AL-7204

1.3m (51”) Ku-Band Linear Maritime Stabilized TVRO System

Installation and Operation Manual

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Revision History & Control

Revision History

Revision #	Date	Description
Rev: -	2002	Initial version
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List of Effective Pages

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 146 CONSISTING OF THE FOLLOWING:

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1 SAFETY PRECAUTIONS

The following general safety information is for installing, operating, and servicing. Specific warnings and cautions will be found throughout the manual where they apply, but may not appear in this summary. Observe the following list of safety precautions when installing, operating and maintaining the TVRO System:

WARNING

The antenna pedestal is equipped with high torque DC motors that develop considerable forces. These forces can be harmful.

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

WARNING

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

WARNING

Before removing the covers of any unit, verify that the main POWER switch is in the OFF position, and disconnect the power cable from the unit. Note: The ACU receives voltage from two sources: from the ship's power network and from the compass gyro.

CAUTION

Metal parts accessible to the operator are grounded to the chassis ground to prevent shock or fire hazard from lightning and similar hazards. The chassis ground conductor must not be removed or defeated. If necessary, make an appropriate power system ground to ensure the enclosure is at ground potential.

CAUTION

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

CAUTION

Although the kevlar radome is light, two to three people are needed to lift it since the radome is bulky and will act as a sail in wind.

CAUTION

To prevent shock or fire hazard, do not expose the equipment (with the exception of the radome) to rain or moisture.

CAUTION

Avoid making unauthorized modifications to the system.

CAUTION

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

NOTES

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

2 ACRONYMS & ABBREVIATIONS

ACU	Antenna Control Unit
ADE	Above Deck Equipment
BDE	Below Deck Equipment
BIT	Built In Test
CONT	Controller
GND	Ground
HDD	Hard Disk Drive
IMU	Inertial Measurement Unit
IRD	Integrated Receiver-Decoder
LAT	Latitude
LONG	Lonitude
LNB	Low Noise Block
MMI	Man-Machine Interface
OVRD	Override
SAS	Spectrum Analyzer Screen
SDU	Servo Driver Unit
TVRO	TV Receive Only

3 ABOUT THIS MANUAL

This Manual provides the shipboard system's operator with system description, operation 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 subjects:

Introduction

System Structure and Units

Theory of Operation

Chapter 2. Basic Operation

Provides detailed basic-operation information and instructions.

Chapter 3. Advanced Operation

Provides brief description of the advanced-operation modes, usually not used by the system's 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 Mounted.

Chapter 6. Maintenance

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

4 SYSTEM DESCRIPTION

4.1 1.3 m (51") TVRO SYSTEM

4.1.1 Introduction

The state-of-the art high performance and cost–effective AL-7204 System is designed to receive high quality analog and/ or digital TV transmissions from Ku-Band satellites and to distribute the TV signal to any desired location on the ship. The system is suitable for installation on all types of vessels from 30m and above.

4.1.2 Main Features

Highly efficient 1.3m (51") Prime Focus antenna

Supports analog and digital reception.

LNB: Quad universal or Dual DBS/GLA

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 world database.

Powerful diagnostic and analysis tools.

Real time data logger.

Built In Spectrum Analyzer

Interface to vessels gyro compass (synchro, NMEA, step-by-step).

Built-in GPS receiver and antenna.

Narrow Band Tracking receiver included.

Light weight: 140 kg (310 lbs), including radome.

Easy and Fast installation.

Proven Reliability (MTBF)

Optional: Support Remote access for monitoring and control

4.1.3 1.3m (51") TVRO SYSTEM SPECIFICATIONS

Table 4-1. Technical Specifications

Parameter	Specification
RF System:	
Antenna type	Prime Focus
Antenna diameter	1.3 m (51”)
Frequency band	Ku-Band
Operating frequency	10.95-12.75 Ghz
Antenna polarity	Linear (V/H)
Antenna gain, typical	42 dB @ 11.7 GHz
EIRP level (min.)	41.5 dBW
Radome size	Radome diameter – 1.52 m (60”) Base diameter – 1.67 m (66”) Radome height – 1.64 m (65”)
ADE Weight	140 kg (310 lb)
Tracking System:	
Pedestal type	AL-7204-1B
Axis configuration	POL/X/Y
Tracking Controller	AL-7204-CONT4
Stepper Drive Unit (SDU)	AL-7200-SDU-07
Pitch/Roll sensors - IMU	AL-7203-IMU-NT3
Ship Gyro Compass Interface *Note: other interfaces are also*	Typical interfaces: Synchro 1:1, 36:1, 360:1, 60:1, or 90:1

Table 4-1. Technical Specifications

Parameter	Specification
supported by the system. Consult ORBIT.	Step-by-Step (both common polarities) NMEA-0183 (RS-422)
Narrow Band Tracking receiver	Yes
GPS	Yes
Ship Motion:	
Roll	30° @ 8 sec
Pitch	15° @ 6 sec
Yaw	8° @ 15 sec
Surge	0.2g
Sway	0.2g
Heave	0.5g
Turning rate	12°/ sec
Environmental (Above Deck Equipment):	
Temperature, Operational	-25°C +55°C with Radome, as per IEC 60945: 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%),

Table 4-1. Technical Specifications

Parameter	Specification
	50/60 Hz (+0, -3%) • ADE – 660 W, max. • BDE – 150 W, max.

4.1.4 System Description

The 1.3m (51") TVRO system components consist of two sections:

Above Deck Equipment (ADE)

Below Deck Equipment (BDE)

4.1.4.1 Above Deck Equipment (ADE)

The Above Deck Equipment (ADE) is installed (secured to a mounting plate) within a weather-tight 1.52-meter (60") radome. The radome is comprised of a base (including a base hatch) and a removable dome.

The radome assembly is mounted on, and secured to, the ship's deck. Removing the radome provides access to the ADE.

The ADE includes the following components:

AL-7204-1B X-Y Pedestal, carrying a 1.3-m (51") reflector (antenna), which is equipped with a Ku-Band, feed assembly.

AL-7200-SDU-07 Servo Driver Unit (including servo cards, GPS receiver and ADE power supply).

GPS antenna - The Omni-Directional GPS Antenna is connected to the GPS receiver in the SDU.

AL-7203-IMU-NT3 Inertial Measurement Unit including a Pitch/Roll sensor and a short-term Yaw sensor.

The following figures provide ADE general views and outline drawings.

Figure 4-1: ADE General View (Radome Installed)

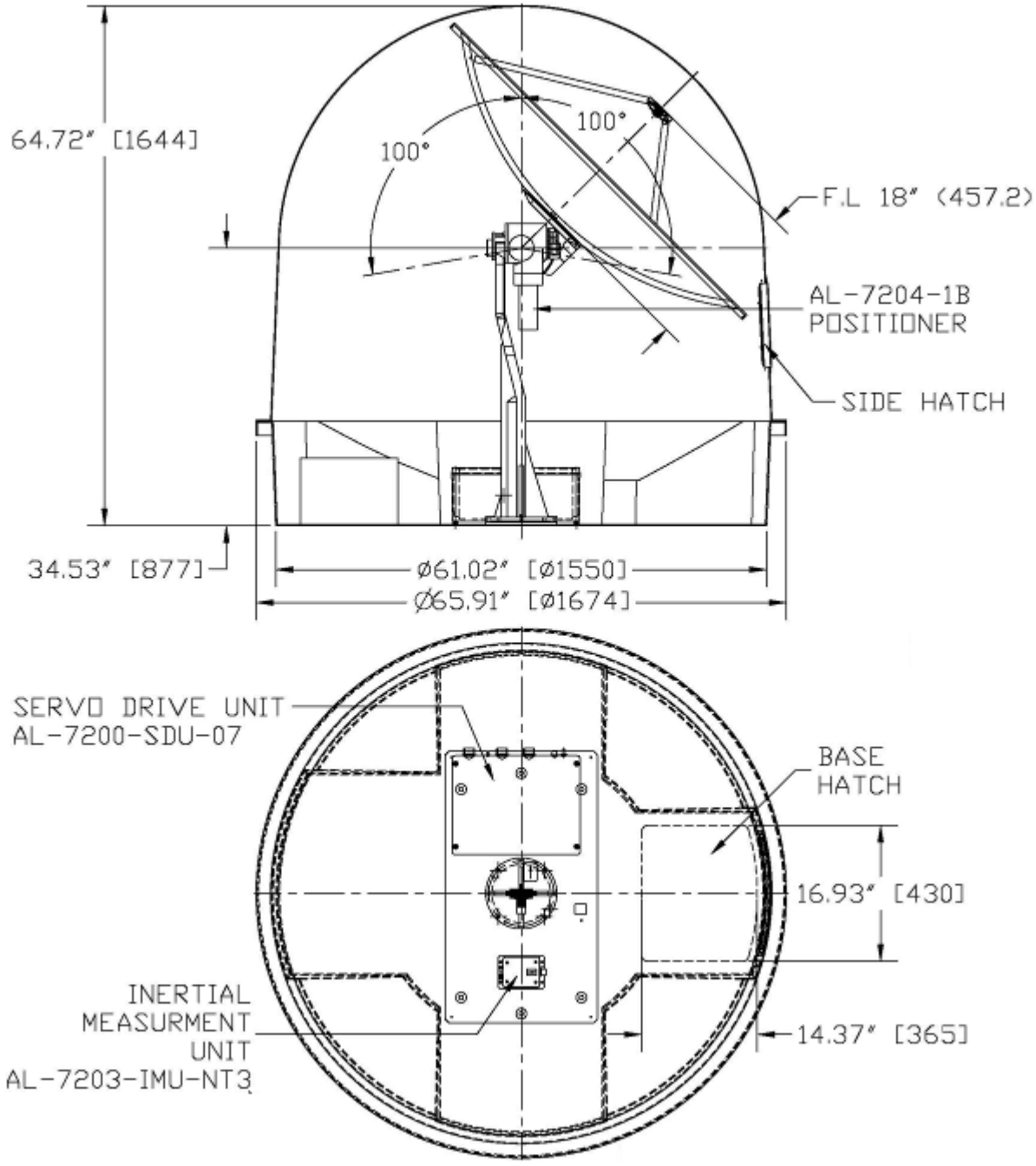


Figure 4-2: ADE – Units Location ,Identification and dimension

Figure 4-3: ADE General View (Radome Removed) – sheet 1

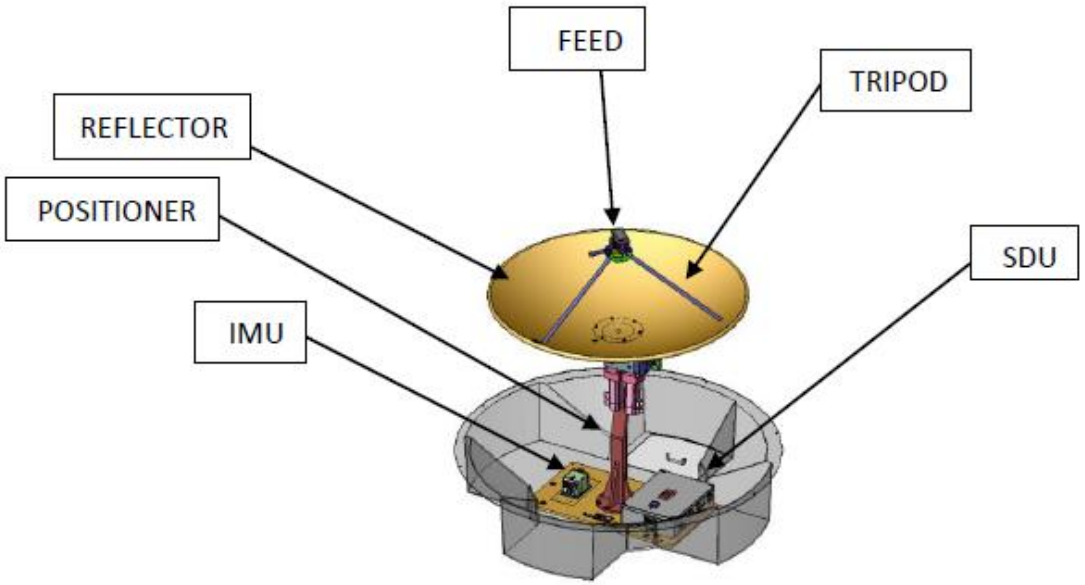


Figure 4-4. ADE – Units Location and Identification

Figure 4-5. Base Hatch

4.1.4.2 Below Deck Equipment (BDE)

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

The ACU includes a narrow band tracking receiver and is able to interface to ship gyro compass.

The AL-7204-CONT4 ACU is a 19" 5U, 14-slot industrial computer, with a TFT LCD and a keypad, featuring a user-friendly man-machine interface.

The AL-7204-CONT4 main features are:

"ON SCREEN" user-friendly man machine interface

Digital Control Loops Interface to the Servo Drivers for X/Y axes, DC Driver for POLL axis and GPS receiver.

Interface to the ship 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 World Coverage Data Base

Powerful diagnostic tools (BIT)

Real time data logger

Built In Spectrum Analyzer

Enhanced maintenance functions

Fully automatic operation

Power: 110 or 230 VAC, 50 or 60 Hz

Built In Narrow Band Receiver

Figure 4-6. ACU General View

4.1.5 Theory of Operation

4.1.5.1 Block Diagram Description

The operation of the TVRO system is fully controlled from the AL-7204-CONT4 ACU (installed below the deck). Using the ACU, the operator can select the desired satellite and channel from a list displayed on the ACU monitor.

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

4.1.5.1.1 ACU Principle of Operation

The AL-7204-CONT4 ACU 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 ACU is able to interface 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).

The ACU recieives the following data from the ADE:

Antenna position signals from the pedestal encoders (via the PEDESTAL ENCODER cable).

Ship's Roll, Pitch and Yaw positions taken from the IMU.

L-band RF signals from the antenna's LNB output.

The ACU analyzes 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.

4.1.5.1.2 SDU Principle of Operation

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

4.1.5.1.3 IMU Principle of Operation

When the system is in use, the IMU provides the ACU with the following ship'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 stabillization.

Yaw variations – measured by a rate-gyro sensor (short-term information). The Yaw short-term data is integrated with the long-term Yaw data received from the ship's gyro compass.

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

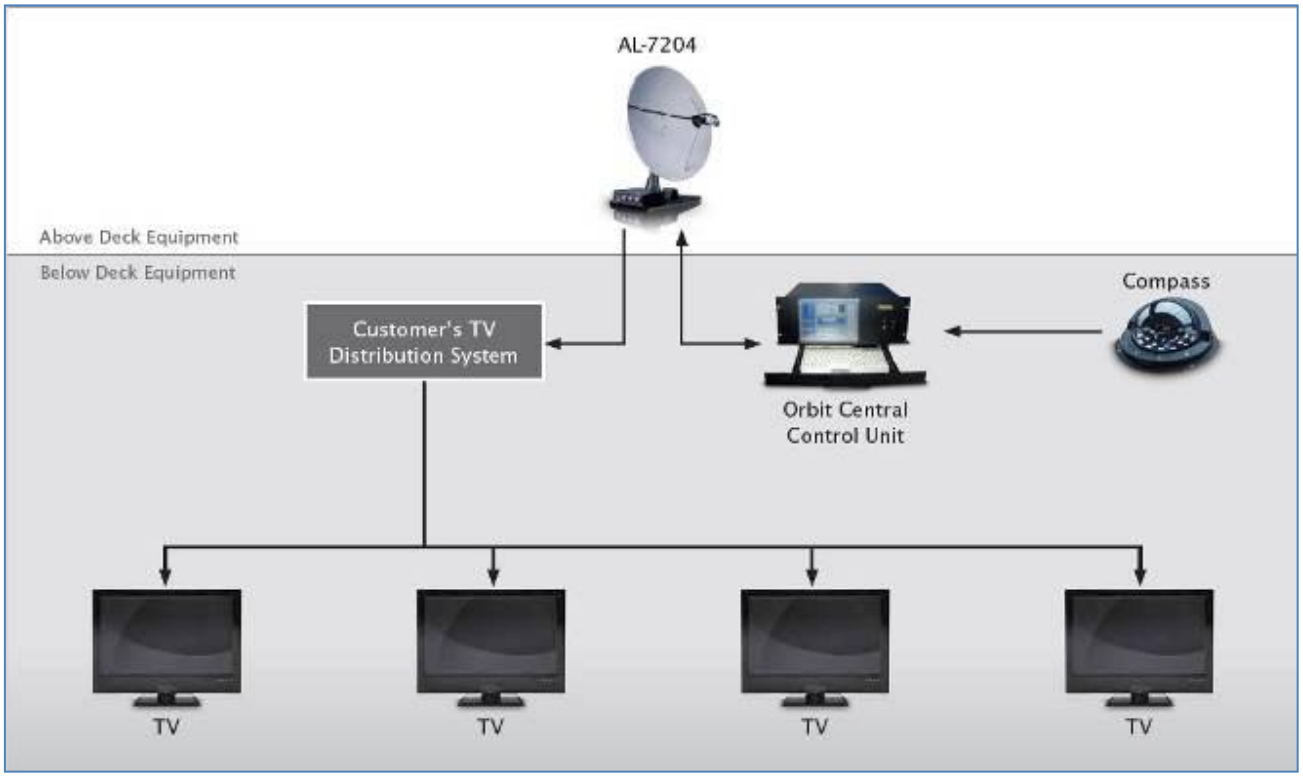


Figure 4-7. TVRO System – Functional Block Diagram

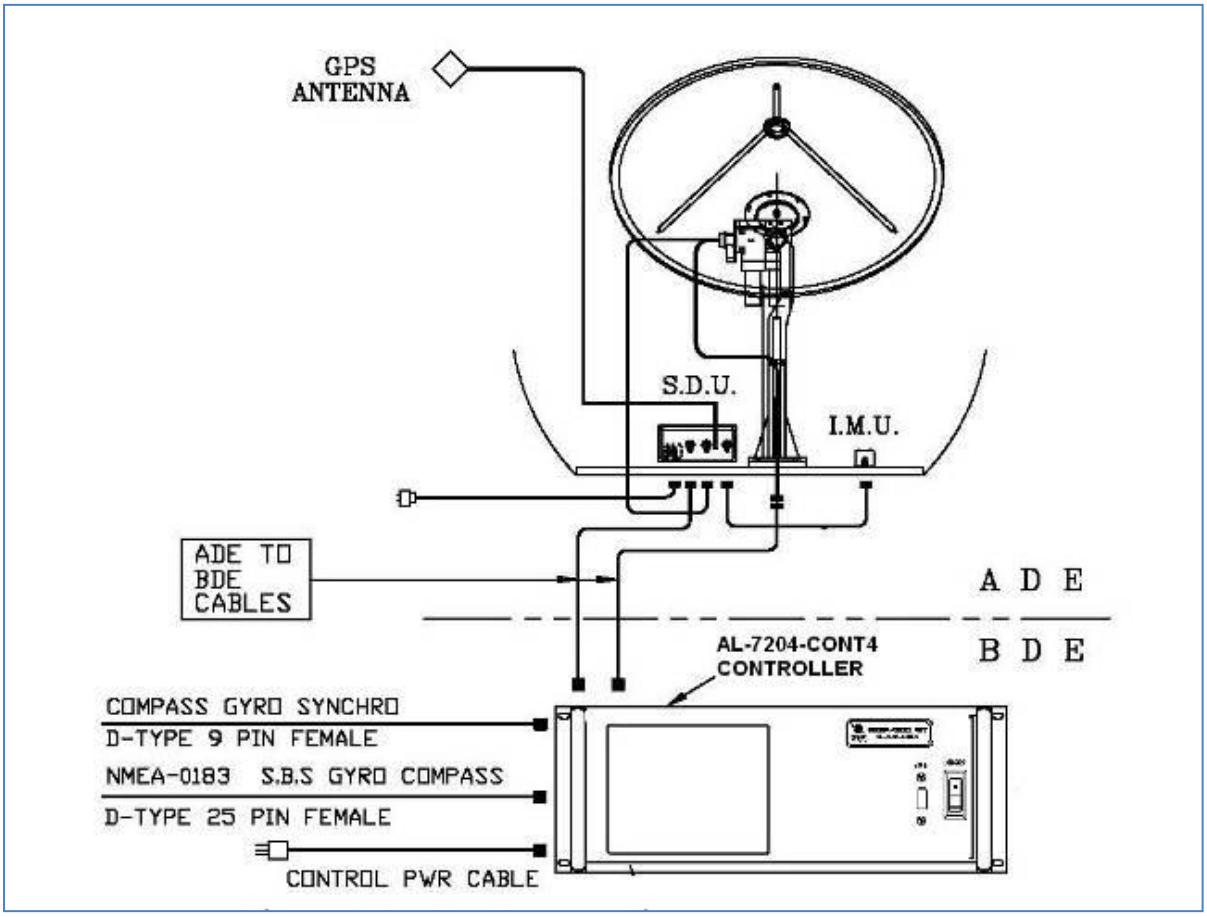


Figure 4-8. TVRO System - Block/Interconnection Diagram

4.1.5.2 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.

4.1.5.2.1 Auto-Restart

When the system is turned-on, an Auto-Restart sequence is initiated, which includes the following steps:

Encoder Initiation procedure, which lasts up to 40 seconds. At the end of this procedure, the antenna is positioned at the 0, 0 position (zenith).

IMU Initiation procedure, which lasts up to 360 seconds. At the end of this procedure, the IMU is “locked”, i.e., the antenna is slaved to and stabilized by the 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

Wait until the auto restart sequence is terminated, and the IMU status is “Locked” before selecting a satellite.

4.1.5.2.2 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 that lists all these satellites. The operator selects a satellite and thus activates the Acquisition Mode.

4.1.5.2.3 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

Ship’s position (given by the GPS)

Ship’s heading (given by the ship’s gyro compass, or manual pier-side input)

Ship’s Pitch and Roll (given by the IMU pitch and roll sensors)

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

4.1.5.2.4 Step-Track Mode

This mode is intended for tracking low angular-dynamic targets such as geo-stationary satellites having some inclination. In this mode, the system maintains the antenna boresight directed towards the satellite.

The ACU implements periodic step-track of the antenna positioner in the Elevation axis (Up/Down) and in the Azimuth axis (CW/CCW) for re-positioning to the point of the maximal reception level.

4.1.5.2.4.1 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 the disregarded - previous peak point prevails.

This improves the case where the system does not see any signal because of temporary blockage, and just wonders 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 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 per operator set-up).

The first five steps do not have any delay between them (continuous steps), even if the Step-Track set-up specifies for “Re-Step time” other then 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, Preset, Stand-by, Step-Track, Restart.

4.1.5.2.5 Search Mode

In this mode, the ACU 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-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 the signal.

If during the pre-defined amount 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, Preset, Stand-by, Step-Track, Restart.

4.2 ADE Sub Assemblies

4.2.1 Servo Driver Unit (SDU) AL-7200-SDU-07

The AL-7200-SDU-07 Servo Driver Unit is an outdoor, compact sized box including Brushless-Motors Servo Drivers and a GPS Receiver. The SDU also provides power to the ADE.

The AL-7200-SDU-07 contains 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 4-9. SDU AL-7200-SDU-07 General View

4.2.1.1.1 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 – SDU's ON/OFF switch. In the ON position, the green LED illuminates.

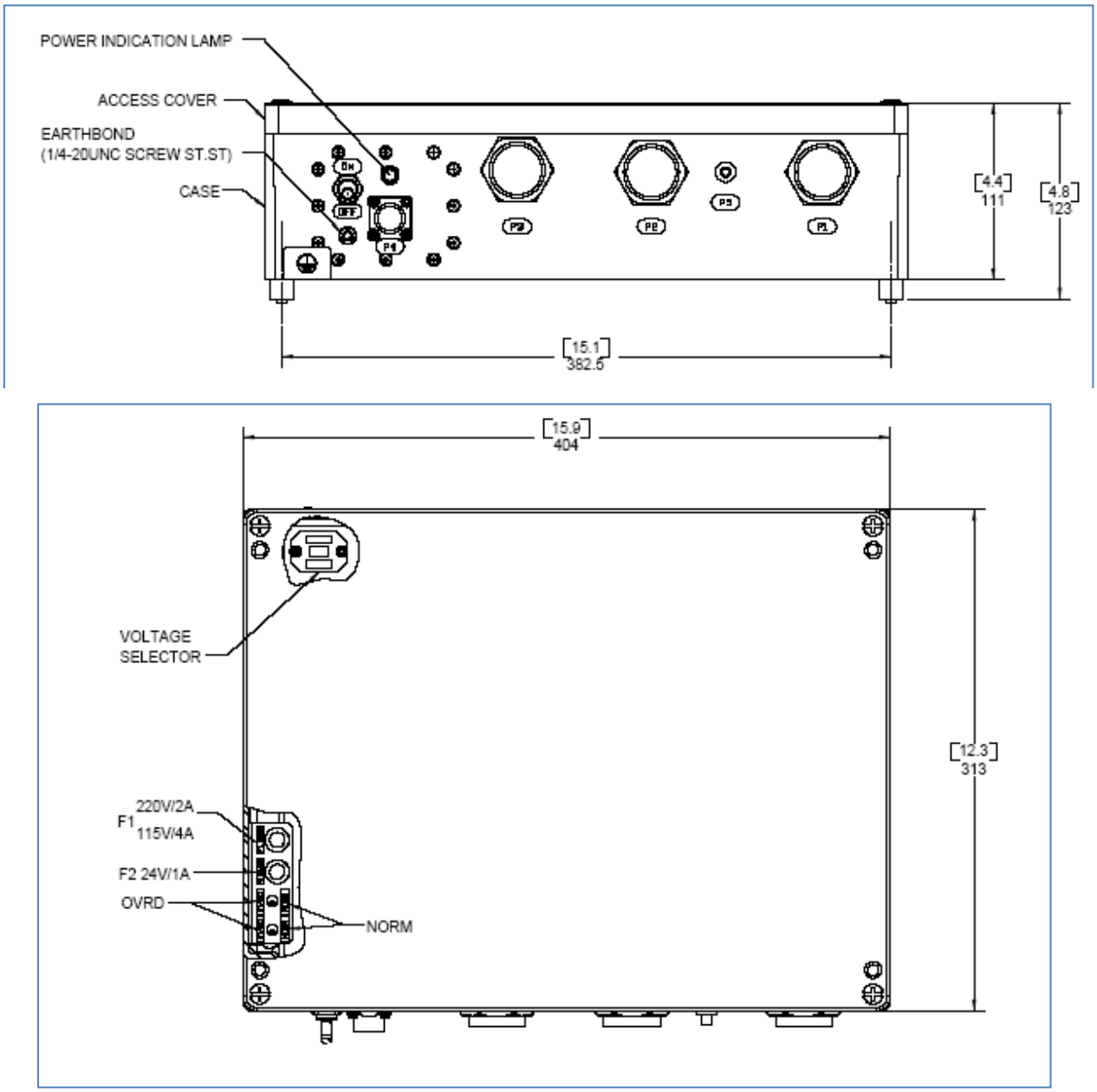


Figure 4-10. SDU Outline Drawing

4.2.2 Inertial Measurement Unit (IMU) AL-7203-IMU-NT3

The Inertial Measurement Unit (IMU) is the “heart” of the antenna stabilized TVRO system. The task of the IMU is to provide accurate dynamic readings of the antenna platform 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 ship’s gyro.

The AL-7203-IMU-NT3 is a solid-state (static sensor platform) inertial measurement unit, designed to stabilize a Ku antenna on a small ship, using the ship’s gyro as a heading long-term reference. The IMU provides extremely accurate information on ship’s motion in Pitch, Roll and Yaw axes.

The Controller software utilizes a 3D-calibration algorithm to correct the individual sensor readings in real-time, thus producing over-all pitch-roll-yaw angle accuracy of better then 0.5 degree.

The AL-7203-IMU-NT3 is an accurate and agile device, suitable for operating in harsh dynamics of a relatively small vessel, such as a yacht.

4.2.2.1 Specifications

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 it is also supplied with the IMU (on a floppy disk). If an IMU must be replaced, its individual set of calibration-parameters must be copied into the Controller’s memory.

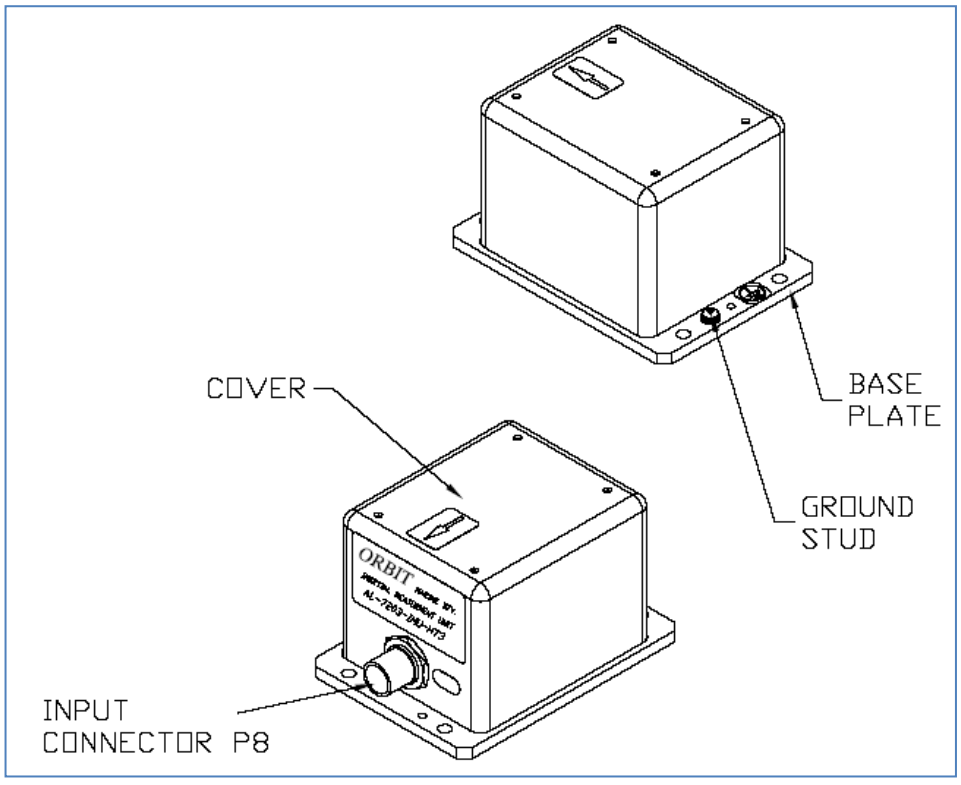


Figure 4-11. AL-7203-IMU-NT3 General View

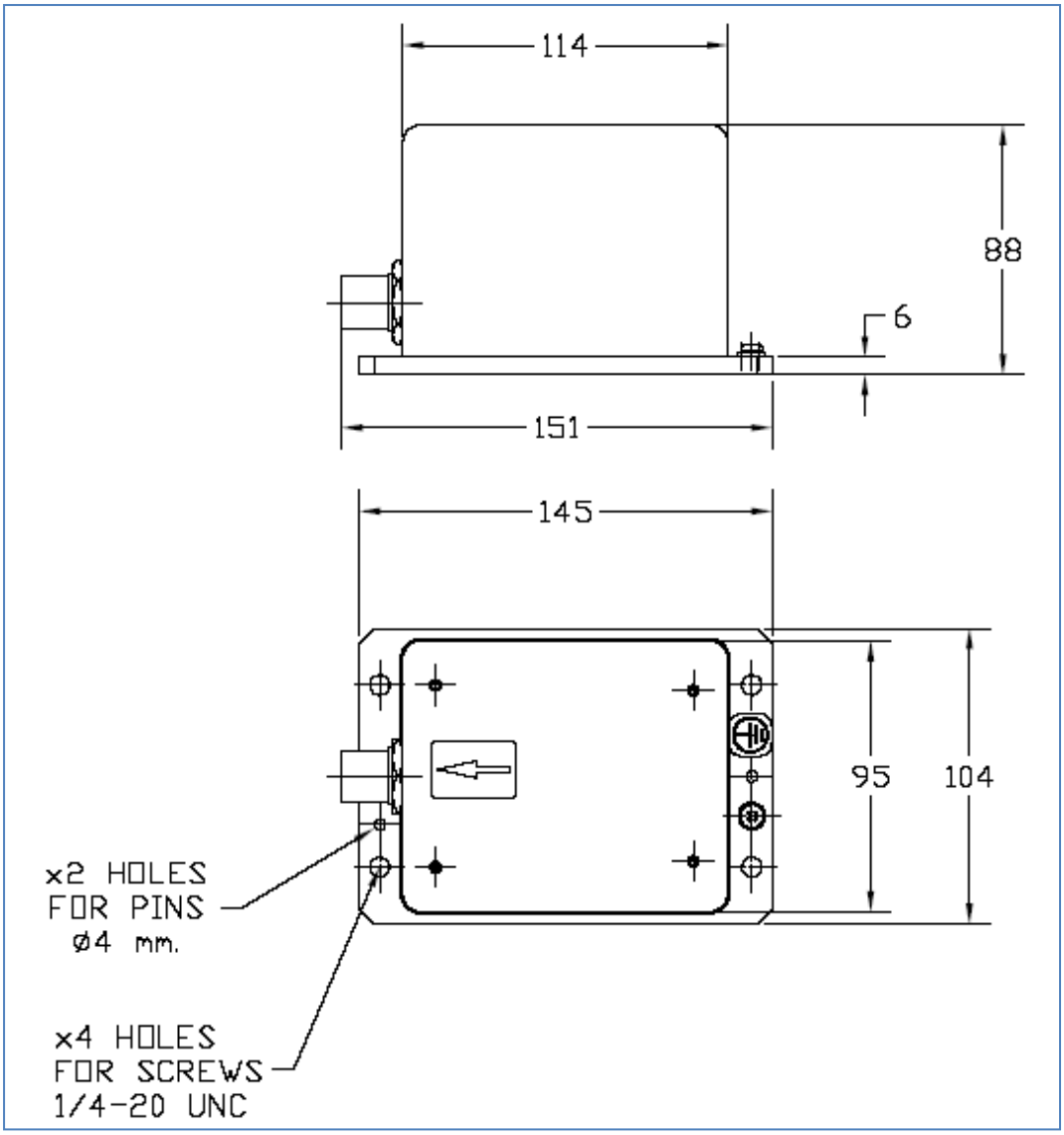


Figure 4-12. AL-7203-IMU-NT3 Outline Drawing

4.2.3 X/Y Pedestal AL-7204-1B

The X/Y pedestal can carry the antenna to any required angle, at high speed and high 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 utilizes 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) and no requirement for rotary joints or slip rings.

NOTES

- *The dish is mounted on the Y axis.*
- *To improve operation, the system should be installed with the X axis pointed toward an obstruction to satellite visibility. The X axis direction is marked 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-7204-1B Pedestal are:
- High torque brushless motors
- High accuracy planetary gear
- No azimuth slip rings, rotary joint or cable wraps are needed
- Continuous rotation
- High accuracy at extreme dynamics
- Exceptional reliability by use of brushless motors and encoders
- Unique and clean design
- Easy installation and maintenance

NOTE

The pedestal nameplate indicates the factory-measured Encoder offset values of the X and Y axes. When replacing the pedestal, these values must be entered into the ACU, via the Maintenance screen, as the Pedestal X and Y axis offsets.

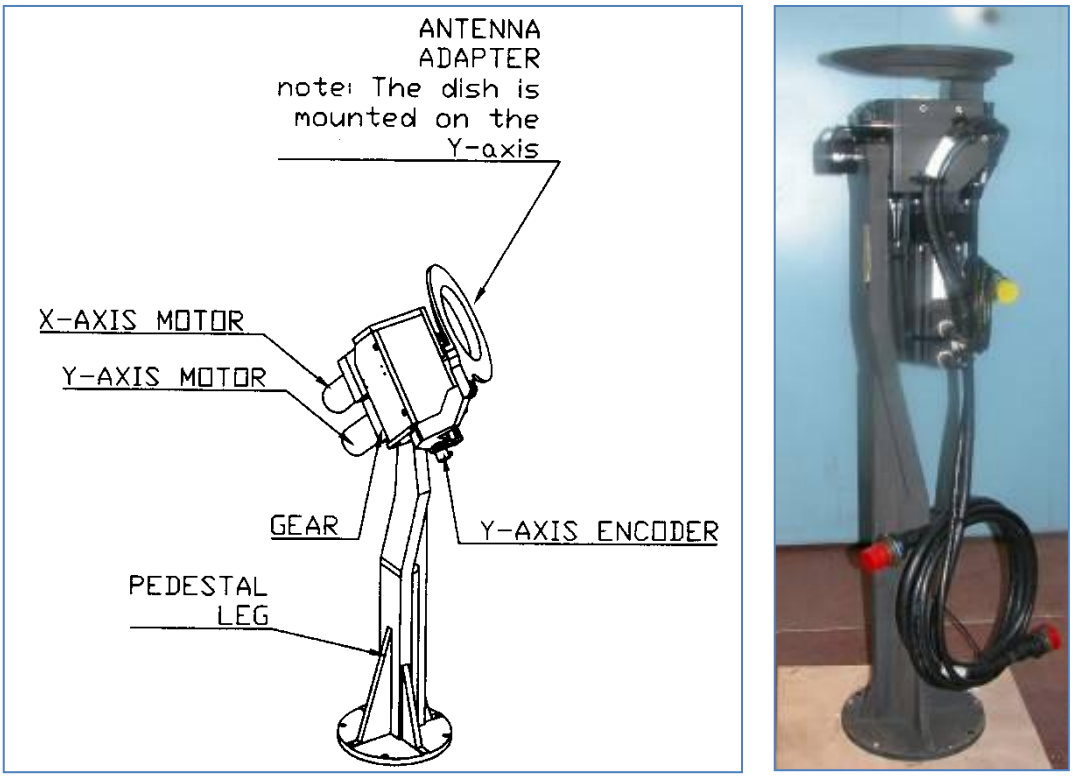


Figure 4-13. Pedestal General View

4.2.4 Antenna and Feed Assembly

4.2.4.1 Universal Feed Mount

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

Figure 4-14. Universal Feed Mount and Available Feed Assemblies

4.2.4.2 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	AL-7204-POLB	Global Linear Ku coverage
 DBS LNBF Assembly	KIT28-0520	USA DBS coverage
 GLA LNBF Assembly	KIT28-0521	Galaxy Latin America coverage

4.2.4.3 Installation of Feed Assemblies

For feed installation instructions, refer to Chapter 4 in this manual, which provides installation guidelines for each feed, and describes the required software configuration changes.

5 BASIC OPERATION

5.1 INTRODUCTION

This section describes the basic operation procedures of the system, to be carried out by the system operator on the ship.

5.2 ACU MMI PRINCIPLES

The below-deck AL-7204-CONT4 ACU controls, monitors and configures the system. Using the ACU's LCD screen, the operator can monitor system status, and using the built in keyboard, menus and functions can be selected, and operational parameters can be changed.

In any screen, the Up and Down arrow keys are used to select one particular item (the Right and Left arrow keys are not active for this function). The item appearing under the blue highlighted bar is the selected item. The "ENTER" key is then used to activate the selection.

Additional controls and utility items are located on the ACU:

- Power ON/OFF switch
- RESET button
- USB port
- Keyboard & Mouse connector

NOTE

The password is factory-set and cannot be altered.

5.3 GETTING STARTED - POWER UP SEQUENCE

1. To power up the ACU, turn ON the ACU's power switch on the rear panel. This commences an automatic restart procedure.
2. After a few operating system messages, the Banner/Self-Test screen appears (refer to the following figure), indicating that the ACU performs the self-test procedure. This screen

is shown for a period of 10 seconds, during which a 10-to-0 countdown is displayed.

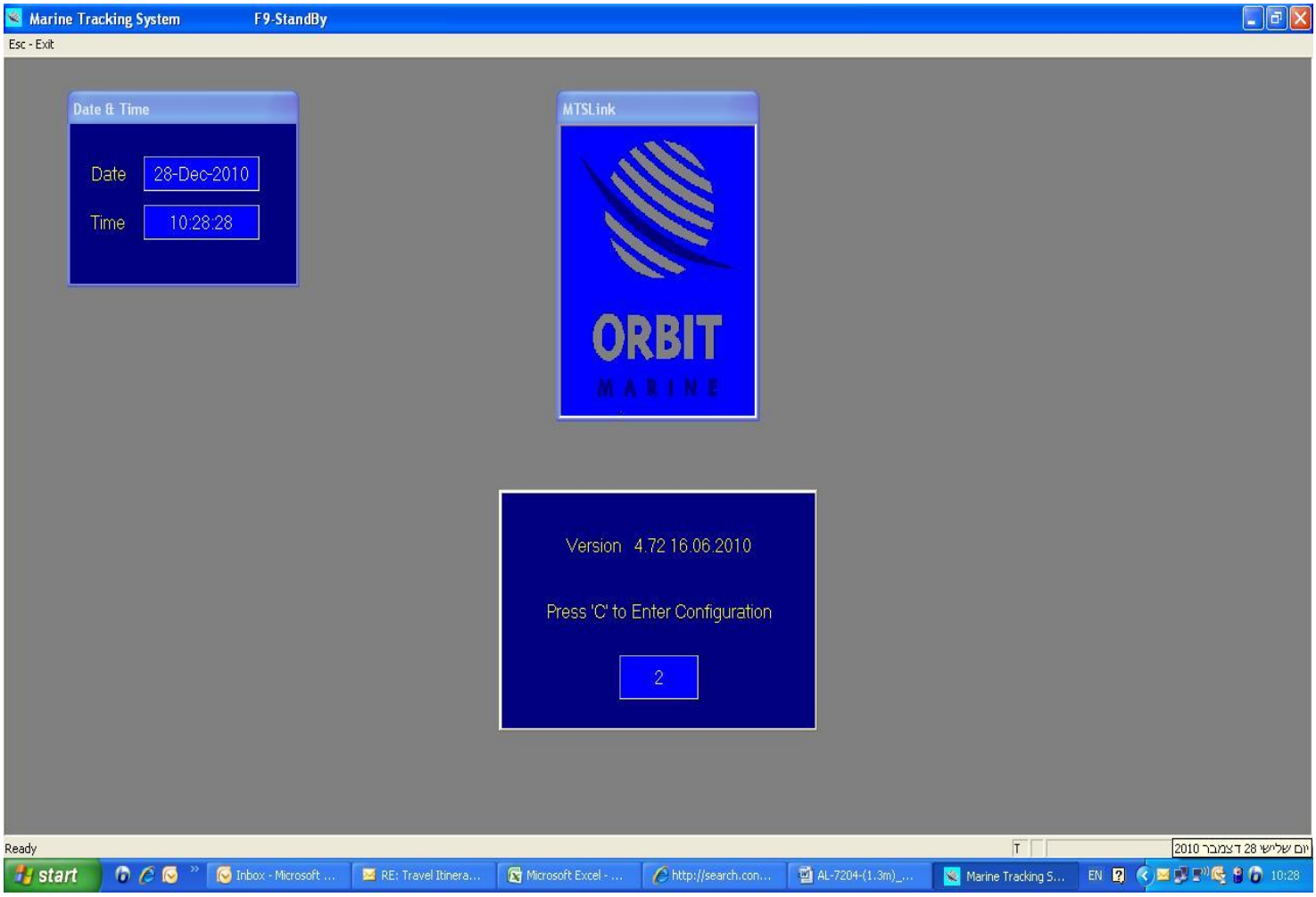
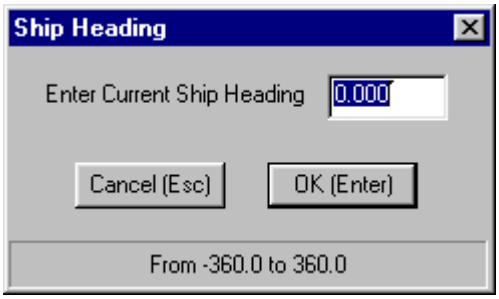


Figure 5-1. Banner/Self-Test Screen

NOTE

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



Typical ship's gyro compass with Incremental-type interface:

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

3. After the self-test procedure is successfully completed, 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 completed, 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 searches for the required satellite within a pre-defined sector. When the received signal AGC exceeds the acquire level, the system automatically revert to Step-Track mode in order to lock on 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 re-positioning to the point of the maximal reception level.

5.4 BASIC OPERATION SCREEN DESCRIPTION

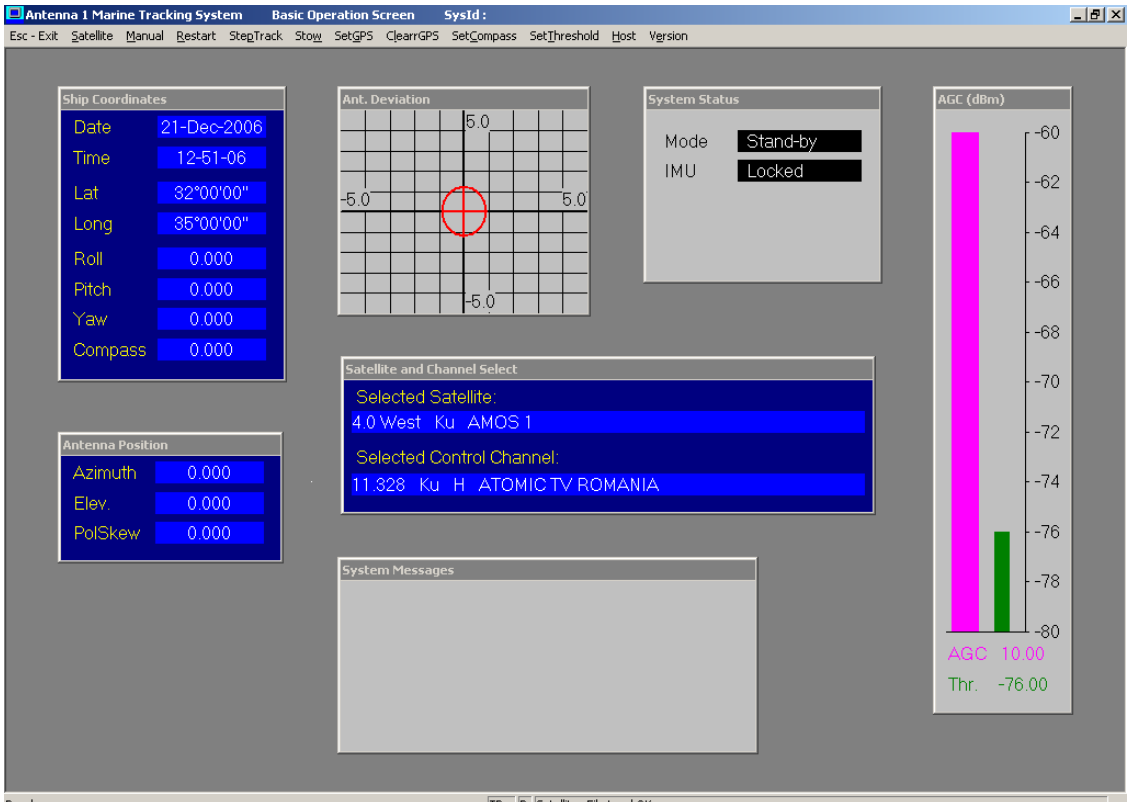


Figure 5-2. Basic Operation Screen

Using the Basic Operation screen, the operator monitors the system parameters, 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 operator.

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 5-1: Basic Operation Screen Fields

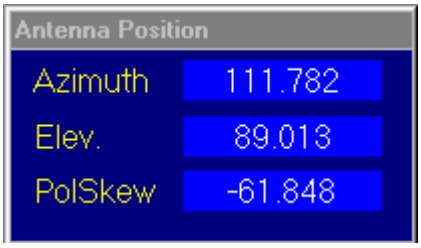
	**Ship Coordinates Field:** • **Date -** From the internal CPU Card • **Time-** From the internal CPU Card • **Lat** - Ship's latitude- From the GPS receiver • **Long** - Ship's longitude - From the GPS receiver • **Yaw -** IMU Yaw • **Pitch -** IMU Pitch • **Roll –** IMU Roll • **Comps** - Ship's Heading (as read from the ship's compass or as entered manually)
	**Antenna Position Field:** The ACU constantly calculates and presents the following parameters: • **Azimuth** - Azimuth axis angle • **Elev.** - Elevation axis angle • **PolSkew** - Polarization Skew axis angle.

Table 5-1: Basic Operation Screen Fields

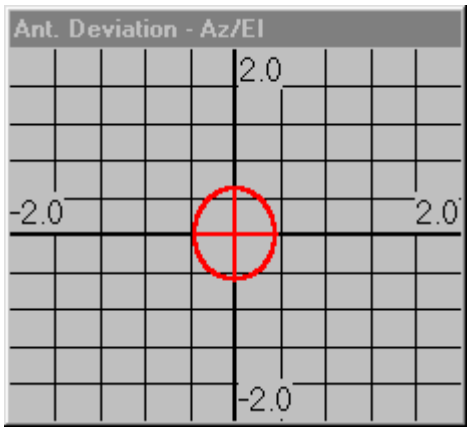
	**Antenna Deviation Field:** This field graphically depicts the tracking error of the antenna (the error between true boresight as calculated by each step-track and the mechanical boresight to which the antenna is pointed), presented in two-dimensional cross-hair type error display. The deviation is presented in degrees of AZ/EL.

Table 5-1: Basic Operation Screen Fields

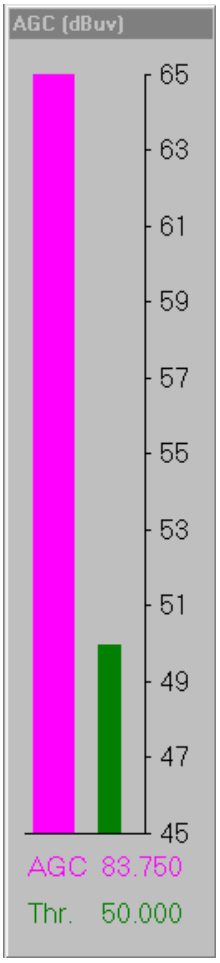
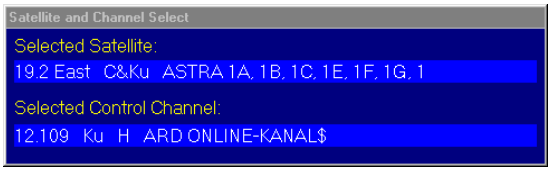
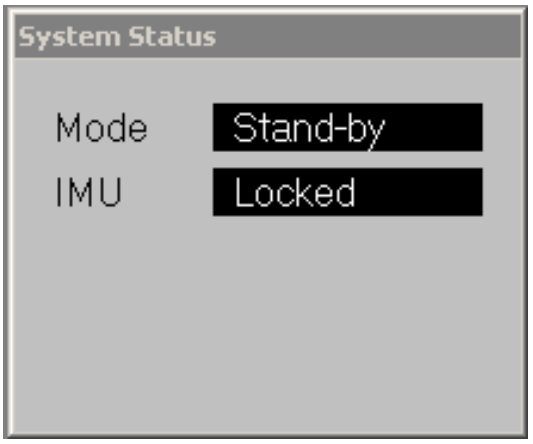
	**AGC Field:** This field presents (both graphically and numerically) the AGC signal level, which represents the strength of the satellite's signal that is received by the antenna. A threshold level is also shown for reference.
	**Satellite and Channel Select Field:** This field presents the following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

Table 5-1: Basic Operation Screen Fields

	**System Status Field:** This field presents the following information: • **Mode –** Current operational mode (StndBy, Step-Track, etc.) • **IMU -** IMU status (locked, unlocked, init, preset).
	**System Messages Field:** The System Messages Field displays the following types of indications: • Messages (green and have no preamble) - Such as “Auto-Restart in progress” or “Acquiring a satellite”… • Warnings (blue and have a “Wrn:” preamble) - Such as “No GPS Position Updates” or “Synchro Compass Fault”… • Errors (flashing-red and have an “Err:” preamble) - Such as “Auto-Restart Failed” or “Pedestal Axis X Mech Fault”…

5.5 SATELLITE AND CHANNEL SELECTION

5.5.1 Guidelines for Satellite and Tracking Frequency Selection

Satellites transmit to limited areas. To receive any given satellite signal, the ship must be within its 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 areas of Ocean in between.

In addition to the system being inside the satellite's footprint, the operator must also select a tracking frequency which is being transmitted inside that footprint. The system will not work if trying to receive a channel transmitted to South America if the ship is located in Europe.

Select a channel with frequency as close as possible to the desired receive frequency. If multiple channels are to be viewed, select a channel at a middle frequency.

Since some satellites transmit to multiple areas and some channels are only available in one 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 given for each Channel: Frequency (GHz), Polarization (H-Horizontal, V-Vertical, L-Left hand Circular, R-Right hand Circular), channel name.

5.5.2 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 is terminated, and the IMU status is "Locked".

1. Press the "S" key or click the Satellite option. The following window opens listing the available satellites:

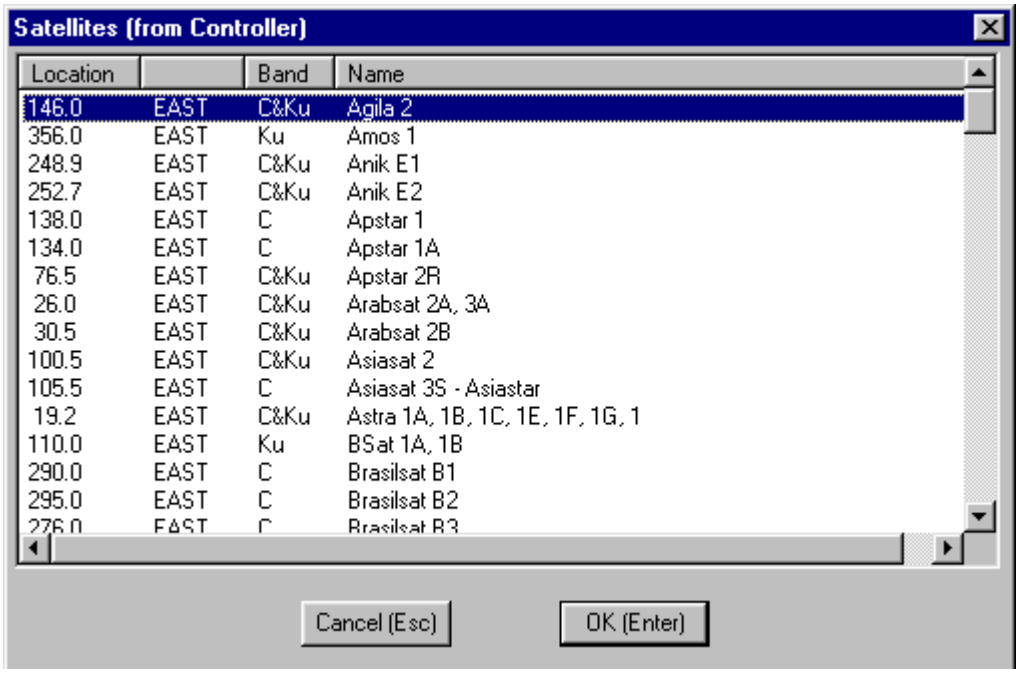


Figure 5-3. Satellites listing window

If the required satellite is not listed, this may be because the ship'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, listing the available selected-satellite channels (transponders - satellite frequencies):

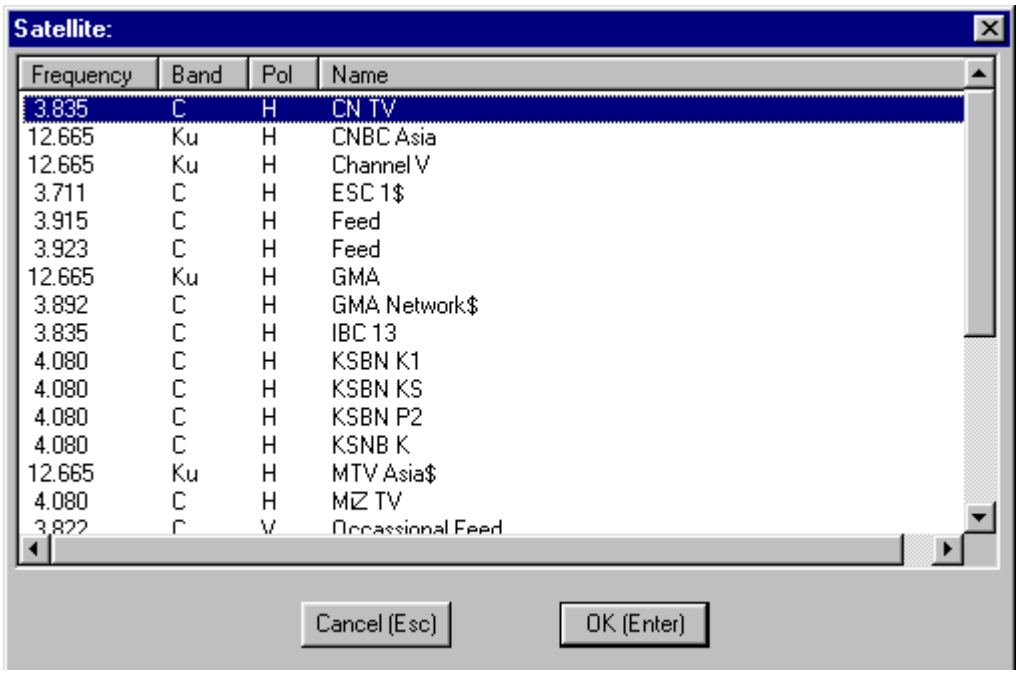


Figure 5-4. Satellite channel listing window

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

5.5.3 Selecting Tracking Frequency Using the Spectrum Analyzer Screen (SAS)

5.5.3.1 Introduction

Use the Spectrum Analyzer Screen (SAS) to select the optimal tracking frequency,

The Spectrum Analyzer Screen (SAS) is used for Viewing Wide-Band Satellite Spectrum. The Spectrum Analyzer screen will only work with Wide-band tracking receiver selected.

To open the Spectrum Analyzer Screen (SAS), press “R”in the “Operation Screen” or “Maintenance Screen”.

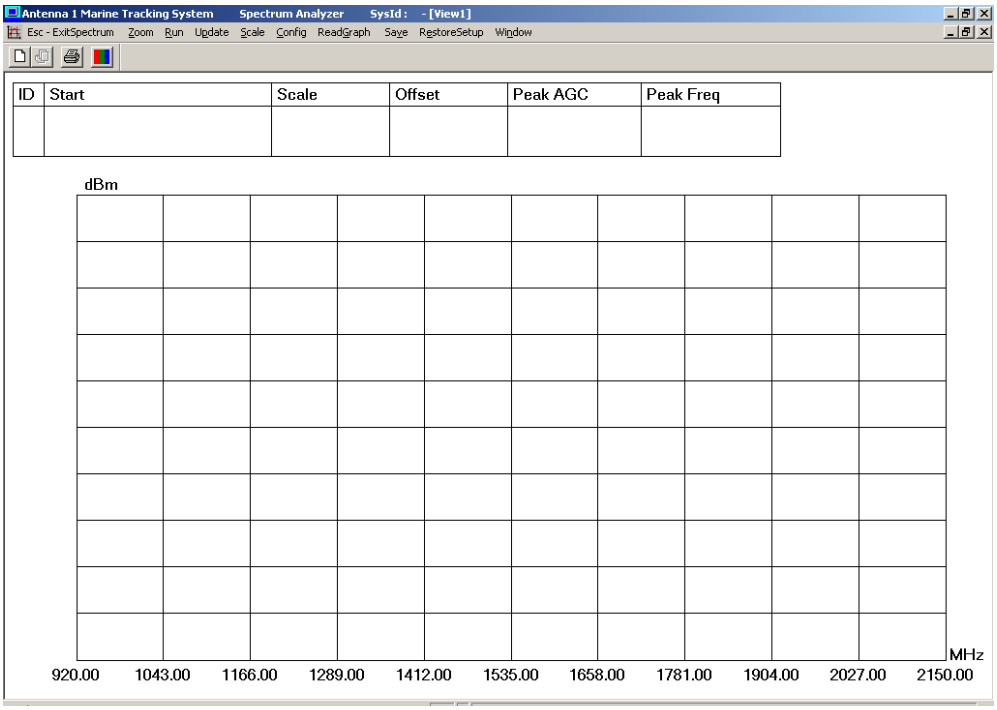


Figure 5-5. Spectrum Analyzer Screen (SAS)

Press “C”to configure the Spectrum Analyzer measurement: The Configuration window opens.

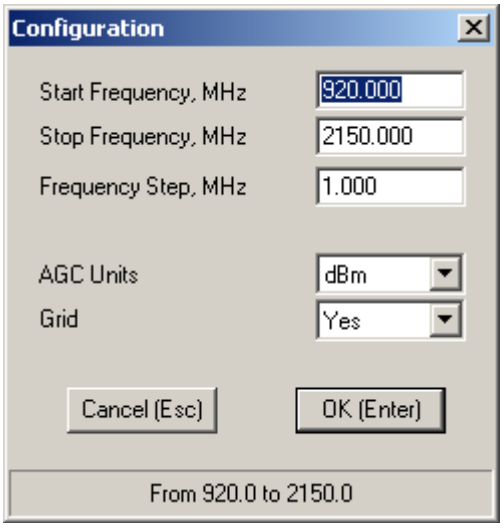


Figure 5-6. Configuration window

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

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

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

Frequency Step can be set up to as fine as 0.125 MHz, but take into consideration that the measurement time rises as the number of steps increase.

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

1. To take a measurement, first make sure that the system is not in “Step-track” since this uses the Tracking receiver resource. If the system is currently in “Step-track” – turn it to “Peak”.
2. To run the Spectrum Analyzer 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.

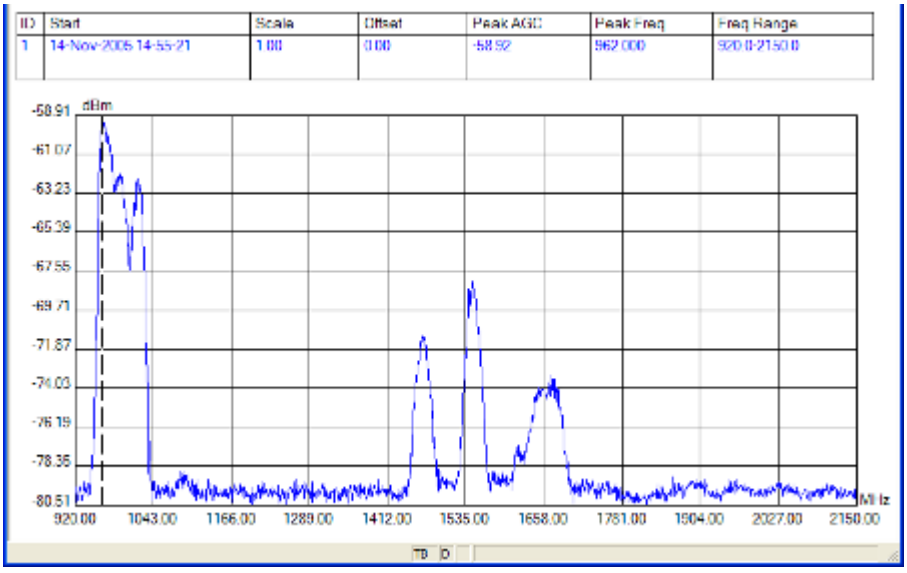


Figure 5-7. Example: Satellite: Amos 4.0 West, Horizontal Pol, Ku-Band, LNB LO 10.0 GHz

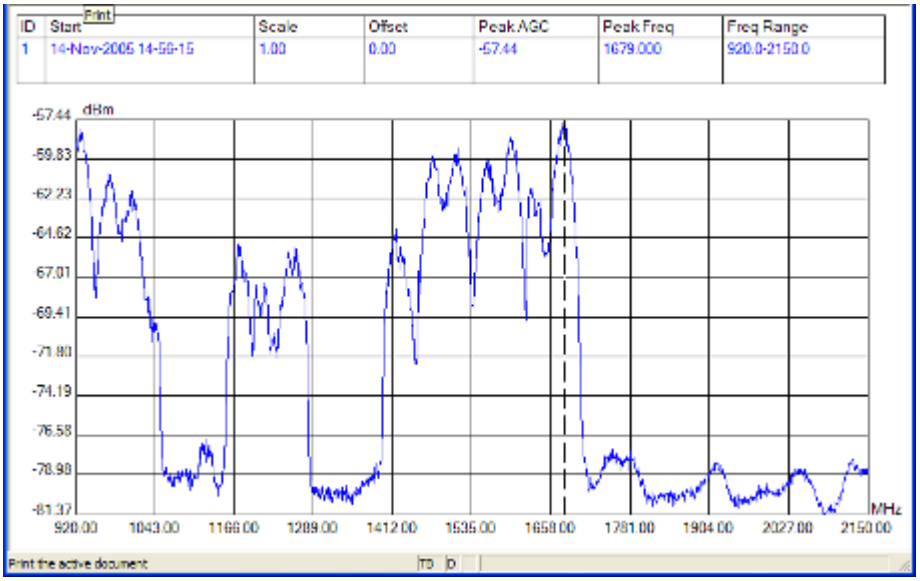


Figure 5-8. Example Satellite: Amos 4.0 West, Vertical Pol, Ku-Band, LNB LO 10.0 GHz

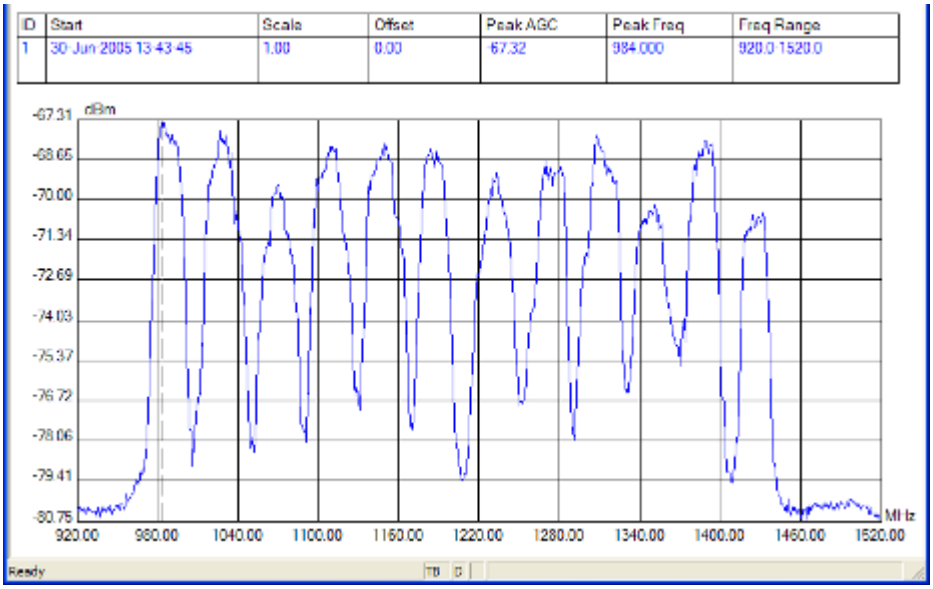


Figure 5-9. Example Satellite: Arabsat 26.0 East, C-Band, Linear Pol Satellite as seen with Circular Pol antenna

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

After a Satellite Spectrum is presented on the Spectrum Analyzer Screen, a vertical dotted line marks the highest-level frequency:

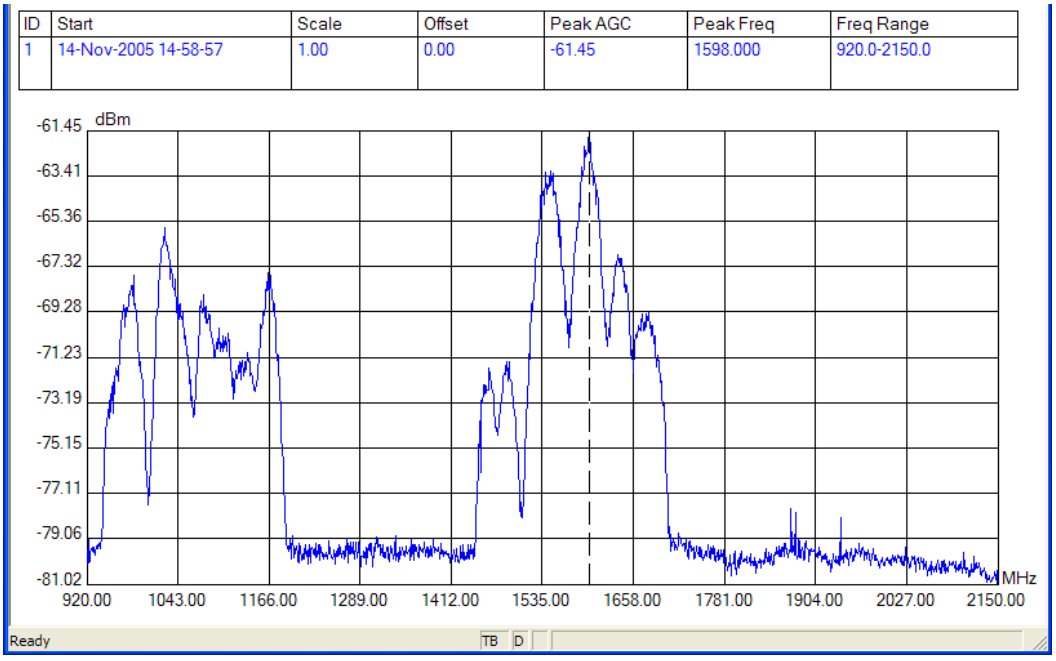


Figure 5-10. Example: Satellite: NSS6 95.0 East, Vertical Pol, Ku-Band, LNB LO 10.0 GHz

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:

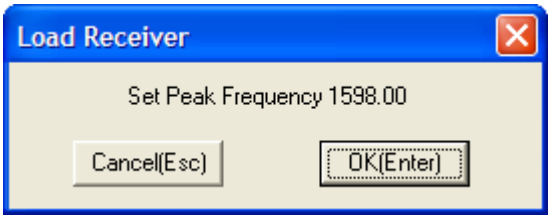


Figure 5-11. Load Receiver confirmation

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

5.5.3.3 Using SAS for Satellite Identification

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

First measure the current satellite pattern:

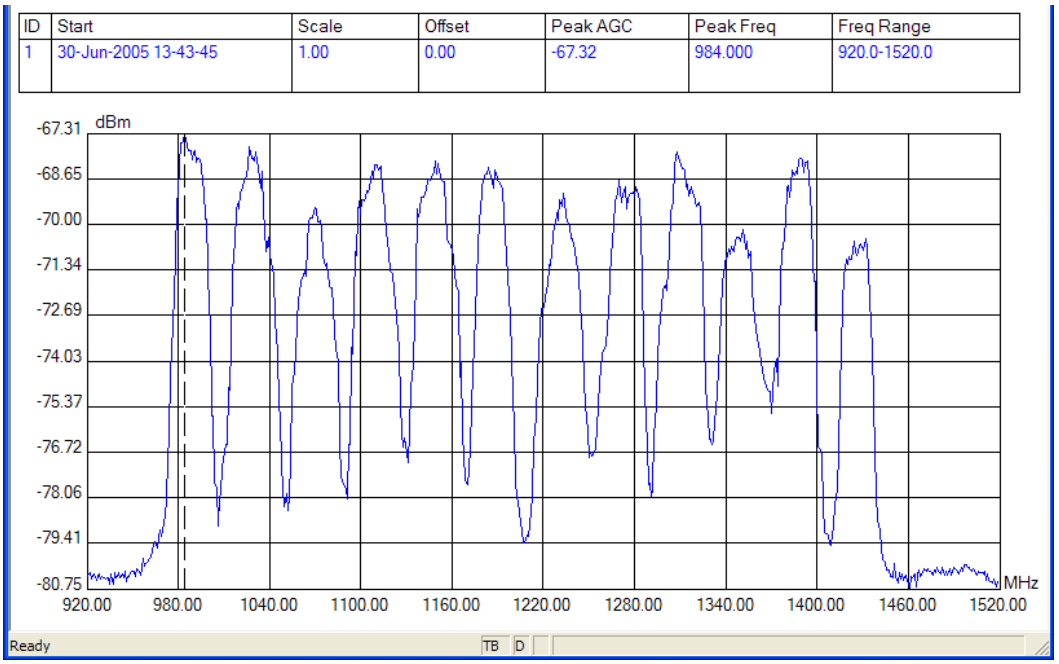


Figure 5-12. Measuring the current satellite pattern

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

Figure 5-13. ReadyGraph > Selected File > Add Menu

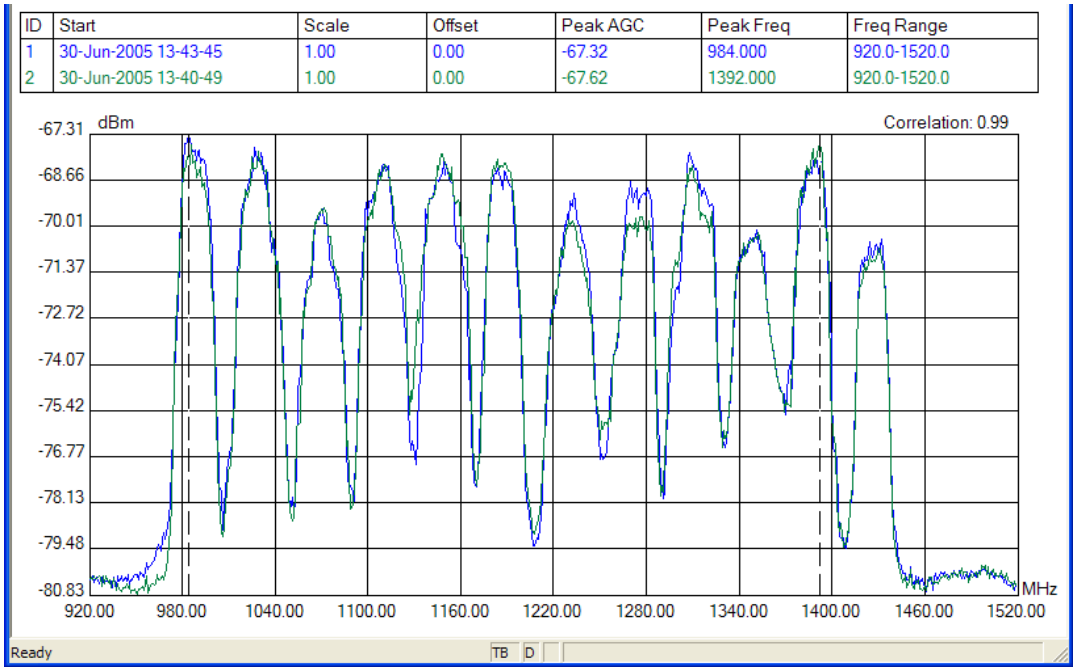


Figure 5-14. Graph showing added satellite pattern

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

If the two curves are not so obviously similar, it is possible to use the “Correlation” number, which is calculated and presented on the upper right corner. In this example, the Correlation is 0.99 out of 1.00.

Usually Correlation of over 0.8 means positive satellite identification.

5.6 USING THE MANUAL MODE TO MOVE THE ANTENNA

NOTE

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

To invoke the Manual Mode, which enables to manually move the antenna axes:

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

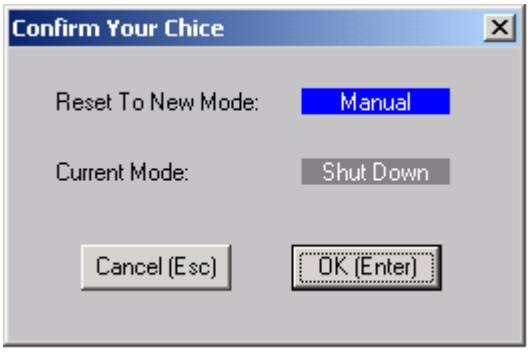


Figure 5-15. Confirmation window

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

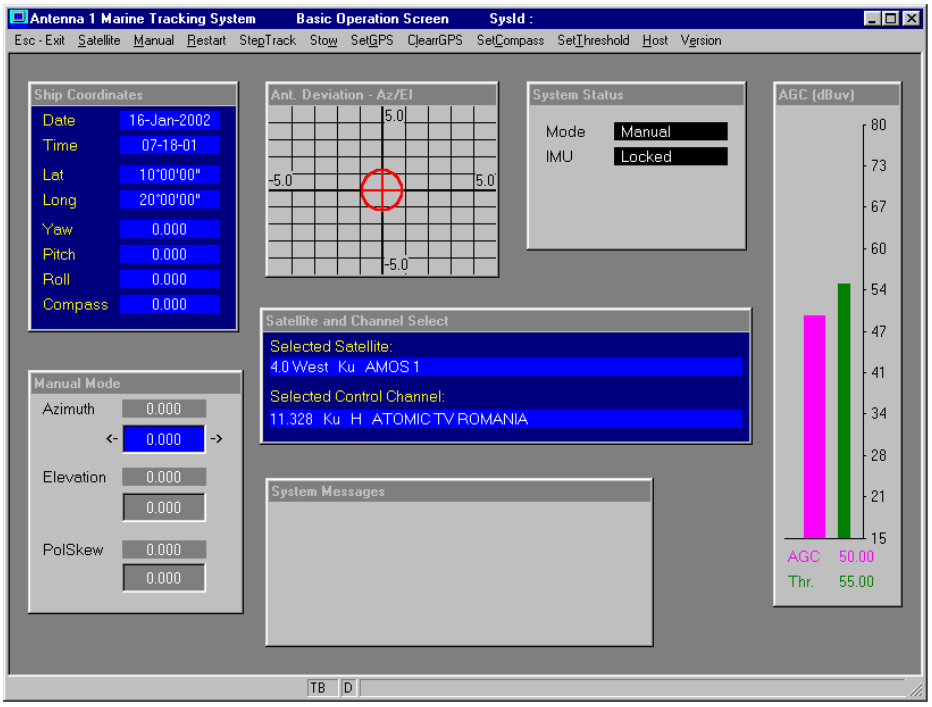


Figure 5-16. Manual Mode window in Basic Operation screen

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 one shows the new manually modified angle.

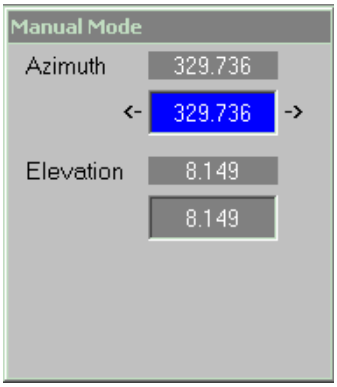


Figure 5-17. Manual Mode window showing current and manually modified values

5. To move the antenna to 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). Default setting: 0.1-degree steps.

5.7 RESTARTING THE SYSTEM

NOTE

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

To restart the system:

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

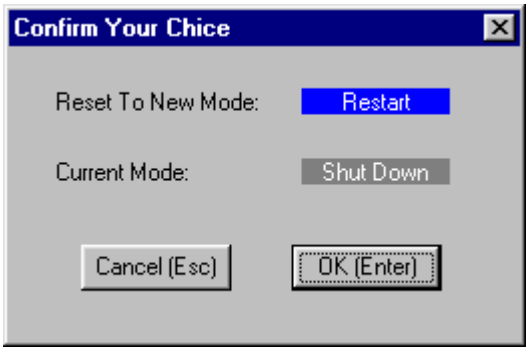


Figure 5-18. Confirmation window

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

5.8 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 be accessed only from the pertaining Advanced Operation screen.

To invoke the Step Track mode,:

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

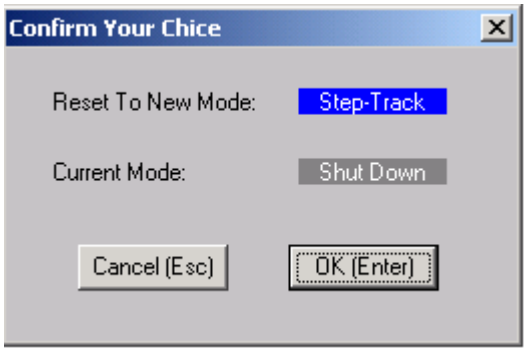


Figure 5-19. Confirmation window

2. Press ENTER to confirm. The system will switch to Step-Track mode.

5.9 SETTING GPS COORDINATES

NOTE

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

To set new GPS Longitude and Latitude coordinates:

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

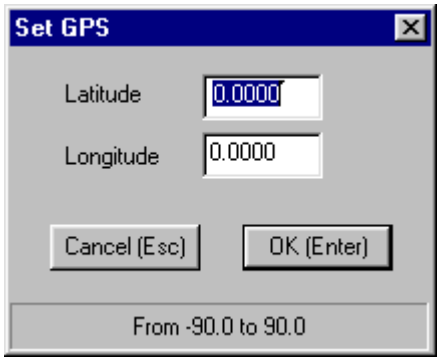


Figure 5-20. Set GPS window

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.

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*

5.10 CLEAR GPS

NOTE

The following function is available only if the Basic Operation Screen menu includes the appropriate command. Otherwise, this function can be accessed only 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 5-21. GPS Reading warning

2. To confirm, 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.

5.11 SETTING COMPASS

NOTE

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

To set new Compass angle:

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

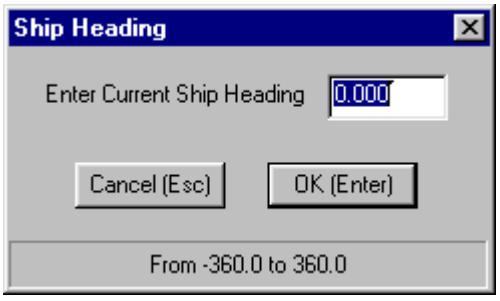


Figure 5-22. Shi Heading window

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 type, (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.

5.12 SETTING AGC THRESHOLD

NOTE

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

To set new Threshold level:

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

Figure 5-23. Set Threshold window

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

5.13 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 be accessed only from the pertaining Advanced Operation screen.

To shut down the system:

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

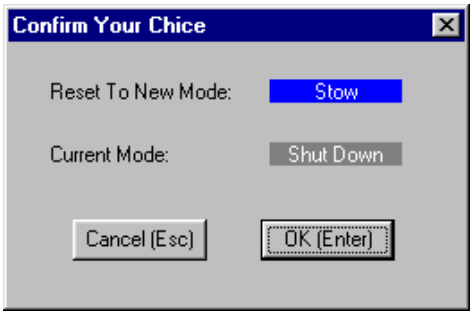


Figure 5-24. Confirmation window

2. Press ENTER to confirm.
3. The antenna moves to the pre-defined Stow position and then halts. In this situation the IMU is unlocked and the antenna is not stabilized.
4. Press ESC and 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 shutdown 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).

6 ADVANCED OPERATION

6.1 INTRODUCTION

This section describes the advanced control functions of the Controller Software.

CAUTION

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

6.2 ACCESS TO ADVANCED CONTROL FUNCTIONS

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

Figure 6-1. Password window

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

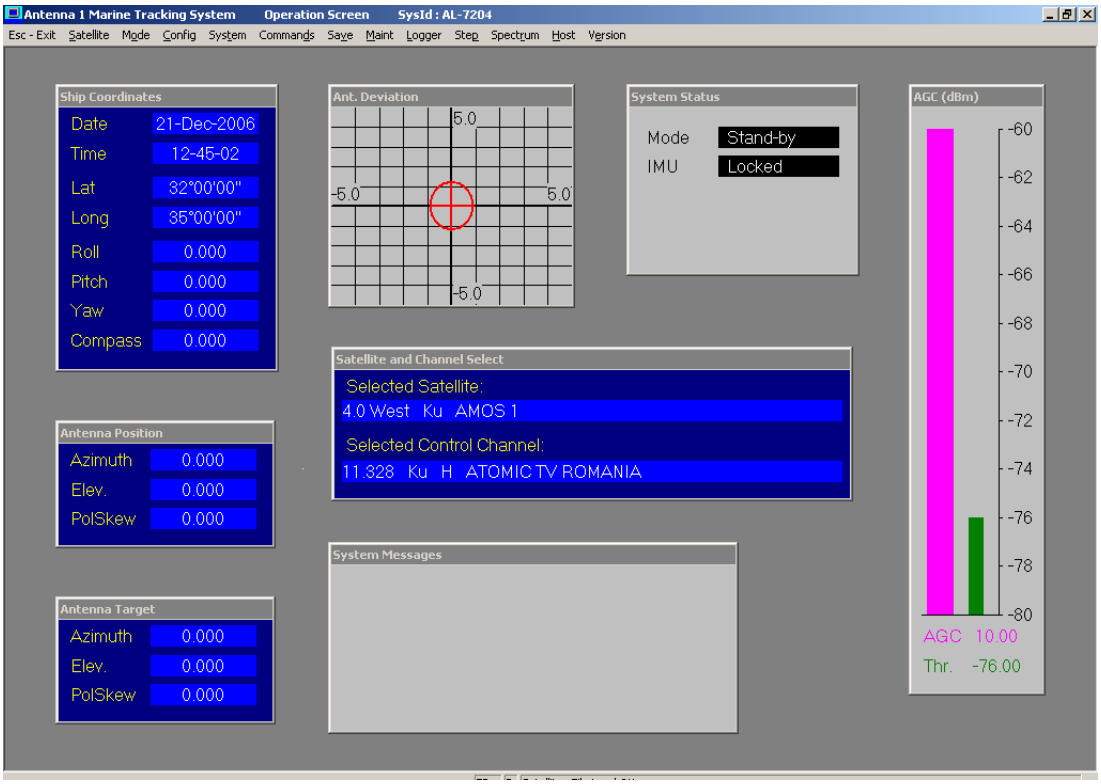


Figure 6-2. Operation Screen

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.

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 6-1: Advanced Operation Modes

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

Table 6-1: Advanced Operation Modes

Menu Option	Shortcut Key	Function	Description
			Step Track mode Satellite Preset – Sends the antenna to a satellite according to its location on the geo-synchronic arc Stow – Sends the antenna to a stow position 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. For each axis, the maintenance screen allows monitoring and changing of operational parameters, changing individual axis modes, and enabling system's 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 set-up in advance and set to trigger at a given 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.

6.3 TROUBLESHOOTING GUIDE

6.3.1 Introduction

Use the following troubleshooting guide when a problem or malfunction is 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 required to repair the system.

6.3.2 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 the symptom persists after performing all recommended actions for a specific possible cause, proceed with the next possible cause.
3. Repeat step (2.) until the malfunction symptom disappears.
4. In case the malfunction is not eliminated by the troubleshooting procedure, consult ORBIT.

6.3.3 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 color:

Message - green (e.g. System Shut-Down, Pedestal Y Axis Jammed)

Warning – blue (e.g. Compass Communication Failed)

Error –red (e.g. Pedestal X Axis Encoder Fault).

The following Table lists all the messages.

Table 6-2. 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 for over 1.5 seconds.
"Warning: GPS Communication Failed"	No valid communication frames were received on the GPS Com port for over 5 seconds.
"Warning: No GPS Position Updates"	No GPS position-fix frames were received on the GPS Com port for over 30 seconds.
"Warning: System not initialized"	The AL-7103 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
"Warning: Antenna view blocked"	The Antenna has moved into one of the predefined blockage areas
"Warning: No communications with host"	The communications with the host computer, identified by a predefined IP address, has timed-out (10 seconds).

Message	*Possible Cause*
"Warning: Signal below threshold"	The controller signal strength indication (AGC) on the selected frequency is lower then the predefined threshold level.
"Warning: IMU-ACU Communication Fault"	The communications between IMU and the controller has timed-out.
"Warning: Receiver Cal Table not Found"	The SBC 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 Exceeds Limit.
Messages (Information)	
"Auto-Restart in progress"	System is going thru initialization stage including – IMU init, Encoder init and optionally, Satellite acquisition
"Acquiring a Satellite"	System is currently acquiring a satellite
"System no initialized"	Encoder and IMU were not yet initialized.
"System Shutdown"	System was shut down
"System Shutdown, Ped-X Jammed"	System was shut down due to "Pedestal-X Jammed" fault (No. 36)

Message	*Possible Cause*
"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 lout 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 lout of tolerance" (No. 121)
"System Halted, Axes Jammed"	System has experienced multiple jammed-axis faults. More than 6 occurred in two minutes – the system is therefore halted.

Table 6-3: 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 center and shield) at the LNB input. Check for 13V/17V voltage on coax cable (between center and shield) at the ACU output. NOTE: In Ku-Band, if only one polarity is missing, perform the above checks only on that polarity path.
	Faulty Ku-Band LNB.	**For Ku Band**: 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). Open the Maintenance screen, and check SDU 5V supply, +12V supply, and GPS updates. On the Maintenance screen, press “P” for power parameter and check all valid voltages in I/O Card, Receiver Card, IMU and SDU. **Turn OFF the ADE power**, and check cables, connectors and power supply in the AL-7204-SDU.

Table 6-3: Troubleshooting Guide

Symptom	*Possible Cause*	*Corrective Action*
	Faulty pedestal axis. 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: **NOTE** *The messages are classified into three categories, each identified by a different color:* • *Message - green* • *Warning - blue* • *Error –red.* *Errors may be configured to shut down system operation on their occurrence.*		
Pedestal X Axis Jammed **Pedestal Y Axis Jammed** **Polarizer Axis Jammed** Accompanied with the following messages, respectively: **System Shut-Down, Ped-X Jammed** **System Shut-Down, Ped-Y Jammed**	A situation occurred when a 100% command was initiated to a particular axis, but it didn't move as expected. Note: For polarizer axis, this error is applicable only if the AL-7204-POL feed is installed. Note that the "System Shut-Down…" messages will appear if the above errors are configured to shut-down the system on their occurrence.	Check for mechanical obstructions and interference. Restart system. If problem persists, consult Orbit.

Table 6-3: 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 axis jam or inability to find encoder zero mark.	Check for mechanical obstructions and interference. Restart the system, if the fault persists, consult Orbit.
SDU/IMU power out of tolerance **I/O power out of tolerance** **LNB voltage out of tolerance** **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 **Receiver 2 card not recognized** **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 (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.

Table 6-3: Troubleshooting Guide

Symptom	*Possible Cause*	*Corrective Action*
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. If these conditions do not exist, check cable between the ADE and the controller.
No GPS Position Updates	The GPS position updates rate, normally an update per second, is interrupted for more than 30 seconds. **NOTE** *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. Check GPS antenna cable and connector.
Illegal Step-by-Step Compass Data (Applicable when using a Step-by-Step compass)	Disconnected cable; Inactive compass; Disconnected compass	Check and connect compass cable; Check and connect compass.

Table 6-3: Troubleshooting Guide

Symptom	*Possible Cause*	*Corrective Action*
Synchro Compass Fault (Applicable when a Synchro type compass interface is selected (1:1, 36:1, 60:1, 90:1 or 360:1)	No 115VAC Reference - or - There is a too large tracking error inside the S/D converter - or - The synchro S1, S2, S3 signals are not present. - or - compass is inactive or disconnected **NOTE** *When a Synchro fault is identified, the synchro readout is forced to the last valid update, which may be then overwritten by the "Set Compass" function.*	Verify that the compass functions properly. Check compass harness and connector. **NOTE** *When the compass is inactive or disconnected and the ship is static (for example, when the ship is in the dock), Activate the Set Compass function and enter the ship's heading.*
System not Initialized	Power to the ADE was disconnected and connected again. This message alerts the operator that after ADE power loss, all the mechanical axes incremental encoders as well as 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.

7 INSTALLATION GUIDE

7.1 INTRODUCTION

The purpose of this chapter is to establish the plan, guidelines and procedures for installation of a typical AL-7204 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. Installing personnel should be totally familiar with the content of this AL-7204 Technical Manual.

7.2 SEQUENCE OF INSTALLATION

Regardless of the varying installation requirements and working conditions onboard different ships, the following sequence of installation is recommended.

3. **Ship Survey and Installation Planning** - ship's survey and installation planning, including choosing 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's components at the installation site (harbor or shipyard).
5. **On-Ship installation** – mounting the ADE and BDE on the ship; laying and connecting system cables and wiring (between the system's units); connecting the system to ship's power supply and gyrocompass.
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 ship. Since the working conditions are strenuous, the process must be properly coordinated among the installation staff and ship crew.

7.3 SHIP SURVEY

7.3.1 Introduction

A Pre-installation Site/Ship Survey should be conducted. The site survey provides an opportunity to collect valuable information on ship facilities and the parameters affecting installation decisions. This site survey should be conducted with a representative of ship's personnel in attendance.

7.3.2 Survey Report

During the site survey, particular attention should be given to requirements for cable runs available, interfaces to the ship's 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 ships configuration.

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

7.4 INSTALLATION PLANNING

7.4.1 Introduction

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

Before installation, make sure that:

5. The ship has been visited and the ship layout was recorded, or a filled-out Survey Report is available.
6. Existing ship layouts have been received, as may be available:

   Ship's construction plan

   Ship's electric mains layout and UPS access (if available)

   Ship's gyro compass interface type, wiring and availability.
7. The following are identified: the ship's power supply voltage, Gyro compass (standard and voltage), and Gyro repeater output (standard and voltage).

CAUTION

The ship's Gyro repeaters may convert the original signals accepted 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.

7.4.2 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.

7.4.3 Choosing the Best ADE Location

Special consideration must be given to selection of installation locations for the ADE. The following parameters should be evaluated to selected 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.

7.4.3.1 Mechanical Stability

Verify that the mounting surface intended for the ADE is rigid, flat, free of vibration, leveled and 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 natural resonance frequency of above 30 Hz.

7.4.3.2 Line Of Site (LOS) Considerations

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

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

7.4.3.3 Radome Outline Dimensions

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

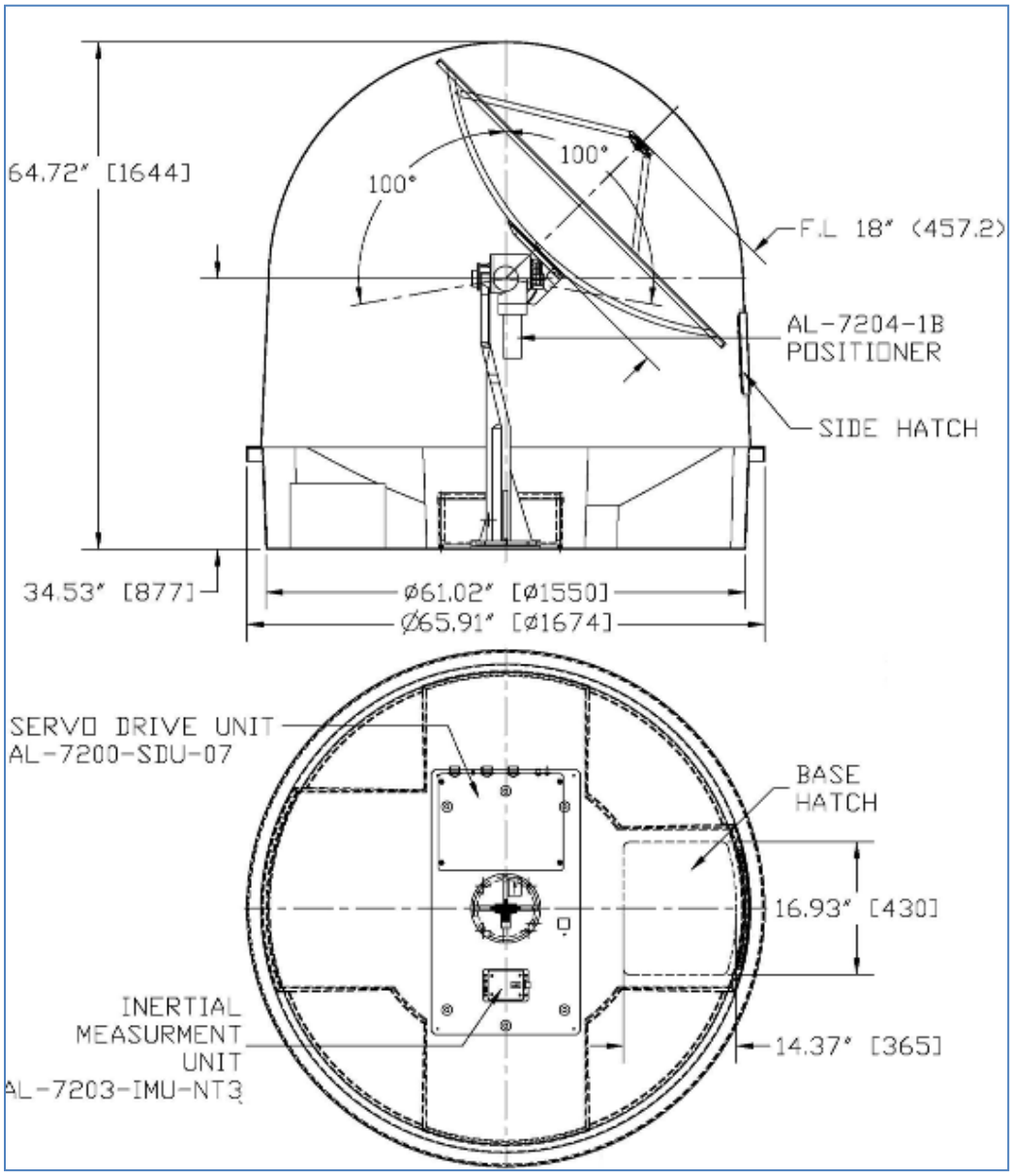


Figure 7-1:Radome Outline Drawing

7.4.3.4 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 165 meter (500 feet).

7.4.3.5 Maintenance Access

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

7.4.3.6 Other Considerations (for Location Selection)

Follow these general guidelines for installation aboard ships:

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 blockage in any direction, the x-axis orientation should point toward this blockage. 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.

7.4.3.7 Power Supply Considerations

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

7.4.4 Mounting Surface (Foundation)

The mounting surface intended for the ADE should be a stable (with 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 match, allowing insertion of the bolts securing the ADE to the foundation.

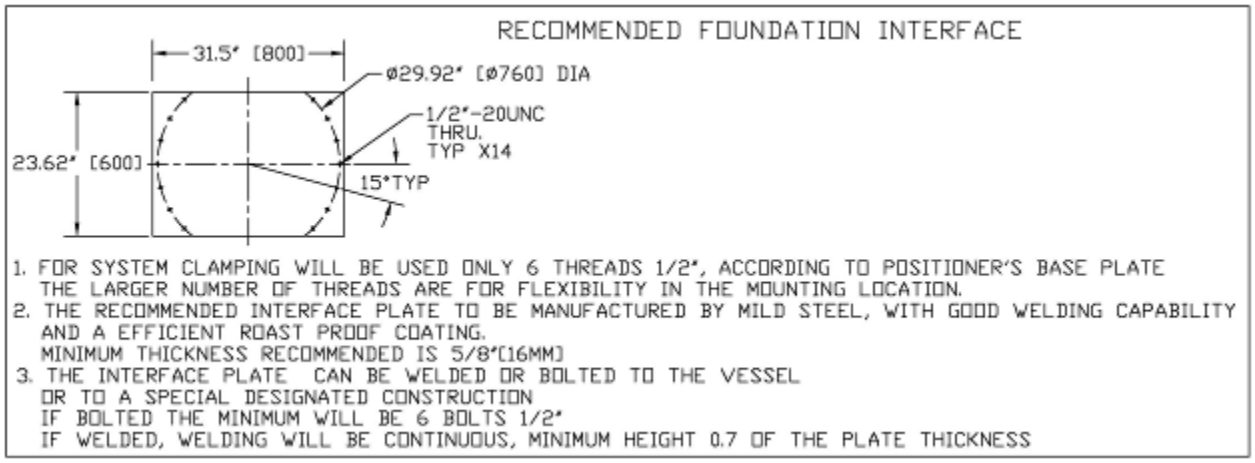


Figure 7-2. Recommended Mounting Surface (Foundation) Layout

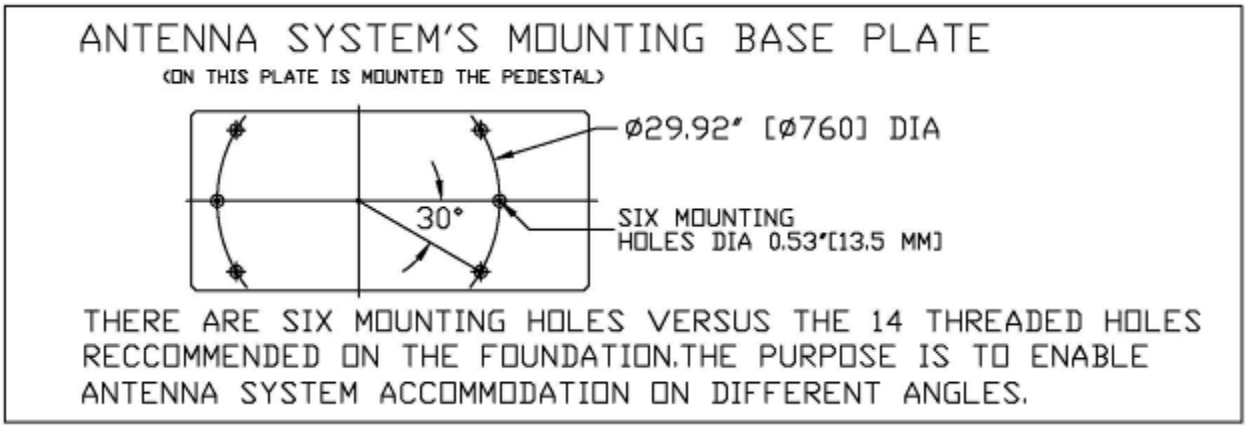


Figure 7-3. ADE Mounting Base Plate Layout

7.4.5 ADE Support Construction

If the ADE will ever need to be elevated, the radome can be mounted on an optional structure, supporting the radome with all ADE units installed in it.

The following figure shows outline drawings of the recommended support construction and base plate, which are designed to carry the AL-7204 system onboard the ship.

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, however, any other construction that is capable of supports the weight of the system and can fit the radome base dimensions can be used.

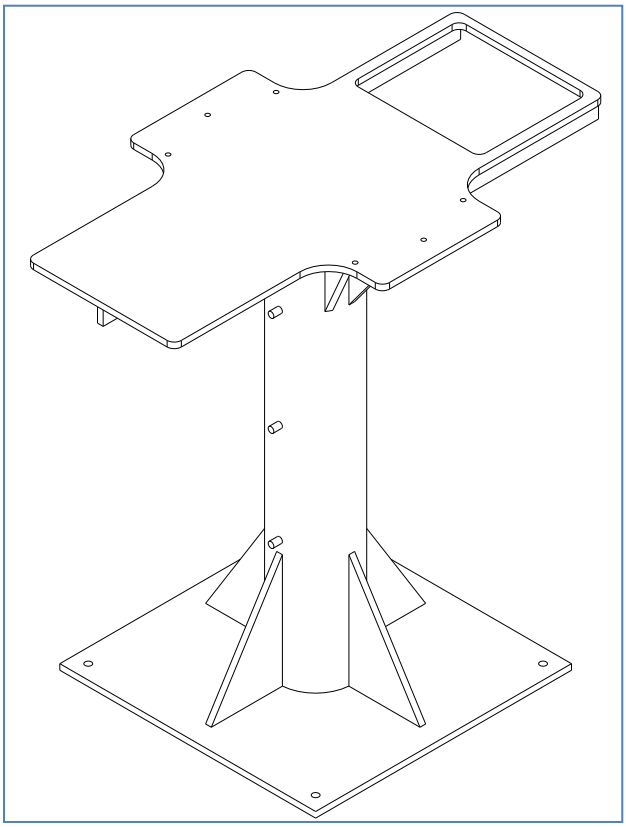


Figure 7-4. Recommended Support – General View

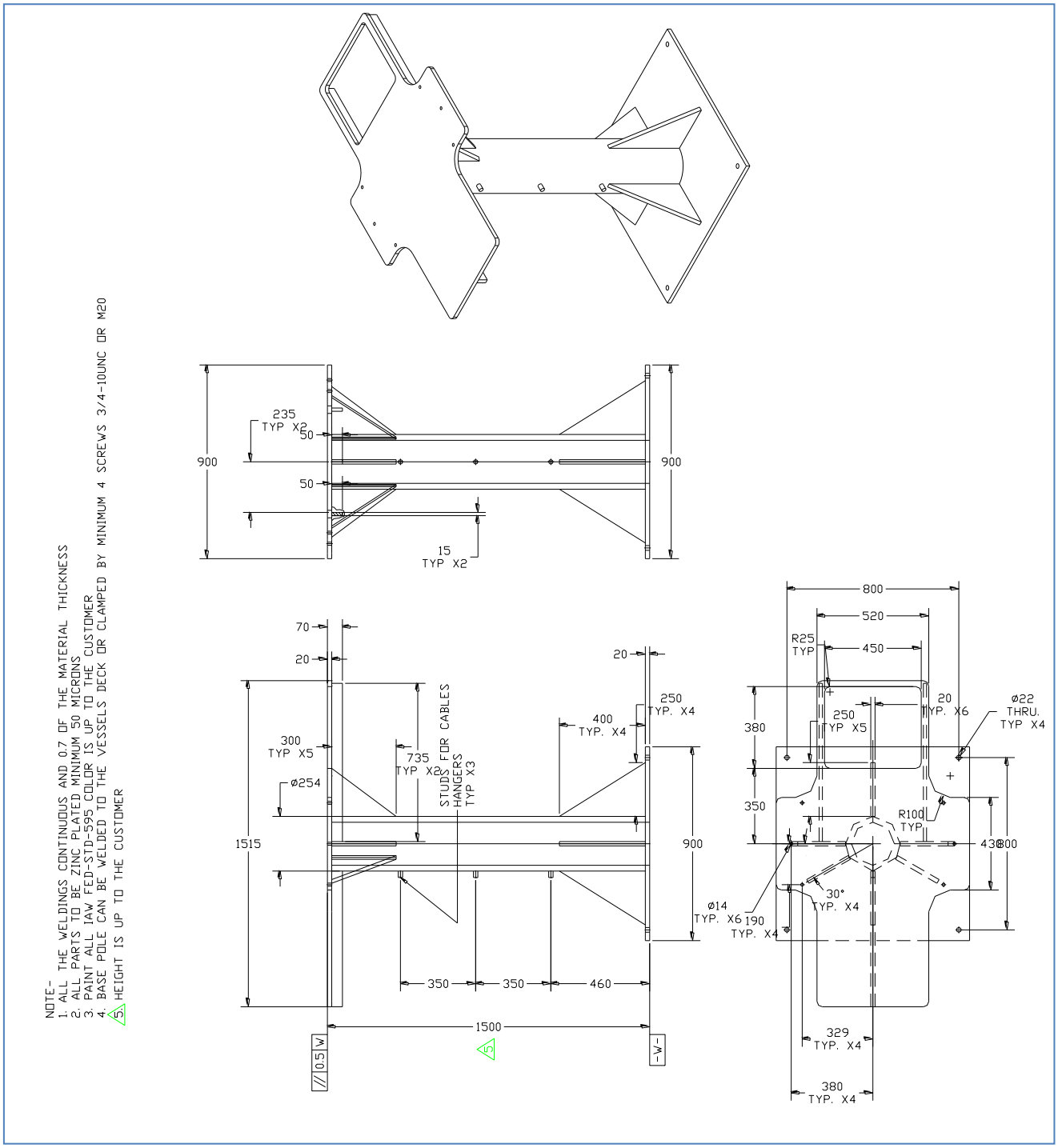


Figure 7-5. Recommended Support Structure

7.4.6 BDE Location Considerations

7.4.6.1 Installation Method

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

NOTE

The BDE environment should be climate-controlled.

7.4.6.2 BDE Cables Length Considerations

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

7.4.6.3 Operator/Maintenance Accessibility

The BDE operation is largely 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.

7.5 ON-SITE UNPACKING AND INSPECTION

7.5.1 Packing List

NOTE

This section presents a typical shipping configuration.

Typically, the AL-7204 System4 (without the radome) and installation tools/materials are sent to the installation site packed into 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 7-6. AL-7204 System4 Shipping Crate

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

Table 7-1: AL-7204 System4 - Packing List / Bill of Materials

Component	***ORBIT P/N***	***Notes***	***Equipment Verification***	
			Check	***Record S/N…***
Positioner	AL-7204-1B			
IMU	AL-7203-IMU-NT3			
SDU	AL-7204-SDU-07			
Controller	AL-7204-CONT4			
Top Assy Kit	TAK22-0150-4-2			
Options				
Universal 220V Power Utility Kit	KIT20-0418			
115V Power Utility Kit	KIT20-0419			
ADE-to-BDE Cables, __M Set	22-0322-9-__M	__M - required length per installation		
DBS LNBF	KIT28-0520			
GLA LNBF	KIT28-0521			
Motorized Ku Linear Kit	AL-7204-POLB			

7.5.2 Unpacking and Inspection Guide (at the 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. The service department will request these numbers when contacting ORBIT 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 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 rigid, leveled surface.
6. Open the crate without 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 in 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.

7.6 ON-SHIP INSTALLATION

7.6.1 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 removed, 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.

7.6.2 Lifting the ADE onto the Ship

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

Figure 7-7. Lifting the ADE

7.6.3 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 mounting surface. Use silicon sealing compound.

Figure 7-8. Mounting and Securing the ADE

7.6.4 Connecting Cables to ADE

7.6.4.1 SDU Connectors

The following figure shows the SDU Front Panel connectors and the connected cables.

Figure 7-9. SDU Connectors and Connected Cables

7.6.4.2 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 7-10. Routing and Securing the RF Cables

Figure 7-11. Connecting the RF Cables to the Feed

7.6.4.3 GPS Antenna Connection

Route and secure the GPS Antenna cable together with all other cables routed down the positioner towards the SDU.

Connect the GPS Antenna cable to SDU Connector P5.

Place and glue the Antenna on the SDU cover.

Figure 7-12. GPS Antenna

7.6.4.4 CONTROL Cable Connection

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

7.6.4.5 PEDESTAL Cable Connection

Connect Pedestal Harness Power Cable J2 to connector P2 on the SDU.

Connect Connector J6 of the Pedestal Harness to ADE-BDE CONTROL cable P6.

7.6.4.6 IMU Connector

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

Figure 7-13. IMU Connector and Connected Cable

7.6.4.7 SDU-to-IMU Harness Connection

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

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

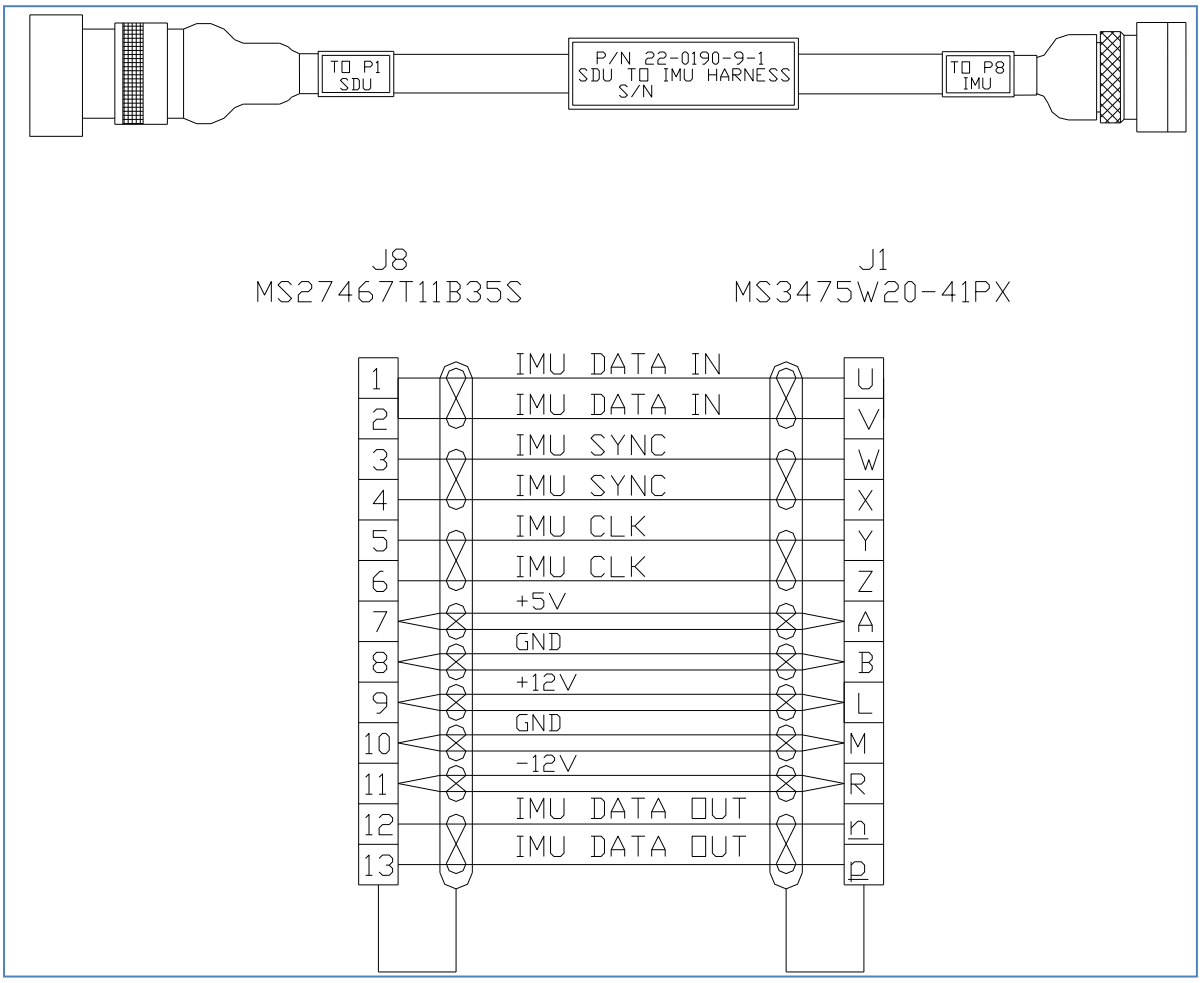


Figure 7-14. SDU-to-IMU Harness

7.6.4.8 Setting the SDU Input Voltage

WARNING

DANGER – HIGH VOLTAGE

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

CAUTION

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

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

Figure 7-15. SDU Voltage Selector S2

Figure 7-16: SDU Voltage Fuse F1

CAUTION

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

7.6.4.9 SDU Power Cable Termination and Connection

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

WARNING

Terminating the Power cable with an appropriate 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.

Connect the POWER cable to connector P4 on the SDU.

Figure 7-17. SDU Power Cable

7.6.4.10 Ground Wire Connection

Use a 14# GND wire, terminated with a terminal lug. Connect the grounding cable to the mounting Plate GND jack.

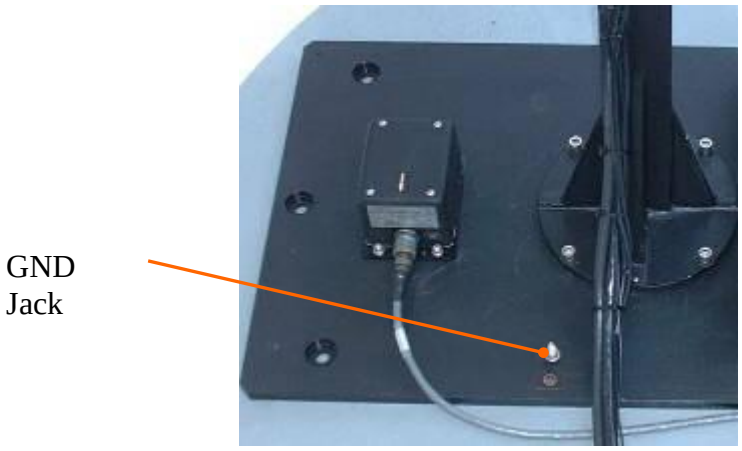


Figure 7-18. Mounting Plate GND Jack

7.6.5 BDE Installation

Mount the Controller into the mounting rack. Verify it is secured to prevent movement during sailing.

CAUTION

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

7.6.6 0.0.1. Connecting Cables to BDE

7.6.6.1 Controller Power Cable Termination

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

WARNING

Terminating the Power cable with an appropriate plug should be performed only by a certified electrician.

Connect the utility plug to the POWER cable. Pay special attention to the wire labels (phase, neutral, ground).

Use a DVM to check and verify the above connections.

Figure 7-19. Controller Power Cable

7.6.6.2 Gyro Compass Cable Termination

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

Use the following wiring diagram to prepare and connect the COMPASS cable to the pertaining connector.

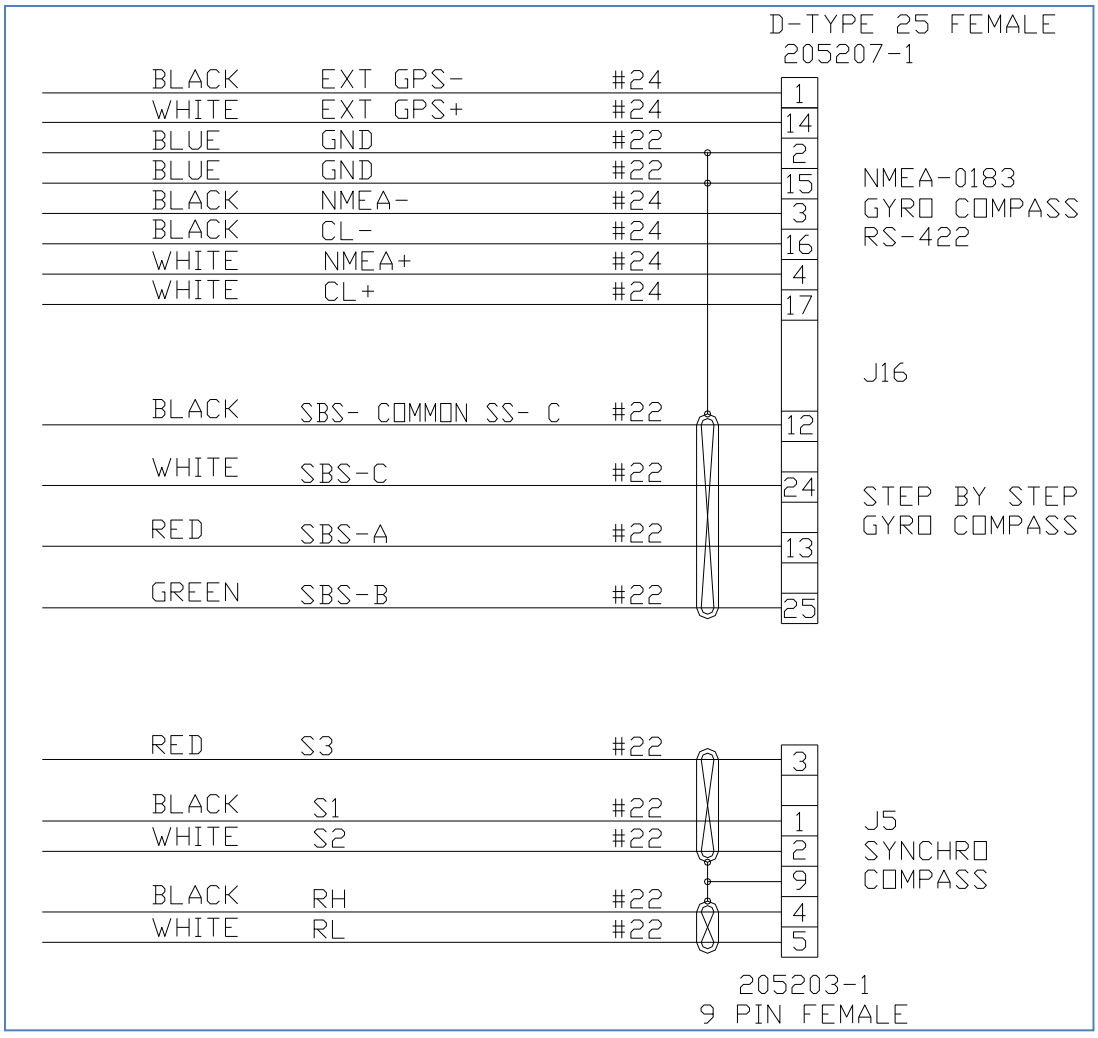


Figure 7-20. Compass Harness Interface

7.6.6.3 ADE-BDE Cables Termination

7.6.6.3.1 General

The system is supplied with two cables (CONTROL and PEDESTAL) that connects between the ADE and BDE, and should be laid down via the ship'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 7-2 ADE-BDE Cables – Ordering Information

Item P/N	Parts List	Length	Production File
22-0322-9-30M	PL22-0322-9-30M	30 ±0.5m	PF22-0322-9
22-0322-9-40M	PL22-0322-9-40M	40 ±0.5m	
22-0322-9-55M	PL22-0322-9-55M	55 ±0.5m	

7.6.6.3.2 Termination Procedure

Both the CONTROL and PEDESTAL cables are supplied with the BDE-side connector removed, to allow easy routing and to prevent damage to the connectors during installation. After the cables are laid down, connect the connectors to the cables.

Each cable is supplied with D-Type pins crimped to the cable wires. The wires are labeled with pin numbers, and protected at the cable's end by transparent shrinkable tubing.

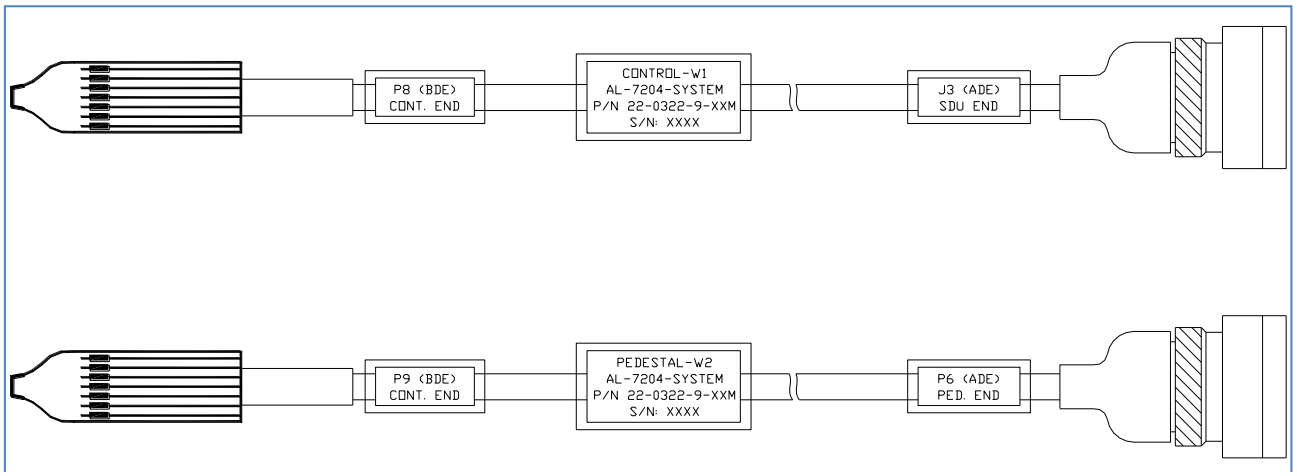
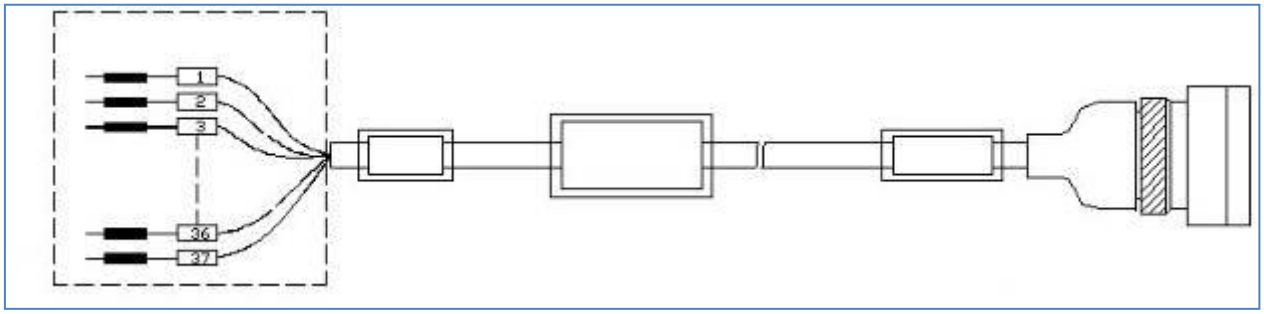


Figure 7-21. ADE-BDE Cables General Views

To terminate the CONTROL/PEDESTAL cable with the connector, perform the following procedure (Installation details and wiring diagram of the CONTROL/PEDESTAL cable are shown in the following figures):

1. Carefully remove the transparent shrinkable tubing at the cable's BDE-end.
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's pins to the D-Type connector.
4. Use appropriate equipment to check current leakage, short circuits and continuity.
5. Fit the DB37 shells to the cable, ensuring that the wires are not pressed nor 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.



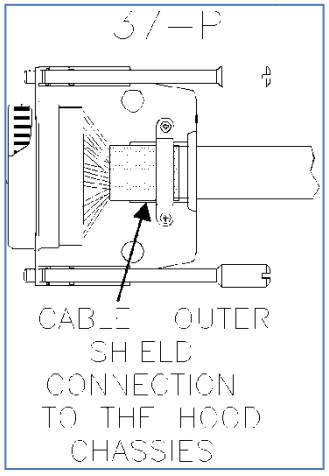


Figure 7-22. CONTROL/PEDESTAL Cables Installation Details

Controller SDU Pedestal

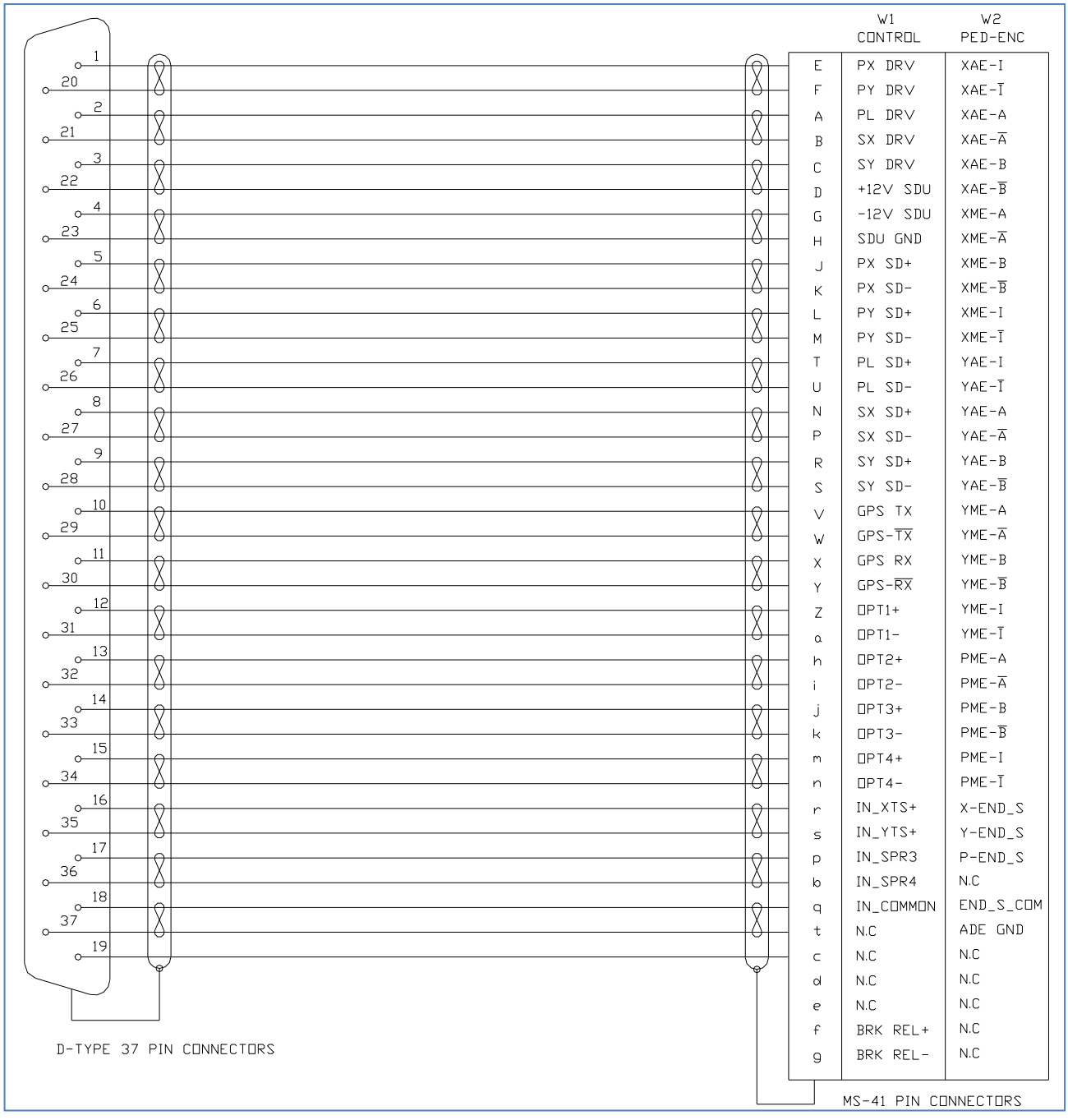


Figure 7-23. CONTROL/PEDESTAL Cables Wiring Diagram

7.6.6.4 Connecting Cables to the Controller

Connect cables to the Controller as described in the following procedure, and as depicted in the subsequent Figure.

1. Connect the RF cable to the LOWER TUNER connector.
2. Connect the Compass cable to J5 (for Synchro Compass) or J16/J17 (for Step-by-Step or NMEA-183 Compass).
3. Connect CONTROL and PEDESTAL cables to J8 and J9, respectively.
4. Fasten the screws securing the cable connectors to the Controller's connectors.
5. Connect the POWER cable to the Controller.
6. Re-connect the POWER and CONTROL cables to the ADE.

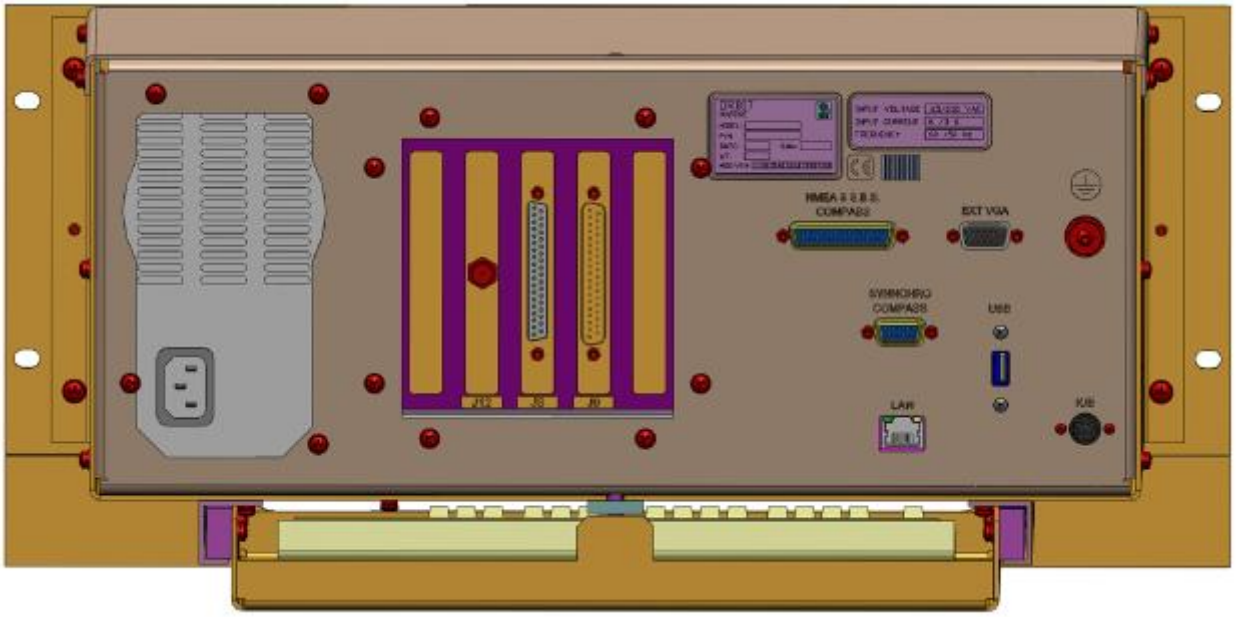


Figure 7-24. AL-7204-CONT4 Rear Panel

7.7 SYSTEM POWER-UP AND SETUP

After completing the installation, the system should be powered up to perform system setup, functional tests and operability verification (satellite tracking/acquisition and RF aspects of system operation).

System Power-Up and Setup includes the following procedures:

Initial Inspections

System Power-Up and Setup Procedure

Pre-Commissioning Checks

System Commissioning and Acceptance

7.8 INITIAL INSPECTIONS

Perform the following visual inspections before starting up the system:

1. **Rack Wiring** - Inspect all internal wiring terminations and labeling as appropriate
2. **Mechanical Completion** - Inspect all metalwork and moving parts and ensure that all edges are smooth and moving parts are operating correctly.
3. **Labeling** - Inspect all equipment labels and equipment tag numbers are correct and that power supplies are properly identified.

7.9 SYSTEM POWER-UP AND SETUP PROCEDURE

7.9.1 Introduction

Use the following procedures 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

Before the system is powered up, verify that the radome is closed and secured.

7.9.2 Initial Set-up

1. Using the relevant terminations detail drawings, ensure all interconnection cables are correctly terminated between below deck equipment (BDE) and above deck equipment (ADE).
2. Carry out verification checks of shipboard mains supply, ensuring that the supply is suitably conditioned.
3. Apply power to BDE/ADE equipment and observe the following:-

BDE Equipment:-

a. Tracking Controller has powered up and loaded control software.

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. SDU front-panel POWER LED is illuminated.

7.9.3 Status and Indications Check

Operation Screen

1. If still at the Basic Operation screen, enter password to enter into the Operation screen (AL-7200).
2. Enter the System Configuration mode. 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:-
   - Check for error/warning messages in the message window. Refer to each as appropriate.
   - Check that the system's ID is displayed (AL-7204).
   - Check 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 matches the ship's compass reading.

Satellite Selection

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

NOTE

For tests and commissioning, it is recommended to select a known accessible satellite.

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 are no red-colored 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.

7.9.4 Setting the AGC Feedback when Using a Multi-Switch

When using a multi switch box to disribute the 4 LNB outputs, one of the outputs is fed to the Controller’s Receiver Card. To configure the Controller to address the desired line, perform the following procedure:

1. At the Operation Screen, Press ‘T’ to enter System Configuration, and select ‘Lower Tuner’.
2. Enter into LNB-V dual polarization.
3. For each one of the 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 multy switch).

7.10 PRE-COMMISSIONING CHECKS

7.10.1 Checking of Axes Movement

1. Press ‘M’ for Maintenance, then ‘S’ for Select Window and select ‘Pedestal X’.
2. Select ‘Mode’, press enter and select ‘Slew’ and perform the following tests: -
    a. Use ‘↓’ to move 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 of 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 during slew, shut down the axis immediately.

c. Use '↓' to move the cursor to 'mode' and select 'Halt' to stop the axis movement

d. Use '↓' to move the cursor to 'mode' and select 'Enc Init'.

e. Ensure the velocity remains steady and the encoder position varies steadily and does not jump. In this case disregard the warnings appearing in the axis window (Jmm, Rlm, Flm).

f. Verify that the red Init flag is turned off after the axis movement.

g. Select new mode of 'slew' again and slew the axis 60 degrees in either direction around the zero position.

3. Repeat steps (1.) to (2.) for 'Pedestal Y' axis.
4. Perform Enc Init test of all axes: Select 'O' at the Operation Screen and select 'Enc Init'. Verify that all axes are moving properly and zeroing.
5. Perform IMU Init test: Select 'D' at the Operation Screen and select 'IMU Init', and confirm by pressing ENTER twice.
6. Monitor Pitch and Roll, taking into consideration the leveling degree of the ADE mounting plate with the ship's deck.

NOTE

Visually inspect the Pedestal's leveling within the Radome.

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.

7.10.2 Restart Initiation

1. On the Operation Screen, press "O" for operation mode and press "Restart" and 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. If 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 Azimuth axis until the AGC level rises.
    c. Verify that the system is pointed to the correct satellite and press "O". Select step-track and press ENTER twice.

7.10.3 Finding and Setting of Heading (Compass) Offset

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

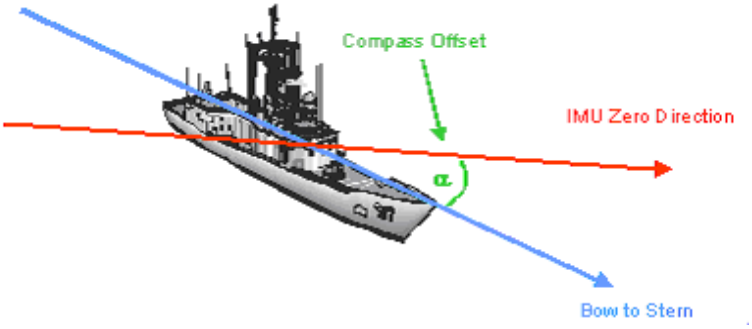


Figure 7-25. Compass offset

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

To establish the exact offset angle:

1. Make a "naked-eye" rough estimate for the offset angle. The drawing above shows an offset of -30 degrees (the negative value is because the offset is counter-clockwise from ship's bow).
2. Set the "naked-eye" estimate into the controller (as shown below).
3. Point the antenna to the satellite. Record the antenna Azimuth as "Nominal Azimuth".
4. Use Manual mode to move the antenna Azimuth orientation to point it to the satellite. The amount of expected movement depends on the accuracy of your initial estimate. Most people can tell direction within +/-10 degrees…
5. Once the satellite is acquired (Beacon receiver locked or, SatModem has locked on the Downstream data channel or, Spectrum analyzer screen shows a recognizable signal

pattern or any other way of validating that it is the correct satellite) put the antenna to Step-track.

6. Find “Azimuth Deviation”, which is how far away is the actual antenna Azimuth from the expected one.
7. To do so, use the graphical cross hair display, which is calibrated in degrees, showing a total of +/- 5 degrees:

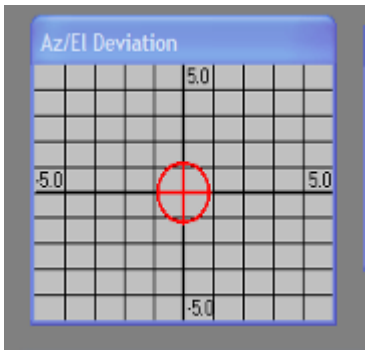


Figure 7-26. Deviation cross-hairs)

8. Or use the Graphical logger, recording the Azimuth Deviation:

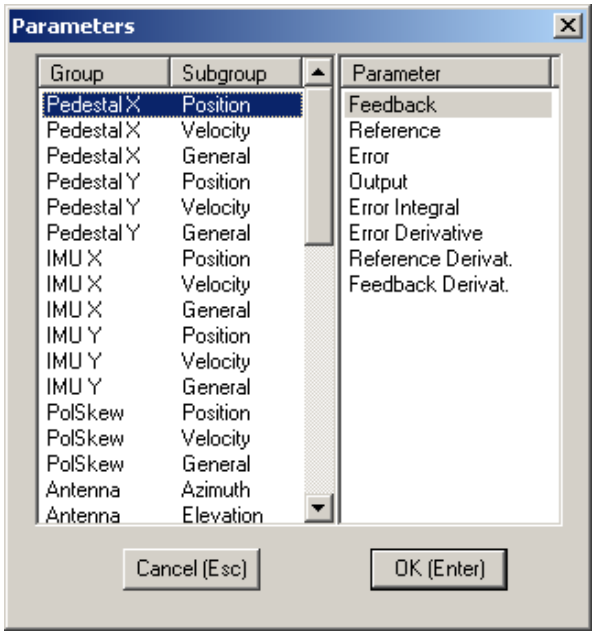


Figure 7-27. Logger Parameters

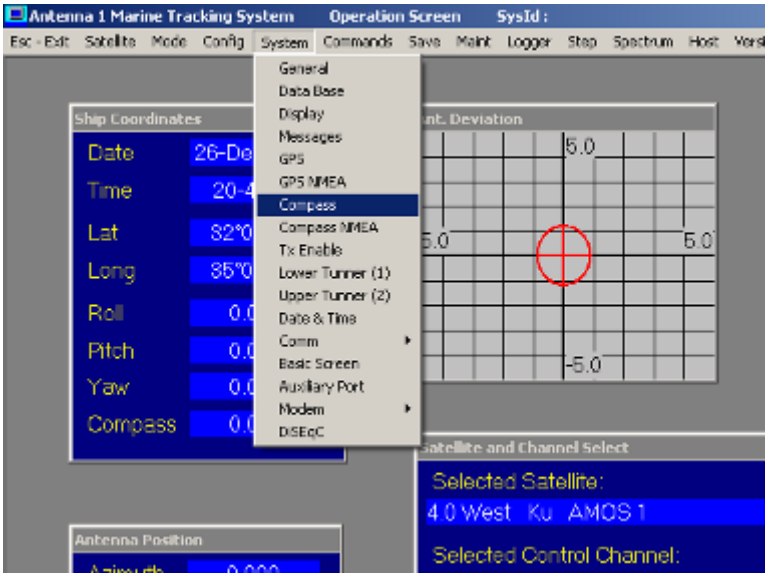
9. Or put the antenna to “Peak” mode and find the “Azimuth Deviation” by calculating the difference between the current antenna Azimuth and the “Nominal Azimuth” as noted above.
10. The “Azimuth Deviation” obtained in one of the methods shown above will be used to refine the “naked-eye” offset estimate. This will be given by:
    Compass Offset Correction = Azimuth Deviation / Cosine (Antenna Elevation).

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

    That means that our initial “naked-eye” estimate of –30 degrees must be corrected by:
    3/Cos (41.4) = 4.0 degrees, resulting in overall Compass Offset of –26.0 degrees

To set the Offset to the controller-

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



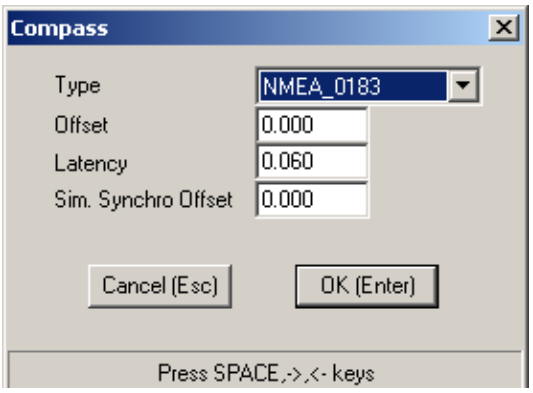
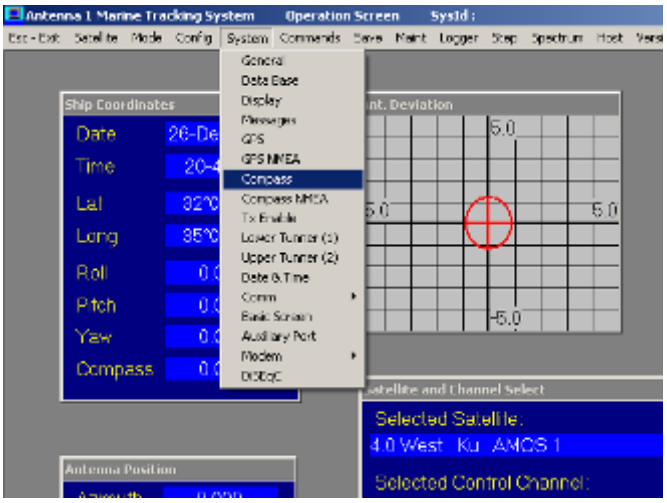


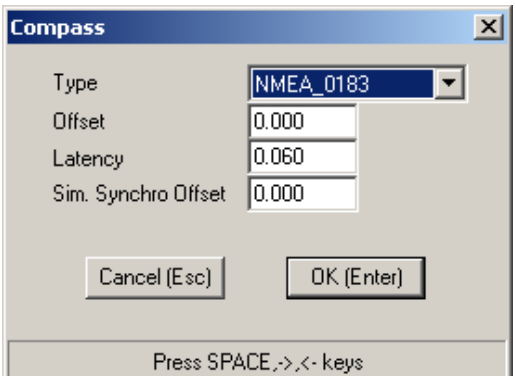
Figure 7-28. Compass window

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

7.10.4 Setting of Interface to Ship's Compass

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





2. Select the relevant compass type:

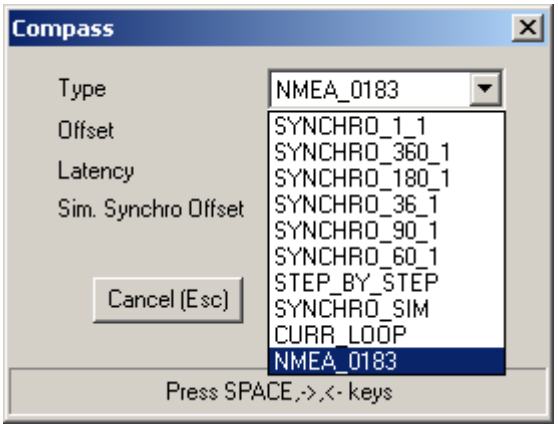


Figure 7-29. Compass selection

Supported interface types:

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

Synchro hardware set-up:

115VAC 50-400 Hz Reference, 90VAC S1, S2, S3 Phases

Synchro 1 to 1:

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

Synchro 360 to 1:

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

Synchro 180 to 1:

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

Synchro 90 to 1:

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

Synchro 60 to 1:

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

Synchro 36 to 1:

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

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

- Both types of Step-by-Step are supported: Common GND, and Common Hot
- Maximal voltage level allowed for active Line in case of Common GND: 20 to 70VDC
- Maximal voltage level allowed for Common Hot: 20 to 70VDC.

7.10.5 Changing the Default NMEA-0183 Compass Sentence

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

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

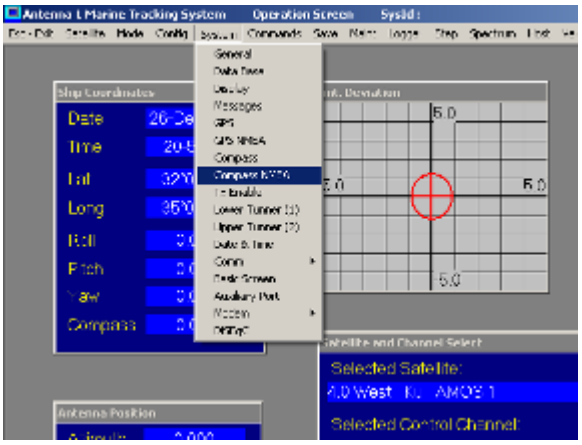


Figure 7-30. Selecting Compass NMEA

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

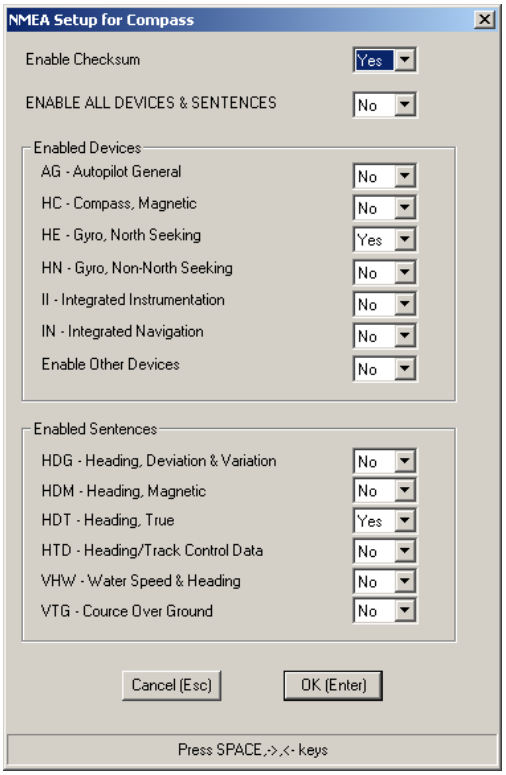


Figure 7-31. NMEA setup

7.10.6 Setting Noise floor and Threshold Values

1. Note the 'On Satellite' receive signal strength in dBμV.
2. Note the 'Off Satellite' receive signal strength in dbμV. This can be obtained by pressing 'O' for Mode in the Operation screen and selecting 'Manual' and 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.

7.10.7 Saving the configuration Settings

CAUTION

The pre-commissioning procedures may take some time, under non-stable ship's power supply. 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.

8 INSTALLATION OF FEED ASSEMBLIES

8.1 DBS / GLA LNBF ASSEMBLY INSTALLATION

To install the DBS / GLA LNBF Assembly on the Universal Feed Mount, perform the following procedure:

NOTE

The following procedure refers to both the DBS LNBF Assembly and the GLA LNBF Assembly.

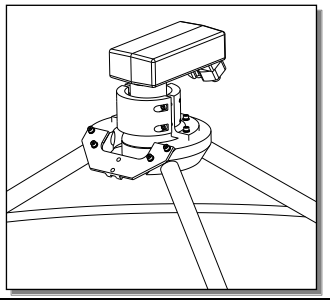
Installation of DBS / GLA LNBF Assembly on the Universal Feed Mount

Step	Description	Details
1.	Perform the Stow and Shut-Down Sequence.	**WARNING** *Verify that the Above Decks Equipment (ADE) units and the Below Decks Equipment (BDE) units are turned OFF and disconnected from the power source.*
2.	Unpack the LNBF Assembly, Feed Mounting Bracket, Feed Mounting Clamp, and required hardware. Obtain an Allen key for 6/32” screws.	
3.	Position the feed mounting bracket on the adaptor ring. Fasten 4 screws securing the feed mounting bracket to the adaptor ring.	

Installation of DBS / GLA LNBF Assembly on the Universal Feed Mount

Step	Description	Details
4.	Position the LNBF assembly into the feed mounting bracket. Position the assembly with the adapter on the tripod ring so that the connectors point towards the dish cables opening. Install the feed mounting clamp, and fasten 2 screws securing the feed mounting clamp to the bracket. **Notes** *The securing screws should be inserted into the bottom through-holes.* *Before fastening the clamp screws, verify that the LNBF assembly is shifted all the way upward.*	
5.	**Note** *If the -installed Feed Assembly was a Linear Ku Feed (Ferotor) Assembly, four coax cables are available. Connect only the coax cables marked HORIZONTAL HIGH and VERTICAL HIGH to the LNBF. Verify that these cables are connected to the distribution system's multi-switch. Verify that the remaining coax cables are terminated with F-TO-F connectors.* Pass the two coax cables through the dish cables opening, and connect them to the LNBF assembly.	

Installation of DBS / GLA LNBF Assembly on the Universal Feed Mount

Step	Description	Details
6.	Place and secure the cables to the pedestal and to the feed tripod arms. Use cable tie-wraps for securing. **CAUTION** *When placing and securing the cables, pay close attention to minimum bend radius specifications.* *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 throughout the full rotation range.*	
7.	Perform software configuration changes.	Refer to the CONTROLLER CONFIGURATION CHANGES FOR DBS & GLA FEEDS section, below.
8.	Perform the Power Up sequence and resume normal operation, as detailed in the User's Manual.	

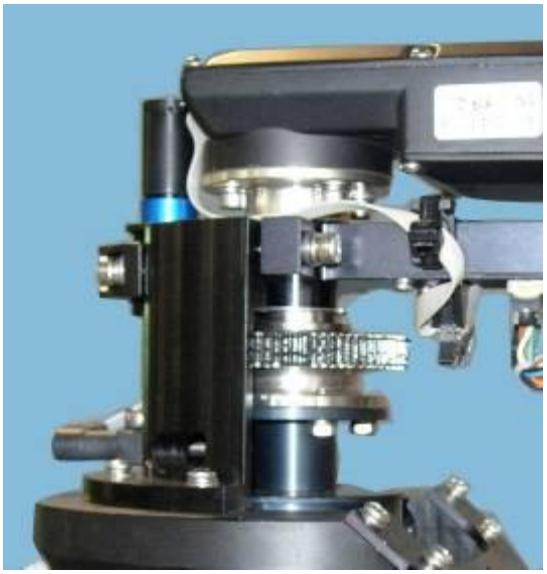
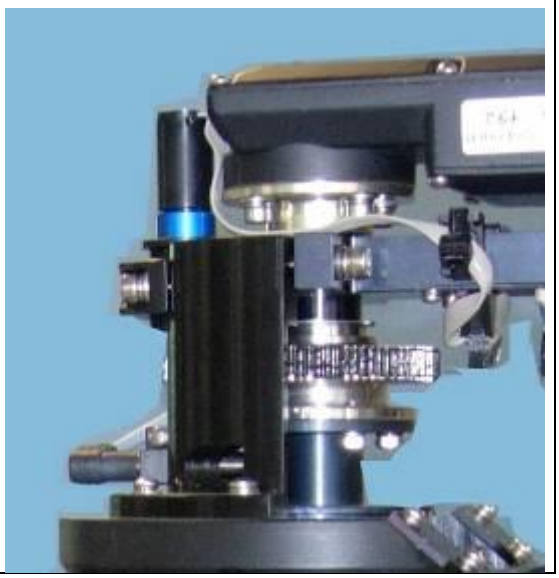
8.2 LINEAR KU MOTORIZED FEED INSTALLATION

To install the Linear Ku Motorized Feed Assembly on the Universal Feed Mount, perform the following procedure:

Installation of Linear Ku Motorized Feed Assembly on the Universal Feed Mount

Step	Description	Details
1.	Perform the Stow and Shut-Down Sequence.	**WARNING** *Verify that the Above Decks Equipment (ADE) units and the Below Decks Equipment (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. Obtain an Allen key for 6/32” screws.	
3.	Position the feed mounting bracket on the adaptor ring. Fasten 4 screws securing the feed mounting bracket to the adaptor ring.	

Installation of Linear Ku Motorized Feed Assembly on the Universal Feed Mount

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

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. Secure the cable to the tripod arm and to the pedestal.	 Feed Control Cable (P14)  Cable Connection to Feed (J14)

Installation of Linear Ku Motorized Feed Assembly on the Universal Feed Mount

Step	Description	Details
7.	**Note** *Verify that four cables* (VERTICAL HIGH, VERTICAL LOW, HORIZONTAL HIGH, and HORIZONTAL LOW) *are connected to the distribution system's multi-switch.* 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).	
8.	Place and secure the cables to the pedestal and to the feed tripod arms. Use cable tie-wraps for securing. **CAUTION** *When placing and securing the cables, pay close attention to minimum bend radius specifications.* *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.	Perform software configuration changes.	Refer to the CONTROLLER CONFIGURATION CHANGES FOR LINEAR Ku MOTORIZED FEED section, below.
10.	Perform the Power Up sequence and resume normal operation, as detailed in the User's Manual.	

8.3 CONTROLLER CONFIGURATION CHANGES FOR DBS AND GLA FEEDS

After the installation of DBS LNBF or GLA LNBF 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. Tthe ACU monitor displays the manufacturer's logo wjo;e 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) at the Controller's keypad. To type capital letters (AL), press and hold the SHIFT key while typing the required 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 the ENTER key.
7. Verify that the 'LNB-V for Dual Polariz.' / **ExKuH** field is set to 18v/00KHz. 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/00KHz option. Press the ENTER key.
8. Verify that the 'LNB-V for Dual Polariz.' / **ExKuV** field is set to 13v/00KHz. 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/00KHz option. Press the ENTER key.
9. Press the ESC key and then the ENTER key to accept changes. If no changes were made press the ESC key twice.
10. To save the configuration changes, press 'V' for Save, select 'All' and press the ENTER key.

11. Press ‘U’ to enter into the Basic Operation screen.
12. Select a Satellite and Channel Frequency, as detailed in the system’s User Manual.

8.4 CONTROLLER CONFIGURATION CHANGES FOR LINEAR Ku-Band MOTORIZED 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) at the Controller’s keypad. To type capital letters (AL), press and hold the SHIFT key while typing the required 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 the ENTER key.
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 the ENTER key.
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 the ENTER key.

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

8.5 Polarization Skew Alignment procedure

1. Access Maintenance Screen → Receiver → NBR and select "150 kHz" from the "IF BW" options list.
2. Access Mode → Acquire to activate "Acquire" mode.
3. Access Mode → Peak to turn SUT to Peak mode.
4. Access Commands → Polarization to change Polarization Switch to the opposite Polarization.
5. Make sure there is no signal on the opposite Polarization – just the noise level.
6. Access InConfig → Step-Track → Ku-Band and change Step-Track setup to: "Step-track Axes: Sk".
7. Make sure that the following parameters are set correctly: (Write down the original settings!)
8. PolSkew Step-type: ON_MIN
9. Change the Axis1 sector value from 0.5 to 0. The velocity remains the same.
10. Change the Axis2 sector value from 0.5 to 0. The velocity remains the same.
11. Change the Axis3 (PolSkew) sector value from 0 to 20. The velocity remains the same.
12. Only for Software Version below 4.5: Access Commands → Set Threshold and set Signal threshold to –80 dBm (write down the original setting!).
13. Access Mode → Step-Track to activate Step-track mode.

14. Access Logger and Log “Antenna Step-track, PolSkew Deviation” for 2 minutes
15. Read mean value of the deviation
16. Access InConfig → Axes Parameters and add the mean value to the PolSkew Offset.
17. Access Mode → Peak to turn SUT to Peak mode.
18. Access Commands → Polarization to return the Polarization Switch back to it original position.
19. Access InConfig → Step-Track → Ku-Band and return the Step-Track setup back to “Step-track Axes: ConScan”
20. Set the PolSkew Step-type and Axis sector values to the original values.
21. Only for Software Version below 4.5: Access Commands → Set Threshold and return the Signal threshold to its original setting.
22. Access Mode → Acquire to activate “Acquire”.
23. To validate that the Polarization Skew is correct, repeat steps 2-11. Make sure that now the recorded PolSkew Deviation’s mean value is within ±0.5 degree. Then repeat steps 13-17.
24. Access Maintenance Screen → Receiver → NBR and restore “150 kHz” from the “IF BW” options list.
25. Access 1-Do → Save → All to save settings in non-volatile memory.

9 MAINTENANCE

9.1 INTRODUCTION

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

9.2 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 accomplish prescribed maintenance:

Philips screwdriver, #2

Flat-blade screwdrivers, set of small and large

Open-ended wrenches

Allen wrenches, standard set of small ones (inches)

Allen wrench, standard set of small ones (metric)

Locking compound, LocTite 270

Multi Meter

Flashlight.

9.3 PREVENTIVE MAINTENANCE

9.3.1 Semi-Annual Inspection

The Above Deck Equipment (ADE) of the TVRO system should be visually examined twice a year, using the following procedure:

Turn OFF power to the ADE.

Open the radome hatch or remove the radome completely.

CAUTION

Although the kevlar radome is light, three people are needed to lift it 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 lockwashers 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 capabilitie.

9.4 CORRECTIVE MAINTENANCE

WARNING

DANGER – HIGH VOLTAGE

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

9.4.1 Replacement of SDU Fuses (F1, F2)

To replace a SDU fuse, perform the following procedure:

1. Verify that the SDU is turned OFF.
2. Disconnect Connector P4 from the SDU.
3. Unfasten 4 captive screws securing the SDU top cover to the chassis. 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 4-Amps slow-blow fuse (115V systems), or a 2-Amps slow-blow fuse (220V systems); For F2, use a 1 Amps 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 cause damage to the equipment.

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

Figure 9-1. SDU Internal View

9.4.2 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 4 captive screws securing the SDU top cover to the chassis.
4. Remove 4 bolts securing the SDU to the mounting plate through the holes in the SDU chassis.
5. Place a new SDU on the mounting plate, with its cover removed.

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 for the correct AC voltage (115VAC or 220VAC).
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 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.

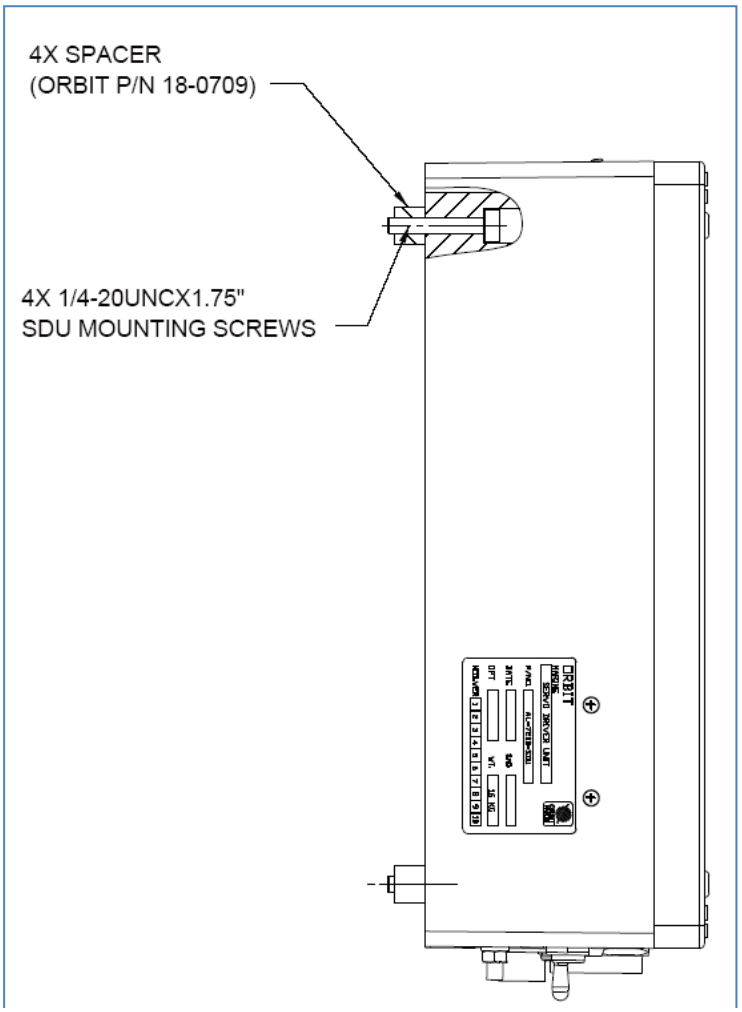


Figure 9-2. SDU Mounting Screws

9.4.3 Replacement of Pedestal Harness

1. Turn OFF the SDU and the Controller.
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. If required, turn ON the SDU.

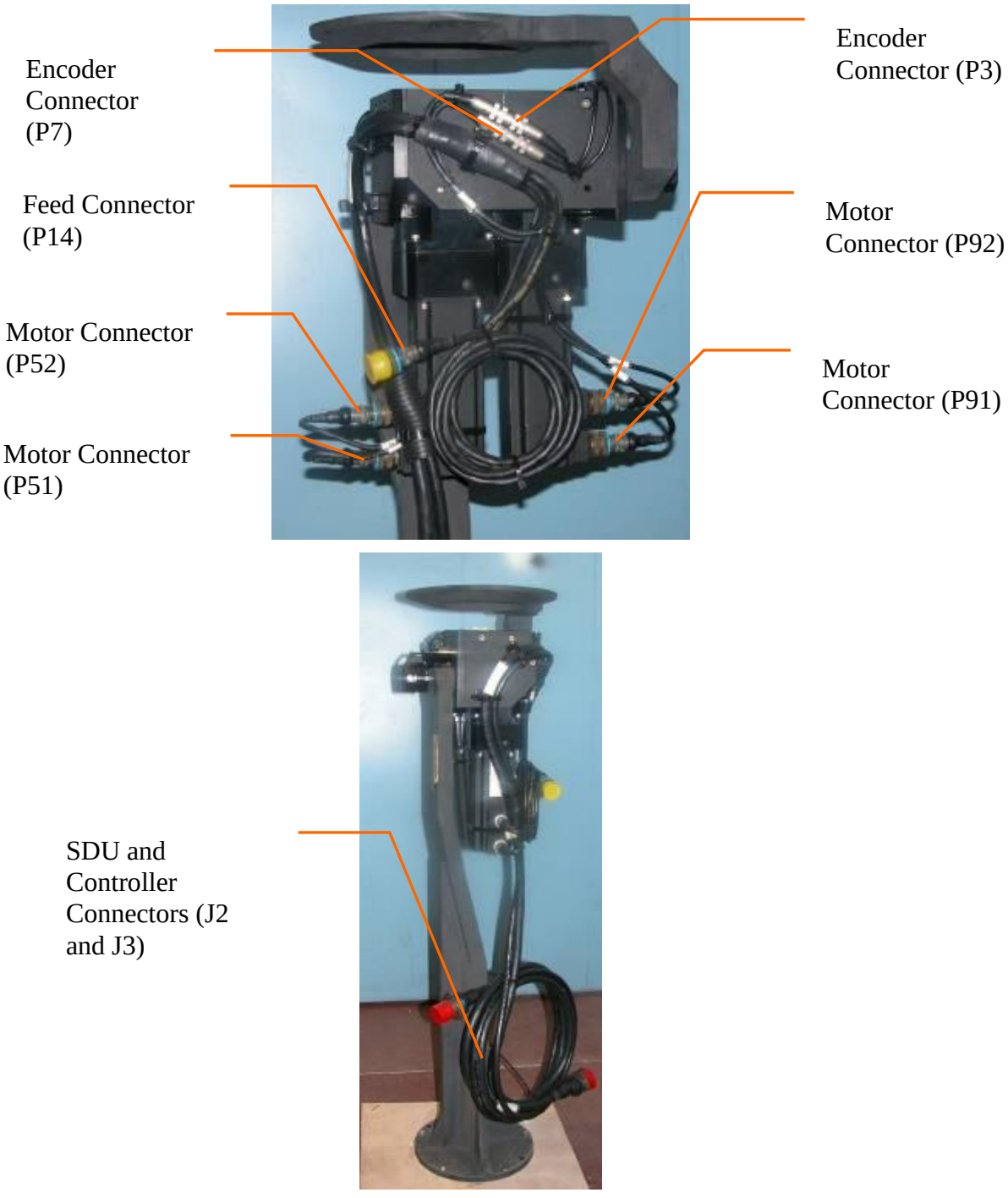


Figure 9-3. Pedestal

9.4.4 System Restart

1. Power down the system.
2. Re-apply the power to the system.
3. Observe the following: -

   The system re-boots.

   The encoders initiate.

   The IMU initiates.

   The system acquires the satellite.

   The system goes into Step-Track.