-Band Feed, LNB and Filter Assembly on the Universal Feed Mount:

1. Perform the Shut-Down Sequence.
2. Position the feed on the adaptor ring, with the filter and LNB pointing towards the dish cables opening, and supported by a tripod leg.
3. Fasten six screws to secure the feed to the adaptor ring.
4. Fasten two screws to secure the assembly support bracket to the tripod leg.
5. Connect the coax cable to the LNB connector.
6. Connect the Ground cable to the feed Chassis..

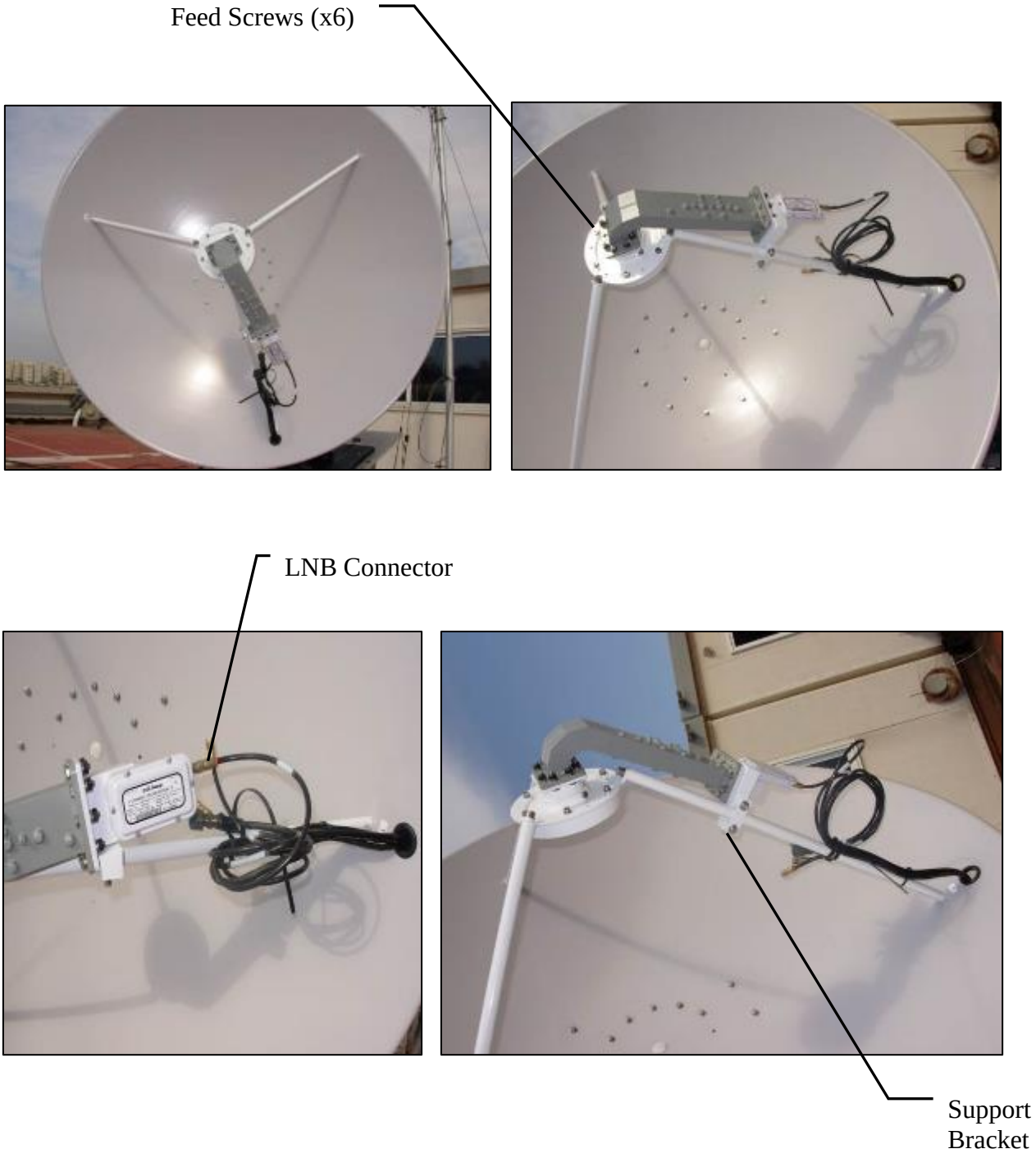



***Figure 105. C-Band Feed, LNB and Filter Assembly Installation***

### 5.1.1. Configuration Changes for DBS and GLA Feeds

Following the installation of the DBS LNBF or GLA LNBF assemblies, the following procedure should be performed to verify that the system is configured to support the installed feed:

1. Apply power to the BDE/ADE equipment.
2. The ACU monitor displays the manufacturer's logo while carrying out a self-test routine. Press the 'C' key to prevent auto-restart during the self-test countdown. The password window appears.
3. Enter the password (AL-7200) on the keyboard (the AL must be capital letters).
4. The Operation screen is displayed. This may be checked by looking at the header on the upper section of the screen.
5. Press 'T' to enter the System Configuration screen.
6. Use the up/down arrow keys to select 'Upper Tuner'. Press ENTER.
7. Verify that the 'LNB-V for Dual Polariz.' / ExKuH field is set to 18v/00KHz. If not, perform the following:

- Use the up/down arrow keys to select the 'LNB-V for Dual Polariz.' / ExKuH field.
- Press the SPACE key, and use the up/down arrow keys to select the 18v/00KHz option. Press ENTER.

8. Verify that the 'LNB-V for Dual Polariz.' / ExKuV field is set to 13v/00KHz. If not, perform the following:

- Use the up/down arrow keys to select the 'LNB-V for Dual Polariz.' / ExKuV field.
- Press the SPACE key, and use the up/down arrow keys to select the 13v/00KHz option. Press ENTER.

9. Press ESC, and then ENTER to accept changes. If no changes were made, press ESC twice.
10. To save the configuration changes, press 'V' for save, select 'All' and press ENTER.
11. Press 'U' to enter the Basic Operation screen.
12. Select a satellite and channel frequencies, as detailed in the system's User Manual.

## 5.2. Configuration Changes for Linear Ku Motorized Feed

Following the installation of the Linear Ku Motorized Feed assembly, the following procedure should be performed to verify that the system is configured to support the installed feed:

1. Apply power to the BDE/ADE equipment.
2. The ACU monitor displays the manufacturer's logo while it carries out a self-test routine. During the self-test countdown, press the 'C' key to prevent auto-restart. The password window appears.
3. Enter the password (AL-7200) on the keyboard (the AL must be capital letters).
4. The Operation screen is displayed. This may be checked by looking at the header on the upper section of the screen.
5. Press 'T' to enter the System Configuration screen.
6. Use the up/down arrow keys to select 'Upper Tuner'. Press ENTER.
7. Verify that the 'LNB-V for Dual Polariz.' / ExKuH field is set to 18v/22KHz. If not, perform the following:

- Use the up/down arrow keys to select the 'LNB-V for Dual Polariz.' / ExKuH field.
- Press the SPACE key, and use the up/down arrow keys to select the 18v/22KHz option. Press ENTER.

8. Verify that the 'LNB-V for Dual Polariz.' / ExKuV field is set to 13v/22KHz. If not, perform the following:

- Use the up/down arrow keys to select the 'LNB-V for Dual Polariz.' / ExKuV field.
- Press the SPACE key, and use the up/down arrow keys to select the 13v/22KHz option. Press ENTER.

9. Press ESC, and then the ENTER key to accept changes. If no changes were made, press ESC twice.
10. To save the configuration changes, press 'V' for save, select 'All' and press ENTER.
11. Press 'U' to enter the Basic Operation screen.
12. Select satellite and channel frequencies, as detailed in the system's User Manual.

## 5.3. Linear Ku Motorized Feed Installation

To install the linear Ku motorized feed assembly on the universal feed mount, perform the following procedure:

***Table 9. Installation of Linear Ku Motorized Feed Assembly on the Universal Feed Mount***

| Step | Description | Details |
|---|---|---|
| 1. | Perform the Stow and Shut-Down Sequence. | ⚠WARNING<br>*Verify that the ADE and BDE units are turned off and disconnected from the power source.* |
| 2. | Unpack the linear Ku motorized feed, feed mounting bracket, feed mounting clamp, and required hardware. Use an Allen key for 6/32” screws. |  |
| 3. | Position the feed mounting bracket on the adaptor ring. Fasten 4 screws to secure the feed mounting bracket to the adaptor ring.<br>( USE ONLY FOR KU OPTION ONLY ) |  |

***Table 9. Installation of Linear Ku Motorized Feed Assembly on the Universal Feed Mount***

| Step | Description | Details |
|---|---|---|
| 4. | Position the linear Ku motorized feed assembly to the feed mounting bracket. |  |
| 5. | Install the feed mounting clamp and fasten 2 screws to secure the feed mounting clamp to the bracket.<br>**Note**<br>*The securing screws should be inserted into the upper through-holes.* |  |

***Table 9. Installation of Linear Ku Motorized Feed Assembly on the Universal Feed Mount***

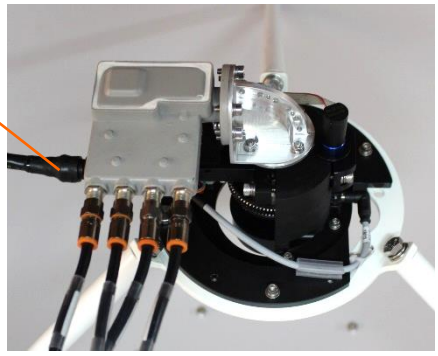
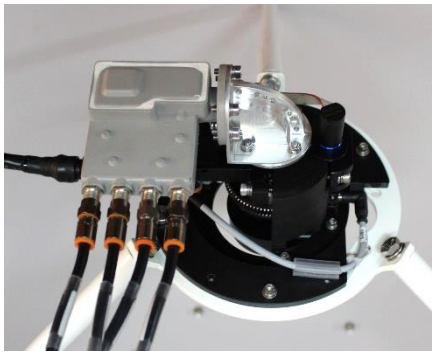
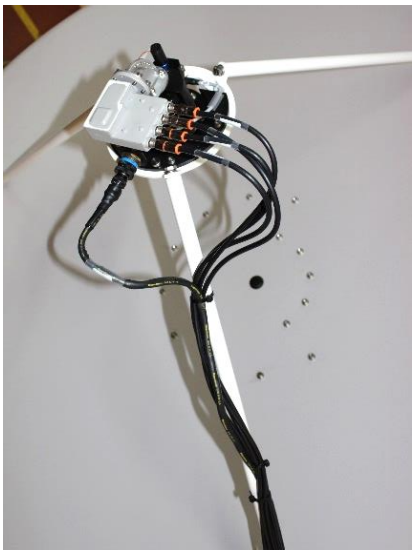
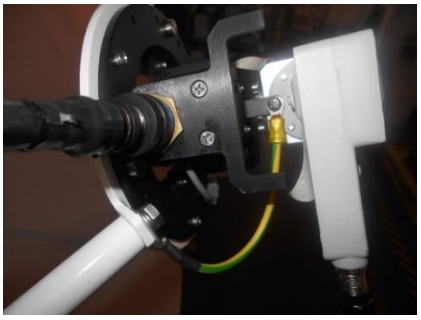
| Step | Description | Details |
|---|---|---|
| 6. | Pass the feed control cable through the dish cables opening, and connect its connector P14 to the feed connector J14.<br>Secure the cable to the tripod arm and to the pedestal. |  <br>Feed Control Cable (P14)<br>  <br>Cable Connection to Feed (J14) |
| 7. | **Note**<br>*Verify that four cables* (vertical high, vertical low, horizontal high, and horizontal low) *are connected to the distribution system's multiswitch.*<br>Pass the four coax cables through the dish cables opening, and connect them to the pertaining feed connectors (vertical high, vertical low, horizontal high, and horizontal low). |  |

***Table 9. Installation of Linear Ku Motorized Feed Assembly on the Universal Feed Mount***

| Step | Description | Details |
|---|---|---|
| 8. | Place and secure the cables to the pedestal and to the feed tripod arms. Use cable tie-wraps for securing.<br>**⚠CAUTION**<br>*When placing and securing the cables, pay close attention to minimum bend radius specifications.*<br>*After cables connection, manually rotate the antenna dish from one end stop to the other, making sure that the cables do not interfere or getting jammed through the full rotation range.* |  |
| 9. | Connect the grounding cable to the Feed Chassis screw. |  |
| 10. | Perform software configuration changes. | Refer to the CONFIGURATION CHANGES FOR LINEAR Ku MOTORIZED FEED section, below. |
| 11. | Perform the power-up sequence and resume normal operation, as detailed in the User's Manual. | |

## 5.4. Configuration Changes for Linear Ku Motorised Feed

After the installation of Linear Ku Motorized Feed assembly, perform the following procedure to verify that the system is configured to support the installed feed:

1. Apply power to the BDE/ADE equipment.
2. The ACU monitor displays the manufacturer's logo while it carries out a self-test routine. **During self-test countdown, press the 'c' key to prevent auto-restart.** The password window appears.
3. Enter the password (AL-7200) using the Keyboard (the AL must be capital letters).
4. The Operation screen is displayed. Check by looking at the header on the upper section of the screen.
5. Press 'T' to enter into the System Configuration screen.
6. Use the up/down arrow keys to select 'Upper Tuner'. Press ENTER.
7. Verify that the 'LNB-V for Dual Polariz.' / ExKuH field is set to 18v/22KHz. If not, do the following:
    - Use the up/down arrow keys to select the 'LNB-V for Dual Polariz.' / ExKuH field.
    - Press the SPACE key, and use the up/down arrow keys to select the 18v/22KHz option. Press ENTER.
8. Verify that the 'LNB-V for Dual Polariz.' / ExKuV field is set to 13v/22KHz. If not, do the following:
    - Use the up/down arrow keys to select the 'LNB-V for Dual Polariz.' / ExKuV field.
    - Press the SPACE key, and use the up/down arrow keys to select the 13v/22KHz option. Press ENTER.
9. Press ESC, and then the ENTER key to accept changes. If no changes were made, press ESC twice.
10. To save the configuration changes, press 'V' for save, select 'All' and press ENTER.
11. Press 'U' to enter the Basic Operation screen.
12. Select satellite and channel Frequencies, as detailed in the system's User Manual.

# 6. MAINTENANCE

## 6.1. Introduction

This section provides instructions and procedures for Organizational Level (O-Level / Shipboard) Maintenance of the TVRO system.

## 6.2. Tools and Test Equipment

The TVRO system does not require any special tools or test equipment for maintenance.

Use the following standard tools and equipment to perform the maintenance tasks:

- Philips screwdriver #2
- Flat-blade screwdrivers, set of small and large
- Open-ended wrenches
- Standard set of small Allen wrenches (metric)
- Standard set of small Allen wrenches (imperial)
- Locking compound, LocTite 270
- Multimeter
- Flashlight.

## *6.3. Preventive Maintenance*

### 6.3.1. Semi-Annual Inspection

The ADE of the TVRO system should be visually examined twice a year with the following procedure:

- Turn off the power to the ADE.
- Open the radome hatch, or remove the radome completely.

**⚠CAUTION**

- Although the Kevlar radome is light, two to three people are needed to lift it with care, since the radome is bulky and will act as a sail in wind.
- Visually inspect the cables for rubbing or chafing.
- Check the inside of the radome for excessive moisture and/or corrosion.
- Verify that there are no screws, nuts, washers lock washers or other parts in the radome base.
- Check feed tightness.
- Check for areas of chipped or peeling paint. Use only non-metallic paint for touch-up painting.
- Verify that all assembled nuts and bolts are secured and tightened. If nuts and bolts are loose, apply LocTite 270 and fasten them.
- Install and secure the radome to the radome base.

**NOTE**

*If the system has not been operated within the last 30 days, it should be initialized and operated to verify proper operation and acquisition capabilities.*

## 6.4. CORRECTIVE MAINTENANCE

**⚠WARNING**

*DANGER – HIGH VOLTAGE*

*The SDU has potentially harmful voltages when connected to the designated power source.*

### 6.4.1. Replacement of SDU Fuses (F1, F2)

To replace an SDU fuse, perform the following procedure:

1. Verify that the SDU is turned off.
2. Disconnect connector P4 from the SDU.
3. Unfasten the 4 screws securing the SDU top cover to the chassis and remove the top cover.
4. Use a flat-blade screwdriver to remove the fuse housing by pressing the fuse housing, and turning it a half turn counter-clockwise.
5. Remove the base from the fuse housing, and put in a new fuse. For F1, use a 6 amp slow-blow fuse (115V systems), or a 3 amp slow-blow fuse (220V systems); For F2, use a 1 amp fuse.
6. Install the fuse housing by pressing it and turning it a half turn clockwise to its locked position.

**⚠CAUTION**

*Setting the SDU voltage selector S2 to the incompatible AC voltage will damage the equipment.*

7. Verify that the internal SDU voltage selector S2 is set for the correct AC voltage (115 VAC or 220 VAC).
8. Install the SDU top cover and fasten 4 screws to secure it to the chassis.
9. Re-connect connector P4 to the SDU.
10. If required, turn the SDU ON.

VOLTAGE SELECTOR (S2)

SDU FUSES AND SWITCH BRACKET

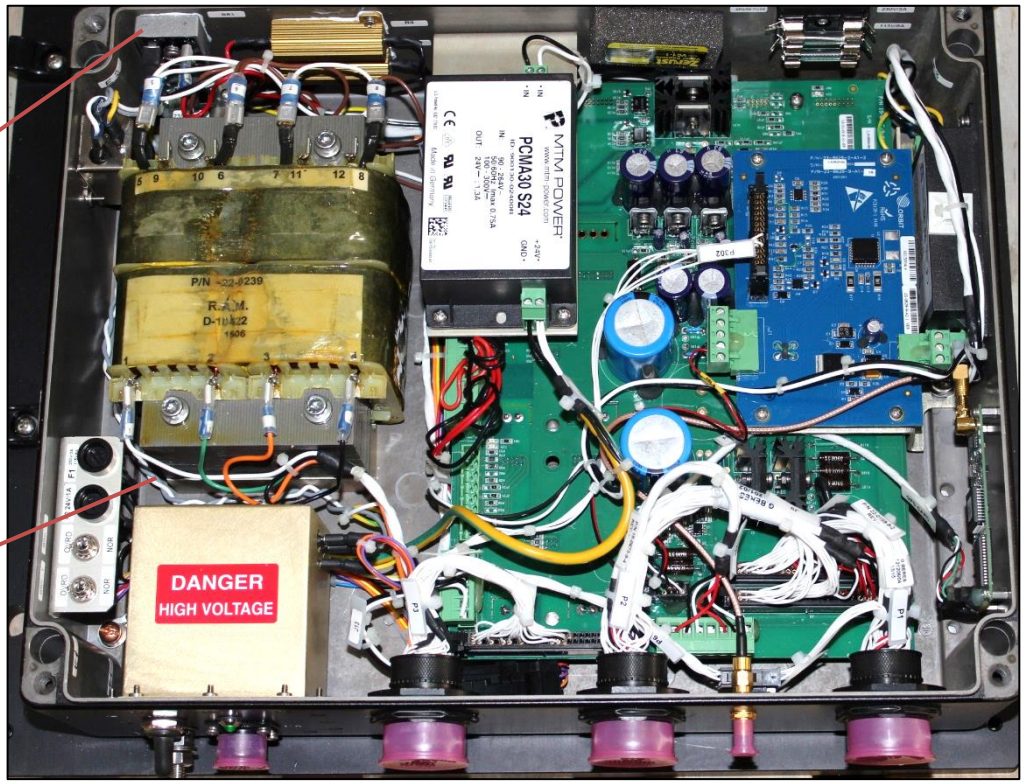



*Figure 106. SDU - Internal View*

MAINS FUSE (F1)

24vdc FUSE (F2)

#### 6.4.1.1. Replacement of SDU

To replace the SDU, perform the following procedure:

1. Turn off the SDU.
2. Disconnect all cables from the SDU connectors (P1, P2, P3, P4, P5 and ground jack).
3. Unfasten the 4 captive screws securing the SDU top cover to the chassis.
4. Remove the 4 bolts securing the SDU to the mounting plate through the holes in the SDU chassis.
5. Place a new SDU without a cover on the mounting plate..

**⚠CAUTION**

*Setting the SDU voltage selector S2 to the incompatible AC voltage will cause damage to the equipment.*

6. Verify that the internal SDU voltage selector S2 is set to the correct AC voltage (115 VAC or 220 VAC).
7. Fasten the SDU to the mounting plate using 4 screws, through the holes in the SDU chassis.
8. Install the SDU top cover and fasten the 4 screws securing it to the chassis.
9. Connect all cables to the SDU connectors (P1, P2, P3, P4, P5 and ground jack).
10. If required, turn on the SDU.

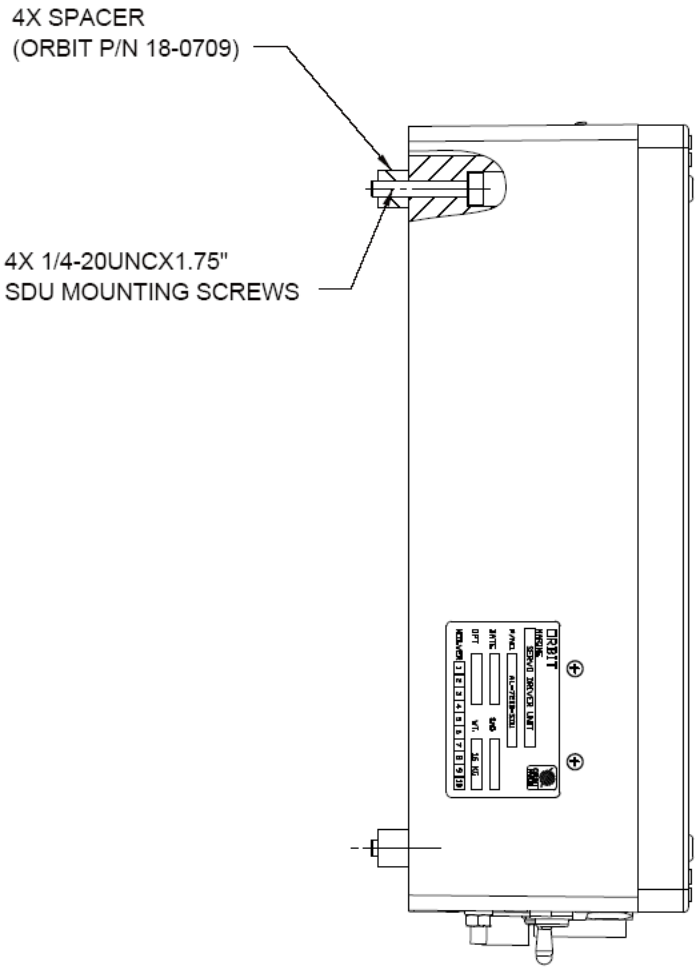



*Figure 107. SDU - Mounting Screws*

*Figure 108. SDU - Mounting Screws*

### 6.4.2. Replacement of Pedestal Harness

1. Turn off the SDU and the controller (ACU/RCU).
2. Disconnect all pedestal harness connectors (P14, J2, J6, P51, P52, P91, P92, P3, and P7). Refer to the following figure.
3. Cut and remove the tie-wraps securing the harness to the pedestal. Remove the pedestal harness.
4. Place and assemble a new harness on the pedestal.
5. Verify that all connections are correct.
6. Turn on the SDU and apply power to the Controller (ACU/RCU).

### 6.4.3. System Restart

1. Switch off power to both Controller (ACU/RCU) and SDU.
2. Re-apply the power to the system.
3. Observe the following: -
    - The Controller booting.
    - The antenna moves to zenith position.
    - The IMU status turn to “locked after 360 sec.
    - The system acquires the satellite.
    - The AGC level is above the threshold.

# 7. JOB DETAILS

| | |
|---|---|
| Equipment / System | |
| Location of Test | |
| Date of Test | |
| Inspection Carried Out by | |

Commissioning Observers

| Installation Contractor | Client |
|---|---|
| | |

| | | | |
|---|---|---|---|
| 1 | Bill of Materials (typical) | | |
| | **Item** | **Part Number** | **Serial Number** |
| | **Above Deck Equipment:** | | |
| | Pedestal | | |
| | Inertial Measurement Unit (IMU) | | |
| | Servo Driver Unit (SDU) | | |
| | KU Band Polarized feed | | |
| | C Band Feed | | |
| | Power Supply Unit (PSU) | | |
| | Single Board Controller( SBC) | | |
| | **Below Deck Equipment:** | | |
| | Antenna control Unit (ACU)<br>or Remote-Control Unit (RCU) | | |
| | Communication Control Unit (CCU) | | |

# 8. INITIAL INSPECTION

- Results and remarks for the following tests should be filled in the Acceptance Test Report

| Item | Action |
|---|---|
| D.3.1 | **Paint and General Finish**<br>• Inspect paintwork and the general finish<br>**Dome Outer Shell:**<br>• Dome infrastructure<br>• Any external damage<br>**Inside the Dome:**<br>• Any internal damage<br>• No signs of water inside the dome<br>• No holes or cracks in the dome structure<br>• All panels are tight<br>• No nuts and bolts are missing<br>• Antenna movement is free of obstructions<br>• Base plate is secured to the radome floor and to the base ring. When shaking the antenna it does not move<br>• GPS antenna is secured<br>• Cleanliness |

| | |
|---|---|
| D.3.2 | **Mechanical & Electrical**<br>• Inspect metalwork and moving parts, ensure that all edges are smooth, and that moving parts are operating properly.<br>• Verify that all bolts attaching the base ring to the radome support (both on the perimeter and the centre of the ring) are present and tightly fastened.<br>**Wiring:**<br>• Check for loose or free cables<br>• Check for visible damage on cables<br>• All cables are secured with tie straps<br>**Dish:**<br>• The dish is secured to the positioner<br>• The feed support is secured to the dish<br>• Perform a visual check for any damage on the dish<br>**SDU:**<br>• The SDU is tightened to the base plate<br>• The SDU to the ACU/RCU cable is intact and properly fastened<br>• The SDU to the IMU cable is intact and properly fastened<br>• The SDU to pedestal cable is intact and properly fastened<br>• The power cable is intact and properly fastened<br>• The ground cable is connected to the base plate |

| | |
|---|---|
| | **IMU:**<br>• The IMU is secured to the base plate<br>• The arrow points to the bow (if not, then adjust compass offset)<br>• The IMU is securely fastened to the front panel cable.<br>**PEDSTAL X and Y AXIS:**<br>• The encoder is properly mounted on the shaft<br>• The encoder cable is secured to the pedestal<br>• The shaft movement is smooth and unobstructed<br>• The 4 screws attaching the motor to the gear box are fastened<br>• The 2 motor cables are secured |

| | |
|---|---|
| | • The 4 screws attaching the gearbox to the shaft are fastened<br>• There is no backlash<br>• Lubrication grease is lightly applied to the cog<br>**Feed:**<br>• Secured to the feed support<br>**For the Linear Feed**<br>• RF cables are connected properly and to the right LNB ports (according to labels)<br>• The motor is firmly attached to the polarizer<br>• Linear feed is rotating CW and ACW and is free of obstructions<br>• Polarizer cable is secured<br>**For the C-Band Feed**<br>• RF cables are properly connected to the LNB<br>• All unused cables are secured to the tripod.<br>**CCU:**<br>• The CCU is secured to the rack<br>• Cat 5 or fibre is connected<br>• Keyboard and mouse are connected<br>• IF inputs are connected to the right port on the switch cards (only on dual system)<br>**ACU/RCU :**<br>• The ACU/RCU is secured to the rack<br>• D-37 cables are intact and properly fastened<br>• Compass cable is properly fastened<br>• IF inputs are connected to right port on the switch<br>• CAT. 5 or fibre is connected<br>• Screen and keyboard are connected |
| D.3.3 | **Rack Wiring**<br>Internal wiring terminations and labelling are appropriate |

## 8.1. Test Procedure

| Item | Action |
|---|---|
| D.4.1 | **Introduction**<br>The purpose of the following tests is to demonstrate the ability of the stabilized pedestal to track a carrier under normal operating conditions.<br>**Initial Setup**<br>1. Using the relevant interconnection drawings, ensure that all interconnection cables are correctly terminated in the ADE, and between the BDE and the ADE.<br>2. Carry out verification checks of the shipboard mains supply, ensuring that the supply is suitably conditioned.<br>3. Verify that the SDU is set to the correct voltage supplied by vessel's mains, and that input fuses are rated for the input voltage<br>4. Apply power to BDE/ADE equipment and observe the following:-<br>BDE Equipment:<br>• CCU has powered up and loaded control software (system is not in auto-restart).<br>• The monitor displays the Orbit Banner screen, whilst it carries out a self-test routine and then changes to the Basic Operation screen.<br>ADE Equipment:<br>• SDU - power LEDs (1) are illuminated.<br>5. Check the following (in Operation and in Maintenance screens):<br>• Time and date are displayed<br>• The following software and files are updated:<br>o Mtslink / Vx works<br>o Sat. database<br>o Mtsdock version<br>o Ftp version<br>• Insert Compass type<br>• Verify that the IMU serial number in the Maintenance screen matches the installed IMU<br>• Check power levels in Maintenance screen<br>• Verify that the offset of the axes are correct<br>• Check that the vessel coordinates are correct |

| Item | Action |
|---|---|
| | • Verify that the vessel's heading and location displayed match the one on the bridge<br>• Verify that there are no error messages on the operation screen<br>**Pedestal Initialization**<br>Access the controller, carry out initialization and alignment and check the following:<br>In the Maintenance screen:<br>1. Encoder Init - find the zero correctly in all axes.<br>Ensure X and Y axes (and IMU axes if mechanical IMU) reach zero with no jams or errors<br>2. Check axes movement to ensure that velocities and positions change correctly<br>3. Test axes trajectory<br>**Satellite Acquisition**<br>1. Select the required satellite and channel from the satellite database.<br>2. Acquire satellite, and verify that AGC is above threshold.<br>3. Check that on acquiring the satellite, the system points toward the satellite and goes into step-track.<br>4. Check that the antenna position corresponds to the position indicated in the 'Antenna Target' window.<br>5. For TVRO systems, verify reception of TV channels in both polarities – digital and analogue.<br>6. For TxRx systems, verify that the modem is locked on a signal without loss<br>**System Restart Facility**<br>1. Power down the system.<br>2. Reapply power to the system.<br>3. Observe the following:<br>• The system re-boots.<br>• The encoders initiate.<br>• The IMU initiates.<br>• The system acquires the satellite.<br>• The system goes into Step-Track.<br>• Modems locks-up. |

## 8.2. Acceptance Test Report

| Test | Pass (✓) | Fail (✓) | Remarks |
|---|---|---|---|
| **3.1 Paint and General Finish** | | | |
| Dome outer shell: | | | |
| Dome infrastructure | | | |
| Any external damage | | | |
| Inside the Dome: | | | |
| Any internal damage | | | |
| No marks from water inside the dome | | | |
| No holes or cracks in the dome construction | | | |
| All panel screws are tight | | | |
| No nuts and bolts are missing | | | |
| Base plate is secured to radome floor and to base ring | | | |
| Antenna movement is free from obstructions | | | |
| GPS antenna is secured | | | |
| Cleanliness | | | |
| **3.2 Mechanical and Electrical** | | | |
| Metalwork and edges of moving parts are smooth | | | |
| Bolts attaching the base ring to the radome support are present and tight | | | |
| **Wiring:** | | | |
| Loose or free cables | | | |
| Damage on cables | | | |
| All cables are properly secured with tie straps | | | |

| Test | Pass (✓) | Fail (✓) | Remarks |
|---|---|---|---|
| **DISH:** | | | |
| The dish is secured to the positioner | | | |
| The feed support is secured to the dish | | | |
| Make a visual check for any damage on the dish | | | |
| Ground cable is connected to the DishChasis | | | |
| **SDU:** | | | |
| SDU is tightened to base plate | | | |
| SDU to ACU/RCU cable | | | |
| SDU to IMU cable | | | |
| SDU to pedestal cable | | | |
| GPS cable | | | |
| Power cable | | | |
| Ground cable is connected to base plate and to IMU | | | |
| All connection cables to the SDU are fastened | | | |
| **IMU:** | | | |
| The IMU is secured to the base plate | | | |
| The arrow points to the bow | | | |
| IMU to front panel cable | | | |
| **Feed:** | | | |
| Secure to the feed support | | | |
| **For the linear feed** | | | |
| RF cables are connected properly (c band feed) | | | |
| The motor is firmly attached to the polarizer | | | |
| Linear feed is rotating and free of obstacles | | | |
| Polarizer cable is secured | | | |
| Ground cable is connected to the Polarizer Chasis | | | |

| Test | Pass (✓) | Fail (✓) | Remarks |
|---|---|---|---|
| **For the C Band feed** | | | |
| RF Cable are properly connected to the Lnb | | | |
| All Unused cables are Secured to the Tripod | | | |
| **CCU:** | | | |
| Is secured to the rack | | | |
| Cat. 5 or fibre is connected | | | |
| Screen, keyboard and mouse are connected | | | |
| **ACU/RCU:** | | | |
| ACU/RCU is secured to the rack | | | |
| D-37 cables are intact and properly fastened | | | |
| Compass cable | | | |
| IF inputs | | | |
| All connection cables to the ACU/RCU are secured | | | |
| Screen, keyboard and mouse are connected | | | |

## 8.3. Equipment Acceptance

| Item | Action | Remarks |
|---|---|---|
| D.5.1 | **Acceptance Certificate**<br>If the equipment has met the design specifications, the acceptance certificate should be completed and signed.<br>**Punch List**<br>If there are outstanding issues for delivery, or there is a failure during testing, or any other equipment non-compliance, it should be recorded on the punch list. If it is determined that the failure is of a minor nature, the acceptance certificate may be issued with the punch list attached. In all cases, an agreed date for clearance of punch list items must be entered. | |

## 8.4. Certificate of Acceptance

The equipment listed below has been tested in accordance with the procedures included in this document.

*The equipment is accepted with no outstanding issues.

*The equipment is accepted subject to clearance of outstanding issues listed on the punch list.

Equipment

Item

Serial Numbers as detailed in the Bill of Materials.

| | For and on behalf of the Installation Contractor | For and on behalf of the Purchaser |
|---|---|---|
| Name: | _____ | _____ |
| Signature: | _____ | _____ |
| Name: | _____ | _____ |

* Delete where appropriate

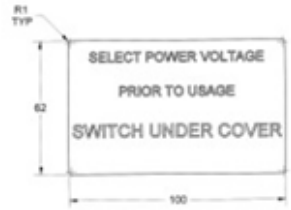
# 9. APPENDIXES

## 9.1. DECLARATION OF HAZARDOUS MATERIALS

**To whom it may concern,**

ORBIT Communication Systems certified that the AL-7205 system manufactured by us are hazardous materials Free.
(e.g. mercury, cadmium, beryllium, chromium VI, asbestos, radio-active materials; or products that are corrosive, irritants, carcinogens, mutagens, or toxic; or products that are hazardous as waste e.g. oils greases, batteries and chemicals/ substances requiring specialist disposal).

The warning labels as display on the equipment is :




Best Regards,
Yaniv Ben Shoshan
QA Manager

## 9.2. COC DRAFT FORM

Orbit Communication Ltd
8d Hatzoran P.O Box 8657 Natanya, 42504 Israel
Tel: +972-9-8922777 Fax: +972-9-8855944
Company Number: 511215634, VAT Number: 557171006

DATE: 07-Jun-2015

**QUALITY DEPARTMENT - CERTIFICATE OF CONFORMANCE NO: 36563**

CUSTOMER: ORBIT CS Europe LTD
SALES ORDER: SL1421138
CUSTOMER P.O: SO1440131
END CUSTOMER P.O: 23033541

| No. | Part No. | Part Description | Serial # | Qty |
|---|---|---|---|---|
| 1 | AL-7205-R | AL-7205 TVRO KU/C-BAND 1.5M RoHs | 0166 | 1 |

**Attached documents: Serviceable tags, Warranty**

**STATEMENT CONFORMANCE**

THIS IS TO CERTIFY THAT ALL THE ABOVE - MENTIONED SUPPLY HAS BEEN DESIGNED, MANUFACTURED, INSPECTED AND TESTED AS APPLICABLE. ALL OF THE ABOVE SUPPLY CONFORMS TO IPC-A-610 STANDARTS. THE AS9100 QUALITY MANAGMENT SYSTEM WAS UTILIZED DURING THE DESIGN, MANUFACTURING AND TESTING OF THIS SUPPLY. SUBJECT TO THE EXCEPTION OR ENGINEERING DEPARTURES AS INDICATED ABOVE, OR MINOR DEVIATIONS AS NOTED ON THE APPLICABLE PRODUCTION DOCUMENTS. IT HAS BEEN FOUND, IN EVERY RESPECT, TO BE IN COMPLIANCE WITH THE SPECIFICATIONS OF THE CONTRACT, WITH THE ORDERS OR SUBORDERS OF THE CUSTOMER, WITH THE PARTICULAR SPECIFICATIONS ATTACHED TO SUCH ORDERS, WITH THE DRAWINGS AS WELL AS WITH THE STANDARDS AND PERTINENT APPLICABLE REGULATION.

Quality Department
QMS

Sincerely,
Ariela Itzhak
QA Production
Telephone no.: +972-9-8922676
E-mail Address: ariela.itzhak@orbit-cs.com
ORBIT Communication Systems Ltd.

## 9.3. Software Licence Agreement

A Real Time Software is installed on Each ACU/RCU (vxworks). A licence is required for each unit, according to the Licence agreement #11990 with WindRiver systems.

PRODUCTION LICENSE REPORT

| | |
|---|---|
| Customer Name | Orbit Ltd. |
| License Agreement Number | 11990 |
| Customer Project | Antenna Controlier |
| License Agreement Date | 2004 |

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The windows CE operation system is installed on each CCU.

A licence label 'Windows CE 5.0 professional' is attached to the rear panel of the CCU of each unit.