INSTALLATION AND OPERATION MANUAL
FOR SUPERTRACK MODEL Z12Mk2(DVBS2)
Ku-BAND TX/RX ANTENNAS

KNS Inc.

Tel)+82-42-932-0351~2
Fax)+82-42-932-0353
Web) http://kns-kr.com/

28. 03. 2011

KNS SuperTrack systems are manufactured in South of Korea.

Revision History

Revision	Date	Description	By	Remark
2.0	Apr 14, 2010	Initial Release (PCU Ver. 2.000 & ACU Ver. 3.400)	Hong	DVBS2
2.1	Mar 28. 2011	Change the radome drawing and add the SCS version (PCU Ver. 2.110 & ACU Ver. 3.400)	Hong	

1. Introduction

1.1 Purpose

The purpose of this manual is to provide the information required to enable the end user, customer and installer to successfully install the Z12Mk2 antenna and controller and to program the KA-160 for operation.

It is recommended that all personnel operating the Z12Mk2 systems know which type of system they are dealing with, read and understand the basic terms, and are fully familiar with the operation of these systems.

Although installation may be completed by personnel preferred or designated by the customer, it is also recommended that personnel be trained in the KNS for more suitable equipment installation procedures, and trained by KNS Inc. experts in the relevant matters.

Section 2 of this document has been provided to ensure that ALL personnel are aware of the specific safety hazards involved in the installation and configuration of the KNS equipment (e.g. electrical, static and RF radiation hazards).

2. Personnel and Antenna

This section defines the areas near or within the radiation area of the auto acquire antennas currently deployed. It is recommended that ALL customers operating this equipment become familiar with the radiation patterns of these units and strictly adhere to the precautions outlined below.

2.1 Radiation Limits

Radiation limits are defined in terms of maximum permissible exposure (MPE), a frequency-dependent level of radiation to which a person is subjected over some duration of time. Besides being frequency-dependent, the MPE level and duration of time based on the Specific Absorption Rate (SAR) of the human body depends on whether the area around the antenna is controlled or uncontrolled. The definitions of these two types of areas are quoted from OET 65, as follows:

"The FCC guidelines incorporate two separate tiers of exposure limits that are dependent on the situation in which the exposure takes place and/or the status of the individuals who are subject to exposure. The decision as to which tier applies in a given situation should be based on the application of the following definitions.

Occupational/controlled exposure limits apply to situations in which persons are exposed as a consequence of their employment and in which those persons who are exposed have been made fully aware of the potential for exposure and can exercise control over their exposure. Occupational/controlled exposure limits also apply where exposure is of a transient nature as a result of incidental passage through a location where exposure levels may be above general population/uncontrolled limits (see below), as long as the exposed person has been made fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means. As discussed later, the occupational/controlled exposure limits also apply to amateur radio operators and members of their immediate household.

General population/uncontrolled exposure limits apply to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Therefore, members of the general public would always be considered under this category when exposure is not employment-related, for example, in the case of a telecommunications tower to which persons in a nearby residential area are exposed.

For the purpose of applying these definitions, awareness of the potential for RF exposure in a workplace or similar environment can be provided through specific training as part of an RF safety program. Warning signs and labels can also be used to establish such awareness as long as they provide information, in a prominent manner, on the risk of potential exposure and instructions on the methods of minimizing such a risk of exposure.”

The following conclusions can be drawn from these tables (Figure 2-1):

Power density between the feed flange and reflector is at a hazardous level and access to this area must be prevented while the terminal is transmitting. Under no circumstances should any part of a person’s body be placed in this region while the terminal is transmitting.

Based on a controlled-area power density of 5 mW/cm^2 over any 6-minute period, in some cases less than 14.6 seconds of exposure is allowable in this region. Note that, in general, an operator would not be manually adjusting the feed during a high-rate, high-power transmission. Also note that the power density decreases toward the reflector (as the beam widens from the feed), so the maximum exposure time increases as the distance from the feed increases.

Near-field levels of radiation are below the controlled-area requirement, but in some cases are above the uncontrolled area requirement. Although the nature of transmissions is such that radiated power levels should not reach full power at any time, there is no absolute guarantee of reduced transmission levels; therefore, access to the near field of the antenna must also be restricted. Since the near field is contained within a cylinder pointed from the reflector toward the satellite, we can compute the horizontal distance from the front of the reflector to which access must be restricted. Table 2-1 computes this distance. At distances in excess of the tabulated limits, access can be unrestricted. Between the antenna and the tabulated limits, access should be limited to less than 10 minutes in any 30-minute interval.

Far-field levels of radiation are below the uncontrolled-area requirement and are therefore not a concern.

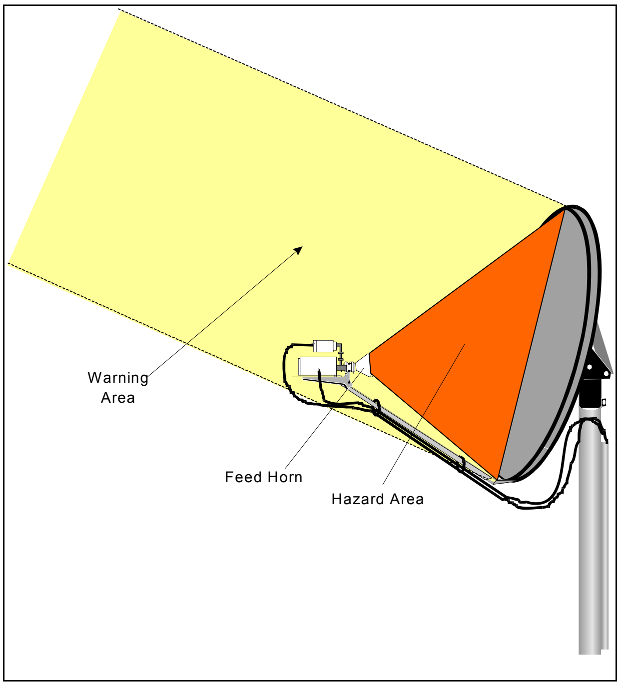

Figure 2-1 Defined Radiation Areas

Hazard Area (Between the feed and reflector): This is the highest power density region because the area of power radiation (the feed flange) is smallest.

Warning Area (Near field): This is the area bounded by a cylinder within the same diameter of the reflector, and which extends from the reflector toward the satellite for, in the case of auto acquire systems, less than 75 meters (the exact distance depends on frequency and the diameter of the reflector).

Far field: This is the area situated at some distance from the antenna, where the radiation density falls off with the square of distance.

2.2 Recommendations

Access to the immediate vicinity of the antenna (reflector and feed) must be restricted to trained customers and certified contracted/service personnel. No member of personnel should interpose any of their body parts between the feed and the reflector while the terminal is transmitting. At full output power, this region is dangerous in cases of exposure of more than about 14.6 seconds.

At full output power, the near-field output of the auto acquire terminals exceeds the allowable levels for *continuous* exposure in an *uncontrolled* area. This near field is a cylindrical region which encloses the reflector and points toward the satellite. Because many sites accommodating the auto acquire terminals are accessible to non-operational personnel, these sites should be considered as uncontrolled and the recommended precautions taken accordingly.

The primary precaution should consist in restricting access to the immediate area in front of the reflector to short durations, which, according to worst-case assumptions, means that access should be limited to less than 10 minutes within any 30-minute interval. If *limited-duration* access cannot be insured, then *no* access should be allowed within the distances specified in Table 2-1 below. (Table 2-1 assumes a member of personnel standing 6ft tall at ground level. The horizontal distance must be scaled upward accordingly if the members of personnel are at a level higher than 6 ft.).

	IA-6
Minimum Elevation City	Rock Springs
Minimum Elevation (deg.)	39
Minimum distance in front of reflector to clear 6 ft. tall person (ft.)	7.4
Minimum distance in front of reflector to clear 1.8m tall person (m)	2.3

Table 2-1 Exclusion Region in Front of Antenna (Random)

3. Installation

3.1 Site Selection

Determine the optimum mounting location for the antenna radome assembly. It should be installed where:

1. The antenna has a clear line-of-sight of as much of the sky as is practical. Choose a location where masts or other structures do not block the satellite signal from the dish as the boat turns.

2. The antenna is at least 5m away from other transmitting antennae (HF, VHF and radar) which may generate signals with the potential to interfere with the SuperTrack Z series antenna. The further away the SuperTrack Z series antenna is from these other antennae, the less likely is it to be affected by their operation.

3. The antenna radome assembly should be rigidly mounted on the boat. If necessary, reinforce the mounting area to assure that it does not flex due to the boat's motion or vibration.

Figure 3-1 Best Location

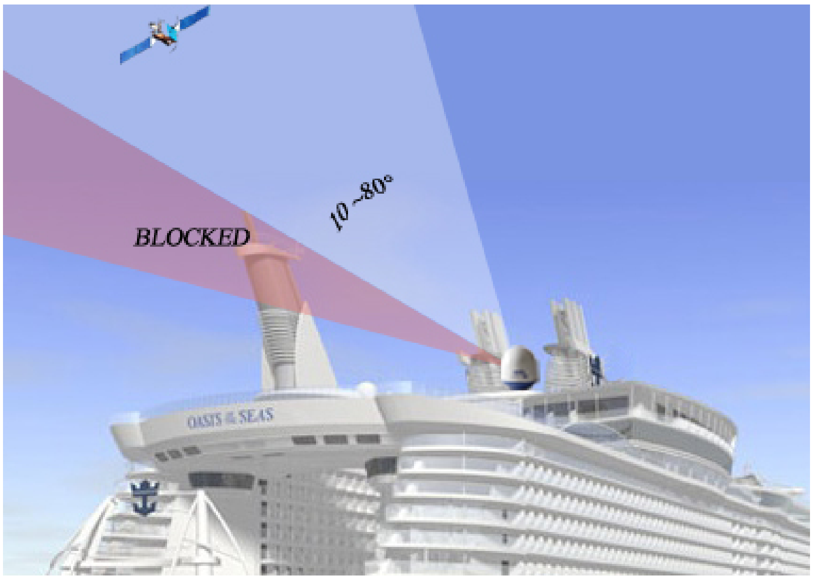

Figure 3-2 Antenna Blockages

3.2 Unpacking

Open the wooden box using pliers and remove the packaging material carefully. Lift the unit out of the box carefully. Do not turn the box and “roll” the unit out, or turn the box upside down to remove it. Be careful when unpacking the equipment.

Figure 3-3 Antenna Wooden Box

Remove the jig, screw, and tie used to protect the antenna from shipping damage after opening the radome. If power is supplied to the antenna without removing the fixed parts (jig, screw, tie), the antenna may be damaged.

The antenna should be secured using the fixed parts during transportation by truck or another vehicle. So please keep the fixed parts in the event that the antenna is to be moved to a different place or ready to be installed after ground testing.

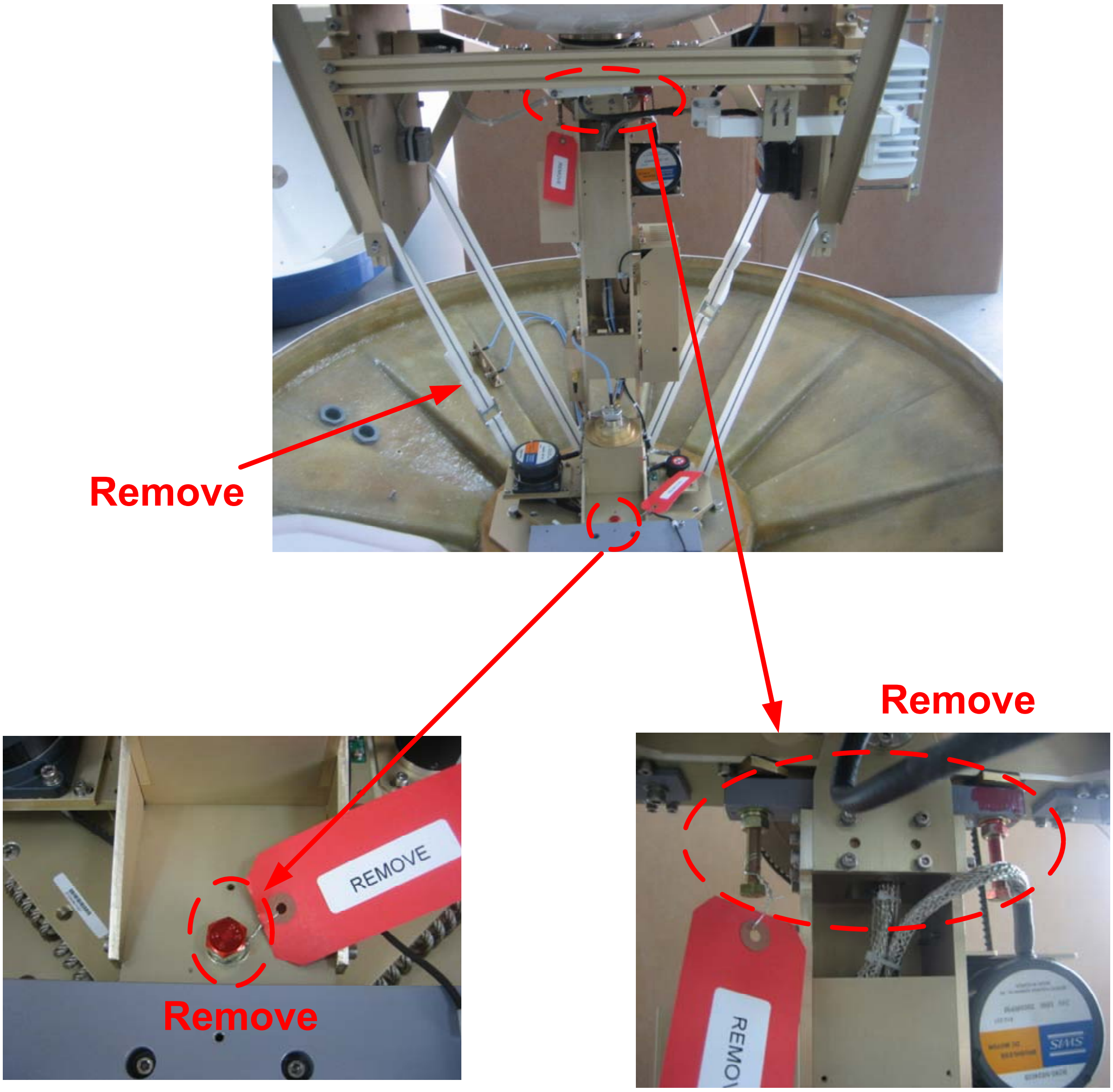

Figure 3-4 Antenna Fixed Part

3.3 Installing the Equipment Cables

The SuperTrack Z12Mk2 comprises two major sections: The Above-Deck Equipment (ADE) is composed solely of the antenna radome assembly, which is mounted outside. The Below-Decks Equipment (BDE) includes the Antenna Control Unit (ACU), satellite modem(s), and all other items of ancillary equipment.

The ADE is connected with the BDE by two coaxial cables; the type of cable to be used depends on the length of cable required.

NOTE: Unused coax connections (on the connector bracket) MUST be terminated with a 75 ohm terminator.

NOTE: We recommend cable type according to cable length, as follows:

-within 20m: RG6

-within 50m: RG11

-within 100m: LMR400

-within 200m: LMR600

NOTE: Impedance of cable is 50ohm. Also you can select the other cable types. However we recommend all attenuation of cable is under 20dB at 2.5GHz.

NOTE: When installing the cables, avoid the use of excessive force. Exercise caution during installation of the cables to ensure that they are not severely bent (within the assured bend radius), kinked or twisted, and that the connectors are not damaged.

NOTE: Make sure that the cables have been passed through watertight fittings and/or that they will prevent water from entering the ship once their installation has been completed. After the cables have been routed and adjusted for the correct cable length at each end, seal the deck penetration glands and tie the cables securely in place.

3.4 Mounting the Antenna Unit

3.4.1 Prepare the Support Post

1. Prepare the antenna support post for the radome. The radome must be bolted to the support post plate. Make sure that the mounting holes have been drilled. Please refer to the appendix for detail drawings.
2. Make sure that the antenna support post is painted appropriately for anti-corrosion.
3. Thread the TX and RX cables from below deck up through the cable access hole on the deck. (Check the number of RF cables required).
4. The support post should be upright. Check the post angle carefully prior to welding the post base to the deck. If it is uneven or not level, weld the clips to the plate or place the foam seal in position on the mounting surface.
5. Refer to Fig 3-5 below. The thickness and size of the support plate can be changed according to the height of the support post

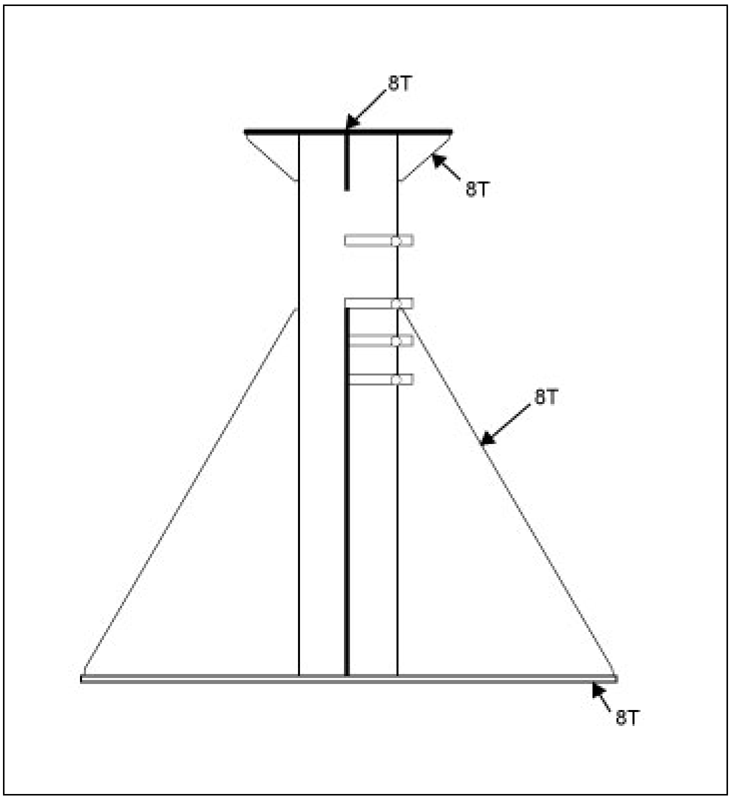

Figure 3-5 Diagram of a typical Antenna Support Post (Unit mm)

3.4.2 Hoisting the Antenna

Refer to the specifications and drawings for the fully assembled weight of your model antenna and ensure that the equipment used to hoist this system is rated accordingly.

The antenna assembly is very light for its size and is subject to large swaying motions if hoisted under windy conditions. Always ensure that the tag lines attached to the radome base frame are properly put while the antenna assembly is being hoisted to its assigned location aboard the ship.

1. Ensure that the antenna is secured before hoisting. Check that all the nuts on the base frame assembly have been tightened according to the torque values mentioned above.
2. Using four-eye nuts, and with a tag line attached to the radome base frame, hoist the antenna assembly to its assigned location aboard the ship by means of a suitably-sized crane.

Figure 3-6 Hoisting the Antenna

3. Position the base plate in place over the mounting holes and the cable access hole,

and then align the radome base plate's "Bow" label (as shown in Figure 3-8) with the ship's bow.

Figure 3-7 Positioning the Radome

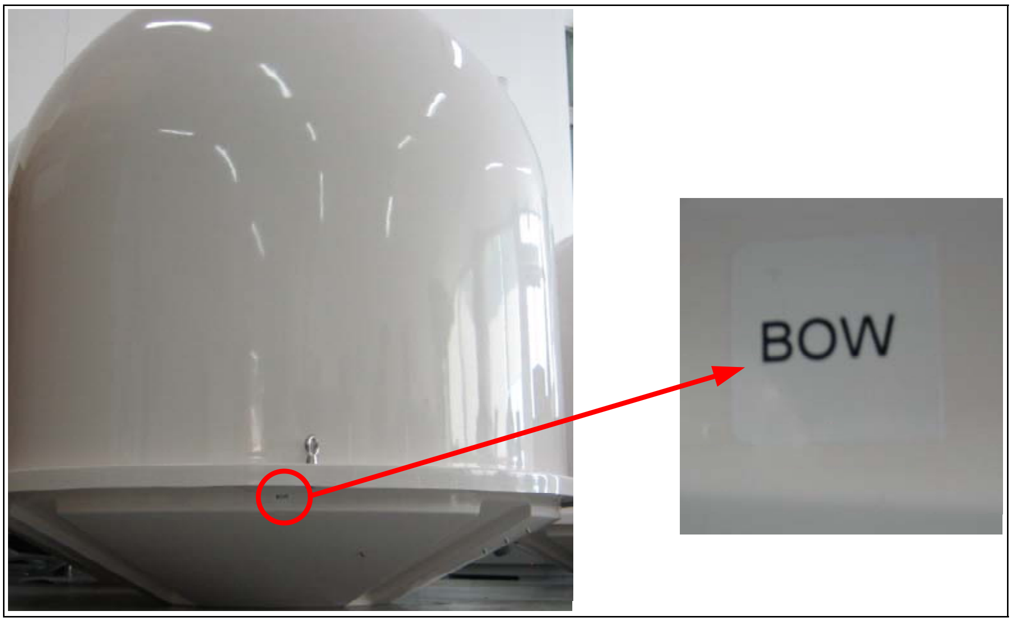

Figure 3-8 "BOW" Label of the Radome Base

3.4.3 Installing the Radome Assembly

Install a flat and spring washers and a mounting bolt (supplied with the product) to each mounting hole of the radome base from the underside of the mounting surface. Apply Locktite to the threads of the mounting bolt up near the mounting surface and tighten each of the 4 bolts to 24 in-lb (21 kg-cm) torque [finger tight, then about 1/4 turn tighter] with a wrench.

DO NOT OVER-TIGHTEN. If the mounting bolt provided is too short, you will have to install mounting bolts of the appropriate length. If the bolt provided is too long, the excess length of threaded rod that extends above the radome base should be cut off.

Figure 3-9 Bolting the Radome/Antenna

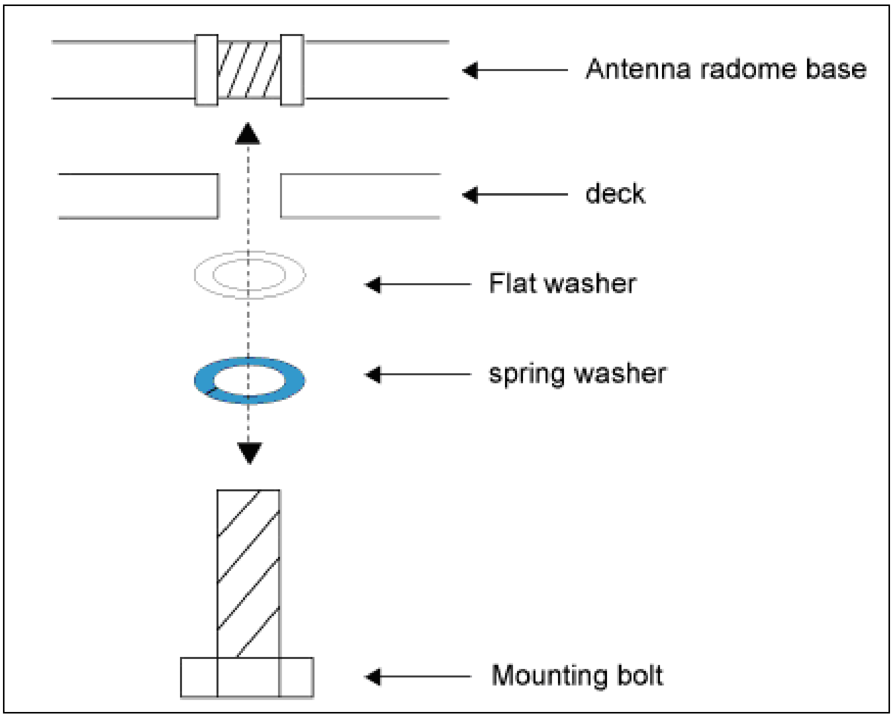

Figure 3-10 Tighten the nuts from below

3.4.4 Installing the Cables

Drill two cable access holes at the Radome base. Make sure that the pre-installed TX/RX cables is close to the access holes before drilling. Smooth the edge of the cable access hole and install the Cable Grand to protect the cables.

Figure 3-11 Typical Cable Grand

Thread the TX/RX cables through the cable access holes and connect them to the connectors of the antenna. Check the labels on both ends of each RF cable to make sure they match the radome base plate connector. Do not use Teflon gel on the cable fittings as it reduces signal strength at high frequencies.

Figure 3-12 Connecting the TX/RX Cables

Figure 3-13 Antenna on the Support Post

NOTE: If the antenna is to be fixed after conducting the ground testing, you have to remove the fixed jig after installing the radome assembly. If you do not remove the fixed jig and then supply power to the antenna, the antenna may be damaged. Please recheck whether the antenna is fixed or free when supplying power to the antenna.

3.5 Mounting the Antenna Control Unit

(ACU)

Install the ACU in front of a standard 19” equipment rack or other suitable location. The following are the recommended conditions for the ACU’s location.

1. The ACU should be placed in a dry location that is convenient for the user.
2. It must not be susceptible to magnetic interference nor be situated on a level surface.
3. It should be placed so that the LCD display is visible and the buttons are accessible.
4. Allow sufficient room at the back to connect all the cables to the rear panel.

Figure 3-14 ACU Rack Mounting

3.6 Installing the ACU Cables

The KA-160 ACU is connected with various systems such as a modem, ship's gyro, PC, etc. There are several functional connections that may be made on the various connectors. You may not need to make all of these connections, but they are listed here to enable you to decide which ones you do need to make during installation.

3.6.1 ACU Connectors

This section provides detailed ACU connectors, the function of connector. Most ACU connectors are located on the rear of the ACU, as shown in Figure 3-15.

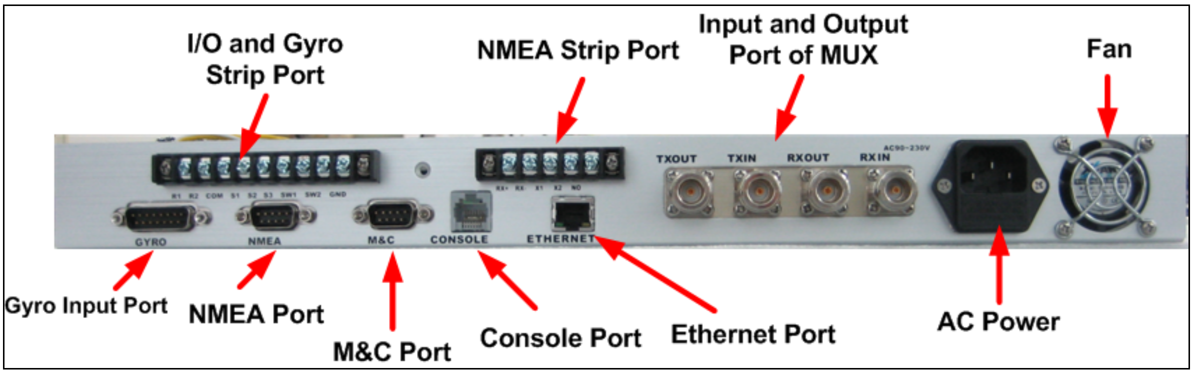

Figure 3-15 ACU Rear View

3.6.1.1 DB-15 Gyro Connector

Use this connector to connect the ship's gyro (synchro gyro, step-by-step gyro, and NMEA output of the gyro compass) to the ACU. Connect the ship's gyro to the ACU using a DB-15 female connector. The layout of the pins of the DB-15 connector is shown in Figure 3-16 below.

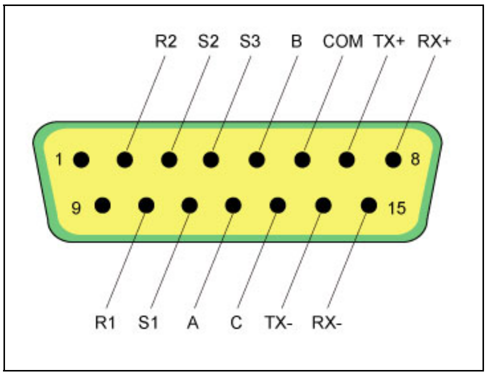

Figure 3-16 Layout of the DB-15 Gyro Connector Pins

3.6.1.2 DB-9 NMEA Connector

An NMEA Connector provides GPS data to the modem or to any other BDE that requires GPS data. Also, if the internal GPS of a Z12Mk2 is broken, the KA-160 ACU can receive external GPS data via a DB-9 NMEA connector

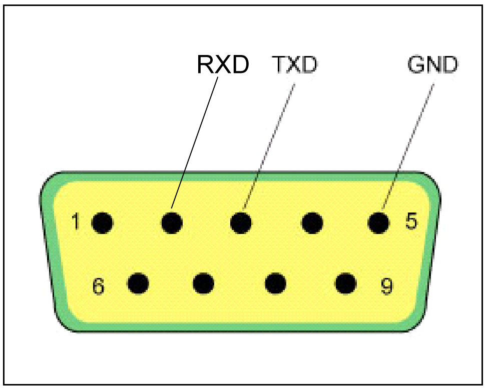

Figure 3-17 layout of the DB-9 NMEA Connector Pins

3.6.1.3 DB-9 Monitor & Control (M&C) Connector

The M&C connector is a DB-9 which supports RS-232 data. The baudrate of the M&C connector is fixed to 57600. The user can set and monitor using SuperTrack control software (SCS) V1.7 when the PC is connected to the ACU via an M&C connector.

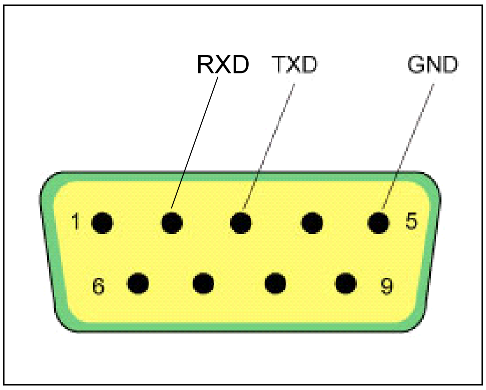

Figure 3-18 Layout of the DB-9 M&C Connector Pins

3.6.1.4 I/O and Gyro Strip Connector

The I/O and gyro strip connector can receive analog gyro output signals such as Synchro and Step by Step.

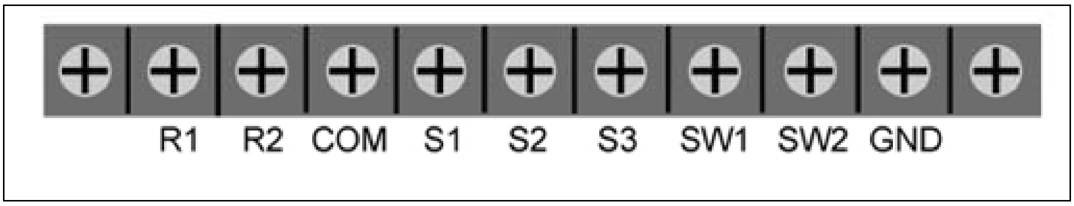

Figure 3-19 Layout of the I/O & Gyro Strip Connector Pins

SW1 and SW2 of the I/O & gyro connector can control the TX mute function of the modem by “contact closure” when the antenna is in the blockage or the preset block area (refer to the operation section). Also, SW1 and SW2 supply the selection signal to coax the switches in VSAT dual-antenna configurations.

The user can select ‘Contact Closure’ or ‘DC 5V Output’ by SW1 and SW3 of the ACU board, as shown in Figure 3-22 below.

SW1, SW3 Mode on ACU Board	Function of SW1, SW2in I/O & Gyro Strip Connector
A(Contact Closure)	Contact Closure
B(Power)	Power Output (SW1 : 5V, SW2 : GND)

Table 3-1 SW1 & SW2 Function

SW1, SW3 Mode on ACU Board	Function of SW1, SW2in I/O & Gyro Strip Connector	
	Tracking	Block, Initializing, Searching
A(Contact Closure)	SW1 ~ SW2 : Closure	SW1 ~ SW2 : Open
B(Power)	SW1 : 5V, SW2 : GND	SW1 : 0V, SW2 : GND

Table 3-2 SW1 & SW2 Function upto the Status of Antenna

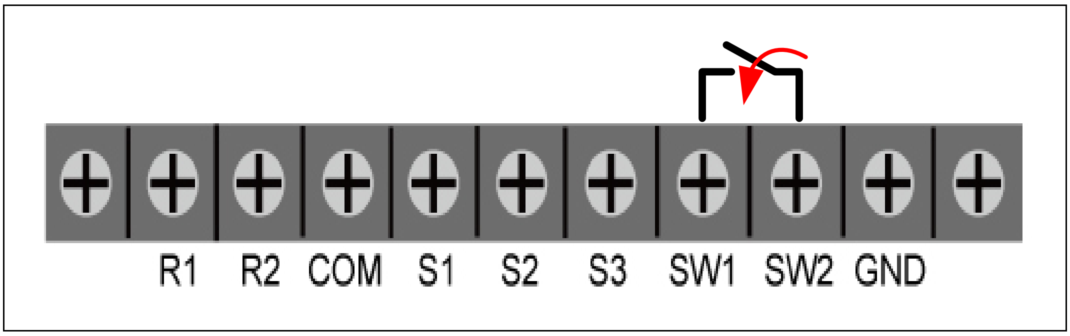

Figure 3-20 A Mode: Contact Closure

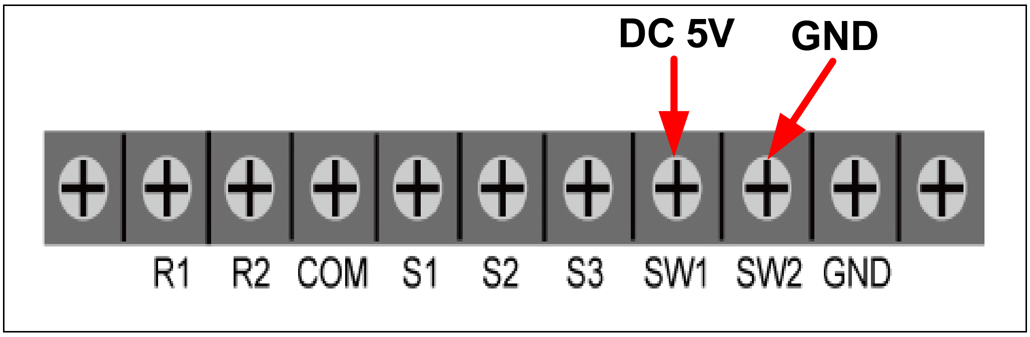

Figure 3-21 B Mode: Power Output

NOTE: Do not use the I/O & gyro strip and the DB-15 gyro connector at the same time as this may damage the ACU.

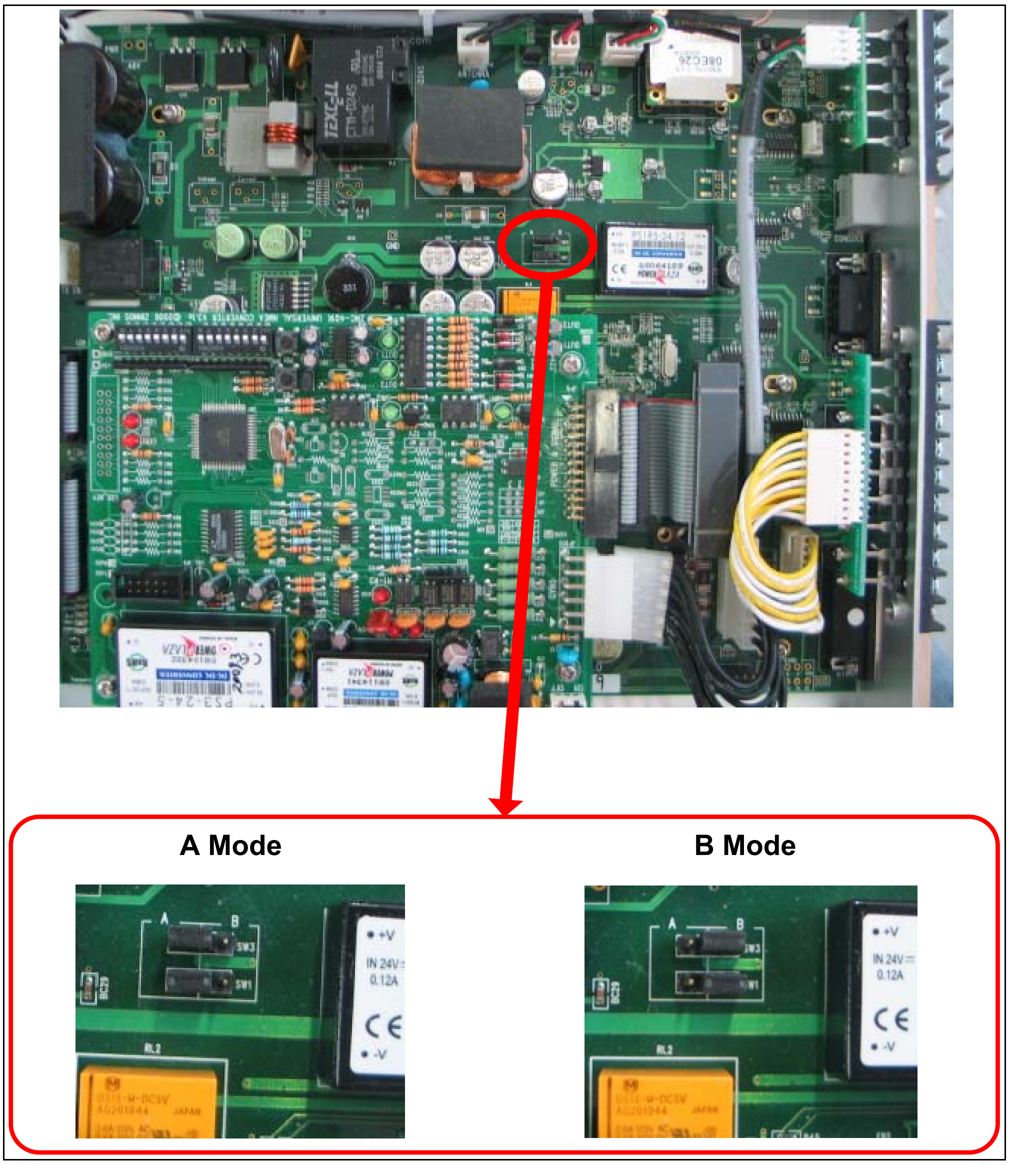

Figure 3-22 ***Mode Selection in the ACU Board using a Jumper***

CAUTION: There is a risk of electric shock from the gyro compass output lines. Make sure that the gyro compass output is turned OFF when handling and connecting the wiring to the ACU gyro connector.

3.6.1.5 NMEA Strip Connector

If the ship's gyro is of the NMEA type, the installer can use an NMEA strip connector. X1, X2, NO are not available.

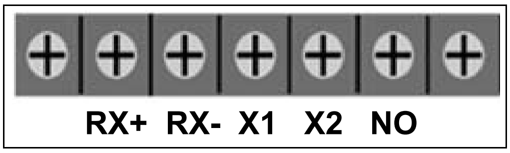

Figure 3-23 Layout of the NMEA Strip Connector Pins

NOTE: Do not use the NMEA strip and the DB-15 gyro connector at the same time as this may damage the ACU.

3.6.1.6 RJ-45 Console Port

The RJ-45 console port provides the following: Transmits GPS information and transmits Mute, receives TX lock and external AGC values (0~5 VDC).

Table 3-3 shows the pins of RJ-45 console port. The signal directions are referenced either into (RX) or out from (TX) the port.

RJ-45 (DTE)	Type
2	RX Lock
4	GND
5	GND
6	GPS
7	TX Mute
8	Ext AGC
All Other Pins	N/A

Table 3-3 Layout of the ACU RJ-45 Interface Pins

3.6.1.7 Ethernet port

The operator can access to the ACU from outer devices via the Ethernet. Then, the operator can monitor the state of the antenna using the T-Monitor program when connected to the ACU via the Ethernet. Also, the operator can set the antenna using the SCS V1.7 program.

3.6.1.8 RX & TX Connectors (N-Type)

The RX IN connector supplies 48V DC power to the antenna and receives RX signals from the antenna. Also, the KA-160 ACU communicates with the antenna using Bluetooth via the RX IN connector.

The RX OUT connector sends RX signals to the satellite modem.

The TX IN connector receives TX signals from the satellite modem when using the TX power supply (48V, 150W) of the KA-160 ACU as BUC power.

The TX Out connector supplies 48V DC power and sends TX signals to the BUC when using the TX power supply (48V, 150W) of the KA-160 ACU as BUC power.

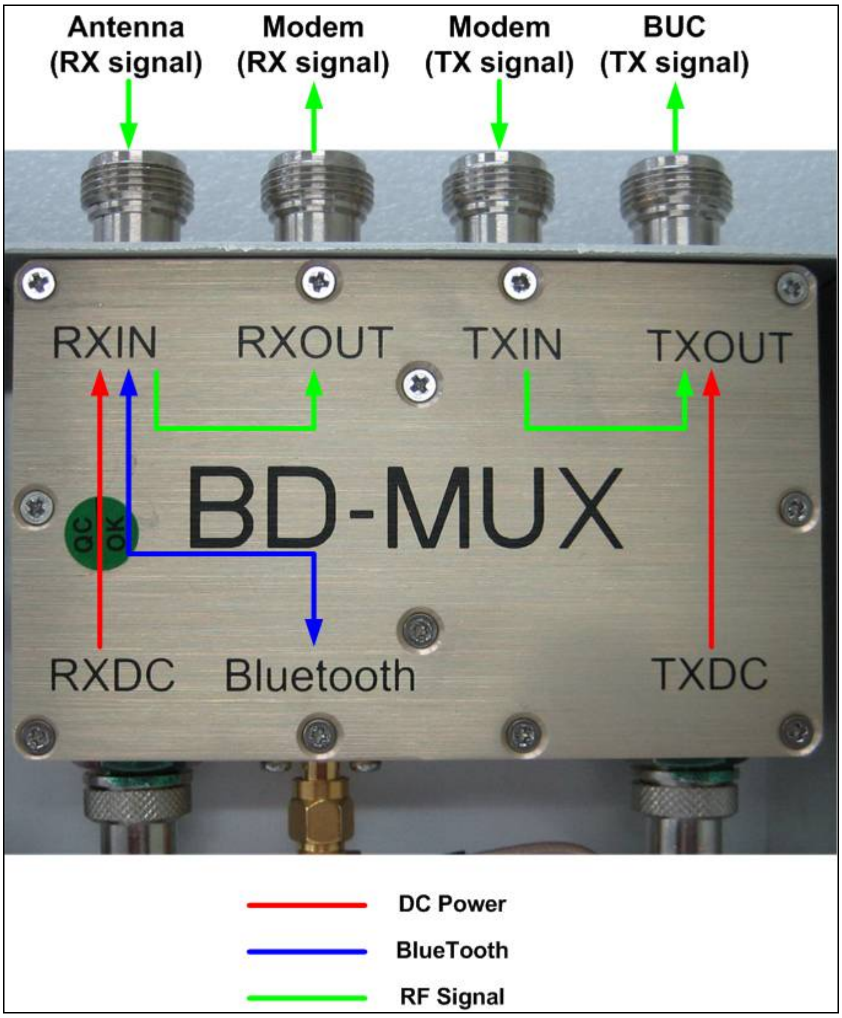

Figure 3-24 Data Flow through the RX and TX Connectors

3.6.2 ACU Cable Connection

There are two types of ACU cable connection. The installer can select the connection types as BUC capacity. If the modem cannot support BUC power consumption, the installer will have to use the TX power supply of the ACU or an external power supply.

In a standard configuration, the cabling between the above-deck equipment (antenna pedestal) and the below-deck equipment (ACU) only requires TX and RX L-band coaxial cables of a type that will be determined during the installation process (based on the length of the cable required).

It is strongly recommended to run the cables directly from the antenna to the ACU, thereby dispensing with the need to go through any IF patch panels to provide the best signal level for viewing.

It is important to keep these cables the grounded (outer shield of the coax cable) isolated from any other groundings due to the sensitivity of the CMOS components of the PCU.

A good rule of thumb is that the receive (RX) L-band cable be directly connected to the antenna control unit. This is because the receive (RX) L-band cable provides the DC power to the PCU to operate that antenna. Technically speaking, the grounds from the TX and RX IFL runs can be different, but a single piece of cable running from the ACU to the antenna will ensure that the antenna operates properly and protect it from a possible 48 VDC, which supports the optional BUC installation.

Refer to Figures 3-25 and 3-26 below for a simplified block diagram of the different sizes of BUC installations.

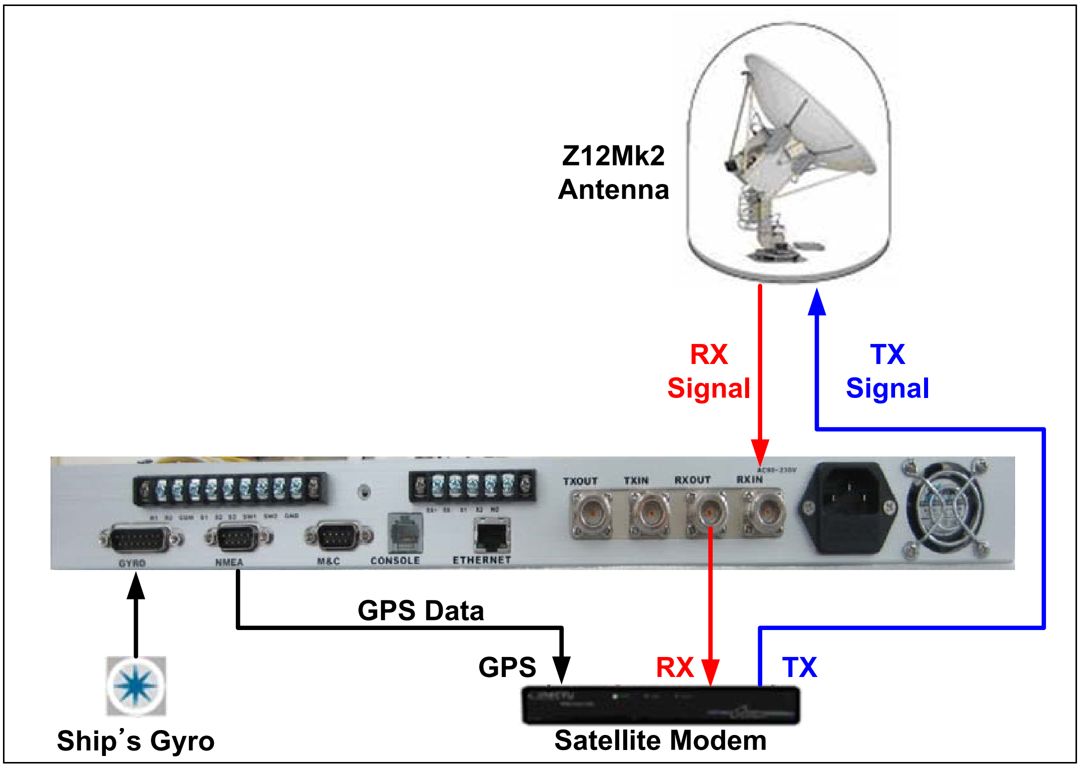

Figure 3-25 ACU Cable Connection (BUC Capacity: Modem supplies the BUC Power)

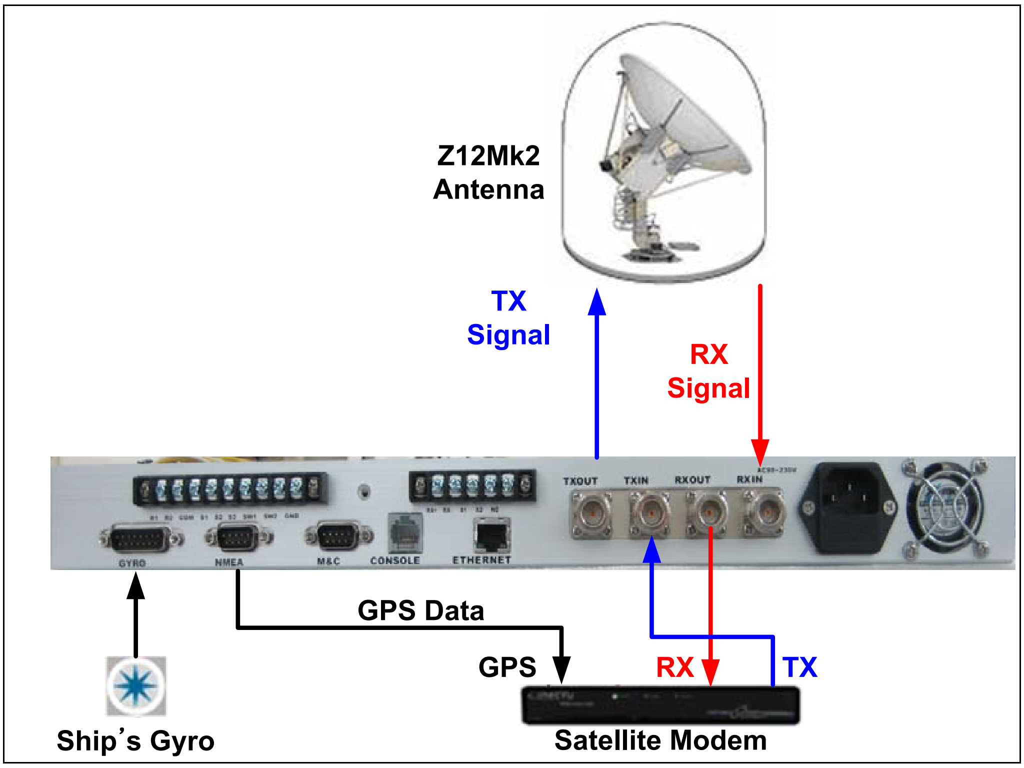

Figure 3-26 ACU Cable Connection (BUC Capacity: ACU supplies the BUC Power)

3.6.3 ACU Gyro Compass Cable Connection

The KA-160 ACU will accept Synchro, Step-by-step, and NEMA interface data for a Gyro compass connection.

The ACU is configured with a terminal strip and a DB-15 port. Care must be taken when completing these connections. These wires may conduct high voltages and can damage equipment and/or cause personal injury.

For the synchro and step-by-step gyro inputs, the installer must enter the ship's heading information for proper operation. Also, it is recommended that a validation test be conducted to determine whether the proper heading updates are being received on the ACU screen.

If the ACU heading is being updated in reverse, the ACU can be modified to change the polarity of the incoming voltage.

3.6.3.1 Synchro-Type Gyro Connection

In the case of the synchro-type gyro, use the 5 pins (R1, R2, S1, S2, S3) of the DB-15 connector or the I/O & gyro strip connector.

Gyro DB-15 Pin No.	Type
10	R1
2	R2
11	S1
3	S2
4	S3

Table 3-4 Pins Used for the Synchro-Type Gyro

NOTE: We recommend AC 11.8~115V (RMS) and 50~500Hz as the input range of the synchro-type gyro.

3.6.3.2 Step-by-Step Type of Gyro Connection

Use the 4 pins (COM, S1, S2, S3) of the DB-15 connector or the I/O & gyro strip connector when the ship's gyro is of the step-by-step type.

Gyro DB-15 Pin No.	Type
11	S1
3	S2
4	S3
6	COM

Table 3-5 Pins Used for the Step-by-Step Type of Gyro

NOTE: We recommend DC 25~75V as the input range of the step-by-step type of gyro.

3.6.3.3 NMEA Type of Gyro Connection

When the ship's gyro is of the NMEA type, use the 8th(RX+) pin and the 15th(RX-) pin.

Gyro DB-15 Pin No.	Type
8	RX+
15	RX-

Table 3-6 Pins Used for the NMEA Type of Gyro

NOTE: KA-160 ACU can accept the various format of NMEA, as follow: HDT; HDG; HDM. But NMEA signal must be matched the regular NMEA format as below.

$HEHDT,x.x,T*hh<CR><LF>

$HEHDG,x.x,x.x,a,x.x,a*hh<CR><LF>

*hh means checksum of format. If there is no this checksum, KA-160 ACU can't accept the gyro signal.

3.6.3.4 RJ-45 Connection for Satellite Modem

The KA-160 ACU and the satellite modem exchange some data with each other, such as GPS data, TX mute functions, external lock state, and external AGC.

Otherwise, please refer to the following:

GPS RS-232 Output

TX Mute: Supply DC voltage to the modem,

'0V' means that the antenna is in normal tracking status.

'5V' means that the antenna is mute or is in block area.

External lock bit: The TTL level can be set as '0' or '1'. Please refer to 'External Lock TTL Level' of 'Installation Mode'

External AGC: The voltage range must be approximately 0~5VDC (the higher the signal strength, the better the signal). If the voltage level is above 5V, the resistor can be used for voltage drop.

RJ-45 Pin No.	Type	ACU	Signal Direction	Modem
2	RX Lock	Receive	←	Send
4	GND	GND		GND
5	GND	GND		GND
6	GPS	Send	→	Receive
7	TX Mute	Send	→	Receive
8	Ext AGC	Receive	←	Send
All Other Pins	N/A			

Table 3-7 Data Type and Data Flow of RJ-45 Console Port

3.6.3.5 NMEA Port Connection for GPS Data

The GPS is located on the elevation plate of the antenna. The GPS antenna sends correct GPS data to the PCU when GPS data is available. Then, the PCU sends the GPS data to the ACU.

However, if GPS data is not available, the GPS antenna does not send GPS data to the PCU. Also, the GPS antenna will not send GPS data to the PCU if it (GPS) is broken. In this case, the PCU sends default GPS data value to ACU, which is saved data gathered from GPS antenna.

The PCU sends the GPS data to the ACU via the receive (RX) L-band cable. The ACU processes and regenerates the GPS information received from the PCU via the DB-9 NMEA (RS232) and the RJ-45 console port.

The format and baud rate of the GPS can be configured as GPRMC or GPGLL or GPGGA, and from 1200 to 115200 bps, respectively, using the KA-160 ACU. The DB-9 NMEA and the RJ-45 ports can each have a different format and baud rate. Please refer to the '7.2.8 GPS Output Format & Baudrate' of installation mode for further details.

NMEA DB-9 Pin No.	Type
2	Receive Data
3	Send Data
5	GND
All other pins	NA

Table 3-8 Pin Layout of NMEA Port

NOTE: At the first power-on for the GPS antenna, it will take about 5 minutes to calculate your location from GPS satellite signals and configure the database.

NOTE: If the internal GPS is broken or non-valid, the KA-160 ACU can accept the external GPS signal. But order of priority is given to the internal GPS signal.

NOTE: If the ship's gyro is a GPS compass that has a heading angle and GPS data, the KA-160 ACU can accept the heading angle and the GPS signal via the Gyro connector (DB-15 pins) at the same time.

3.6.3.6 M&C Port Connection

Use the M&C port when monitoring and configuring the antenna using the PC and SCS ver 1.7. This requires the installation of a serial cable or Mini USB-to-Serial cable for communication between the two devices. Remember that the baud rate of the M&C Port is fixed at 57600.

M&C DB-9 Pin No.	Type
2	Receive Data
3	Send Data
5	GND
All other pins	NA

Table 3-9 Layout of M&C Port Pins

3.6.3.7 Ethernet Port

Both installer and operator can access to the ACU from outer devices using the Ethernet. You must configure the host IP address, gateway, and subnet-mask to use the Ethernet. We provide remote access software (SCS V1.7 & TMonitor) to the dealer. If you wish to obtain this software, please contact us.

4. Theory

4.1 Self-Disciplining Algorithm

The greatest difference of the KNS antenna system from other stabilized antennas is its superbly designed algorithm. Pin-point accuracy can be easily obtained with a spectrum analyzer during satellite cut-over. The key reason for this pin-point accuracy is to guarantee the capacity for self-discipline, whereby the algorithm constantly calculates the difference between theoretic and real-time values and disciplines itself accordingly. This algorithm requires very complex computations, and the KNS antenna system uses the 32-bit DSP process with 150 MHz of clock when it performs the calculation at nano-second (10^{-9}) speeds (i.e. a thousand times faster than a micro-second).

The motioning patterns in land-mobile and maritime applications are very different. For example, dramatic acceleration or deceleration occurs in land-mobile applications, whereas pitch-roll-yawl motions occur in maritime applications.

Some vendor stabilized systems may have up to two different sets of algorithms specific to land-mobile and maritime applications. The KNS stabilizer uses a single algorithm for land-mobile and maritime applications simply because the motion sampling process of the DSP is far faster than any actual motioning condition.

4.2 Searching and Tracking Reference

Z12Mk2 antenna uses the “tuning” and “fine tuning” methods. Searching is a “tuning” process which tries to find the satellite by covering a wide range of elevation and azimuth motions; tracking is a “fine tuning” process which optimizes the pointing by a “Dish Scan” mode after searching for the signal of the target satellite.

There are seven searching references, as follows: DVB C/N(Carrier to Noise) Threshold; DVB AGC Threshold; RSSD Threshold; DVB Carrier Lock Bit; External Lock Bit; External AGC Threshold; External Lock Bit & DVB C/N Threshold. And, there are three tracking references: DVB Tuner AGC Level; DVB C/N Ratio; and RSSD Level. The ACU can be configured by the operator to function in any combination of Searching and Tracking references.

NOTE: With the threshold searching references the antenna will perform a search pattern until the receive level measured by the RSSD or DVB tuners exceeds the pre-configured threshold level.

4.2.1 Searching Reference

4.2.1.1 DVB C/N Threshold

The antenna searches for the satellite using the DVB tuner and a C/N threshold level.

The antenna "believes" that it points towards the target satellite whenever the DVB C/N level is above the threshold. Hence, the threshold level value should be carefully selected to ensure the success of the searching process.

4.2.1.2 DVB AGC Threshold

The antenna searches for the satellite using the DVB tuner and an AGC threshold level.

The DVB tuner measures a power spectrum of about 2 MHz at its tuned center frequency and represents its strength as an AGC level (higher is stronger).

The antenna "believes" that it is pointing towards the target satellite whenever the DVB AGC level is above the preset threshold. Hence, the threshold level value should be carefully selected to ensure the success of the searching process.

4.2.1.3 RSSD Threshold

The antenna searches for the satellite using an RSSD threshold level.

RSSD measures a power spectrum of about 50 KHz at its tuned center frequency and represents the strength as an RSSD level (higher is stronger). The antenna "believes" that it points towards the target satellite whenever the RSSD level is above the threshold. Hence, the threshold level value should be carefully selected to ensure the success of the searching process.

4.2.1.4 DVB Carrier Lock Bit

The antenna searches for the satellite using the DVB carrier lock.

We recommend a DVB carrier lock bit as a searching reference if a DVB carrier is available. The search speed is much faster than other searching references.

If the antenna points towards the target satellite and the DVB tuner has the correct carrier parameters, the DVB demodulator locks on the carrier and sets the lock bit on, which means the antenna is pointing towards the correct satellite, provided that an identical DVB carrier is not present on an adjacent satellite (low probability).

This requires the DVB tuner to be configured with the correct carrier parameters, such as frequency, symbol rate, and FEC.

4.2.1.5 External Lock Bit

The antenna searches for the satellite using the logical voltage status of an external contact closure (CC). Lock bit state by the logical voltage depends on the type of modem. In the case of an HNS modem, when the voltage level of the CC is logical high (2.6~5VDC), the lock bit is considered to be on. Conversely, the iDirect modem's lock bit is on when the logical voltage is low. For the specifications of each, please refer to the modem manual.

Like the in-built DVB tuner, some external demodulators are capable of generating a lock signal when the carrier is locked. This information can be used for searching in the same manner as the DVB carrier lock. However, the response time of the external device between detecting lock and setting lock on must be as fast as the speed of the Z12Mk2 searching process.

To keep the response times to a minimum, it is necessary to use a lower value for the acquisition range (no higher than 30 KHz) and a PLL-based LNB (LNB stability should be within +/-10Khz).

NOTE: A drawback occurs when antenna is in the tracking process and the lock bit is off (logically unlocked) stemming from the loss of CC connection. And then, the antenna returns to the searching process. This will also apply to the External AGC threshold if used for searching.

4.2.1.6 External AGC Threshold

The antenna searches for the satellite using the AGC threshold level of an external device like an in-built DVB tuner. Some external demodulators are capable of generating an AGC level RX carrier strength from an analog voltage level.

This information can be used for searching in the same manner as the RSSD or DVB AGC threshold. However, if the response time between detecting the change of the carrier level and generating an AGC level is slow, it cannot be used. To keep the response time to a minimum, it is necessary to use a minimum value of acquisition range and PLL-based LNB.

NOTE: A drawback occurs when the antenna is in the tracking process and the AGC level is below the preset threshold (logically unlocked), due to the disconnection with the CC source. After that, the antenna restarts the searching process. This also applies to the External Lock Bit.

4.2.1.7 External Lock Bit & C/N Threshold

The antenna searches for the satellite using the external lock bit and the C/N (AGC value of modem) threshold level.

4.2.2 Tracking Reference

The tracking algorithm uses selected energy level variations while the antenna scanning process is on. The tracking process is only initiated when the searching conditions have been met.

4.2.2.1 RSSD Level

The antenna tracks the satellite by dish-scan by reading the RSSD power level of 100 KHz of the desired carrier for the target satellite. Usually, the RSSD frequency is the L-band frequency of the target carrier, but the user can change the RSSD frequency to the desired L-band frequency.

4.2.2.2 DVB AGC Level

The antenna tracks the satellite by dish-scan by reading the DVB AGC level changes of the desired carrier on the target satellite. AGC level tracking may result in tracking off from the target satellite, when there is severe interference from an adjacent satellite that has a stronger carrier level.

4.2.2.3 DVB C/N Ratio

The antenna tracks the satellite by dish-scan by reading the DVB C/N ratio change of the desired DVB carrier on the target satellite. The DVB tuner C/N ratio is very useful where there is adjacent satellite interference (ASI). ASI can create a higher energy level but will reduce the C/N ratio at the same time. The C/N ratio tracking method will not cause the antenna to track off the target satellite.

4.3 Methods of Finding Satellite

Z12Mk2 has four satellite finding methods: manual pointing, auto searching, manual searching, and reference searching. The user can select the proper method by satellite.

4.3.1 Manual Pointing

In this pointing method, the user controls the antenna manually by entering the desired EL and AZ. The ACU will not perform any searching pattern but tracking is always on. This is a handy option, and is used primarily during the initial installation and troubleshooting process.

4.3.2 Manual Searching

The EL and AZ values are entered manually in lieu of being automatically calculated by the ACU. The antenna first points the manually-entered EL and AZ values and then performs the search to locate the target satellite. After the searching condition has been met, the antenna will automatically enter a tracking mode.

4.3.3 Auto Searching

Auto-Searching is the most recommended searching method. The system runs a built-in satellite calibration program using pre-configured information such as satellite longitude and automated GPS (site) location data, which can be manually entered in the case of a GPS failure.

The program calculates the EL and AZ values, and then the antenna points to that calculated satellite position and begins the search process to find the target satellite. After the searching condition has been met, the antenna enters into the tracking mode.

4.3.4 Reference Searching

In cases where the target carrier of the desired satellite and the carrier of the adjacent satellite have the same parameters (frequency, symbol rate, FEC, etc.), the antenna can search for the carrier of the adjacent satellite. This method is strongly recommended in such cases.

To use this method, the user must select the reference satellite which is certain to search and track the carrier. The reference searching process is as given below. Please refer to Figures 4-1 and 4-2 below.

a. First, the antenna searches and tracks the reference satellite.

b. The antenna tracks the reference carrier for 10 seconds.

c. Then, the antenna searches for the desired carrier.

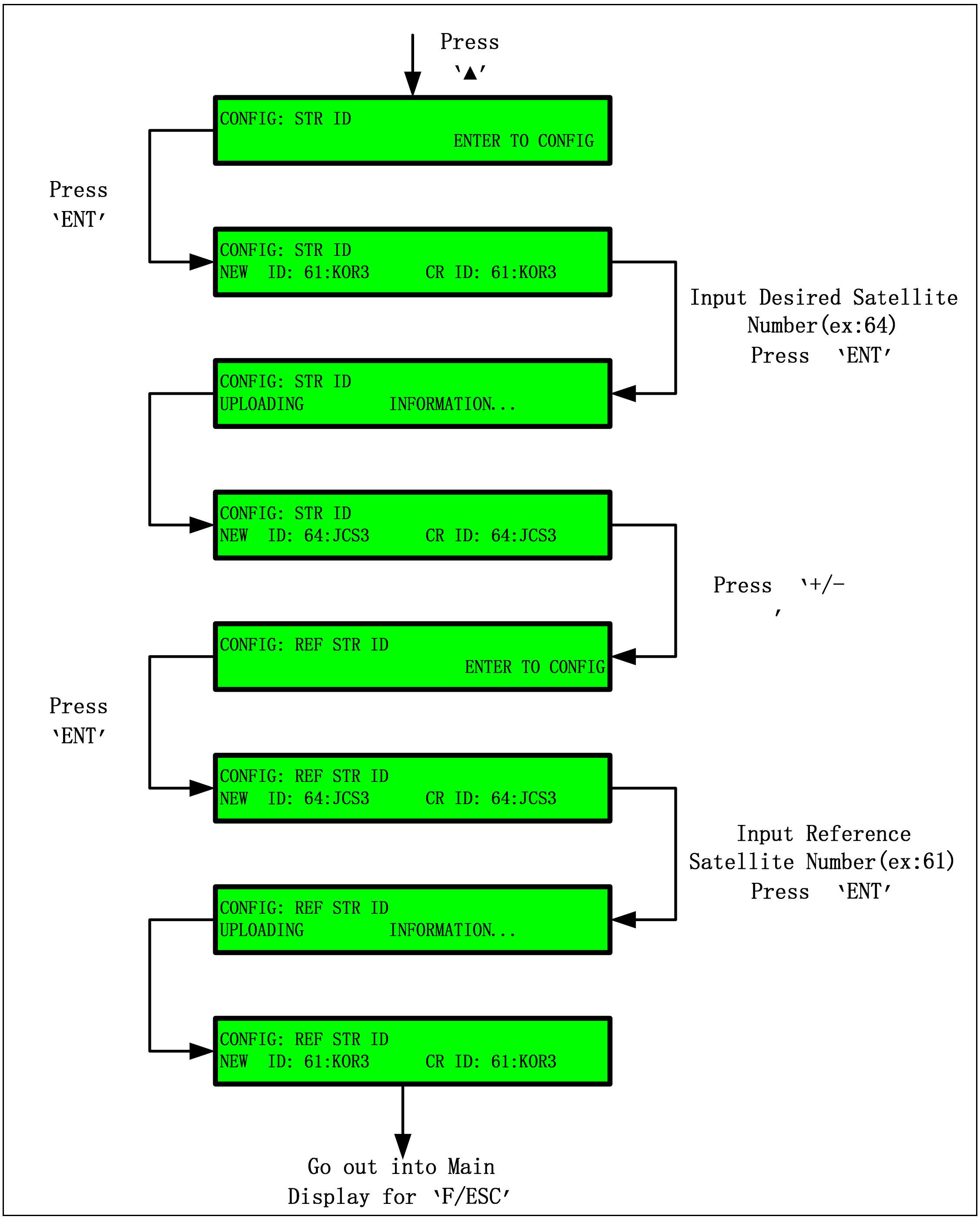

Figure 4-1 Step 1 of Reference Searching (Definition)

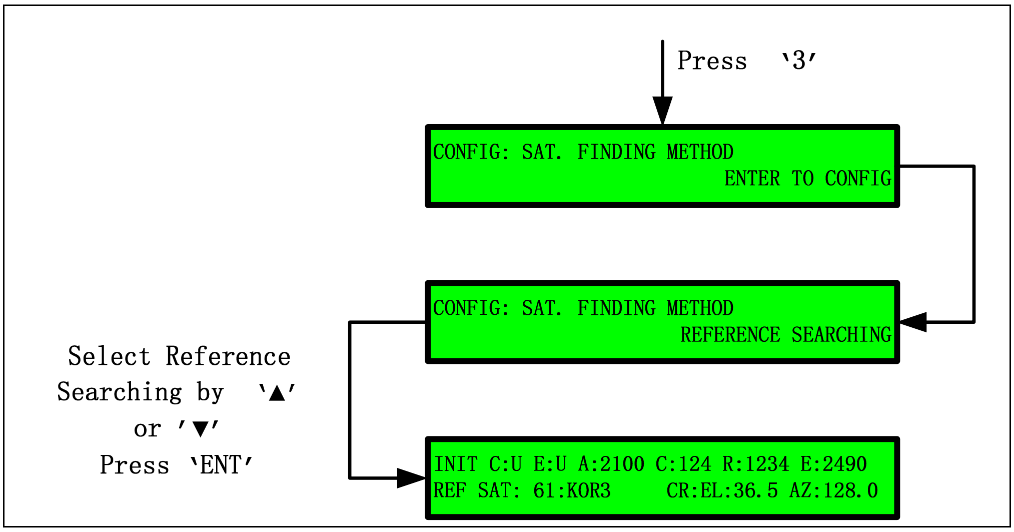

Figure 4-2 Step 2 of Reference Searching (Start the Reference Searching)

4.4 Searching Standard

Z12Mk2 with DVB-S2 has four searching standard methods: manual pointing, auto, DVB S1, DVB S2, DSS. The user can select the proper method according to desired carrier.

4.4.1 Auto

In this searching standard method, PCU will analyze the carrier using DVB tuner for tracking of carrier. But 'Auto' mode spends more time to search the carrier. So we recommend the other methods like 'DVB S1' or 'DVB S2', 'DSS'.

4.4.2 DVB S1

In this searching standard method, PCU will search the DVB S1 carrier. User must know the proper system encryption to find desired carrier.

4.4.3 DVB S2

Select this method, if your desired carrier is using the DVB S2 encryption.

4.4.4 DSS

Select this method, if your desired carrier is using the DSS encryption.

4.5 LNB Compatibility

To validate the LNB compatibility, the operator must know the following steps.

1. RF downlink frequency in Ku-band: If the searching and tracking reference is configured for an RSSD or DVB carrier, then the operator must know the center frequency of the RF down-link (receive) within the range of 10.95 ~ 12.75 GHz (Ku-band RX frequency range).
2. LNB input frequency range: The LNB specifications sheet or manufacturer's label on the LNB usually identifies the input frequency range.
3. This value can also be calculated from the LNB LO frequency and the output frequency range.
4. The BW of the carrier which the modem is receiving: Carrier size given in MHz.
5. The LNB stability: The specifications of the LNB usually include its stability.

First, the installer should determine whether:

1. The RF downlink frequency is within the 2 LNB input frequency. If not, the DVB or RSSD tuner cannot be locked on the carrier.
2. If the searching reference is RSSD (narrow band tuner) or external lock, it is important to use an LNB with +/- 10 KHz stability; typically, a DRO LNB has +/-500 KHz of stability, which can be problematic at best if the tracking carrier is a very narrow carrier, as in a beacon and CW carrier. Also, the external modem can't lock on fast enough with the installed LNB with +/- 500 KHz of stability, which is also problematic if the external lock is used for the searching method.

NOTE: The KNS antenna supports a universal LNB. The DC voltage selects different LO frequencies to cover the entire Ku-band. However, most universal LNBs are of the DRO type, where stability is +/- 500 KHz.

4.6 BUC Compatibility

The block up-converter (BUC) is a device comprising an up-converter and power amplifier in a single package. It has an operating frequency range which supports standard Ku-band frequencies from 14 ~ 14.5 GHz, while the extended Ku-band operates in the frequency range of 13.75GHz ~ 14.5GHz.

It is important to make sure that the desired carrier frequency is within the operating range of the BUC. Most BUCs require a 10 MHz external reference and a DC voltage from the modem or the ACU. However, if a BUC is activated with an internal 10 MHz reference, there is no need to provide 10 MHz reference from the modem.

Make sure that the proper DC voltages are provided to the BUC. The equipment will be damaged if a 24 VDC BUC is provided with voltage of 48 VDC, which is generally used in larger BUCs. Note that, currently, the ACU only provides 48 VDC down the TX IFL cable.

5. Initial Configuration

After installing the radome assembly and the ACU, the Z12Mk2 antenna must be configured with some parameters to ensure correct operation of the antenna. This section concerns 'How to configure the antenna for the first time'. If the initial configuration is incorrect, it may have a detrimental effect on the antenna's operation.

5.1 Supply AC Power

During the initial power-up sequence, the ACU provides DC current (48 VDC) via the receive (RX) L-band cable. The ACU has a built-in short-circuit protection to ensure that there is no short circuit between the center conductor of the L-Band RX cable and the shield or other metallic surfaces.

5.1.1 ACU Operation Procedures

The KA-160 ACU is initialized as shown in Figure 5-1 or Figure 5-2 of the ship's gyro types when the ACU power is on.

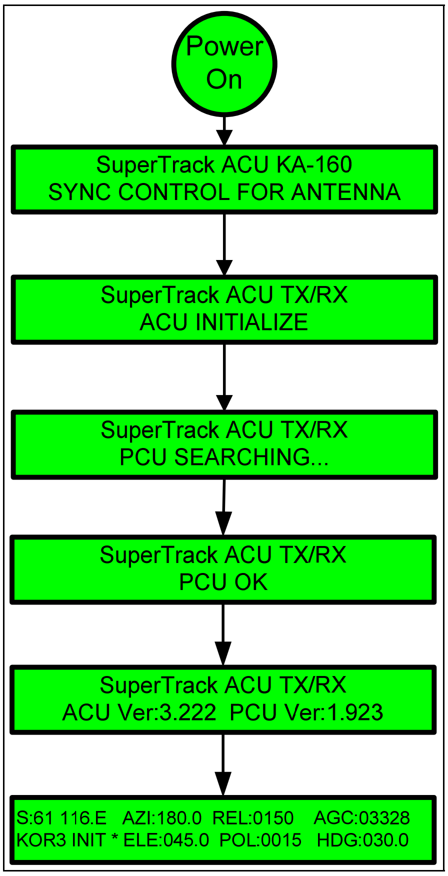

Figure 5-1 ACU Starting Normal Operation (Gyro Type: NMEA, Synchro 1:1)

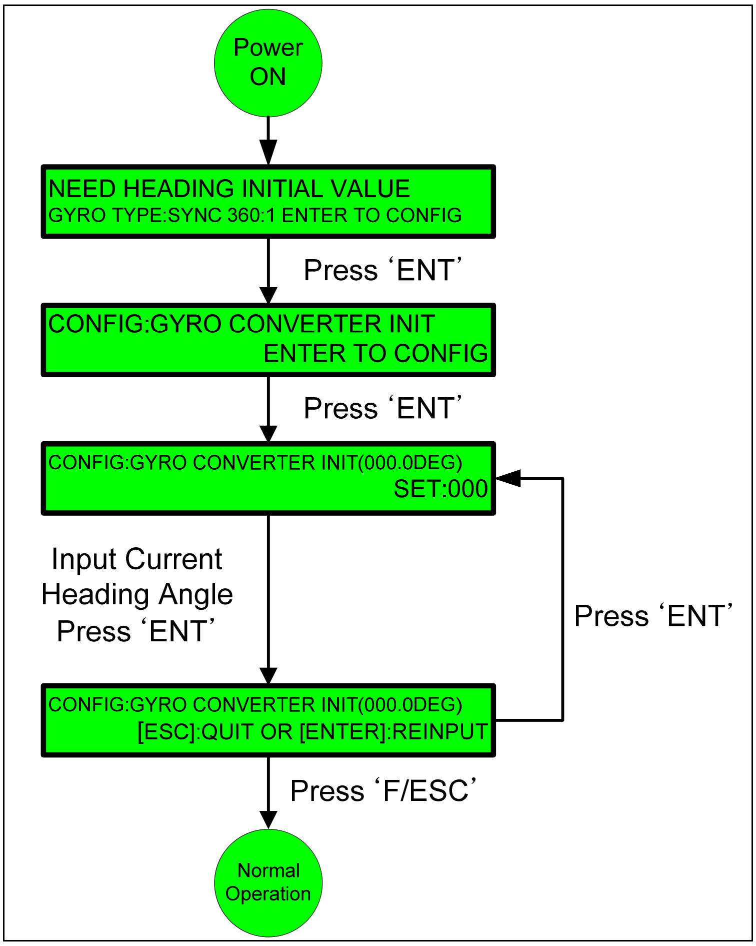

Figure 5-2 ACU Starting Operation Requiring Heading Angle (Gyro Type: Other)

If the ship’s gyro is of the NMEA or Sync 1:1 type, the ACU operates normally. In other cases, the user has to input the ship’s current heading angle into the ACU, or else the ACU will not operate.

5.1.2 Bluetooth Communication

The Z12Mk2 and the KA 160 ACU communicate with each other using Bluetooth. The

Bluetooth data flows via the RX (L-band) cable. All data are transported by Bluetooth, except for the RX signal and DC power.

The ACU Bluetooth connects with the preset PCU Bluetooth when the ACU is initializing. The antenna is initializing when the connection of ACU Bluetooth and PCU Bluetooth is a success.

Bluetooth was paired in a factory, but the user must re-pair the Bluetooth if the Bluetooth module is changed. Refer to Figure 5-3 below.

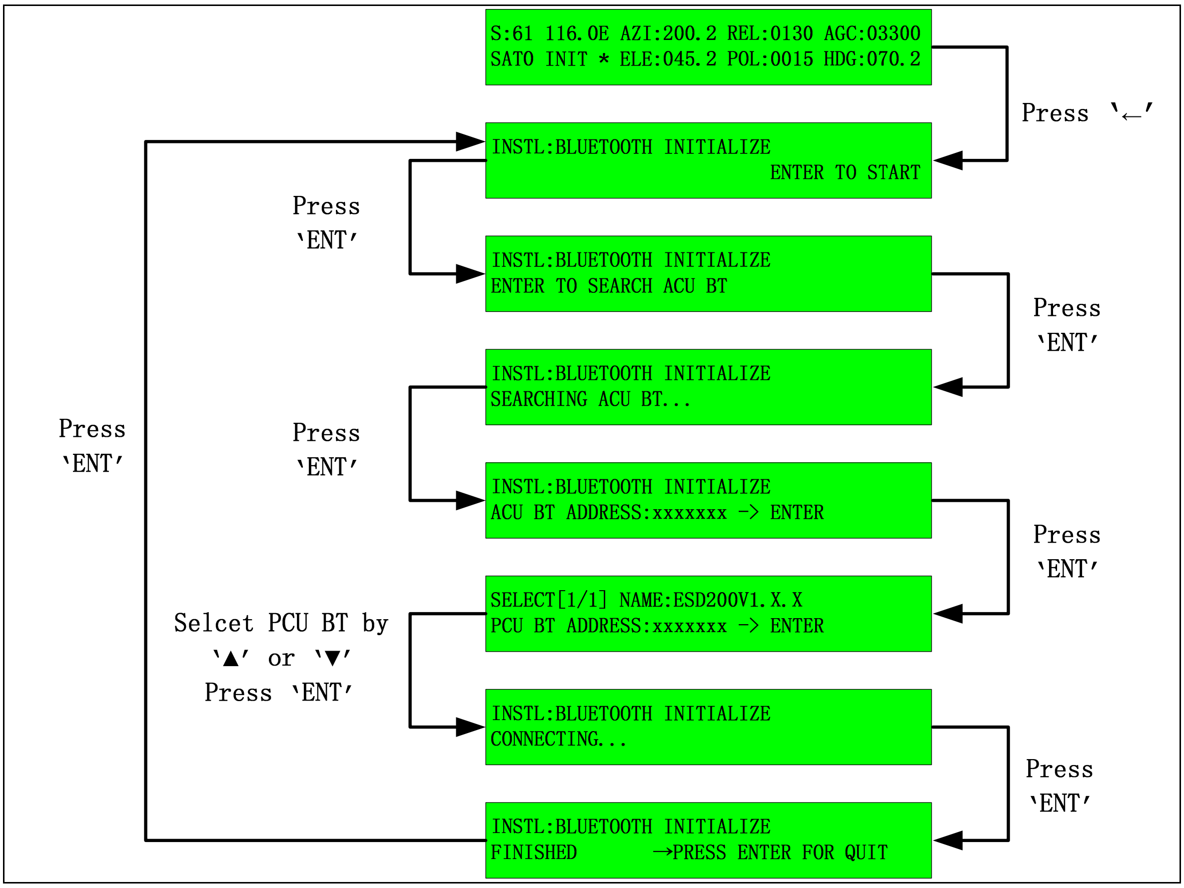

Figure 5-3 Bluetooth Pairing Step

NOTE: You can see the Bluetooth systems around the ACU when pairing the Bluetooth, so you have to select the proper Bluetooth module. Our Bluetooth module's name is 'ESD' and Bluetooth module's address is on the top side of the Bluetooth module.

5.1.3 Main Display of the ACU

You can see the parameters, such as those given below in Figure 5-4, after connecting Bluetooth.

- S: 60: Satellite ID. Z12Mk2 has 80 ID as 1~80.
- SAT0: Satellite name. Operator changes the satellite's name; please refer to 'Configuration Mode' to change the satellite's name.
- 116.0E: Longitude of the satellite.
- INIT *: State of antenna. '*' means that the receive signal is not stable or that the antenna is in the preset block area.
- AZI: Azimuth angle of the antenna's pointing position.
- ELE: Elevation angle of the antenna's pointing position.
- REL: Relative angle of the ship's bow and the antenna's pointing position.
- POL: Polarity (Skew angle)
- AGC: Energy level as tracking reference : DVB AGC or DVB C/N or RSSD
- HDG: Heading angle of the ship's gyro

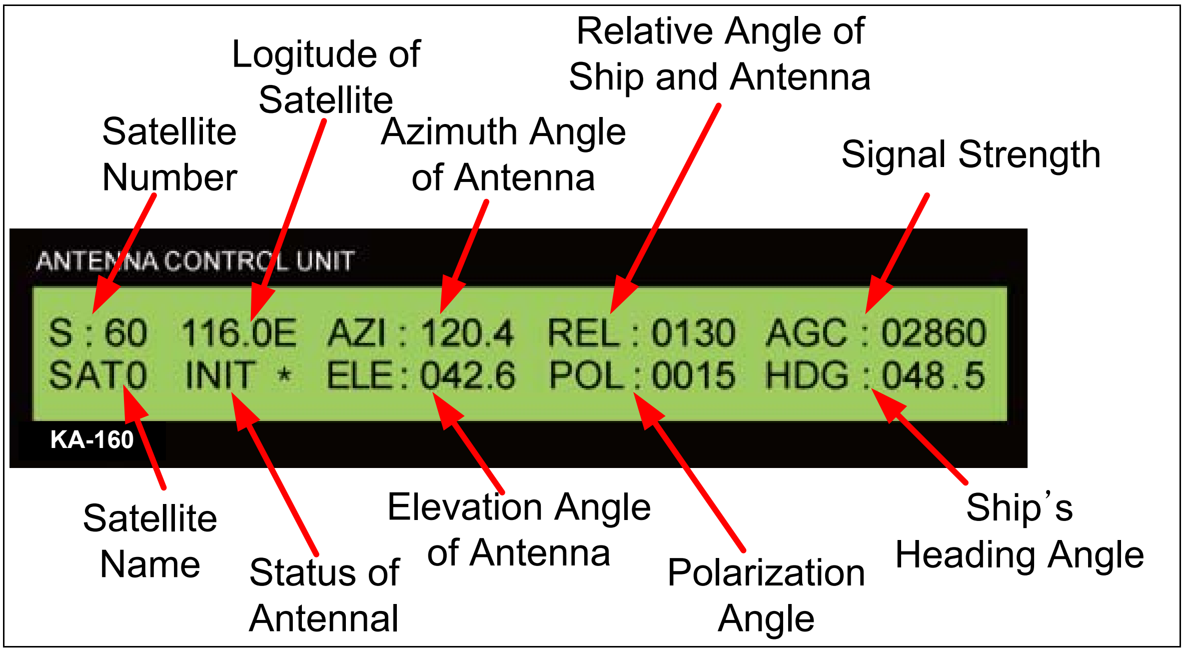

Figure 5-4 Main Display of ACU

5.2 Alignment of the Antenna and the Ship's Bow

We recommend that the bow mark of the radome base be aligned with the ship's bow for correct tracking of the satellite. But the ship's mounting condition usually varies and is limited, so the installer can mount the antenna in a direction other than the recommended direction. If the antenna is mounted in another direction, the installer must re-set the heading offset. Please refer to the steps outlined below to configure the heading offset.

NOTE: Heading offset is only required when the PCU compass mode is 'NORMAL', 'ENHD FAILED (Enhanced Failed)', 'GYRO FAILED'. An internal magnetic mode does not reuquire the heading offset. Please refer to 'Installation Mode' to determine the PCU compass mode.

NOTE: Heading offset only affects the azimuth angle, and has nothing to do with elevation.

5.2.1 Confirming the Current Heading Offset

You can see the current heading offset in the 'Installation Mode' as shown in Figure 4-4 below. Be sure to remember the current heading angle before moving to the next step.

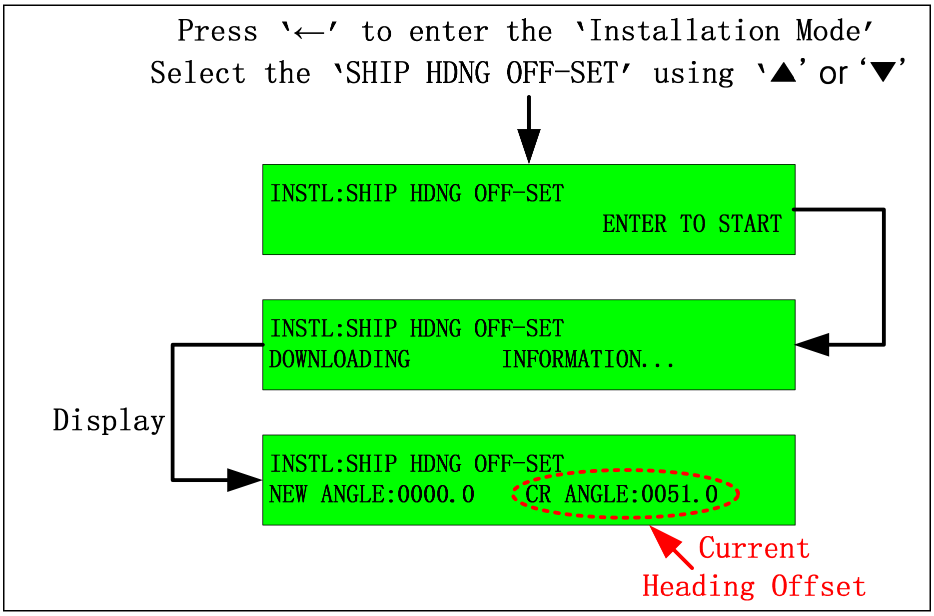

Figure 5-5 Confirming the Current Heading Angle

5.2.2 Determining the Heading Discrepancy

Input the current heading offset in 'NEW ANGLE' to determine the heading discrepancy. Then, the antenna will move to the heading offset position established at the factory. The angle between the pointing direction of the antenna and the ship's bow is the heading discrepancy.

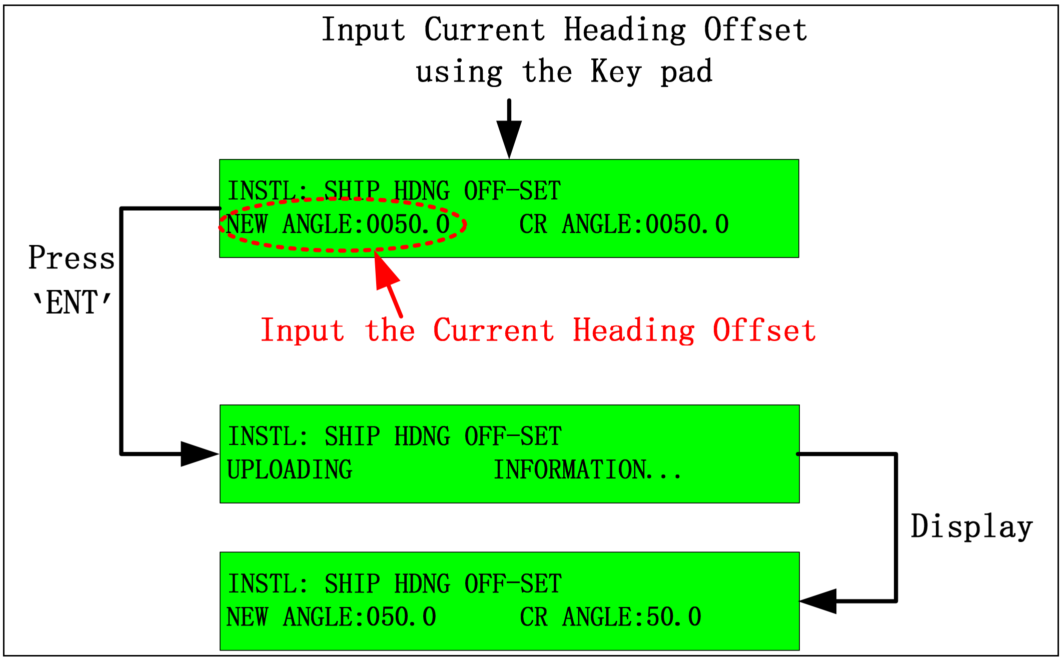

Figure 5-6 Inputting the Current Heading Angle

Open the hatch of the radome and look at the antenna inside the radome to determine the heading discrepancy, as shown in Figure 5-7 below.

NOTE: The direction of the heading offset is as shown in Figure 5-8. If you want the antenna to move counter-clockwise, you have to input a positive value.

CAUTION: The heading offset must be correct for quick and exact operation. We recommend that the heading discrepancy remain within ±5 degrees. If the heading discrepancy is as high as ±10 degrees, the antenna will not be able to search for the satellite.

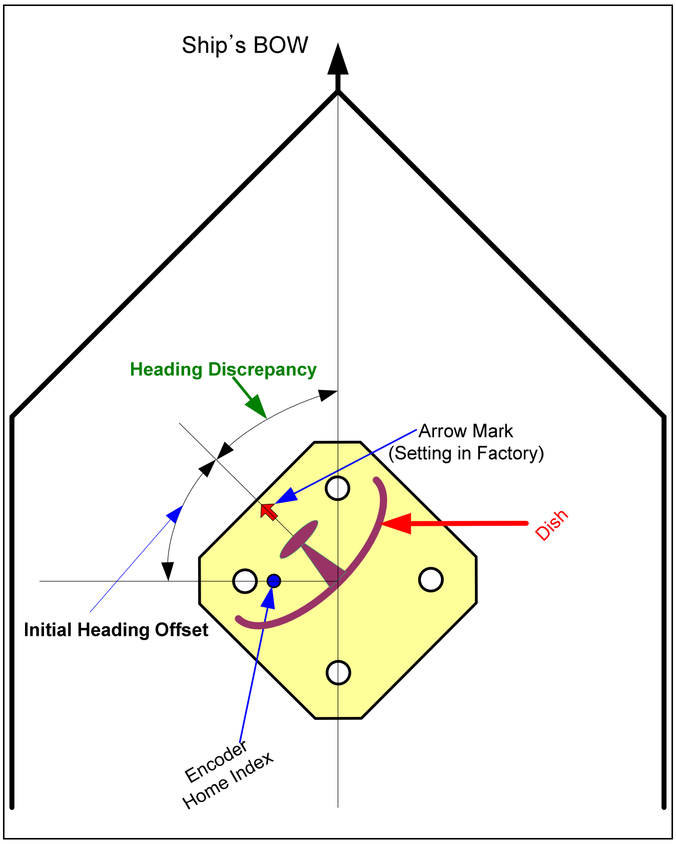

Figure 5-7 Determining the Heading Discrepancy

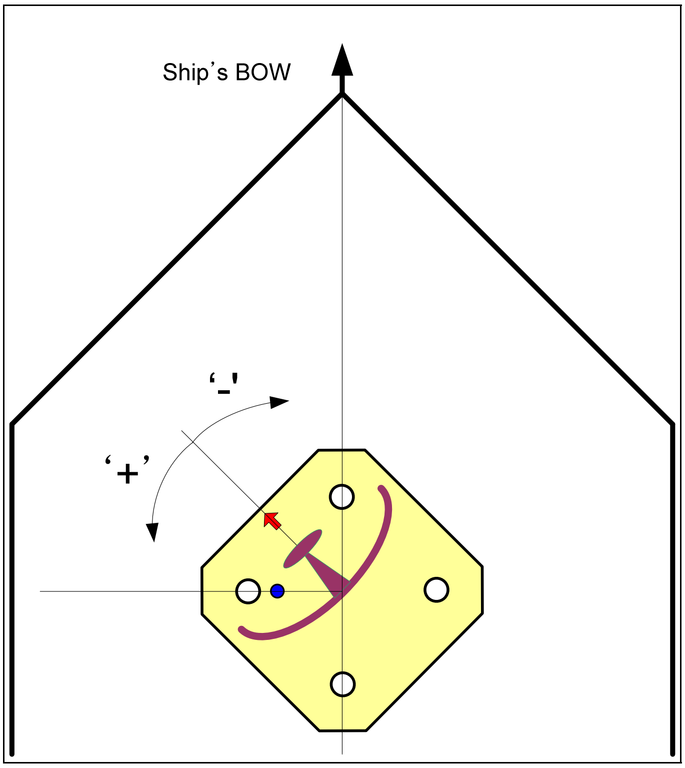

Figure 5-8 Direction of the Heading Offset

5.2.3 Adjusting the Heading Offset

Refer to Figure 5-9 below for adjustment of the heading offset.

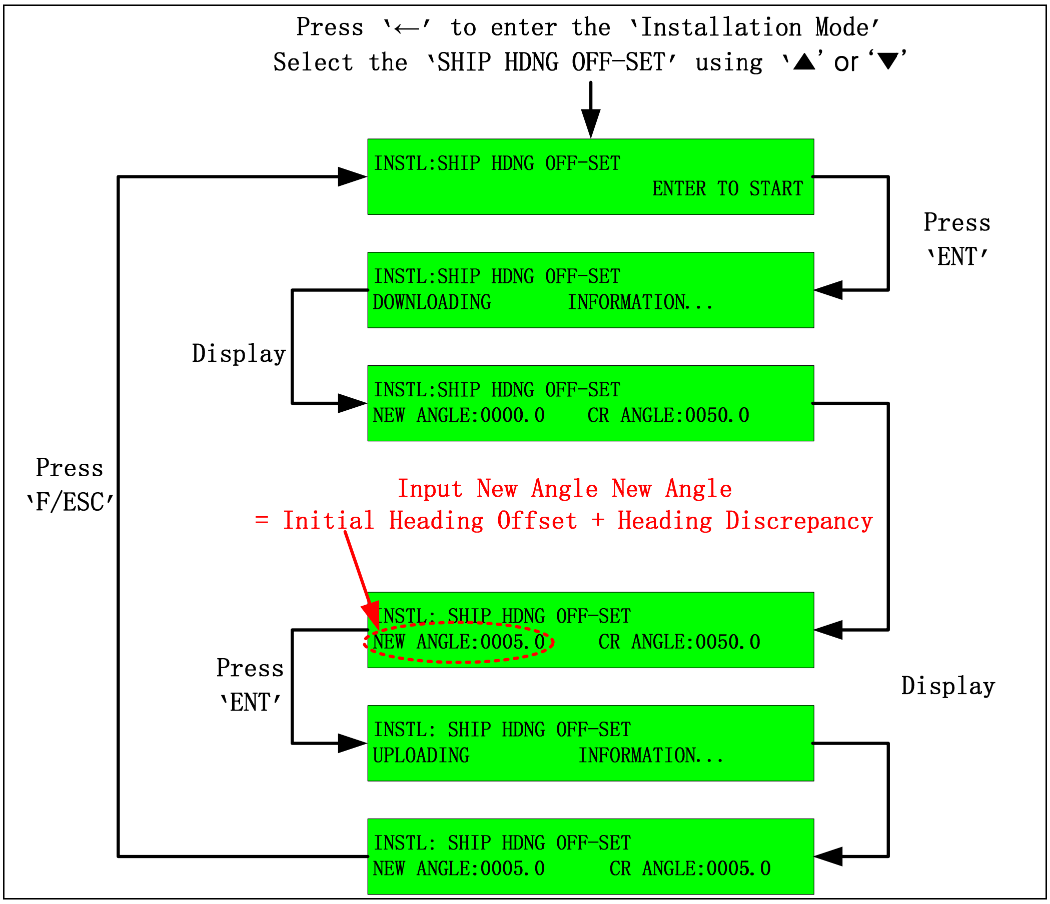

Figure 5-9 Heading Offset adjusting Steps

NOTE: Save the changed parameters in 'Installer Mode' after adjusting the heading offset. Otherwise, the antenna will remember only the preset heading offset. Refer to 'Installer Mode' if you would like to know how to save it.

6. Configuration of the STR and the DVB Tuner

The STR (Searching and Tracking Reference) and the DVB tuner can be configured manually from the ACU front key or from the remote software (SCS Ver. 1.7). Regardless of whether they use the ACU front panel or remote software to configure the STR and the DVB tuner, users should at least prepare all the information required to configure the STR and the DVB tuner, namely: satellite orbit location and polarity, searching and tracking reference, compatibility of LNB LO frequency, etc.

6.1 Deciding on the Searching and Tracking Reference

With the Z12Mk2 antenna, there are multiple search and tracking options, as previously discussed. Operators need to decide which searching and tracking option to use from among multiple selections.

The searching reference is used to provide a “sense”, on the basis of which the antenna determines whether it is pointing to the correct satellite or not. Please refer to 4.2 Searching & Tracking Reference for a detailed explanation of its operation.

Lock-bit searching is preferred to threshold searching because the latter cannot guarantee the correct pointing out of the desired satellite, although its searching speed will be faster than that of lock-bit searching.

Recommended Preference	**Searching Reference**
Very High	**DVB Carrier Lock with Reliable DVB carrier**: As the DVB tuner provides a very fast response, this reference will result in the fastest searching speed while guaranteeing targeting accuracy.
High	**External Lock with external device:** This option will find the satellite a little slower than the DVB carrier lock because the current searching speed is tuned to iDirect’s response time, which is not as fast as that of the DVB tuner. However, this option, if available, will guarantee that the antenna always targets the correct satellite as long as an external device can provide the RX lock signal. One

	drawback would be that the antenna will return to search when the external device is disconnected or the external carrier is down, which may be problematic during troubleshooting.
Medium	**RSSD Threshold:** Sometimes, the user transmits a CW carrier with a very high C/N or the satellite may have very strong beacon carrier with a unique frequency. (Caution: Please make sure that the adjacent satellite is not using the same frequency for the beacon signal*!!!*). These carriers can be used for the purpose of searching and tracking sources. In such cases, the RSSD tuner is recommended because it has a very narrow BW of about 100KHz. However, the RSSD must be used with a PLL-LNB with a high stability option. **DVB C/N Threshold:** We recommend the DVB C/N threshold instead of the RSSD threshold when the antenna has no RSSD tuner or if the RSSD tuner is broken. The DVB tuner can correctly detect the desired carrier better than the DVB AGC threshold because the noise level increases with the energy level when there is interference from an adjacent satellite. Note, with the threshold option, reference searching is the recommended Sat. Finding method because it increases the targeting accuracy.
Medium-low	**DVB AGC Threshold: The** DVB tuner can only detect the energy level, like RSSD. However, the valid detection range of BW is within 2MHz.
Low	**EXT. AGC Threshold:** This option is not recommended if the response time of the external device is slow. As such, it would not be advisable to use it with the iDirect modem due to its slow response time.

Table 6-1 Preference of searching reference

One of the most important facts when considering the tracking reference is how well the tracking reference can resist interference from an adjacent satellite or a local radar/microwave, etc. For example, C/N ratio tracking is preferred to AGC level tracking.

When there is some interference, the C/N ratio is reduced, which renders the antenna incapable of tracking towards the interfering source, while the AGC level increases, which makes the antenna track towards the interference source.

Recommended Preference	**Tracking Reference**
High	**DVB AGC LEVEL:** The most recommended tracking reference is DVB AGC if a DVB carrier is available. DVB AGC tracking can keep the antenna point correct because fluctuation is lower than with DVB C/N.
Medium	**RSSD LEVEL:** When there is no reliable DVB carrier available on the satellite, RSSD is the next preferred reference. It has a very narrow BW so that the frequency can be tuned into a “sweet spot” when there is interference. However, LNB must have very good stability.
Low	**DVB C/N RATIO:** This option is recommended when there is severe interference from an adjacent satellite (ASI) or a local radar/microwave, etc.

Table 6-2 Preference of tracking reference

6.2 Example of Using the DVB carrier

The DVB carrier is the most recommended method of searching and tracking if the desired DVB carrier is available. The polarity, beam type, and LNB operating frequency range of the DVB carrier must be the same as those which the on-board satellite’s modem is using. Most public DVB carriers can be found in *www.Lyngsat.com*.

The benefit of using a DVB carrier is that it fully utilizes a state-of-the-art KNS built-in DVB tuner, so the probability of tracking the wrong satellite is very low. Also, typically, the uptime of a DVB carrier is very high. When maintenance is being carried out on the carrier which the satellite’s modem is using, antenna tracking is not interrupted.

NOTE: If possible, it is recommended to pre-configure the necessary parameters to use an external lock even though the DVB lock has already been selected as the searching reference.

1. How to choose the DVB carrier using www.Lyngsat.com:
2. Click the desired region (Asia, Europe, Atlantic, America).
3. Select the desired satellite.
4. Write down the four parameters (Frequency, Polarity, Symbol rate, FEC) from the selected DVB carrier.

TP. Freq	RF RX Frequency(MHz)
H/V	Polarity of Carrier (Horizontal/Vertical)
System Encryption	System encryption type : DVBS1, DVBS2, DSS
SR	Symbol Rate - the symbol rate unit used by Lyngsat is Kilo-symbols per second (Ksps).

NOTE: The NID is not recommended for use with a public DVB carrier in cases where the NID is not inserted frequently or fast enough to be used in the searching process.

6.3 Example of Configuration of the STR and the DVB Tuner When Using the DVB Carrier

This section provides an example of configuration in steps.

Desired satellite parameters (DVB)

Satellite: Astra 3A

Satellite Longitude: 23.5°E

Frequency TP: 12,605MHz

Polarity: Horizontal (Down link)

System encryption: DVB-S2

Symbol Rate: 27500KHz

NOTE: FEC rate isn't required in DVBS2 tuner. Tuner automatically detects the FEC rate.

Please refer to Figures 6-1 and 6-2 for configuration of the satellite parameters.

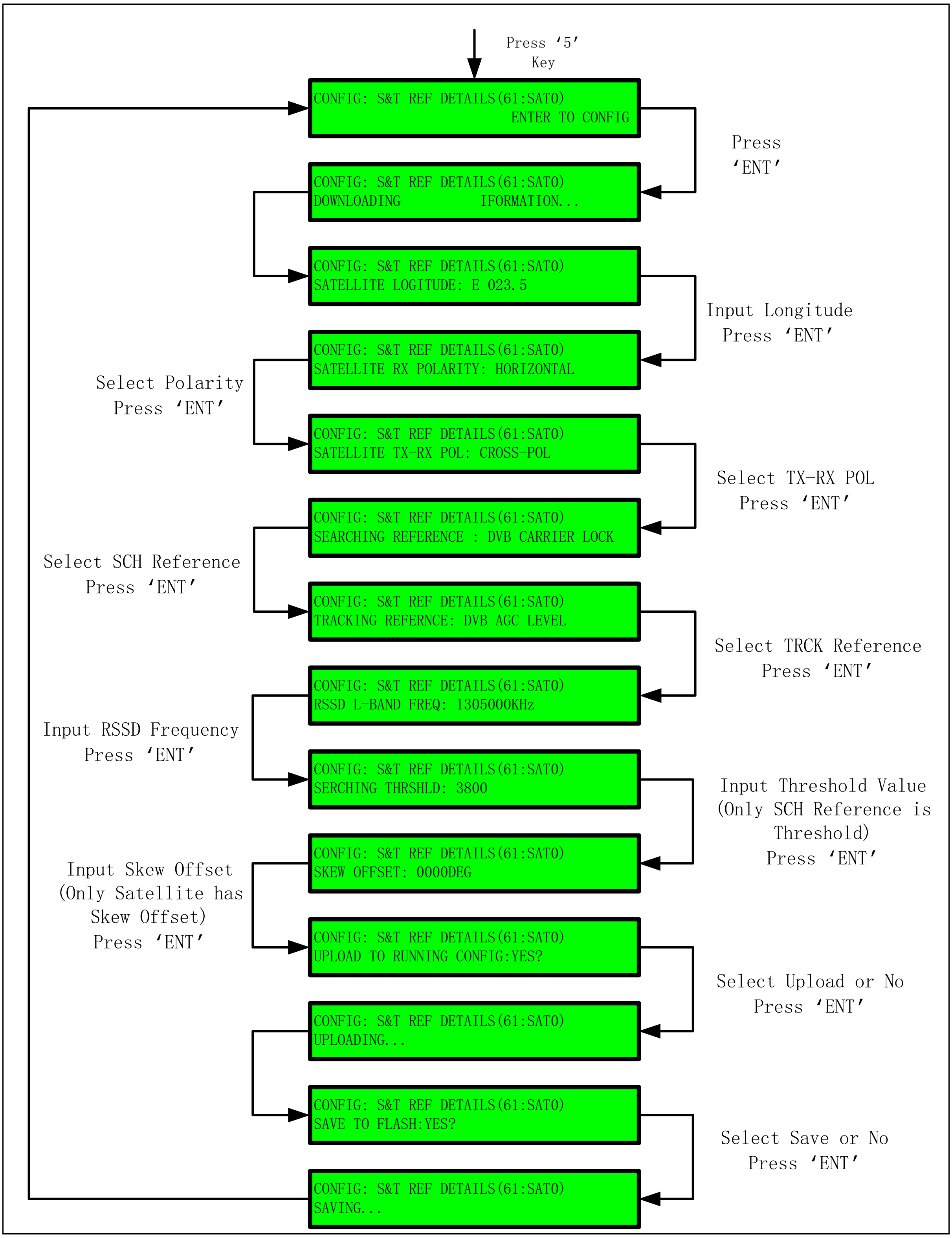

Figure 6-1 Configuration of S&T Reference

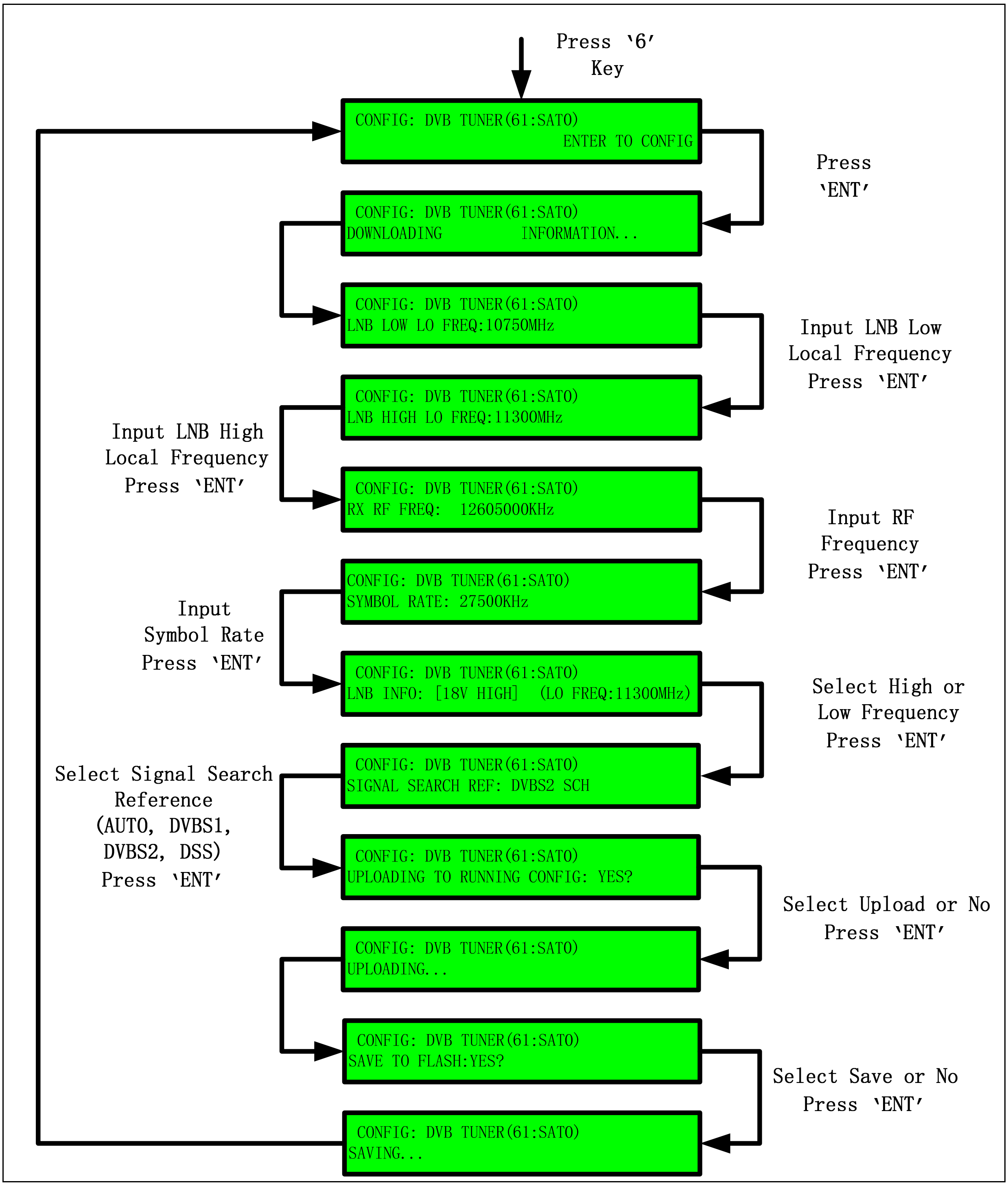

Figure 6-2 Configuration of DVB Tuner

NOTE: Almost all satellites are what is known as 'cross-pol', wherein RX polarity and TX polarity are crossed. If the RX polarity is 'Horizontal', then the TX polarity is 'Vertical'. However, some satellites have what is known as co-pol. We supply co-pol kits for co-pol satellites. Please contact us for further details.

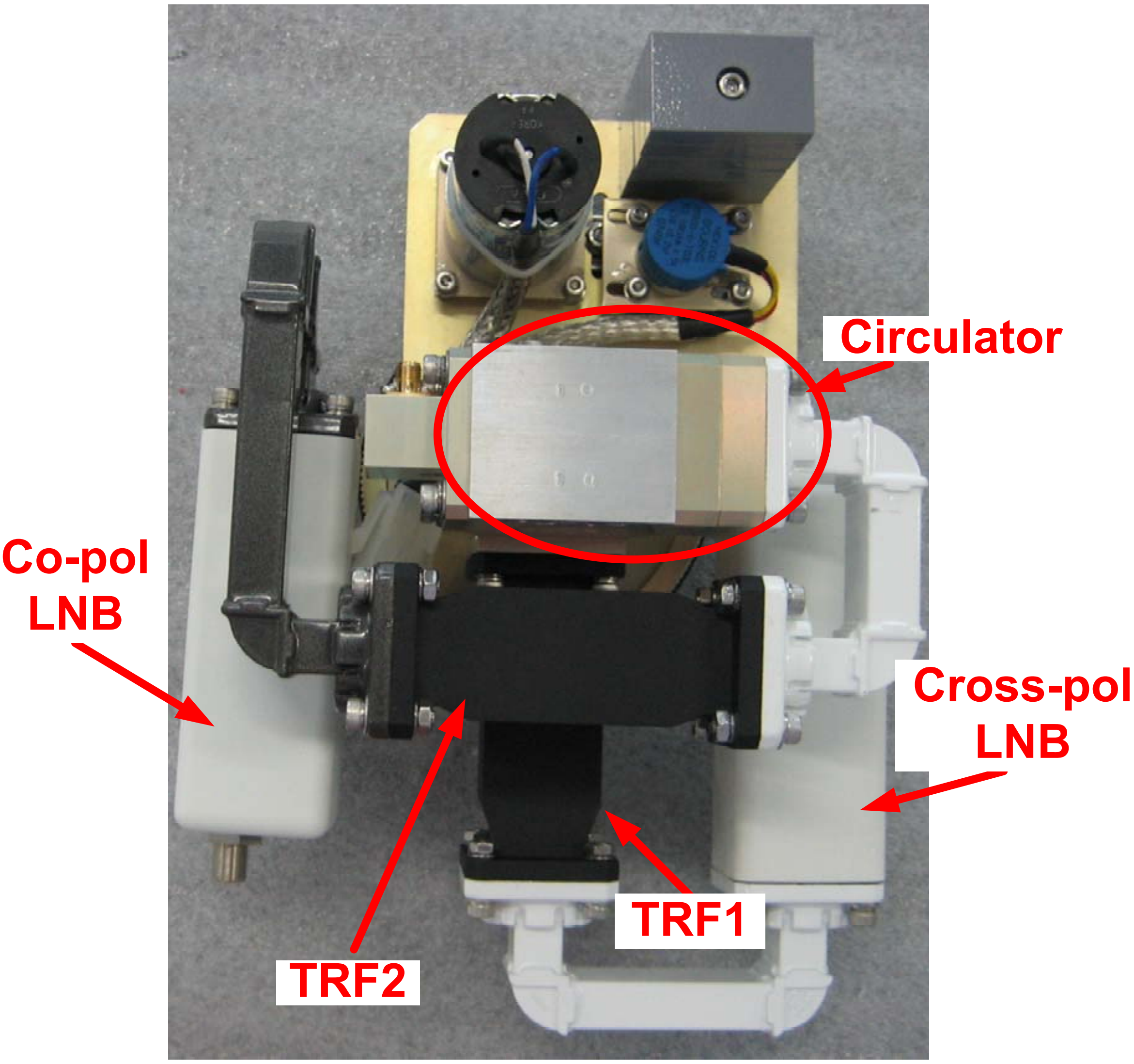

Figure 6-3 Co-pol Kits (Optional)

NOTE: If you examine the specifications of the LNB, you can find the operating range. The operating frequency of the KU-down link is 10.95 ~ 12.75GHz = 1.8GHz of BW. But the standard LNB covers 500 MHz of BW, while a wide-band LNB covers 750 MHz.

The output of 750 MHz LNB is 950~1700 MHz, but the extra 250 MHz may not be useful if the satellite's modem supports 950~1450 MHz.

No matter how good an LNB is, it will not be able to cover 1.8 GHz while meeting the necessary RF performance. Thus, it is important to use an LNB that covers your operating frequency.

LNBs can be categorized by the fixed frequency of their local oscillator (LO).

LO (GHz)	KU-Band In (GHz)	L-band Out (MHz)
10.00	10.95 ~ 11.70	950 ~ 1700
10.25	11.20 ~ 11.70	950 ~ 1450
10.75	11.70 ~ 12.20	950 ~ 1450
11.30	12.25 ~ 12.75	950 ~ 1450

Table 6-3 Operating Range by LNBs' Local Frequencies

NOTE: We provide a universal LNB that can cover the entire Ku-Band of 10.95~12.75GHz. This LNB has four local oscillators. The operator can select the desired oscillator according to the LNB input voltage and 22KHz tone.

EXAMPLE: If your desired RF frequency is 12.565GHz, you have to select the 11.3GHz as LNB local frequency. For that, you must set the 11300MHz to 'LNB Low Local Frequency', and then select [18V Low]. Please refer to the 'DVB Tuner Configuration' step.

LO(GHz)	LNB Voltage	22KHz Tone	KU-Band In (GHz)	L-band Out (MHz)
10.00	13VDC	OFF	10.95 ~ 11.70	950 ~ 1700
10.75	13VDC	ON	11.70 ~ 12.25	950 ~ 1500
11.30	18VDC	OFF	12.25 ~ 12.75	950 ~ 1450
9.75	18VDC	ON	10.70 ~ 11.70	950 ~ 1950

Table 6-4 Specifications of Universal LNB (Type R)

LO(GHz)	LNB Voltage	22KHz Tone	KU-Band In (GHz)	L-band Out (MHz)
9.75	13VDC	OFF	10.70 ~ 10.95	950 ~ 1150
10.00	13VDC	ON	10.95 ~ 11.70	950 ~ 1700
10.75	18VDC	OFF	11.70 ~ 12.25	950 ~ 1500
11.30	18VDC	ON	12.25 ~ 12.75	950 ~ 1450

Table 6-5 Specifications of Universal LNB (Type N)

6.4 Example of Using Threshold Searching

If your desired carrier is not a DVB, you can use threshold searching using your modem. Please refer to Figurse 6-4 and 6-5.

Desired satellite parameters

- Satellite: Galaxy 18
- Satellite Longitude: 123°W
- Frequency TP: 12,140MHz
- Polarity: Horizontal (Down link)
- System encryption: NTSC
- Symbol Rate: ?

NOTE: If your desired desire satellite does not support the DVB, you will not be able to track the satellite using the DVB carrier lock. In this case, you can try threshold searching methods. Best searching reference is the ‘External lock & C/N threshold’ using modem when desired carrier isn’t a DVB.

NOTE: C/N of ‘External lock & C/N threshold’ is the AGC of modem. When define the threshold value, operator has to check the value on LCD of ACU and then decide higher value than noise level as threshold.

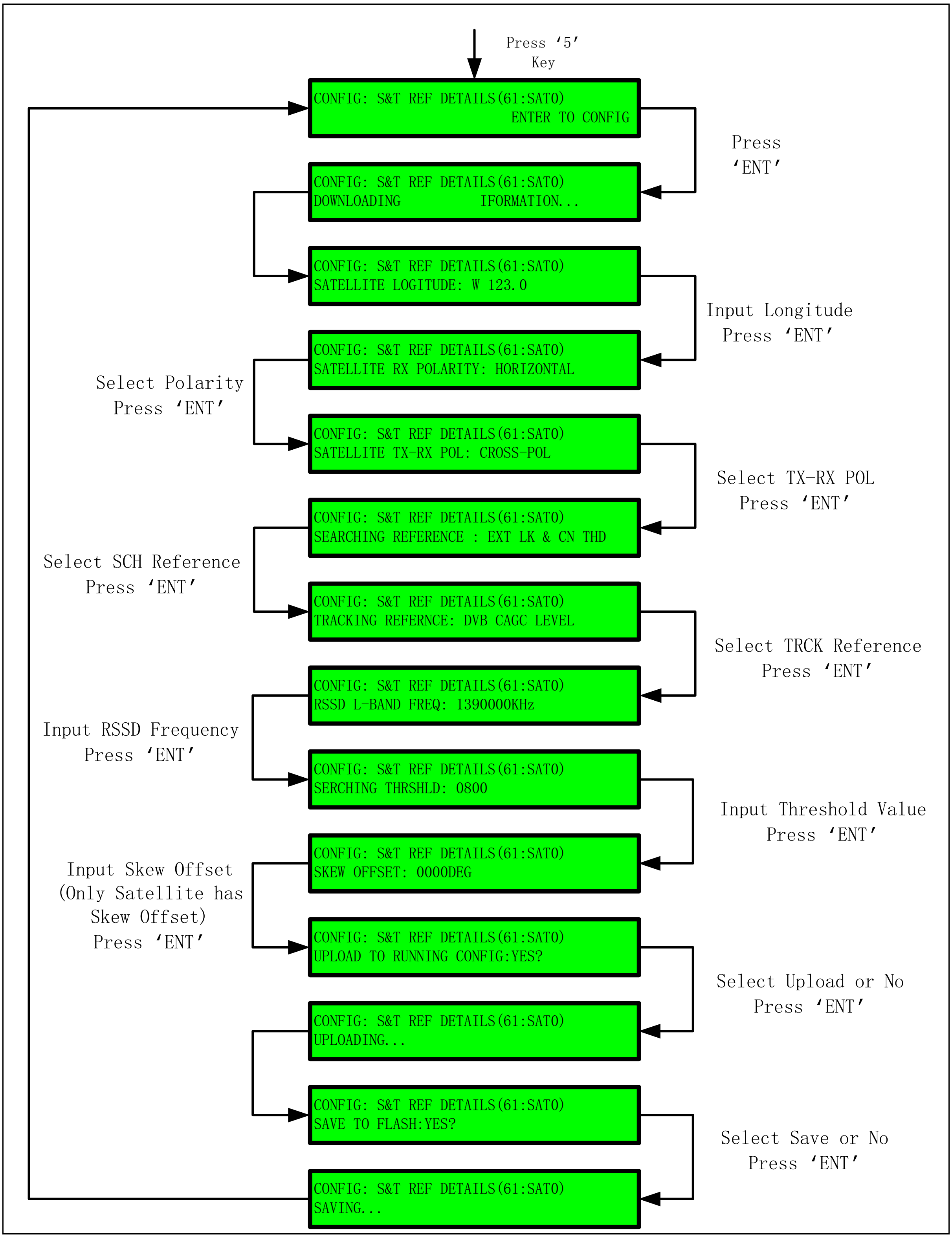

Figure 6-4 Configuration of S&T Reference (Threshold Searching)

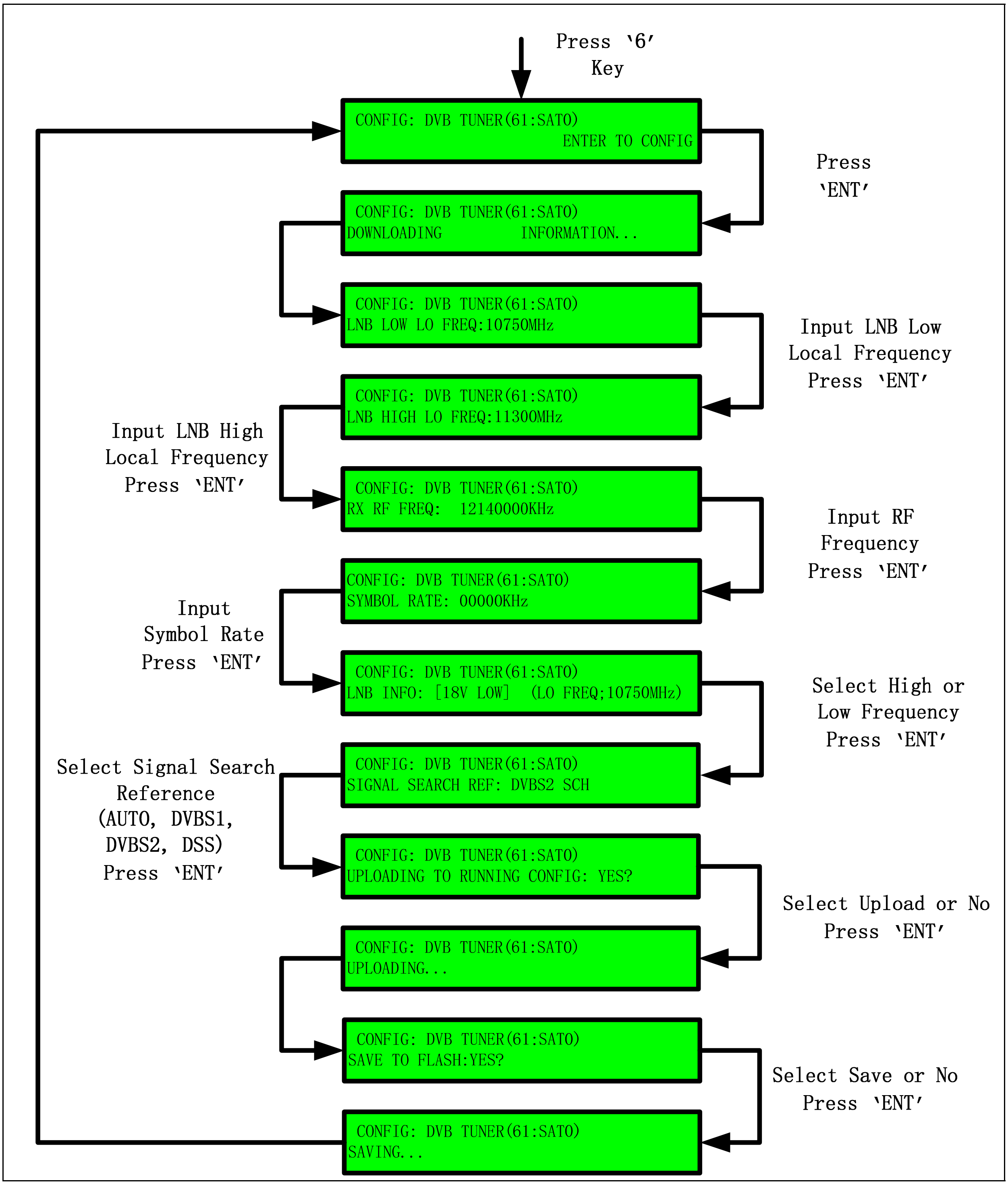

Figure 6-5 Configuration of DVB Tuner (Threshold Searching)

7. Operation using Front Key Pad

There are two modes in the ACU configuration: Configuration Mode and Install Mode. In the Configuration Mode, the operator configures the parameters required for standard operation. In the Installation mode, the installer configures the parameters required for installation of the antenna and/or repair work.

Front Keypad

Figure 7-1 ACU Front Keypad

7.1 Configuration Mode

This section will describe the configuration of the ACU.

7.1.1 Key Mapping

The following table provides a quick reference source on Key Mapping of the ACU.

Key (Main Status)	Action
1	CONFIG: SHIP LOCATION
2	CONFIG: SHIP HEADING
3	CONFIG: SAT. FINDING METHOD
4	CONFIG: POLARITY
5	CONFIG: S&T REF DETAILS
6	CONFIG: DVB TUNER
7	CONFIG: TEMP S&T REF TEST
8	CONFIG: YAW AXIS INITIALIZE
+/-	CONFIG: SEARCHING ON/OFF
·	CONFIG: TRACKING ON/OFF
▲	CONFIG: STR ID
▼	STATUS of all searching and tracking references
Holding '←' 3 sec	Go to INSTALLATION MODE
Holding 'C '3 sec	Monitor and Control using PC

Table 7-1 Key Mapping (Quick Reference)

7.1.2 Ship Location (Key '1')

Press key '1' to access 'SHIP LOCATION'. The KA-160 ACU displays the longitude (LON) and latitude (LAT) data of the antenna when the GPS is operating normally. Also, if the internal GPS is broken and an external GPS is not being used, the operator can enter the GPS data using the ACU. Refer to Figures 7-2 and 7-3 to configure and check the GPS.

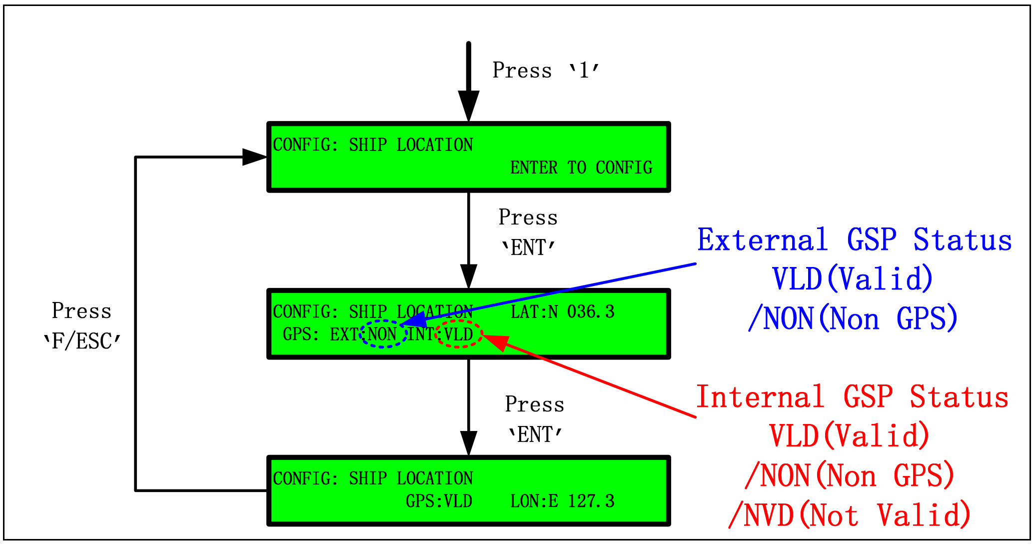

Figure 7-2 Check GPS Data and Status

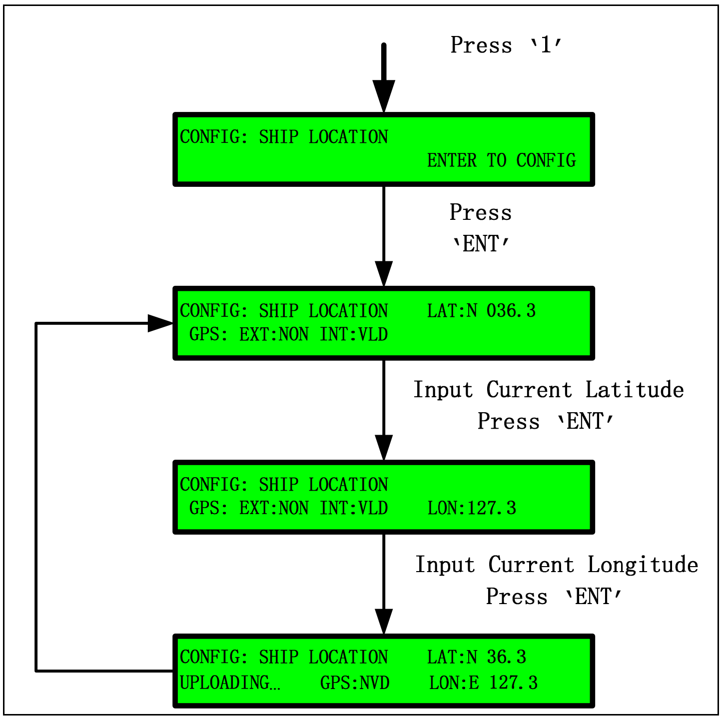

Figure 7-3 Manual Inputting of GPS Data

NOTE: In the event of a GPS failure, the user must enter the correct GPS value for the antenna to calculate the EL and AZ of the target satellite; the same applies if the ship has traveled a significant distance from the last manually entered location. Since antenna searches for satellites based on its current position, correct LAT & LONG data is needed to be entered.

NOTE: Press the '+/-' key to change 'North' or 'South' when setting the latitude, and press the '+/-' key to change 'East' or 'West' when setting the longitude.

7.1.3 Ship Heading (Key '2')

Press key '2' to access 'SHIP HEADING'. The correct ship heading information must be entered whenever the ACU is initialized (power reset), as with most types of Gyro compasses. This configuration is not required for NMEA or Synchro 1:1 Gyro inputs.

Use this configuration when the heading angle displayed in the ACU is different from the ship's heading angle.

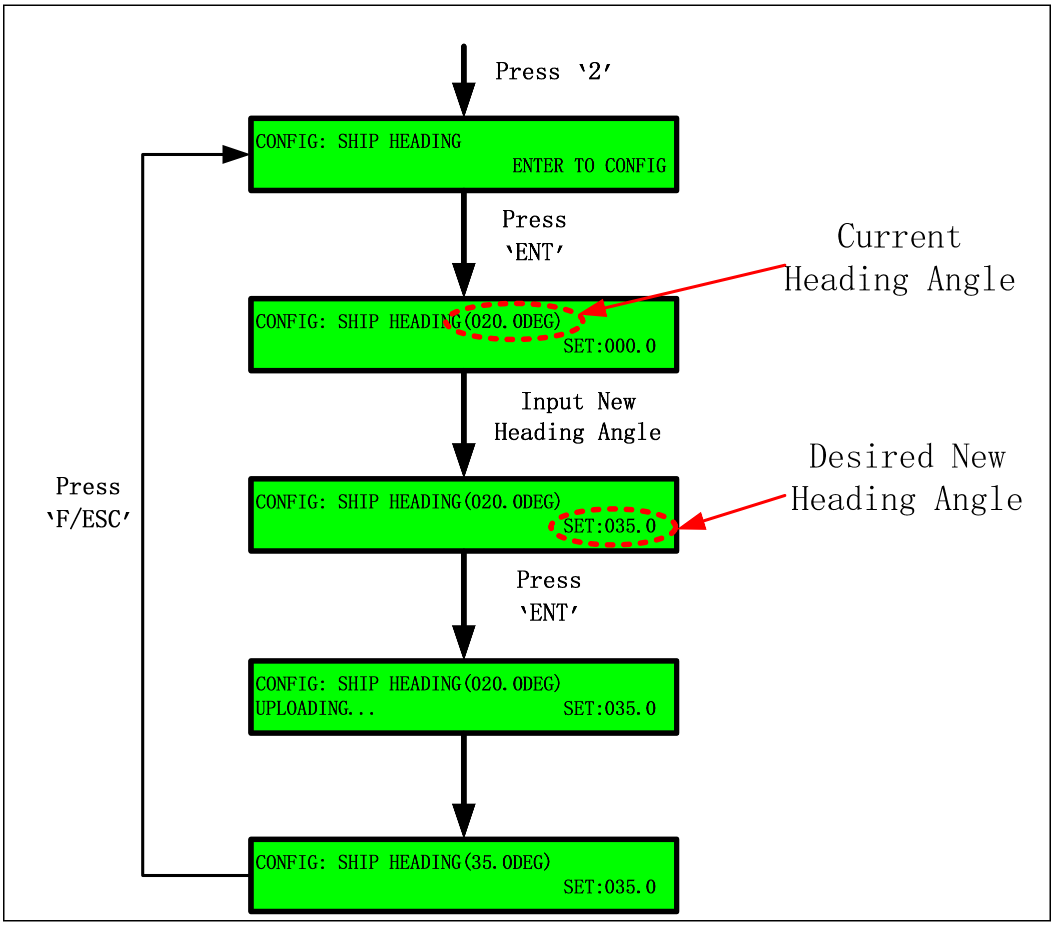

Figure 7-4 Configuration of Ship Heading

7.1.4 Satellite Finding Method (Key ‘3’)

Press key ‘3’ to access ‘SATELLITE FINDING METHOD’. Please refer to the ‘Theory’ section.

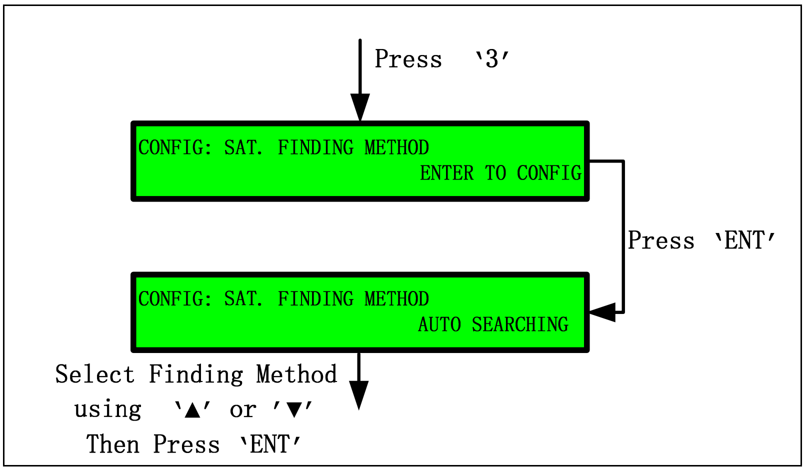

Figure 7-5 Configuration of Satellite Finding

- **Auto Searching**

If you select auto searching, you will see Figure 7-6 shown below.

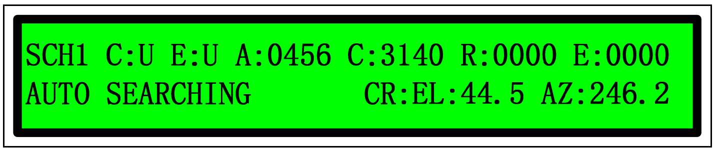

Figure 7-6 Auto Searching

- **Manual Searching**

If you select auto searching, you will have to input the desired position (elevation and azimuth angles). Then, the antenna will start to search for the satellite from the desired position.

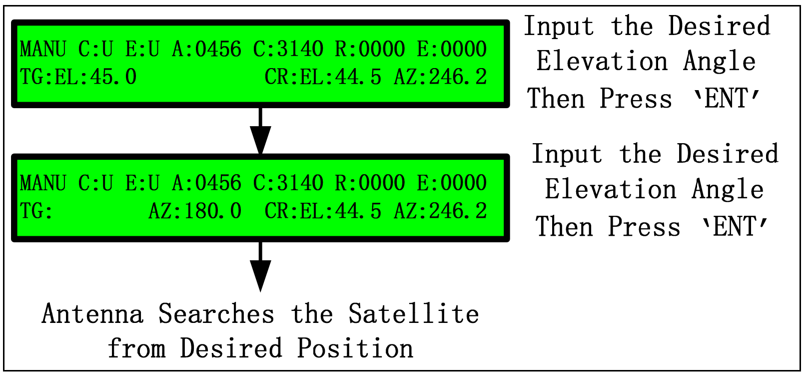

Figure 7-7 Manual Searching

NOTE: The antenna will start searching from the desired position after inputting the elevation and azimuth values. (You must press ‘ENT’ after inputting the elevation and azimuth values, otherwise the antenna will be pointing [holding]).

- **Manual Pointing**

If you select manual pointing, you will have to input the desired position (elevation and azimuth angles). Then, the antenna will point to the desired position.

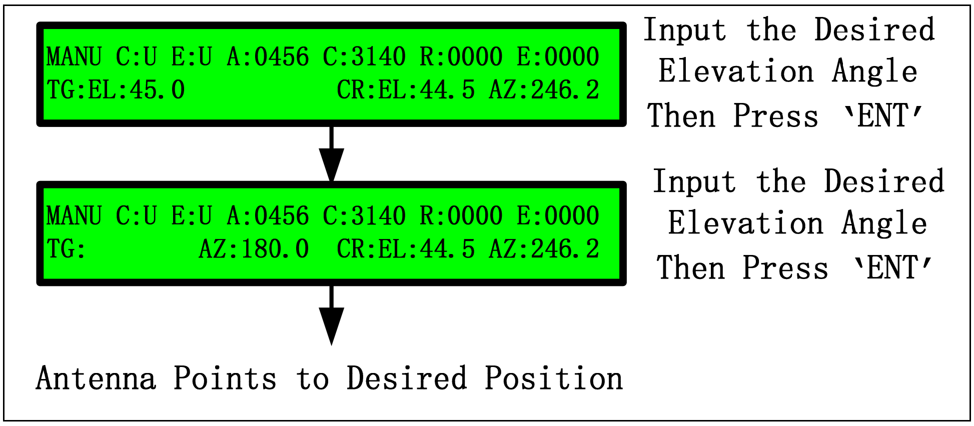

Figure 7-8 Manual Pointing

NOTE: The antenna will start tracking towards the desired position after inputting the elevation and azimuth values. (You must press ‘ENT’ after inputting the elevation and azimuth values, otherwise the antenna will be pointing [holding]).

- **Reference Searching**

If you use reference searching, you will have to select the reference satellite. You can check the reference satellite when selecting reference searching. Please refer to the ‘Theory’ section for a more detailed description.

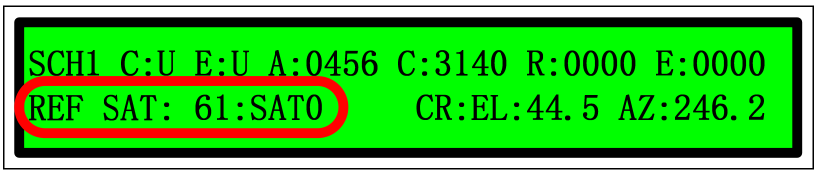

Figure 7-9 Reference Searching

C:L/U	DVB Tuner lock status L = Locked

	U = Unlocked
E:L/U	External device lock status L = Locked U = Unlocked
A: XXXX	DVB AGC Level
C:XXXX	DVB C/N Level
R:XXXX	RSSD Level
E:XXXX	External device AGC Level

7.1.5 Polarity(Key '4')

The operator can move the angle of skew using one of 3 methods, namely 'AUTO', 'MANUAL', and 'JOG'.

- AUTO Mode: The PCU calculates the skew angle based on the polarity of the satellite and antenna's current position. The skew moves to the calculated angle when selecting the 'AUTO' mode. The skew angle ranges from 95°to -95°.
- MANUAL Mode: The operator can change the skew angle by inputting the desired angle. The skew angle ranges from130°to -130°.

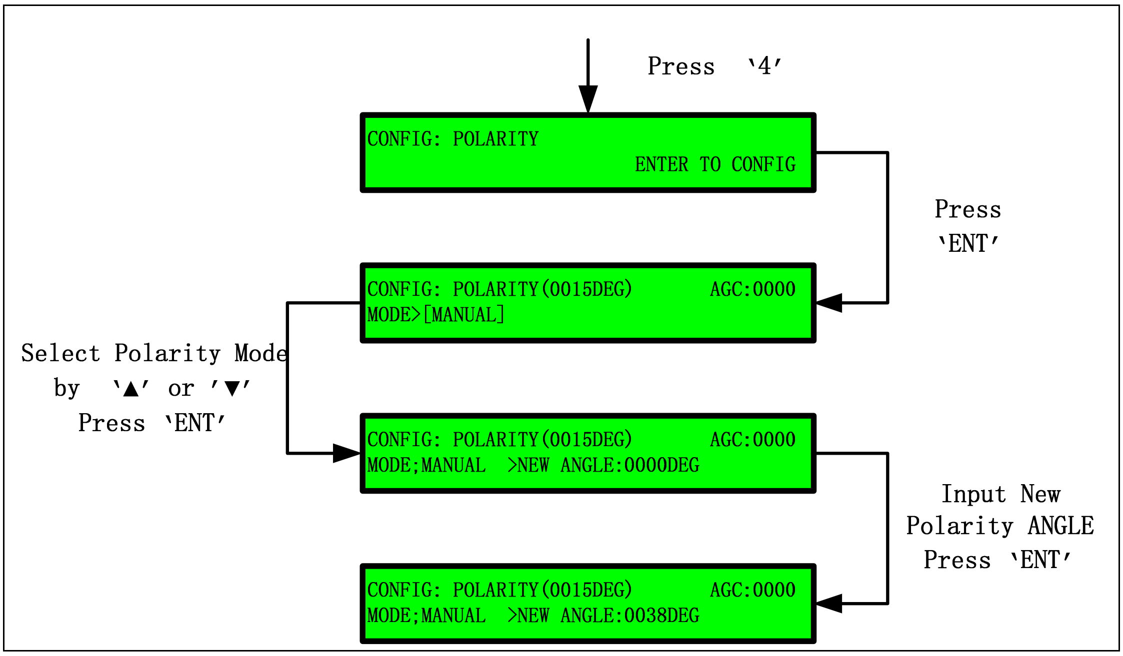

Figure 7-10 Skew in Manual Mode

- JOG Mode: The operator can change the skew angle using the '▲' or '▼' keys. The skew angle increases when the '▲'key is pressed, and decreases when the '▼' key is pressed. If you want to stop the skew, pull out the key.

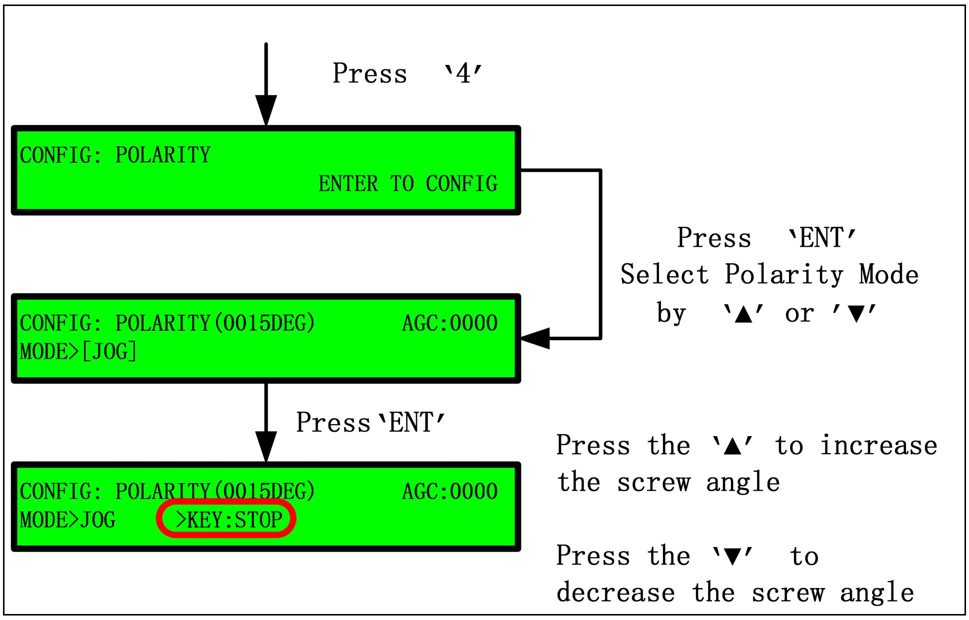

Figure 7-11 Skew in Jog Mode

7.1.6 S&T Reference Details (Key '5')

The operator can input the details of the searching and tracking references.

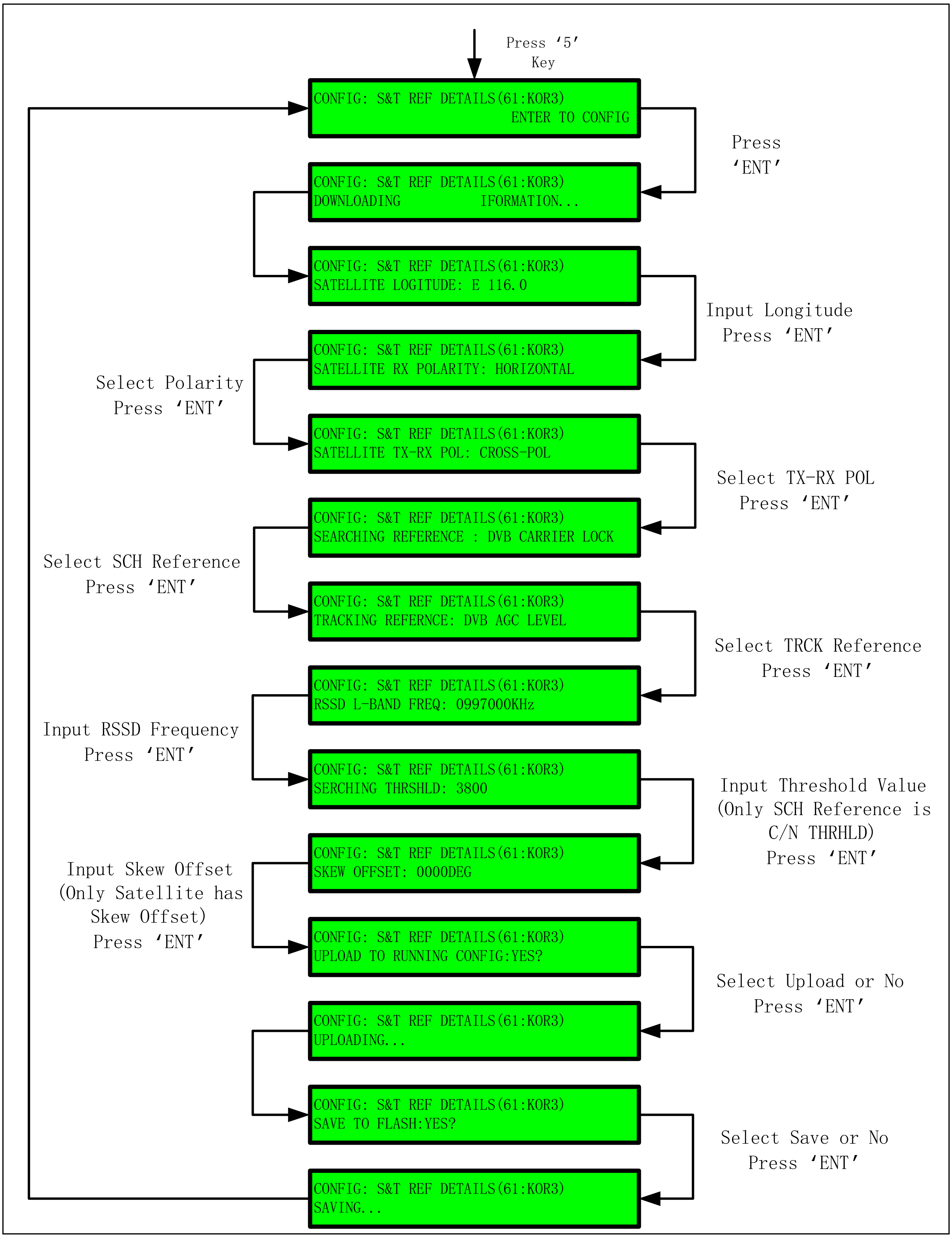

Figure 7-12 S&T Reference Details (Steps)

NOTE: Fortunately, most satellites use standard polarity. However, some satellites use a non-std way of linear polarity. If a satellite uses standard polarity (most US and EU satellites), it is not necessary for the operator to input the skew offset. However, in the case of non-standard polarity satellites, the operator must input the skew offset in the configuration given under ‘S&T Reference Details’.

Go to ‘Polarity’ (Key ‘4’) and search for the polarity angle where the energy level (DVB C/N, AVB AGC, RSSD) is at its highest, using either the MANUAL or JOG functions. Then, changed skew angle value will be ‘default’ in the selections of the skew angle.

Figure 7-13 Check the Energy Level in Jog Manual and Jog Mode

7.1.7 DVB Tuner (Key '6')

The operator can input the parameters of the satellite using the configuration of the 'DVB Tuner'. Please refer to Figure 7-12 below.

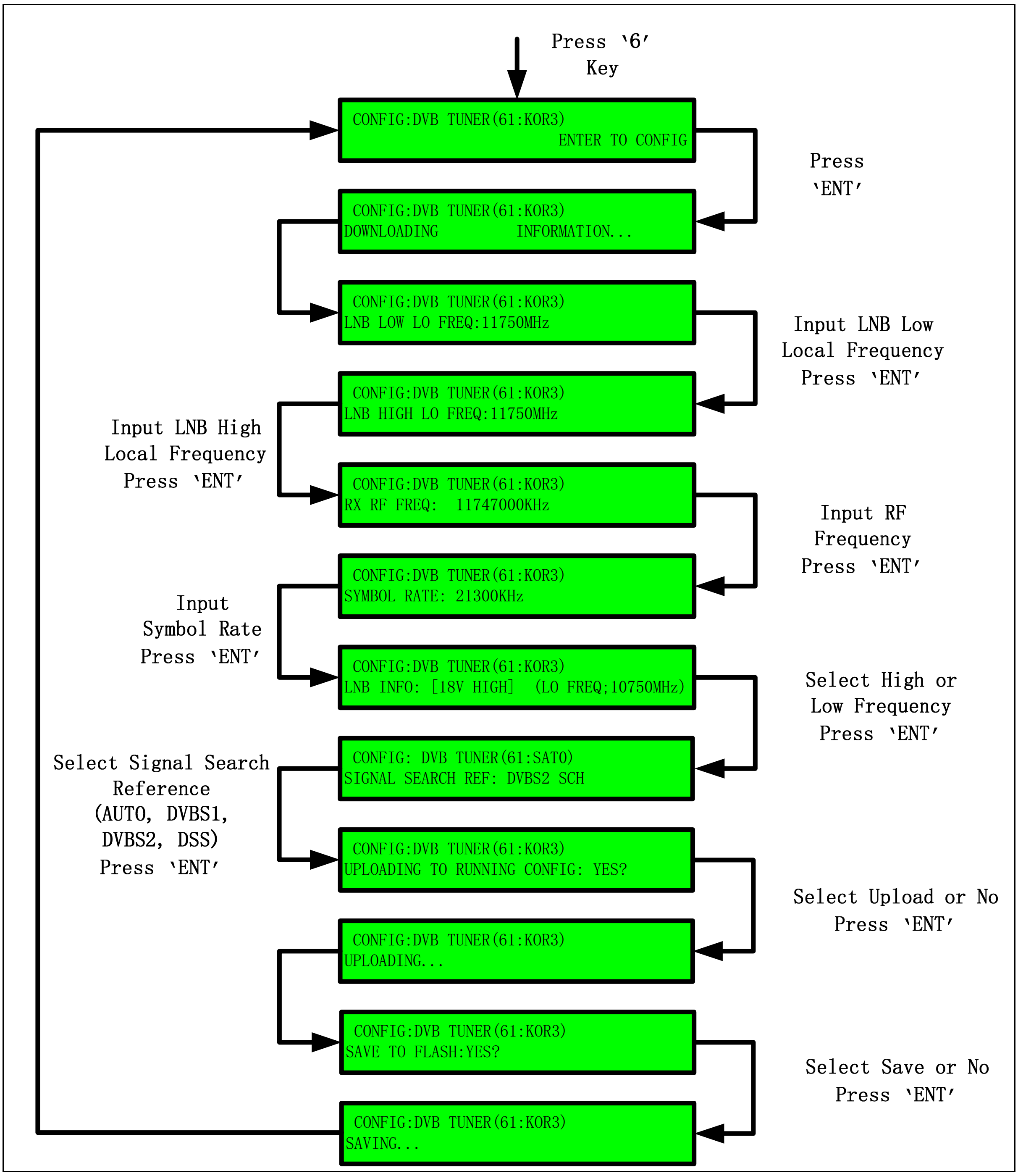

Figure 7-14 Configuration of DVB Tuner by Steps

7.1.8 Temp S&T Reference Test (Key '7')

With this configuration, the operator can evaluate all of the S&T references and choose the best one. The operator can see simultaneous readings of all the S&T references, and select any one of the pre-configured S & T references as an active reference (so that it can be used in the searching and tracking process), and then enters its AGC threshold level.

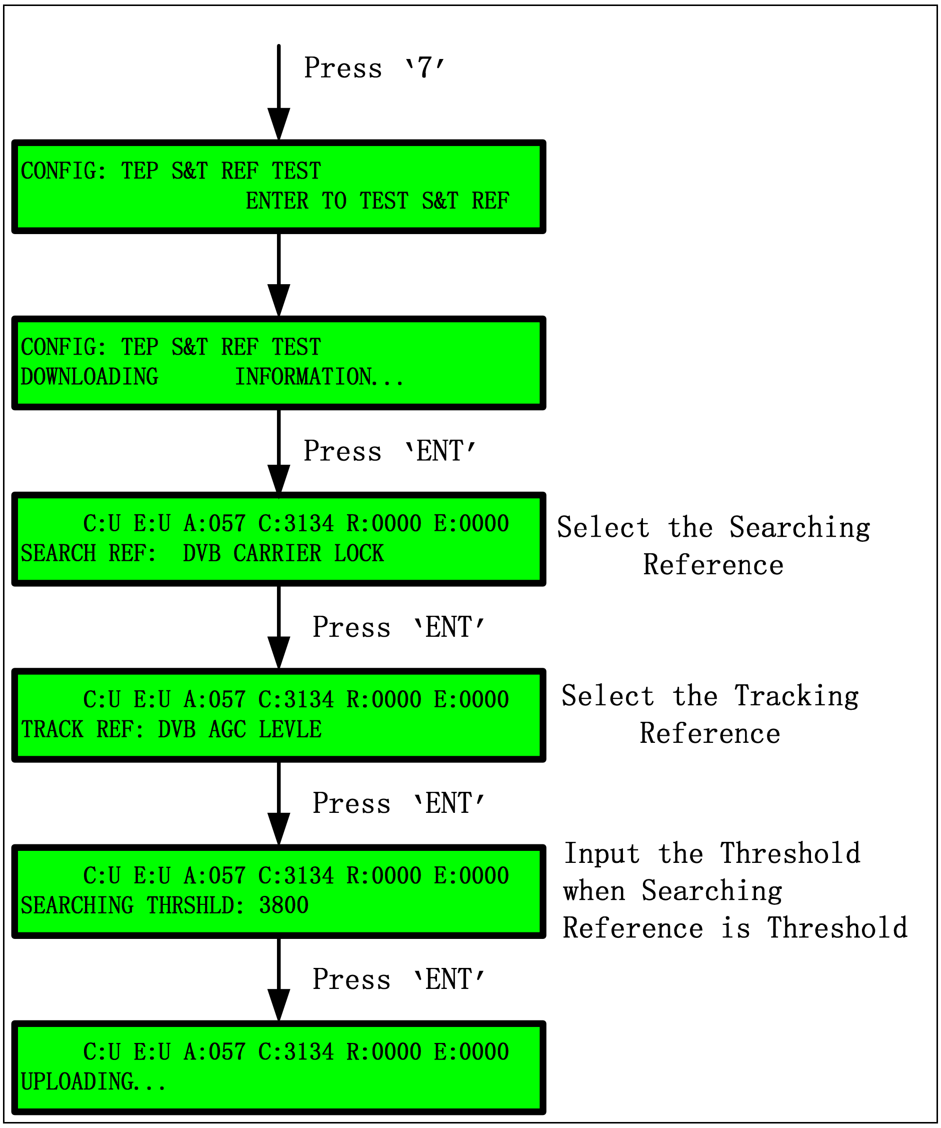

Figure 7-15 Configuration Temp S&T Reference

C:L/U	DVB Tuner lock status

	L = Locked U = Unlocked
E:L/U	External device lock status L = Locked U = Unlocked
A: XXXX	DVB AGC Level
C:XXXX	DVB C/N Level
R:XXXX	RSSD Level
E:XXXX	External device AGC Level

7.1.9 Yaw Axis Initialize (Key ‘8’)

This configuration is required when the gyro is in need of repair.

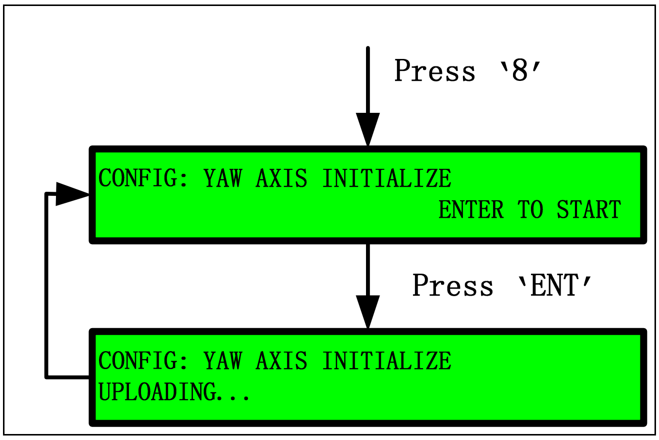

Figure 7-16 Yaw Axis Initialize Configuration

7.1.10 Searching ON/OFF (Key ‘+/-’)

Searching OFF is a special function to prevent the antenna from going into the searching process when a searching problem occurs, such as a tracking failure.

The Searching OFF function is very useful when there are frequent blockages of short duration. If you select Searching ON, any blockage (up to searching delay) causes the antenna to go searching wherever the searching pattern has been initiated.

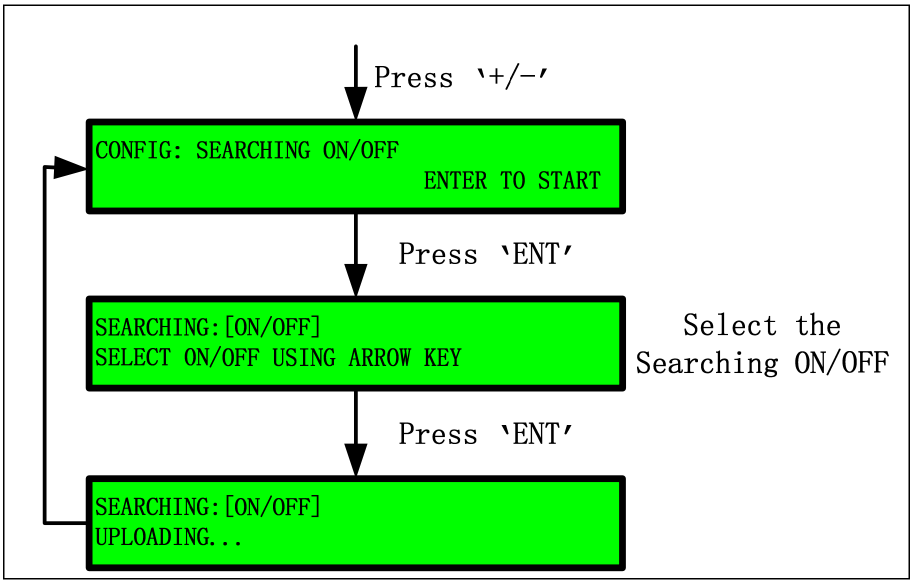

Figure 7-17 Configuration of Searching ON/OFF

7.1.11 Tracking ON/OFF (Key '·')

Under certain test environments, the operator can turn off the tracking process. When the tracking is turned off, the antenna ceases its conical scanning and points towards the current position.

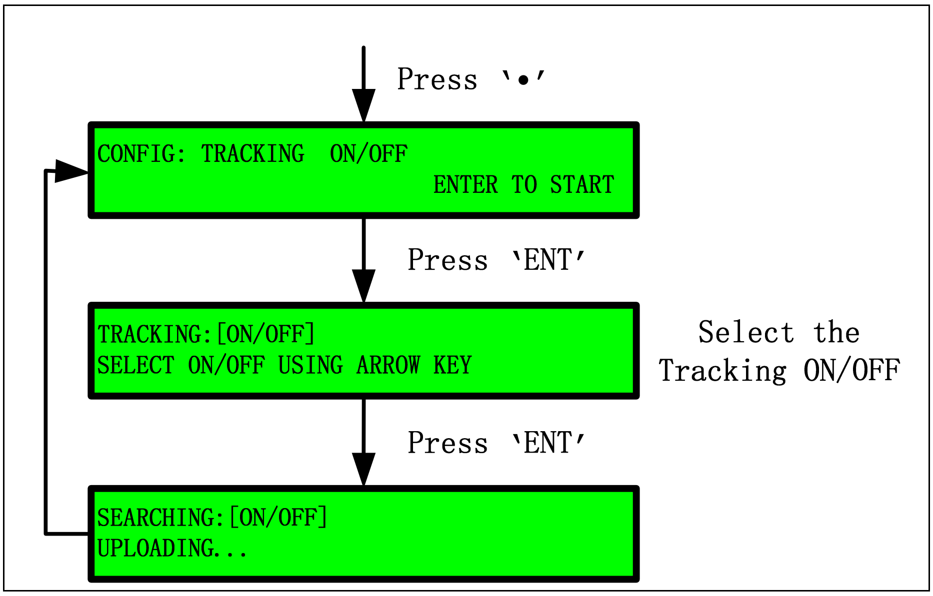

Figure 7-18 Configuration of Tracking ON/OFF

7.1.12 STR ID (Key '▲')

With this configuration, the operator can select a different S&T Ref. ID. When selecting an S&T reference, the antenna starts the searching and tracking processes as per the parameters based on the selected STR. If the new STR uses a different satellite, then the antenna will search for a different satellite.

For example, let's assume that there are two fully-configured records of the STR, i.e. 01:SMX5 (Satmex-5) and 02:NSS7 (NSS7). If the antenna is using STR 01:SMX5 and the operator selects 02:IA07, then the antenna will search and track the NSS-7 satellite as per the details of STR record 02:NSS7**.** To use this option effectively, it is recommended that the operator configures multiple records of the Searching and Tracking Reference (STR) in advance for multiple satellites.

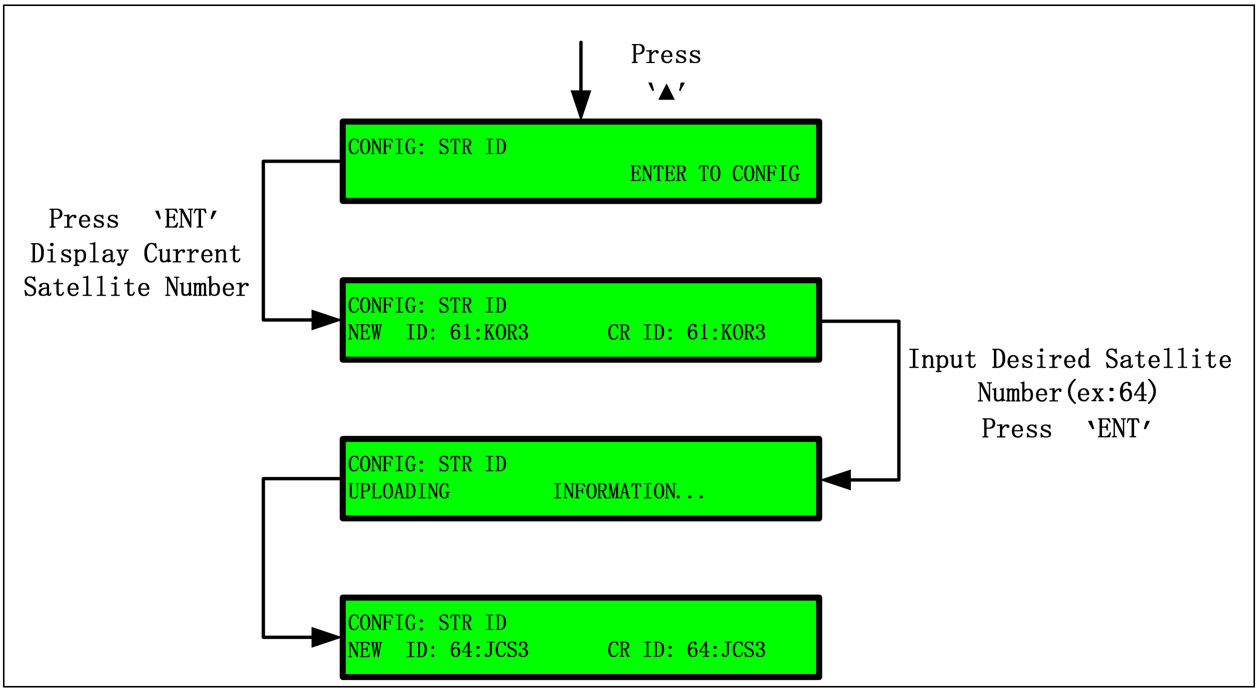

Figure 7-19 Configuration of STR ID

NOTE: The operator can change the satellite's name using the ACU key pad. Refer to Figure 7-18 below if you wish to change the satellite's name.

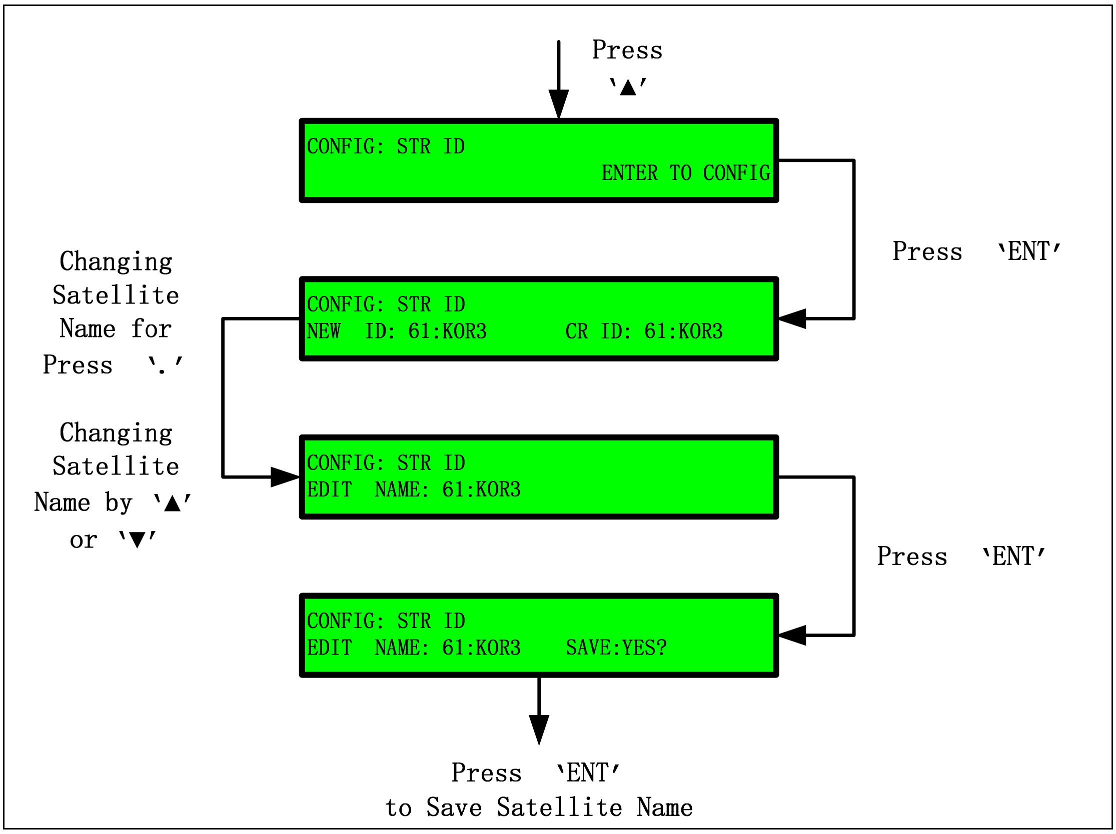

Figure 7-20 Changing the Satellite's Name

7.1.13 Checking the Signal Status (Key '▼')

If this function is entered, the operator can check the status of the signal, the NID of the signal, and the automatic beam switching mode.

a. Status of signal

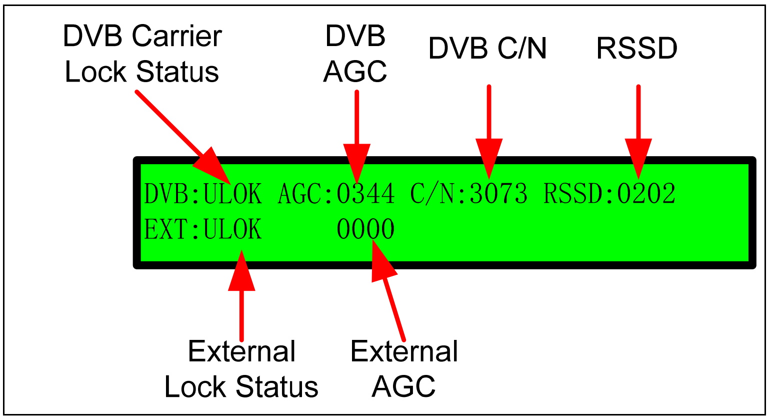

Figure 7-21 Status of Signal

b. Network ID

In the case of the correct DVB carrier, the PCU analyses the NID (Network ID) from the target satellite's signal. The ACU displays the Network ID (NID) on an LCD.

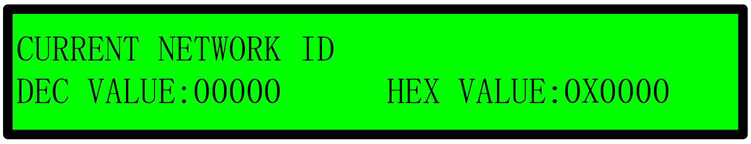

Figure 7-22 NID

c. Automatic beam switching mode

The operator can check the automatic beam switching mode, as shown in Figure 7-23 below. If the automatic beam switching mode is off, the ACU displays the recent value.

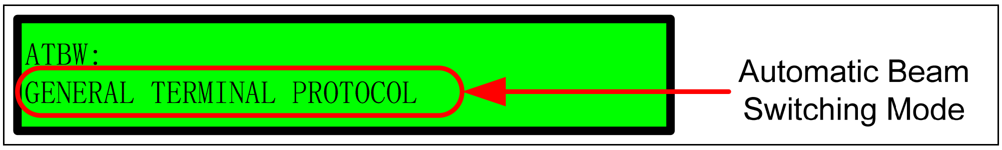

Figure 7-23 Automatic Beam Switching

7.2 Installation Mode

If you push and hold the "←" key in the main display for 2~3 seconds, you can enter the 'Installation Mode'. The 'Installation Mode' has 17 sub menus. Use this mode when replacing any board or hardware, or when changing the gyro type, etc.

NOTE: You must save the changed parameters when you change any parameter to the desired parameter. If the new parameters are not saved, they will be lost the next time the ACU is power cycled, and the previous parameters will be restored.

7.2.1 Bluetooth Initialize

The antenna and the ACU communicate with each other using Bluetooth via an RX cable. When the Bluetooth module is replaced, it is necessary to pair the Bluetooth. Please refer to the 'Bluetooth Communication' section of 'Initial Configuration'.

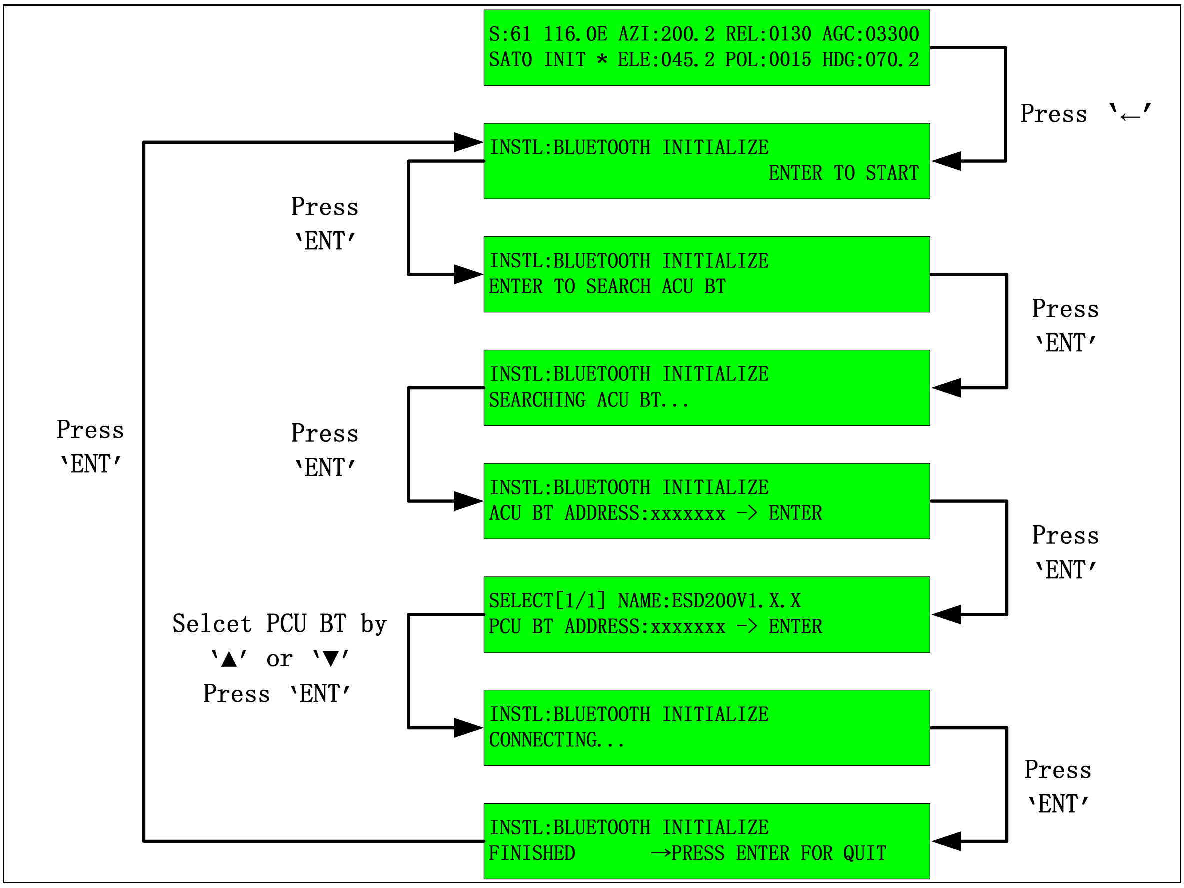

Figure 7-24 Pairing the Bluetooth

7.2.2 Ship Heading Offset

The antenna's heading must be aligned with the ship's heading to ensure accuracy of searching and tracking. This only concerns the antenna pointing position and the ship's bow when configuring the heading offset. Please refer to '5.2.2 Determine Heading Discrepancy' to find out how to calculate the heading discrepancy.

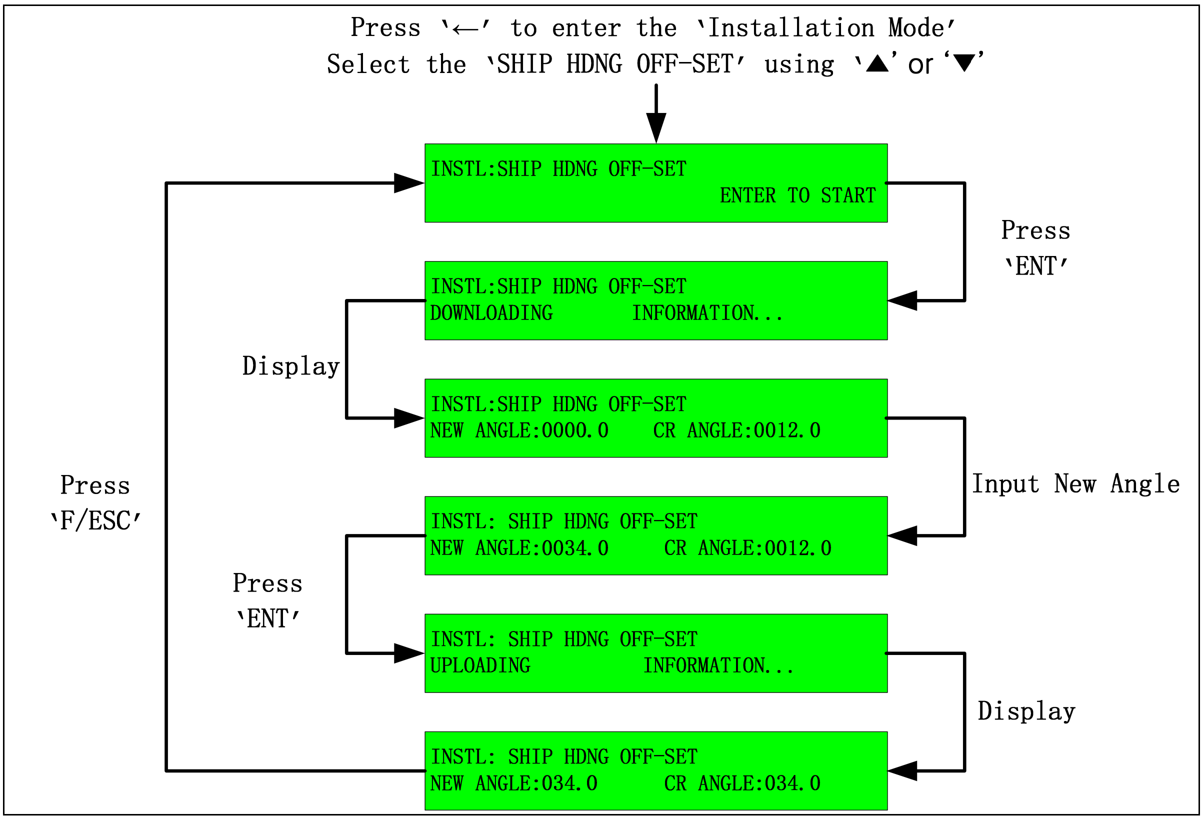

Figure 7-25 Configuration of Ship Heading Offset by Steps

7.2.3 Searching Parameter Setting

The searching parameter is a range which the antenna searches for the satellite from the position derived from PCU. If it is too narrow, the antenna will not be able to search for the antenna. Also, if it is too wide, the antenna searching time will be slower than inputting the proper parameter. Please be deliberate when changing the searching range.

- Azi(Azimuth) Range : Searching range (degree) of azimuth axis
- Ele(Elevation) Range : Searching range (degree) of elevation
- Step : Increase range in former step
- SCH (Searching) Delay : Time-out for automatic initiation of a search when the

signal level drops below the threshold level or the antenna loses of the lock bit.

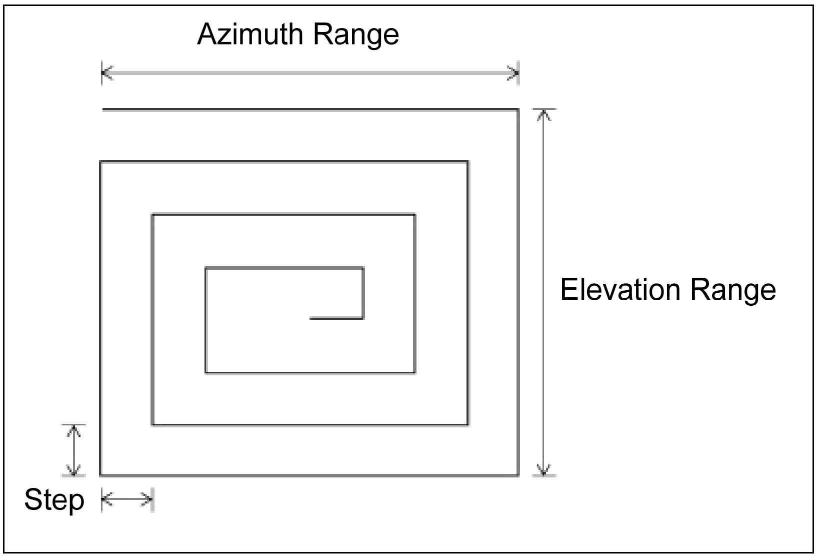

Figure 7-26 Searching Range

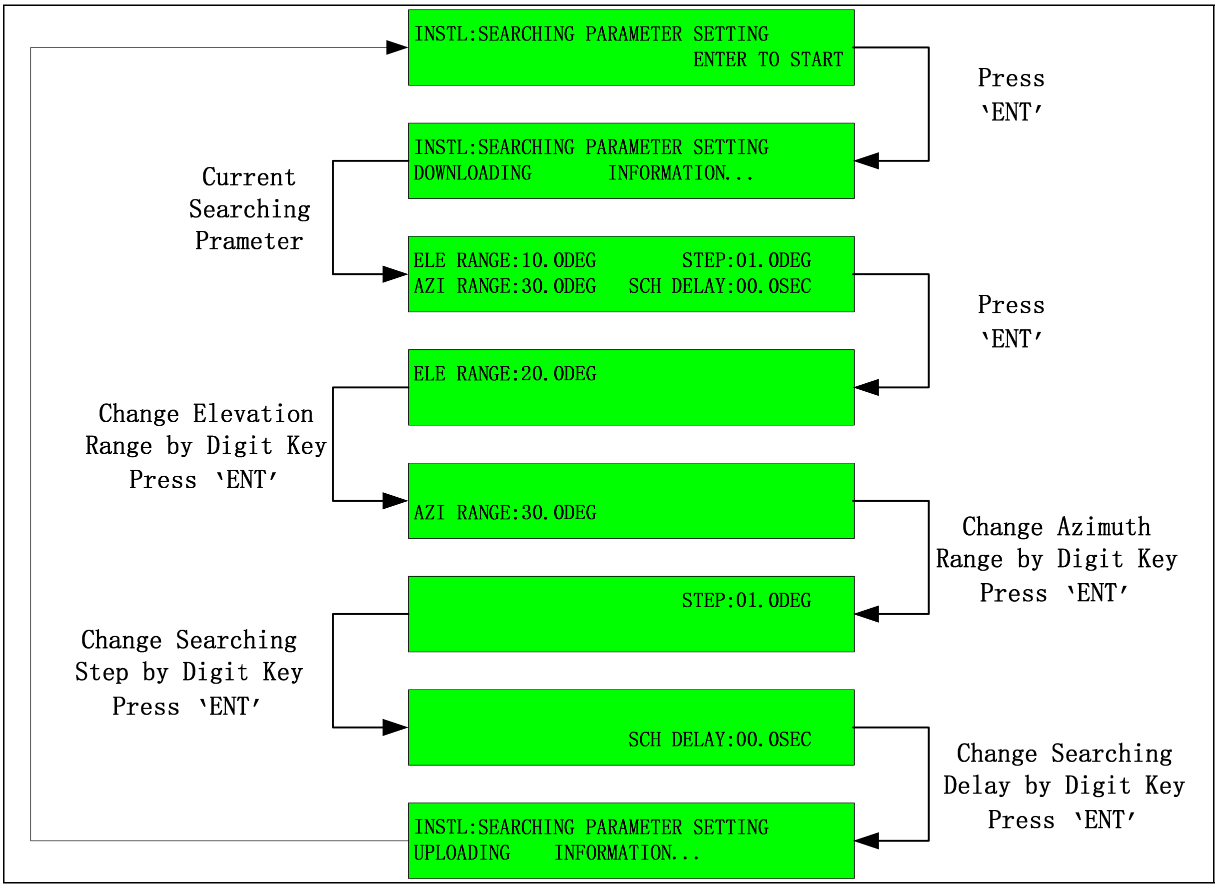

Figure 7-27 Configuration of Searching Parameter

7.2.4 Polarity Calibration

This setting is required when the skew block or the PCU is replaced. During normal operation, any change in this parameter other than a factory set value may cause faulty operation of the automatic polarity adjustment

The skew block must be zeroed by setting this configuration, when replacing the skew block or the PCU. The skew zero position is as shown in Figure 7-28 below. The top side of the skew plate runs parallel to the cross bar. The skew block is moved by 'Jog' or 'Manual' mode. The jog and manual modes of the installation mode are the same as the jog and manual modes of polarity configuration. Refer to 'Polarity (Key '4')'.

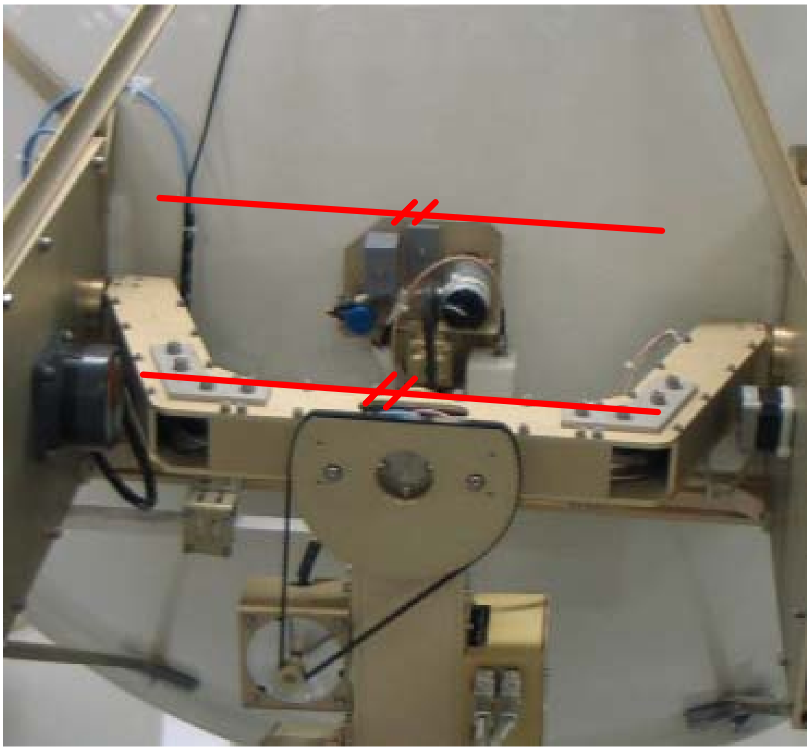

Figure 7-28 Skew Zero Position

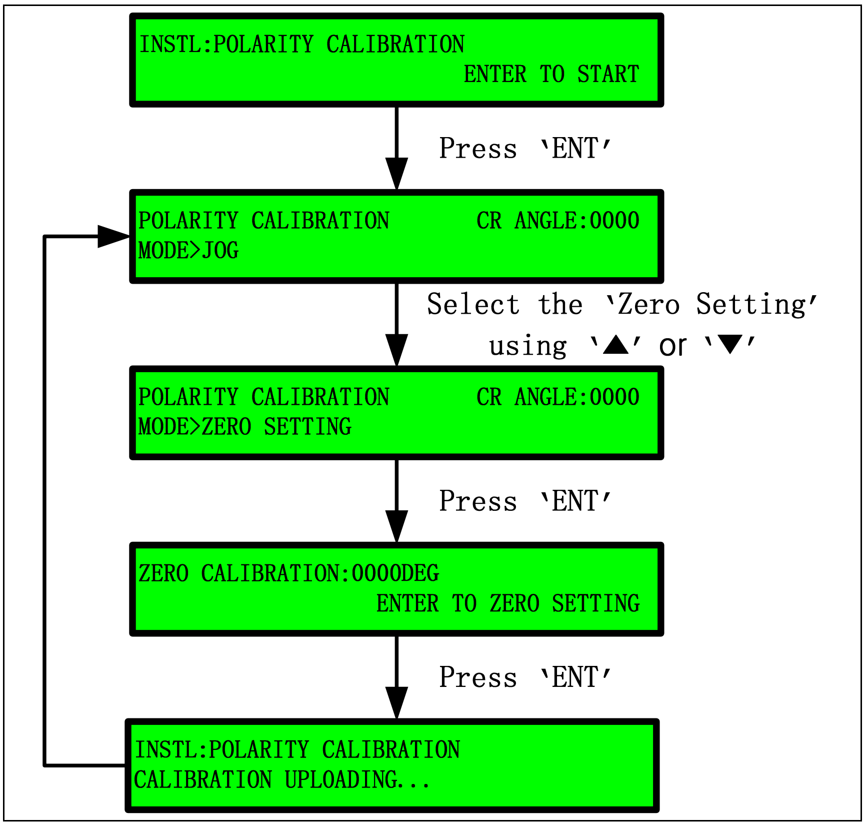

Figure 7-29 Skew Zero Setting

Use 'Scale factor setting' to optimize the skew angle when it is at +90 or -90 degrees.

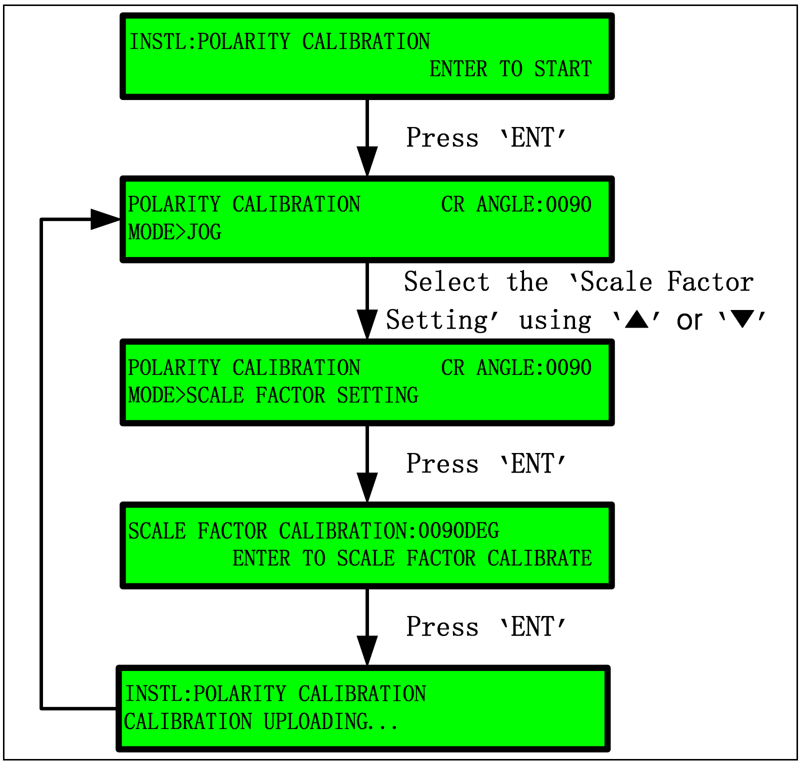

Figure 7-30 Skew Scale Factor Setting

7.2.5 Block Area Setting

The signal from a satellite to the antenna is a line-of-sight (LOS) signal which enables ship structures to block the signal in a certain azimuth angle. When the antenna is transmitting during this structural blockage, it may cause harmful interference or radiation. During the initial installation, the installer can store up to three blocking areas in the ACU flash memory, from which the ACU can determine whether the antenna is within a block area or not, and send a contact-closure (CC) signal via the SW1 and SW2 positions. It is normally closed (NC) for non-blocking areas. This CC can be used by the operator to control an RF inhibit function (transmission on or off).

NOTE: The azimuth angle of the block area is calculated relatively to the ship heading.

NOTE: The operator can set the 3 elevation zones and 3 azimuth zones to the block area.

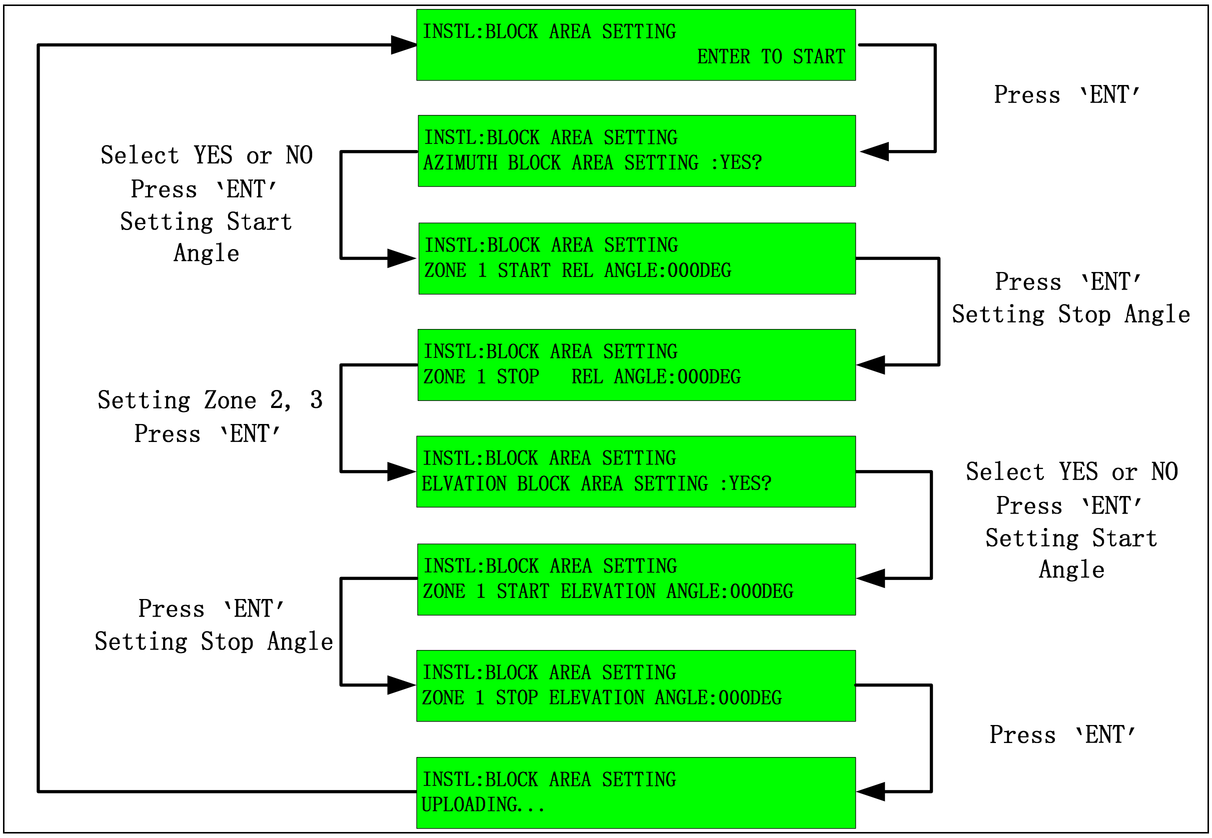

Figure 7-31 Block Area Setting

7.2.6 ACU Gyro Compass Type

There are multiple types of Gyro compasses, each of which requires a unique selection.

The KNS antenna supports the following Gyro type.

NMEA	0183
SYNC	360:1
SYNC	180:1
SYNC	90:1
SYNC	36:1
SYNC	1:1
STEP	360:1
STEP	180:1
STEP	90:1

NOTE: SYNC and STEP gyros require a direction setting which provides two choices: Normal and Reverse.

NOTE: The SYNC gyro also requires a frequency setting which provides two choices: 50/60Hz and 400/500Hz.

When the Direction setting = NORMAL, a change in voltage is proportional to a change of heading within a defined ratio (e.g. 1:1, 360:1, etc.). When the Direction setting = REVERSE, a change of voltage is inversely proportional to a change of heading in a defined ratio (e.g. 1:1, 360:1, etc.).

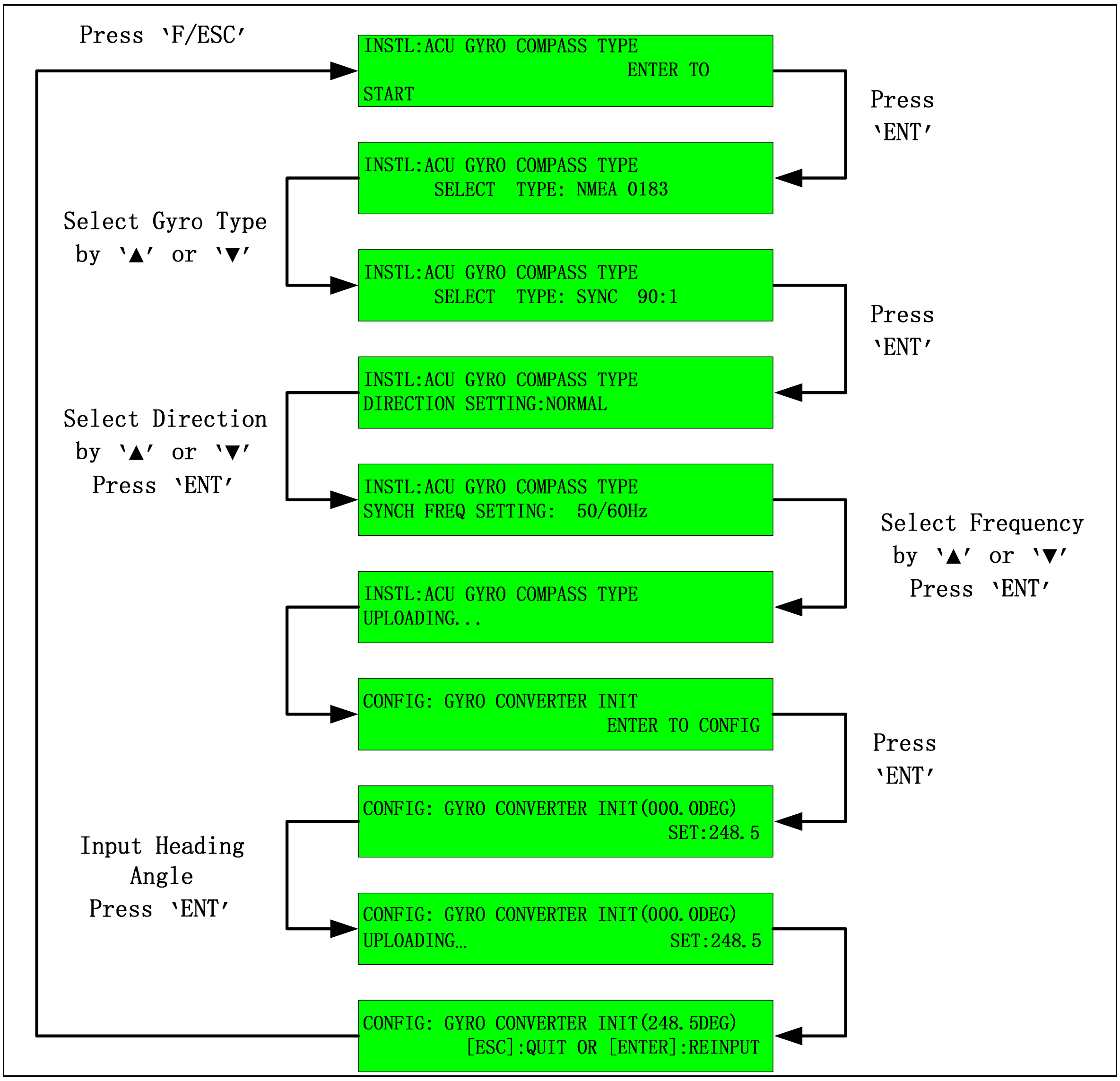

Figure 7-32 Configuration of Gyro Compass Type

7.2.7 PCU Compass Mode

There are four modes, as outlined below. The operator can select the PCU compass type according to the state of the ship's gyro. The antenna will start initializing after selection of the PCU compass mode.

a. NORMAL (GYRO COMPASS): Select the 'NORMAL' mode when using the ship's gyro. The ACU provides GYRO info to the PCU, which the PCU uses for its computation. For Gyro cable connection, refer to '3.6.3 ACU Gyro Compass Cable Connection'.

b. FAILED (Failed GYRO COMPASS): In the event that a gyro compass is not available, the user must select the 'FAILED' mode and must manually input the heading value.

(Refer to ‘7.1.3 Ship Heading’ for inputting the heading value.) The PCU uses the heading angle when the PCU is receiving the STR ID command from the ACU or when the antenna is searching for the satellite after initializing of the antenna.

c. ENHD FAILED (Enhanced Gyro Failure Mode): The ‘ENHD FAILED’ mode is an enhanced version of the ‘FAILED’ mode. In the case of the ‘ENHD FAILED’ mode, the PCU uses the heading angle when the antenna starts another search for the satellite after search failure.

NOTE: The Z12Mk2 points to the calculated position for about 30 seconds when the antenna’s satellite search fails, whereupon the antenna starts another search for the satellite.

d. INT. COMPASS (Internal Magnetic Mode): The Z12Mk2 has an internal magnetic sensor in a sensor cage. The PCU uses the azimuth angle obtained from the internal magnetic sensor for its computation.

NOTE: “INT. COMPASS’ mode is useful when testing the antenna on the ground without an external gyro signal. However, this mode is not recommended in cases where any of the ship’s material consists of a magnetic metal, as this can affect the magnetic field of the internal magnetic sensor, and the azimuth angle of the antenna will consequently differ from the real azimuth angle. If there are no non-magnetic metals among the materials of your ship, you can use the ‘INT. COMPASS’ mode. But internal magnetic value is more incorrect than gyro compass value, so we recommend that the antenna is used with a gyro compass.

7.2.8 GPS Output Format & Baudrate

The ACU provides GPS information via two external ports, the NMEA output port and the CONSOLE port. The format and baud rate of each port can be configured separately. The pin-out from the console port is specially designed. Please refer to ‘3.6.3.4 RJ-45 Connection for Satellite Modem’ for the pin-out of the console port.

NMEA DB-9 FORMAT: GPRMC/GPGLL/GPGGA

CON RJ-45 FORMAT: GPRMC/GPGLL/GPGGA

NMEA DB-9 BAUDRATE: 1200~115200

CON RJ-45 BAUDRATE: 1200~115200

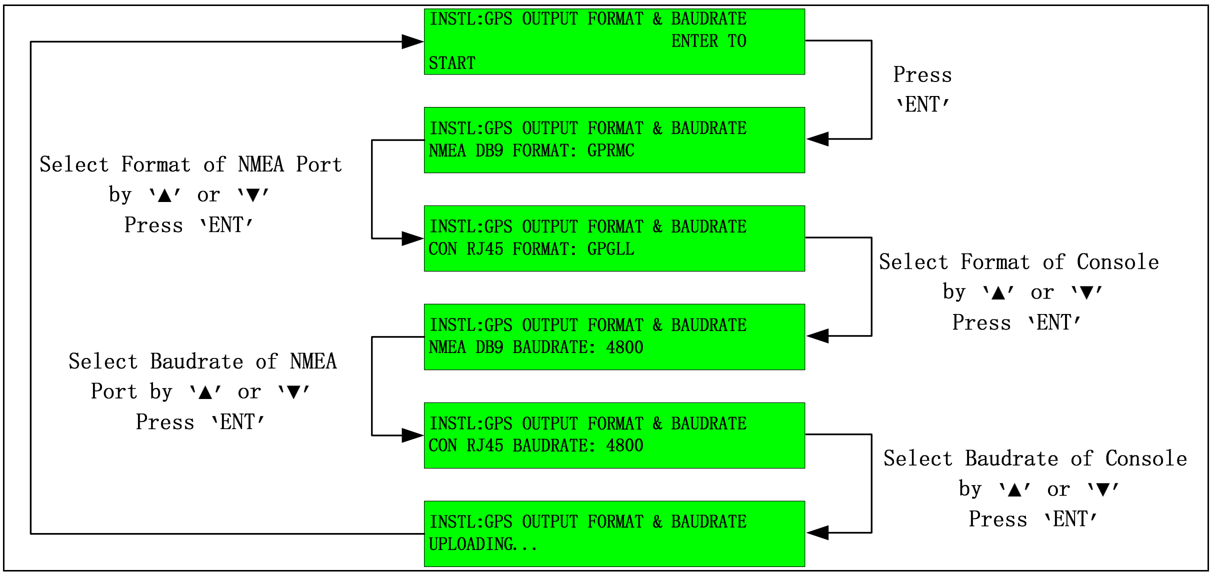

Figure 7-33 Configuration of GPS Format & Baudrate

7.2.9 Tilt Sensor Offset

The Tilt sensor has two axes: level and cross. When a tilt sensor or PCU is replaced, both axes must be leveled by adjusting the offset of each tilt axis. The bubble inclinometer on the top side of the level cage is used to do this. The bubble must be placed in the center after the adjustment.

LEVEL OFFSET ANGLE: Adjust this value by using the up and down keys or by typing the value until the level axis of the tilt sensor box has leveled.

(Press Key ENT to execute the value)

CORSS OFFSET ANGLE: Adjust this value by using the up and down keys or by typing the value until the cross axis of the tilt sensor box has leveled.

(Press Key ENT to execute the value)

NOTE: The antenna will be initializing when entering the 'TILT SENSOR OFFSET' or selecting the 'INITIALIZE: YES' after the adjustment.

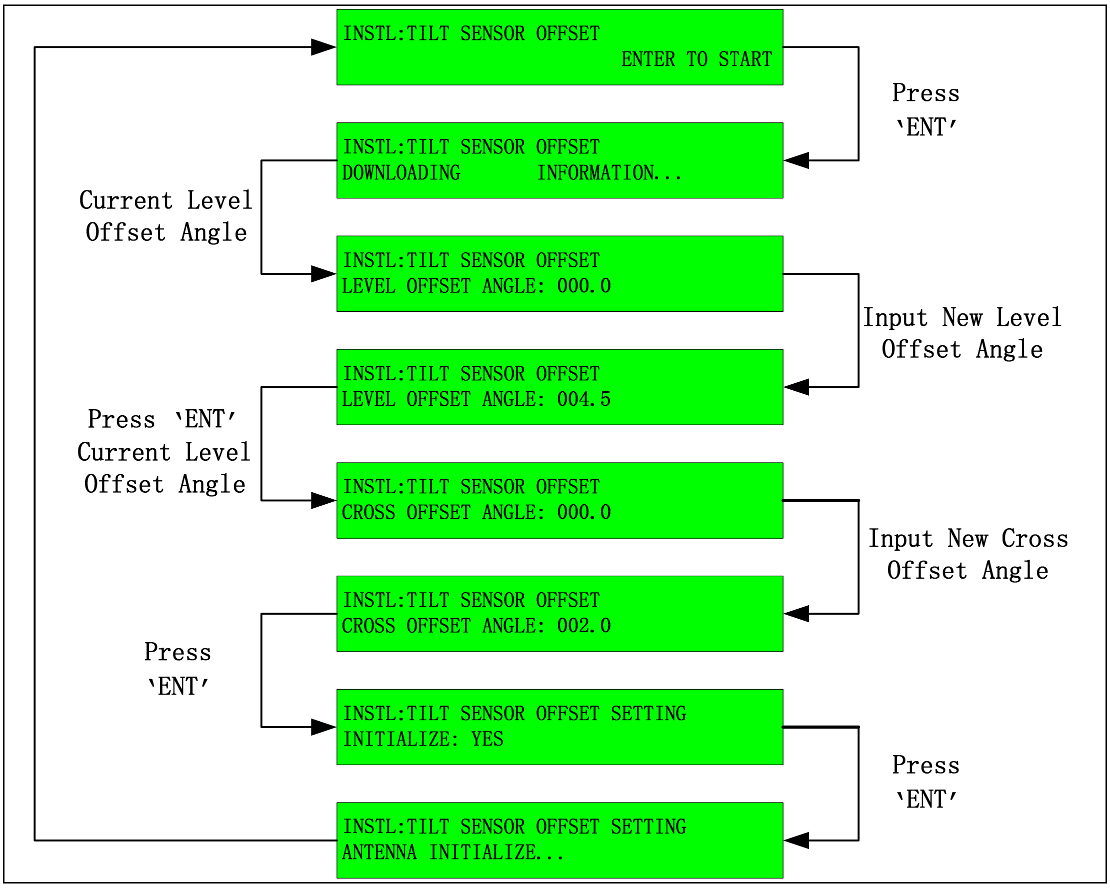

Figure 7-34 Configuration of Tilt Offset

7.2.10 TX DC 48V Power ON/OFF

The ACU has a built-in 48V DC power supply, (150W). Most L-band modems can supply 24V DC power and support BUCs up to 4~6 Watts. When a customer requires an 8W BUC, such modems cannot supply enough power, so an external DC power supply is commonly used. With a built-in 150W DC power supply dedicated to a TX BUC, the ACU can provide enough power to the BUC. For applications using less than 6W BUC, most standard L-band modems can provide DC power internally (24V DC).

The operator can control the TX DC voltage using the 'TX POWER MUTE' function. If you select 'ENABLE', the antenna shuts off the TX DC voltage when the antenna is in blockage or when the antenna is not tracking the satellite. But we do not recommend that you shut off the TX DC power, because the BUC can cause electrical damage.

NOTE: The default TX DC power voltage is 48V. We can install the 24V TX power supply (optional), if the dealer requests it.

NOTE: If the BUC is installed by the operator (not by KNS), then please be aware that the voltage is 48V.

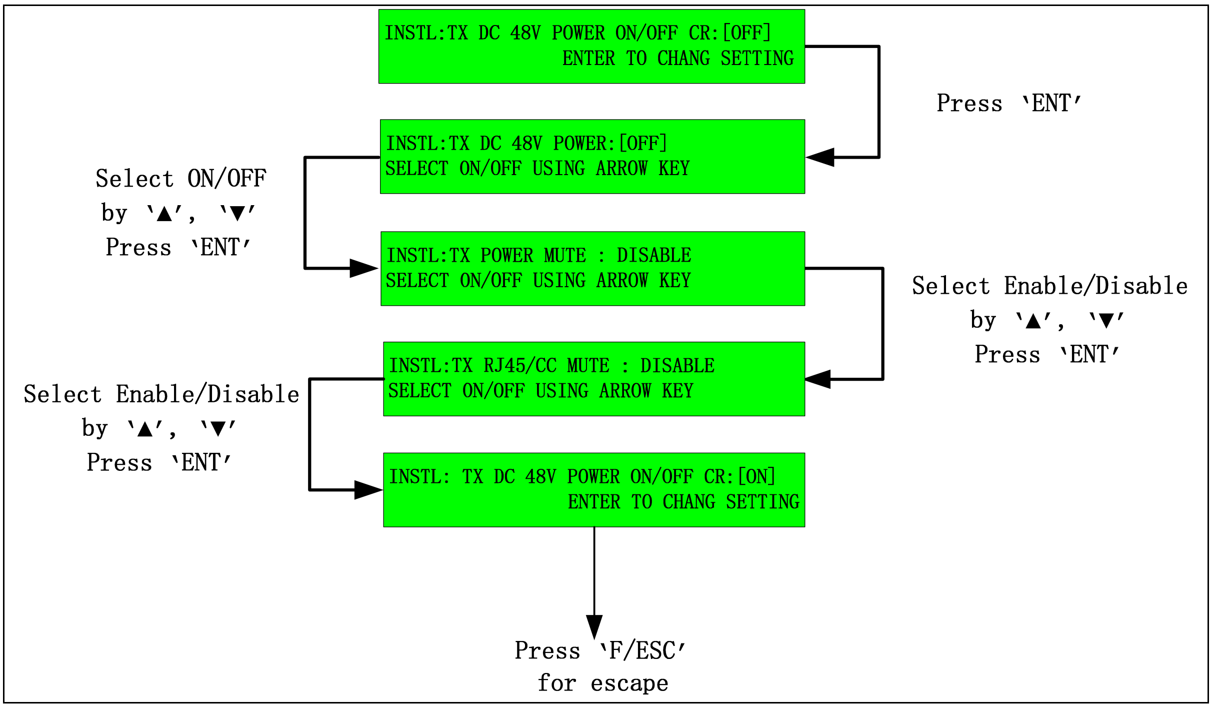

Figure 7-35 TX DC Mute Function & CC using Console Port

7.2.11 Azimuth and Elevation Trim

Use the 'Azimuth and Elevation Trim' when it is necessary to adjust the heading offset and cage offset while the antenna is tracking the satellite. (Condition for trim: Valid GPS data, Tracking of correct target satellite (Correct satellite longitude), Correct heading angle)

Azimuth Trim: When the operator selects the 'Azimuth and Elevation Trim' function, the PCU calculates the discrepancy between the calculated azimuth angle and the current azimuth angle. Then, the PCU changes the heading offset to the new heading offset.

Discrepancy of Azimuth Angle = Calculated Azimuth Angle by PCU – Current Azimuth Angle

New Heading Offset = Current Heading Offset – Discrepancy of Azimuth Angle

Elevation Trim: When the operator selects the 'Azimuth and Elevation Trim' function, the PCU calculates the discrepancy between the calculated elevation angle and the current elevation angle. Then, the PCU changes the cage offset to the new cage offset.

Discrepancy of Elevation Angle = Calculated Elevation Angle by PCU – Current Elevation Angle

New Cage Offset = Current Cage Offset – Discrepancy of Cage Angle

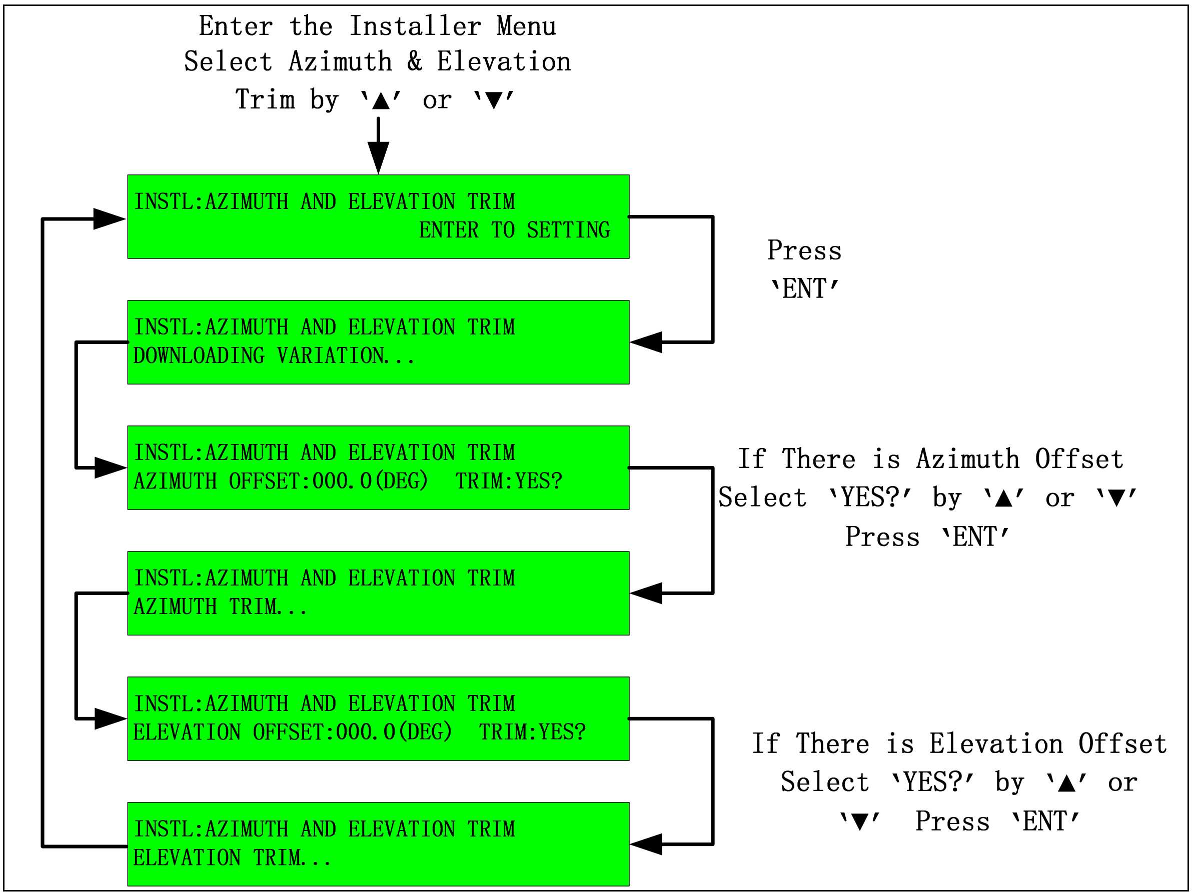

Figure 7-36 Azimuth and Elevation Trim (Steps)

NOTE: Cage offset is configured by a KNS engineer during factory setting. The operator cannot change the cage offset, except the 'Azimuth and Elevation Trim'.

NOTE: The operator must save the changed parameters using 'SAVE NEW PARAMETER'.

7.2.12 Diagnostic for Sensor and Driver

The operator can check the operating state of the antenna using 'Diagnostic for Sensor and Driver'. The operator can see the following parameters.

ERROR: Antenna Pointing Accuracy Error of Elevation, Cross and Azimuth Axis (Unit: Degrees)

DRIVING OUT: Motor Driving Torque of Elevation, Cross and Azimuth Axis

SEN ANG: Angle of Elevation and Cross Tilt Sensor, Angle of Azimuth Gyro Rate, Encoder Value

SEN VEL: Angular Velocity of Elevation, Cross, Azimuth Axis

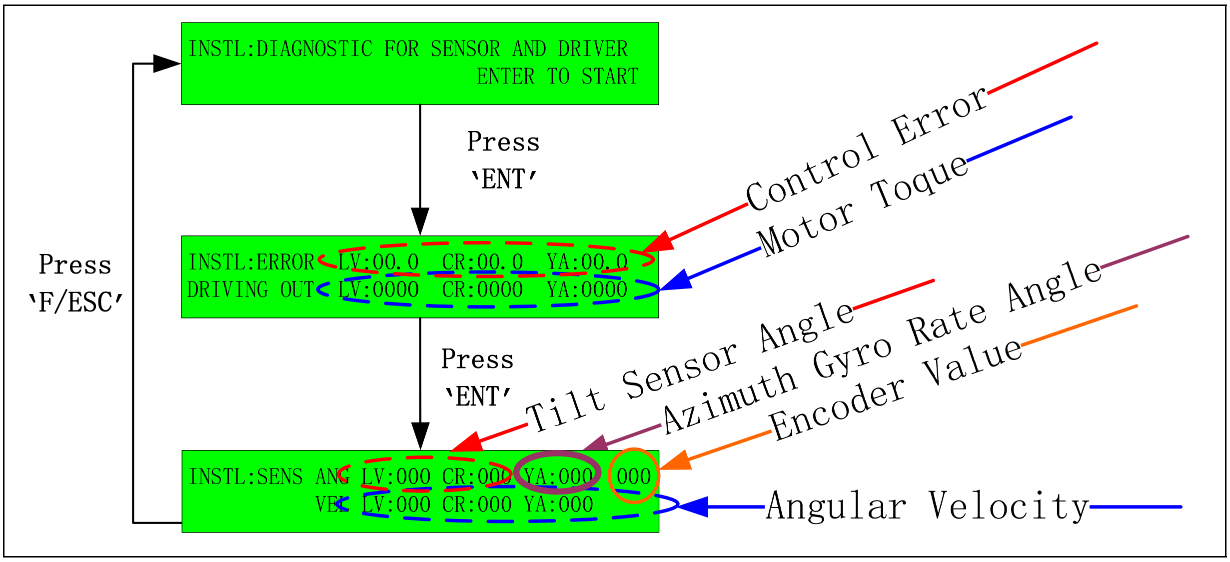

Figure 7-37 Diagnostic for Sensor and Driver

7.2.13 Automatic Beam Switching Protocol

The ACU can change the target satellite upon receiving the modem protocol (iDirect, iDrtABS, VIASAT,) of the KNS protocol (GTP) from the external device. This function is the 'Automatic Beam Switching (ABS)'. The ACU receives the ABS protocol via the NMEA port or the Ethernet port.

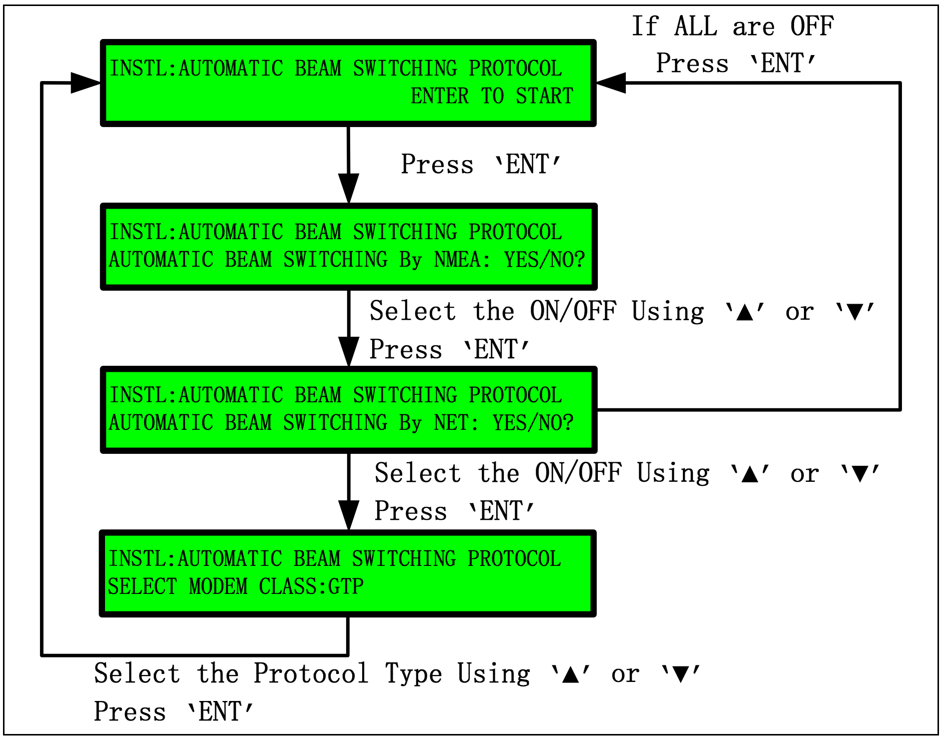

Figure 7-38 ABS Protocol Configuration

7.2.14 External Lock TTL Level

When the searching reference is 'External Lock Bit', the ACU receives the lock signal via the RJ45 console port from the satellite modem. If this lock signal is DC voltage, the ACU considers 2.6~5VDC as logical high and anything less than 2.6VDC as logical low. The lock signal varies according to the manufacturer. Logical high is the lock signal in the HNS modem, whereas iDirect modem's lock is logical low. Please refer to the modem manual.

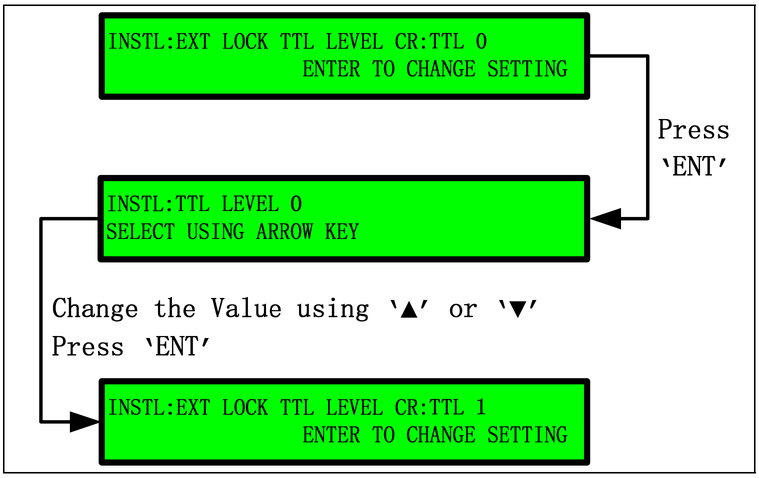

Figure 7-39 External Lock TTL Level Configuration

7.2.15 TCP/IP v4 Setting

The installer and operator can access to the ACU from outer devices using the Ethernet. You must configure the host IP address, gateway, and subnet-mask to use the Ethernet. We provide remote access software (SCS V1.7 & TMonitor) to the dealer. If you want to obtain this software, please contact us.

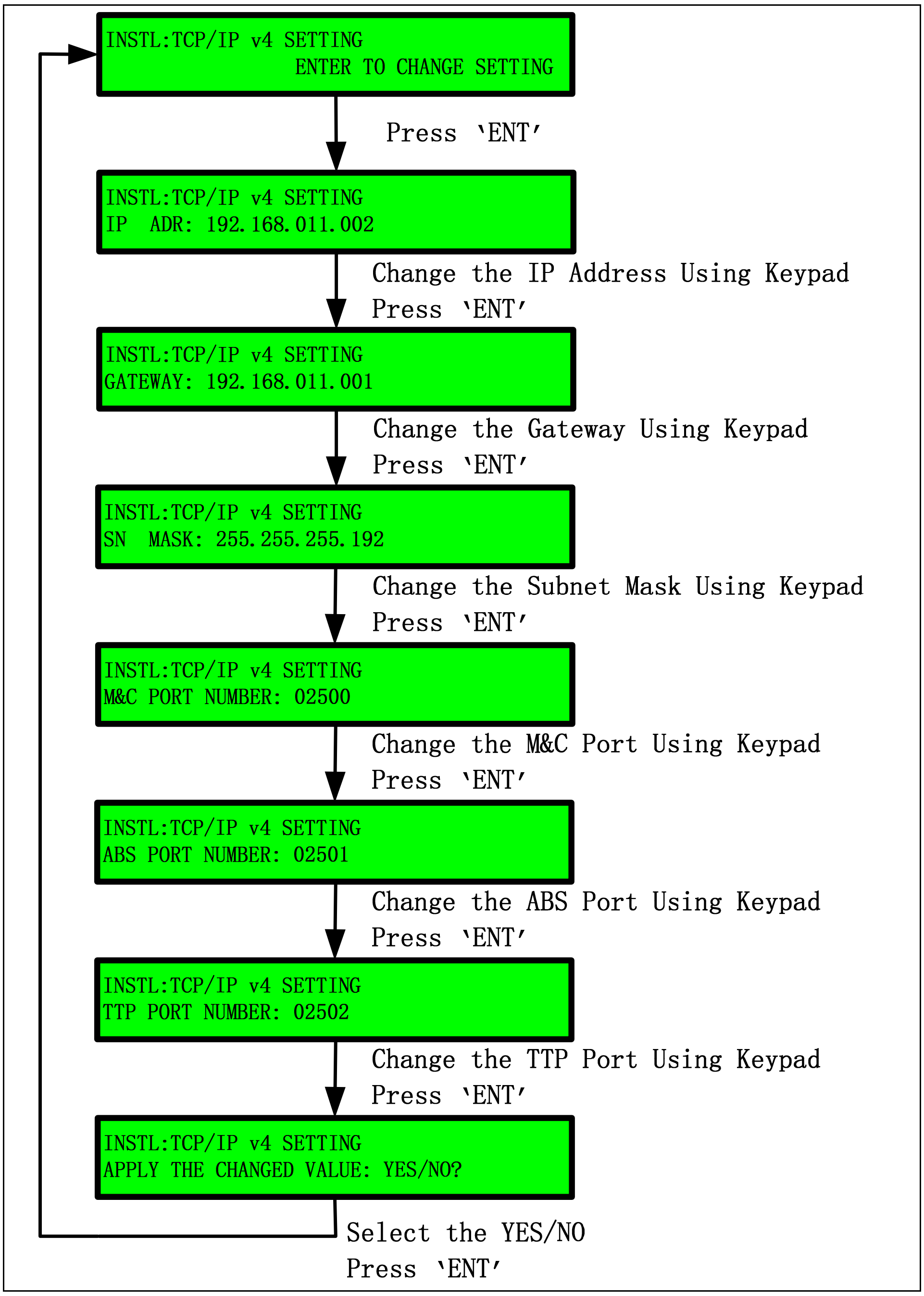

Figure 7-40 TCP/IP v4 Setting Steps

7.2.16 Save New Parameters

Please save all the changed parameters, or they will be lost the next time the ACU is power cycled, and the previous parameters will be restored.

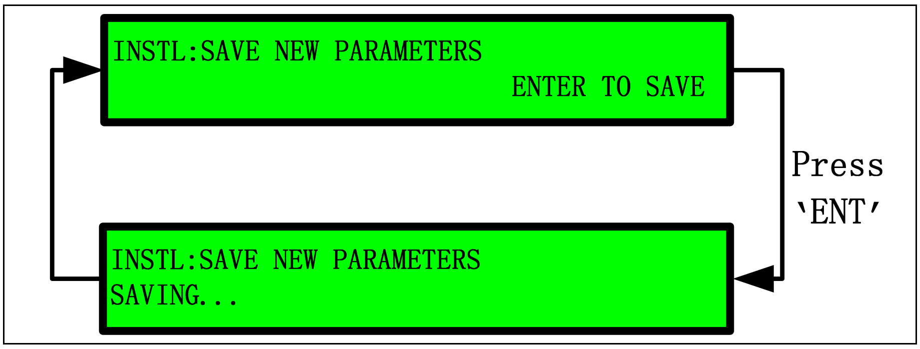

Figure 7-41 Saving Steps

7.2.17 Reset Parameters

If the operator wants to reset the satellite name, enter 'RESET PARAMETERS' and select the 'SAT ID RESET: YES?'. Then, all the satellite names will be reset to 'SAT0'.

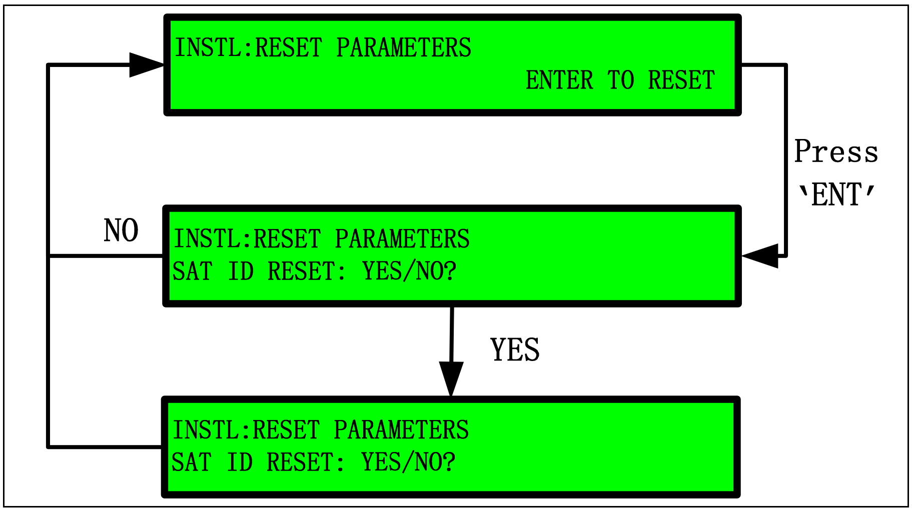

Figure 7-42 Reset Steps

8. Operation of the Antenna

8.1 Antenna Operation Procedure

The Z12Mk2 operates as shown in Table 8-1 when the antenna is in a normal state.

Procedure	Operation
1. ACU Power ON	1. The operator turns power on using the power switch on the front panel of the ACU.
2. Supply Power to Antenna	2. The ACU supplies power (48VDC) to the antenna via the RX cable.
3. ACU Initializing	3. The ACU initializes.
4. Bluetooth Connection	4. Bluetooth of the ACU searches the Bluetooth of the PCU. A software version of the ACU and PCU is displayed on the ACU LCD panel when the Bluetooth connection succeeds.
5. Step Motor Initializing	5. Step motor (Sensor cage) initializes to level off the sensor cage.
6. Search the Home Index	6. The antenna rotates until the hall sensor searches the home index.
7. Search and Track the Satellite	7. The antenna starts searching and tracking.

Table 8-1 Antenna Operation Procedure

- 1st: The RX power supply provides 48VDC to the ACU's main board when the operator turns the ACU power on.

- 2nd: The ACU's main board supplies 48VDC to the antenna via the BD-MUX and RX cable.
- 3rd: The ACU checks the DC line during initializing.
- 4th: The Bluetooth of the ACU searches the pre-paired Bluetooth of the PCU, and the ACU then displays the software version on the LCD panel of the ACU.
- 5th: Firstly, the sensor cage rotates counterclockwise until it pushes the limit switch. Then, the sensor cage rotates clockwise to level off.
- 6th: The Z12Mk2 uses the magnet as a home index of the antenna. After the initializing of the sensor cage, the azimuth axis of the antenna rotates to search for the magnet. The antenna stops the rotation when the hall sensor meets the magnet.

NOTE: We named the 5th~6th steps "antenna initializing".

- 7th: The antenna will start searching for the satellite after the initializing.

8.2 Check the Antenna's Operational Status

8.2.1 Antenna Status

The Z12Mk2 has 3 or 4 statuses in accordance with searching reference, as given below. The operator can see the state on the ACU LCD panel.

INIT(Initializing): The antenna is initializing.

SCH1(1st searching): The antenna searches for the target satellite signal.

SCH2(2nd searching): The antenna searches for the highest target satellite signal. Only the searching reference is 'DVB Carrier Lock' and 'EXT LOCK'.

TRCK(Tracking): The antenna tracks the target satellite signal.

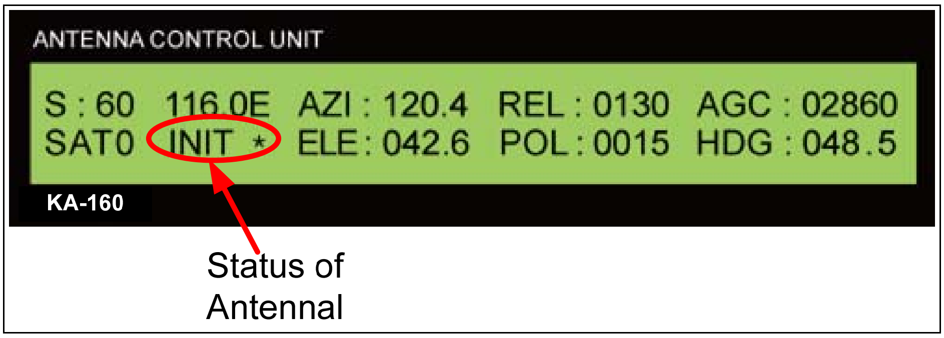

Figure 8-1 Antenna Status

NOTE: '*' means that the RX signal is unstable. The operator can see '*" when the antenna is in initializing or searching or when the antenna is in blockage.

8.2.2 Signal Strength

The operator can check the signal strength of the target satellite on the LCD panel of the ACU, as shown below in Figure 8-2. This signal strength is changeable by tracking reference. If you select the 'DVB AGC', you can see the DVB AGC level. (But the 'AGC' character remains unchanged.)

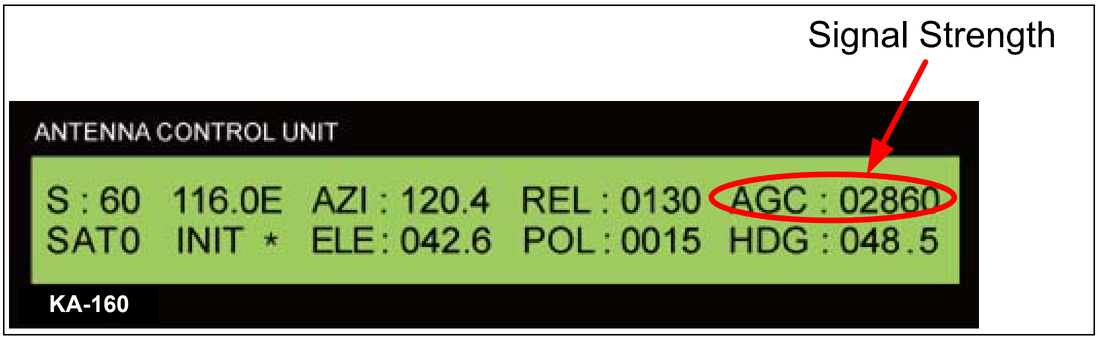

Figure 8-2 Signal Strength

8.2.3 Antenna Status LED

The operator can check the status of the antenna using the LED on front panel of the ACU. The ACU has 3 LEDs: TRACK, GPS, and ERROR

LED	LED State	Meaning
TRCK	OFF	Antenna is in initializing.
	Blink	Antenna searches for the satellite.
	ON	Antenna tracks the target satellite.

GPS	OFF	GPS antenna is broken or not connected.
	Blink	GPS data is not available.
	ON	GPS data is available.
ERROR	OFF	Antenna has no problems.
	ON	Antenna has an error. Please refer to error index.

Table 8-2 Meaning of Status LED

Figure 8-3 Status LED

8.2.4 M&C using Mini USB

The operator can connect the PC with the ACU using the mini-UBS port on the front panel of the ACU. The functions of the mini-USB port and the M&C port on the back panel of the ACU are the same.

Figure 8-2 M&C Port using Mini-USB

9. Troubleshooting

It is important that the operator recognizes symptoms correctly and searches for broken parts, as KNS or the installer will then be able to cope with a problem more rapidly.

This section concerns symptoms indicating breakage and offers a list of points for checking for those symptoms. There may be many checkpoints for one symptom, so you must follow the checkpoint steps. If your problem is solved in the 1st step, there is no need to follow the subsequent steps: Otherwise, you will have to go to the next step.

Symptom #1	ACU does not turn on following ACU power on.
Check Point	1. Make sure that the AC power cabling is connected between the ACU and the AC connector.
	2. Check the output power (48VDC) of the RX power supply.
	3. Check the power line of the ACU board.

Symptom #2	The ACU LCD blinks continuously when the ACU power is on, and the relay switch clicks repeatedly.
Check Point	1. Remove the cable between the RX power supply and the ACU board. Then, check the output voltage of the RX power supply.
	2. If the 1st step is OK, re-connect the cable. Check the short-circuit of power line on the ACU board.

Symptom #3	ACU repeatedly displays 'ACU INITIALIZE', and relay switch clicks repeatedly.
Check Point	1. Disconnect the RX cable on the back panel of the ACU, then re-try the power on.
	2. If it is ok in the 1st step, re-connect the RX cable.
	3. Check the rotary joint: Disconnect the RX cable (CH1) on the top side of the rotary joint, and then re-input the power to the ACU. If the symptom is resolved, the rotary joint has a problem. Please replace the

	rotary joint.
	4. If the problem is not resolved, re-connect the rotary joint cable. And remove the cable of the RX connector from the AD-MUX. Re-input the power to the ACU.
	5. If the problem is not resolved, re-connect the RX cable of the AD-MUX. And remove the cable of the power connector from the AD-MUX. Re-input the power to the ACU.
	6. If the problem is not solved, re-connect the power cable of the AD-MUX. And remove the cable of the power connector in the PCU. Re-input the power to the ACU.
	7. If the problem is not resolved, re-connect the power cable of the PCU. And remove the cable between the PCU motor driver. Re-input the power to the ACU.
	8. If the problem is not resolved, re-connect the cable between the PCU and the motor driver. And remove the cable between the PCU and sensor cage. Re-input the power to the ACU.

Symptom #4	ACU Bluetooth cannot search the PCU Bluetooth. (ACU ERROR: 0X 01 00)
Check Point	1. Make sure that the Cable between the ACU and the Antenna is properly connected.
	2. Please re-connect the PCU Bluetooth with the ACU Bluetooth. Refer to ‘7.2.1 Bluetooth Initialize’.
	3. If you cannot pair the PCU Bluetooth with the ACU Bluetooth, check the state of the PCU power supply.
	4. If the PCU is off, check that the RX L-band cabling between the ACU and PCU is properly connected.
	5. If the PCU is on, replace the PCU Bluetooth module.

Symptom #5	The sensor cage keeps hitting the limit switch. (In normal: The sensor cage rotates counterclockwise until it hits the limit switch, whereupon it rotates in a clockwise direction.)
Check Point	1. Make sure that the cable between the sensor board and the PCU is properly connected. Replace the cable (sensor board to PCU).
	2. If the problem is not resolved, check the sensor board. Replace the sensor board.
	3. If the cable and sensor board do not have a problem, check the sensor connector of the PCU.
	4. If the problem still is not resolved, replace the motor driver.

Symptom #6	The sensor cage directly rotates clockwise before hitting the limit switch.
Check Point	1. Make sure that the cable between the sensor board and the PCU is properly connected. Replace the cable (sensor board to PCU).
	2. If the problem is not resolved, check the sensor board. Replace the sensor board.
	3. If the cable and sensor board do not have a problem, check the sensor connector of the PCU.
	4. If the problem still is not resolved, replace the motor driver.

Symptom #7	The antenna has a ‘Cross-level axis error (PCU Error 0X 02 00 00 00), and the cross axis continually hits the stopper on both sides.
Check Point	1. 1. Make sure that the cable between the sensor board and the PCU is properly connected. Replace the cable (sensor board to PCU).
	2. If the problem is not resolved, check the sensor board. Replace the sensor board.

	3. If the cable and sensor board do not have a problem, check the sensor connector of the PCU.

Symptom #8	Operation of the sensor cage is OK, but the elevation or cross axis is not working. (In normal: Elevation and cross axis are moving to level off the sensor cage after operation of the sensor cage.)
Check Point	1. Check the motor driver. Replace the motor driver.
	2. If the antenna still has a problem, please replace the elevation motor or cross motor.
	3. If the problem is not resolved, you must check the cable between the motor driver and the PCU.
	4. Lastly, check the motor driver connector of the PCU.

Symptom #9	The azimuth axis does not move after the sensor cage stays parallel to the ground. (The azimuth axis normally moves once the cage is parallel and stable.)
Check Point	1. Check the motor driver. Change the motor driver.
	2. If the problem is not resolved, change the azimuth motor.
	3. If the problem is not resolved, you must check the cable between the motor driver and the PCU.
	4. Lastly, check the motor driver connector of the PCU.

Symptom #10	All axes of the antenna are not working after initializing. The antenna has a 'PCU error 0X 40 00 00 00'.
Check Point	1. Check the hall sensor. Replace the hall sensor.
	2. If the problem is not yet resolved, check the PCU.

Symptom #11	Heading angle does not synchronize to the ship's gyro.
Check Point	1. Check the ship's gyro signal. Is the gyro signal level within the proper range? Refer to '3.6.3 ACU Gyro Compass Cable Connection'.
	2. Check the cable connection between the AUC and the ship's gyro.
	3. Check the matching of the gyro compass type and the direction, etc. of the ACU and the ship's gyro
	4. Check the NMEA converter. Replace the NMEA converter.

Symptom #12	Searching fail error message (PCU error 0X 10 00 00) occurs immediately after initializing.
Check Point	1. Check the longitude of the target satellite. If the calculated elevation angle and azimuth angle are out of its range, the ACU will be displaying the searching fail error message (PCU error 0X 10 00 00).
	2. Check the state of the GPS. Are the GPS data correct?

Symptom #13	The antenna is searching continually without tracking.
Check Point	1. Check the 'S&T Reference Details' (Key '5').
	2. Check the 'DVB Tuner' (Key '6').
	3. Is the antenna blocked?
	4. Check the skew angle. Is the skew mode on 'AUTO'?
	5. Please confirm that the RX frequency of the target satellite is within the input frequency range of the LNB.

Symptom #14	The antenna is tracking the satellite, but cannot hold the tracking.
Check Point	1. Is the antenna blocked?
	2. Check the LNB. Replace the LNB.
	3. If the problem is not resolved, please check the PCU.

Symptom #15	The GPS LED is off.
Check Point	1. Check the GPS antenna. Replace the GPS antenna.
	2. Check the cable connection between the PCU and the GPS antenna.

Symptom #16	The GPS LED blinks continuously after about 20 minutes.
Check Point	1. Check the GPS antenna. Replace the GPS antenna.
	2. Check the cable connection between the PCU and the GPS antenna.

Symptom #17	The antenna is tracking, but the modem is not locked.
Check Point	1. Please confirm that the target satellite of the ACU and the target satellite of the modem are the same.
	2. Check the state of the GPS data. Is the GPS LED on?
	3. Check the cable connection between the ACU and the modem, console, and RX.
	4. In the case of the TDMA modem, check the GPS data on the modem.

Symptom #18	RX is locked but the link is not locked on the modem.
Check Point	1. Check the TX voltage on the ACU or modem. Is the TX voltage of the ACU or modem within the input voltage range of the BUC?
	2. Check the TX frequency of the modem.
	3. Check the cable connection between the BUC and the TX port on the modem or ACU.

Symptom #19	The antenna is tracking, but the AGC or C/N level is lower than the normal state.
Check Point	1. Check the weather: Deep fog and cloud, heavy rain, etc.
	2. Check for blockage of the antenna.

	3. Confirm what the antenna is tracking the side lobe. Then re-try the search for the satellite using the '▲' button.

Symptom #20	The antenna cannot save the changed parameters.
Check Point	1. Check the state of communication between the ACU and the PCU.
	2. Check the PCU.

10. Error Message

If the antenna has problems, then error LED on ACU will come on. Press the 'ENT' key to check the error code; then, the error code will be displayed as a hexadecimal on the LCD panel of the ACU. If the antenna has more than two errors, the ACU will display combined error codes. Table 10-1 is the general error code and error index.

NOTE: Please refer to Appendix A for further details. BUT, convert hexadecimal into binary to use the Appendix A (Error code define).

Error Code					Error Index
0x	01	00	00	00	Level Axis Control Error
0x	02	00	00	00	Cross-Level Axis Control Error
0x	04	00	00	00	Yaw Axis Control Error
0x	08	00	00	00	GPS Error
0x	10	00	00	00	Satellite searching parameters are not correct.
0x	20	00	00	00	Tuner Error
0x	40	00	00	00	Yaw Encoder Index Error
0x	00	04	00	00	Searching Failure
0x	00	10	00	00	DSP Flash Writing Error
0x	00	20	00	00	DSP EEPROM Error
0x	00	40	00	00	RSSD PLL Error
0x	20	00	00	01	System has restarted
0x	20	00	00	02	Unknown RS232 error has occurred
0x	20	00	00	03	Unknown or invalid command has been received

0x	20	00	00	04	Unknown or invalid data has been received
0x	20	00	00	05	The 'TS' command must be sent prior to the command. This is for programming the transponder/satellite data.
0x	20	00	00	06	A tuner I2C bus failure has occurred. This could indicate that the tuner is not working properly.
0x	20	00	00	07	The LNB polarity voltage is not within the LNB polarity range. This could indicate that the LNB voltage is not switching or that the LNB voltage has shorted.
0x	20	00	00	08	The LNB signal level is below the valid range. This could indicate that no LNB is connected.
0x	20	00	00	09	The E2Ram has failed.

Table 10-1 Error Code & Error Index

Appendix A: Error Code Define

PCU Version: after 1.925

Syntax: 0x: FF(1) FF(2) FF(3) FF(4)

0x FF(1) $=1_8 1_7 1_6 1_5\ 1_4 1_3 1_2 1_{1b}$

1_1: Level motor driving error

1_2: Cross motor driving error

1_3: Yaw motor driving error

1_4: GPS non-valid error in time

1_5: Satellite information is not acceptable (satellite longitude or current antenna latitude, longitude information)

1_6: DBS tuner error

1_7: Cage limit switch error during initialization

1_8: Not used

0x FF(2) $=1_8 1_7 1_6 1_5\ 1_4 1_3 1_2 1_{1b}$

1_1: Axis driving error exceeds 0.5 deg for FCC

1_2: Yaw encoder variation too small or not operational during initialization

1_3: Searching failed

1_4: No gyro input (means communication error)

1_5: PCU DSP flash writing error

1_6: PCU DSP EEPROM writing error

1_7: RSSD board is not operational

1_8: Not used

0x FF(3) $=1_8 1_7 1_6 1_5\ 1_4 1_3 1_2 1_{1b}$

1_1: Skew control is not normal

1_2: Not used

1_3: Not used

1_4: Not used

1_5: Not used

1_6: Not used

1_7: Not used

1_8: Not used

0x FF(4)

0x01: System has restarted

0x02: Unknown RS232 error has occurred

0x03: Unknown or invalid command has been received

0x04: Unknown or invalid data has been received.

0x05: The 'TS:' command must be sent prior to the command.

This is for programming the transponder/satellite data.

0x06: A tuner I2C bus failure has occurred.

This could indicate that the tuner has gone bad.

0x07: The LNB polarity voltage is not within the LNB polarity range.

This could indicate that the LNB voltage is not switching or that the LNB voltage has shorted.

0x08: The LNB signal level is below the valid range.

This could indicate that no LNB is connected.

0x09: The E2Ram has failed

Appendix B: Specification

Above Deck			
Dish Diameter	120cm (47")	**Antenna Dimension(1)**	161cm(H) x 157cm(D)
Antenna Weight(2)	142kg (Based on 4W BUC)	**Radome Material**	FRP
RX / TX Frequency Band	TX : 14.0 ~ 14.5GHz Ku Band, RX : 10.95 ~12.75GHz Ku Band	**Humidty**	Up to 100% @ 40˚C
G/T	20.4dB/K	**RX / TX Gain**	41.9dBi / 43.7dBi
BUC	4W / 6W, 8W, 16W, 25W(Option)	**Operating Platform**	3-Axis
LNB	Linear / Internal PLL	**Skew Control**	Automatic (-130˚ ~ +130˚)
Elevation Angle	-20˚ ~ +110˚	**Azimuth Range**	Unlimited
Cross Angle	+/- 30˚	**Tracking Speed**	More than 90˚/sec
Vibration Damper	Wire Rope Isolator	**Temperature**	-20˚C to 55˚C
Below Deck			
ACU Size	19" Rack 1U size	**External I/O**	RS232C, USB, Ethernet
Input Power	110/220VAC Free	**Gyro Compass Input**	NMEA, Synchro Step-by-Step
Output Power	48VDC 100W		
Packing			
Size	174 x 174 x 186cm	**Gross Weight**	310kg
Packed by	Wooden Crate		

Specifications subject to change without notice

Appendix C: Layout of Radome and Antenna Mounting Holes

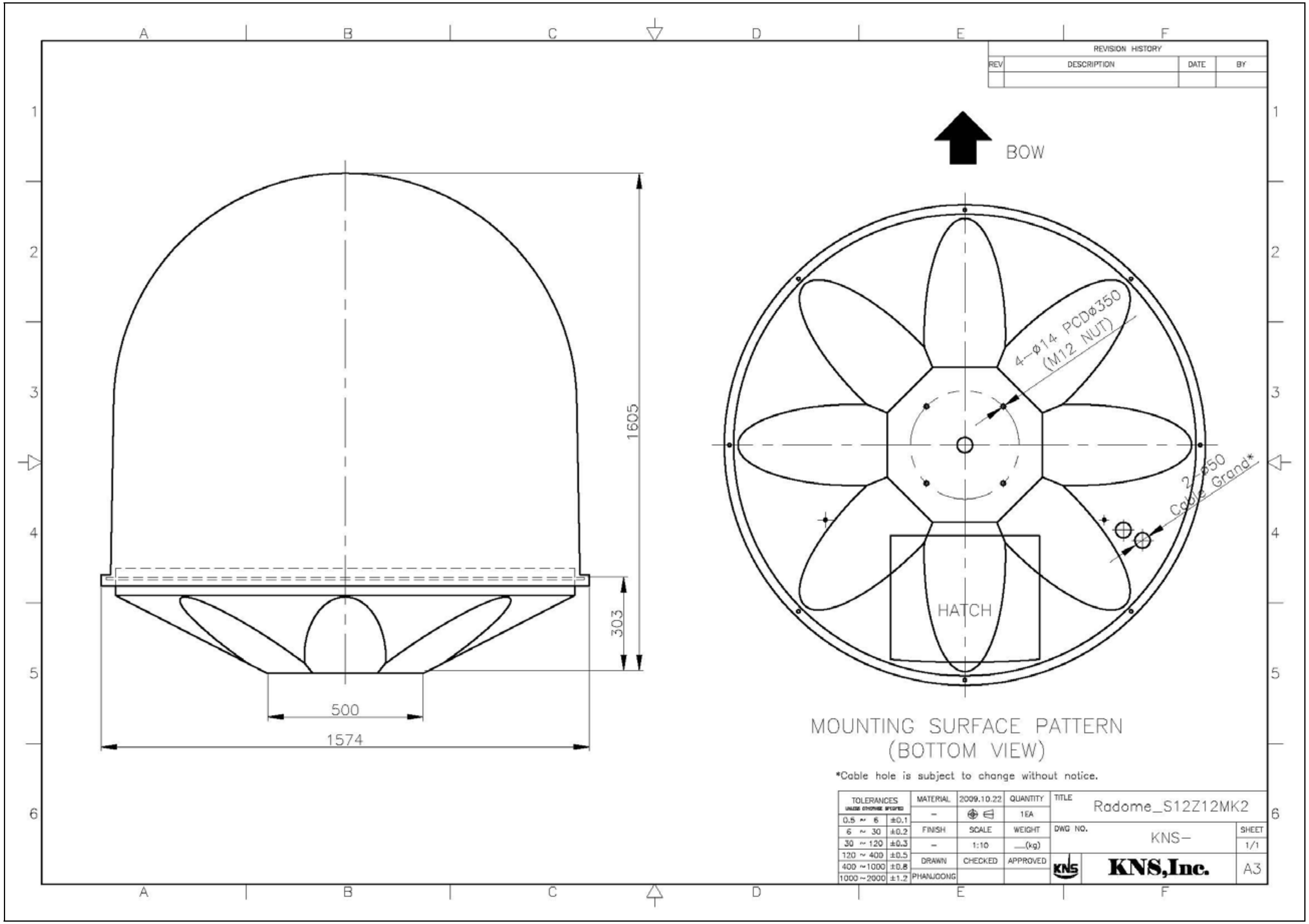

Figure C- 1 FRP Radome

CE Label

Antenna Control Unit

KNS, Inc.
www.kns-kr.com

Antenna Control Unit
CE0678 ⓘ
Model : KA - 160
Input : 100 - 240V~, 50-60Hz, 4.5-1.8A
Output : RX - 48V ⎓ , 2.3A
TX - 48V ⎓ , 3.2A
Manufacturer : KNS, Inc.
S / N :
TEL : +82 42 932 0351~2 FAX : +82 42 932 0353 MADE IN KOREA

KNS, Inc.
www.kns-kr.com

Antenna Control Unit
CE0678 ⓘ
Model : ACU - 200
Input : 100 - 240V~, 50-60Hz, 4.5-1.8A
Output : RX - 48V ⎓ , 2.3A
TX - 48V ⎓ , 3.2A
Manufacturer : KNS, Inc.
S / N :
TEL : +82 42 932 0351~2 FAX : +82 42 932 0353 MADE IN KOREA

KNS, Inc.
www.kns-kr.com

Antenna Control Unit
CE0678 ⓘ
Model : H 200
Input : 100 - 240V~, 50-60Hz, 4.5-1.8A
Output : RX - 48V ⎓ , 2.3A
TX - 48V ⎓ , 3.2A
Manufacturer : KNS, Inc.
S / N :
TEL : +82 42 932 0351~2 FAX : +82 42 932 0353 MADE IN KOREA

KNS, Inc.
www.kns-kr.com

Antenna Control Unit
CE0678 ⓘ
Model : HOS 200
Input : 100 - 240V~, 50-60Hz, 4.5-1.8A
Output : RX - 48V ⎓ , 2.3A
TX - 48V ⎓ , 3.2A
Manufacturer : KNS, Inc.
S / N :
TEL : +82 42 932 0351~2 FAX : +82 42 932 0353 MADE IN KOREA

Marine Satellite Antenna