

## A Guide to TracVision 4

# technical manual

- Installation
- Configuration
- Maintenance



KVH TracVision® 4

# TracVision 4-HP

## Technical Manual Addendum



**(ECO #7622)**

The following changes apply to Revision G of the TracVision 4-HP Technical Manual (KVH Part Number 54-0150).

### 4.3 TracVision 4 Field Replaceable Units

*Table 4-1 has been updated to show the new part number for the RF PCB.*

FRU	Part Number
Radome	02-0925-04
Main PCB	02-0992
<b>RF PCB</b>	<b>02-1524</b>
Antenna Gyro Sensor	02-1090
Antenna Gyro Gasket	24-0139
Elevation Drive Belt	24-0105-104
Elevation Motor	02-1356
LNB (North American System)	02-0870
LNB (European System)	02-1278
Data Cable	32-0619-50 <sup>†</sup> 32-0619-100 <sup>††</sup>
RF Cable	32-0417-50 <sup>†</sup>
PC Cable	32-0628-06
Power Cable	32-0510-50
Ground Cable	32-0583-50
CPU Fuses	16-0017-3150

**Table 4-1**

*TracVision 4 Field Replaceable Units*

<sup>†</sup> North American system

<sup>††</sup> European system

# TracVision 4-HP Technical Manual Addendum *Sky Mexico Customers Only*



**(ECO #7247)**

The following changes apply to Revision G of the TracVision 4-HP Technical Manual (KVH Part Number 54-0150).

## Installed Satellites

The Sky Mexico satellite TV service is broadcast via the PAS 9 satellite located at 58° West longitude. Therefore, the Sky Mexico-configured antenna (KVH part number 01-0234-05HPT) is programmed to track the following satellites:

Satellite A	Satellite B
PAS_9	NONE

If you choose, you can install any other satellite from the antenna's satellite library as Satellite B (following the procedure in *Section 2.7, "Installing Satellites to Track" on page 28*). However, please note that the antenna may not be able to find your selected second satellite when you switch from PAS\_9 to Satellite B, since the satellite may not be viewable from your location. *For example, in Mexico, you can receive Sky Mexico signals from PAS 9, but you cannot receive signals from DSS\_101, which provides DIRECTV service to the U.S.*

## Multiswitch Restrictions

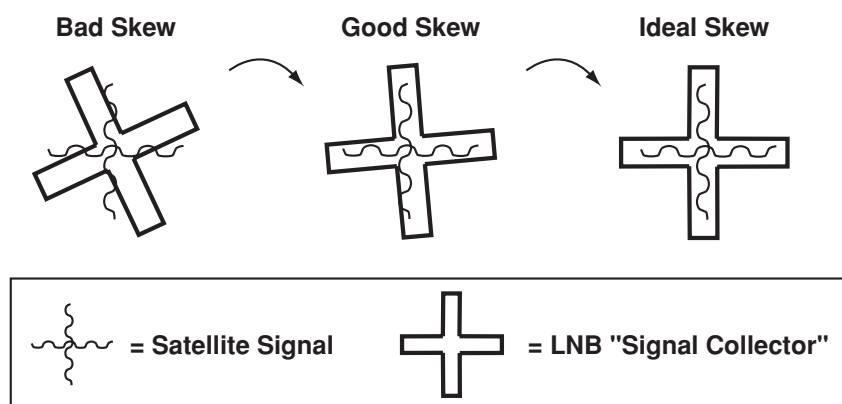
If you need to connect more than two receivers to the antenna system for PAS 9 service, you must use an **active multiswitch that generates a 22 KHz tone** (for example, Spaun models 5602NF or 5802NF).

## LNB “Skew” Adjustment

Unlike most satellite TV signals in North America, which are circularly polarized, the PAS 9 signal is linearly polarized, which means it is transmitted in a certain orientation. Your Sky Mexico-configured antenna is equipped with a special LNB that collects these linear signals. To optimize reception, however, the LNB must be oriented in the same way as the satellite signal. This orientation adjustment is referred to as the LNB’s “skew.”

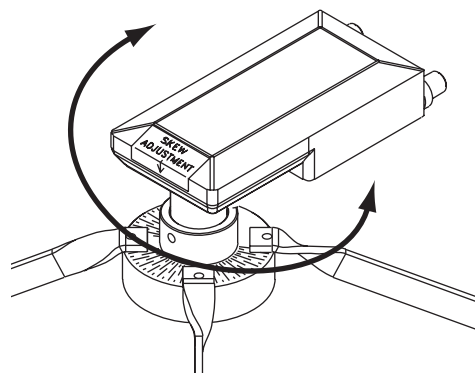
Figure 1 shows how skew determines the amount of signal the LNB collects. The more signal it collects, the better the reception.

**Figure 1** *How Skew Works*



To set the skew, you simply need to rotate the LNB to the proper angle, as shown in Figure 2.

**Figure 2** *LNB Can Be Rotated to Adjust Skew*



The correct skew setting varies depending on your geographic location, since the orientation of your antenna to the satellite changes as you move. Follow the instructions on the following pages to find the correct skew for your location and to adjust the LNB’s skew setting.

## Finding the Correct Skew for Your Location

You can find the correct skew for your location by either:

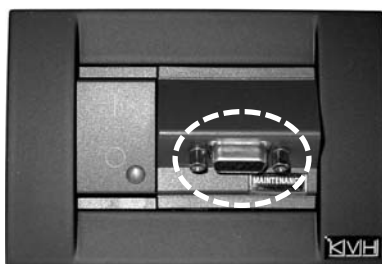
- A. Querying the antenna (by entering commands via a laptop connection), or
- B. Finding your location on the PAS 9 skew map.

### Option A - Querying the Antenna

To find the correct skew, follow the steps below.

1. Connect your laptop PC to the switchplate's Maintenance port using a serial data cable.

**Figure 3** Switchplate Maintenance Port



2. Open Windows HyperTerminal and establish the following settings:
  - Bits per second: 9600
  - Data bits: 8
  - Parity: None
  - Stop bits: 1
  - Flow control: None
3. Turn on the antenna and allow the antenna to initialize. Data should be scrolling on your PC.
4. Type **HALT** then press Enter.
5. Type **DEBUGON** then press Enter.
6. Type the GPS command as shown below, then press Enter:

Command:	<b>GPS,XX,&lt;N or S&gt;,YYY,&lt;E or W&gt;</b>
Where:	<b>XX</b> = your latitude <b>YYY</b> = your longitude

*Example: If your position is 24.8 North, 112.3 West, you would enter **GPS,25,N,112,W**.*



*If your computer does not have a DB9 serial COM port, you can use the following USB-to-RS232 adapter:*

*IOGear part number GUC232A  
(visit [www.iogear.com](http://www.iogear.com))*



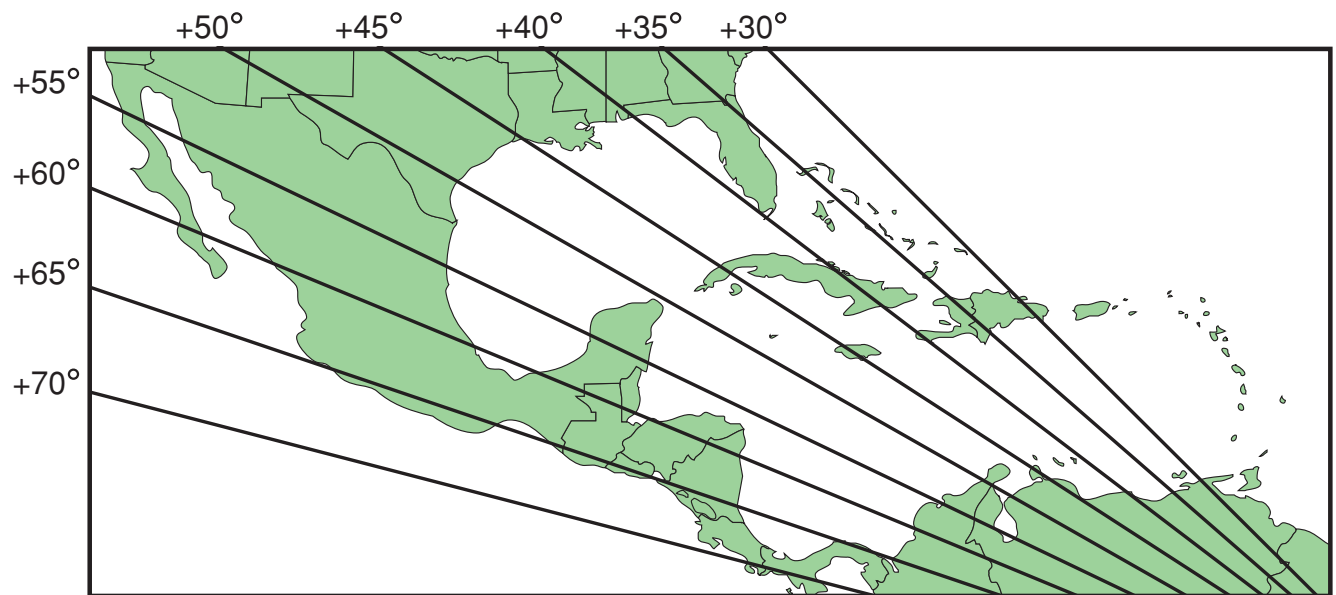
*Instead of HyperTerminal, you can use the **KVH Flash Update Wizard** to enter antenna commands. The Flash Update Wizard can be downloaded from [www.kvh.com/wizard](http://www.kvh.com/wizard).*

7. Type **ZAP** then press Enter to restart the antenna.
8. Once the antenna has initialized, type **DEBUGON** then press Enter.
9. Type **SKEWANGLE** then press Enter. The antenna reports the correct skew angle for the location that you entered in Step 6.

### **Option B - Using the PAS 9 Skew Map**

If you do not have a laptop, you can find the approximate skew for your location using the map below.

**Figure 4** *Approximate Skew Settings for PAS 9 Satellite*



### **When to Change the Skew**

In general, if your LNB's skew is set to within  $\pm 8^\circ$  of the ideal skew for your location, the antenna should continue to provide good satellite TV reception. However, if you travel to a location in which your LNB's skew differs by  $9^\circ$  or more, or if reception degrades the further you travel, you should readjust the LNB's skew for your new location.

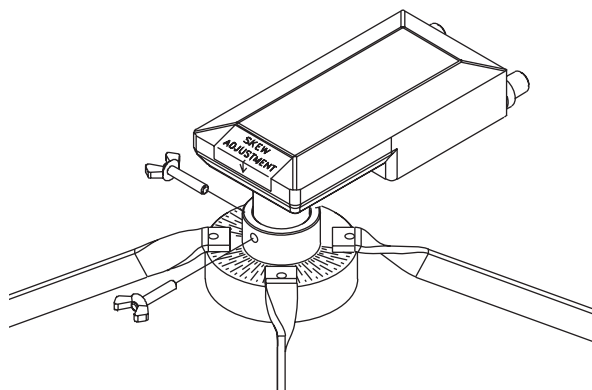
**Example:** If you traveled from El Salvador to Acapulco along the coast, you wouldn't need to change the skew, since the correct skew is  $66^\circ$  for both locations. Even if you continued traveling north to Cabo San Lucas, you should still have good satellite TV reception, since the correct skew is  $63^\circ$ , a  $3^\circ$  difference. However, if you traveled all the way to San Diego, where the correct skew is  $54^\circ$ , a  $12^\circ$  difference, you might then need to readjust the skew to enjoy satellite TV reception.

## Setting the Skew

To set your LNB to the proper skew, follow the steps below.

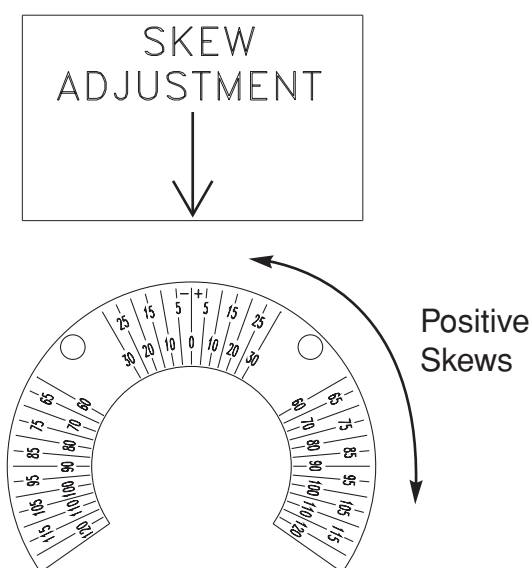
1. Turn off the power to the antenna.
2. Remove the radome and set it aside in a safe place.
3. Loosen the two wing screws securing the LNB within the choke feed, as shown in Figure 5.

**Figure 5** LNB Skew Adjustment



4. Refer to the skew labels on the end of the LNB and on the LNB choke feed (shown in Figure 6) and adjust the LNB as necessary to match as closely as possible the correct skew.

**Figure 6** Skew Labels



*Skews for PAS 9 are all positive (+) angles. Do not set the skew to a negative number.*

5. Retighten the wing screws.
6. Reinstall the radome.



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# TracVision 4-HP

## Technical Manual Addendum



**(ECO #7243)**

The following changes apply to Revision G of the TracVision 4-HP Technical Manual (KVH Part Number 54-0150).

### **Antenna Restarts After =CALGYRO Command**

When the antenna receives an **=CALGYRO** command, it calibrates the gyro *then restarts*. This eliminates the need to enter a **ZAP** command following the calibration process.

If you need to calibrate the gyro, follow the updated procedure below. This procedure replaces the “Calibrating the Antenna Gyro” instructions in *Section 4.6, “Replacing the Antenna Gyro Assembly.”*

1. With a PC connected to the switchplate’s maintenance port, apply power to the antenna unit.
2. Type **HALT<cr>** (<cr> = Press the ENTER key) while the system is performing the limit switch initialization routine.
3. Type **DEBUGON<cr>** to enter Debug mode.
4. Type **=LSTEST<cr>**.
5. Type **EL,300<cr>**.
6. Type **=CALGYRO<cr>**. Verify that the Antenna Gyro Azimuth scale factor is between -0.00090 and -0.00110 and the Antenna Gyro Elevation scale factor is between 0.00090 and 0.00110.

The antenna restarts. *The gyro calibration process is complete!*



*Refer to Section 3.5, “Computer Diagnostics” for details on connecting a PC to the maintenance port.*



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# TracVision 4-HP Technical Manual Addendum



## ***(ECO #7134)***

The following changes apply to Revision G of the TracVision 4-HP Technical Manual (KVH Part Number 54-0150).

*The “=TV” configuration command printed in the manual is incorrect. For your TracVision 4-HP system, the correct configuration command is **=TVG4HPT**, not **=TVG4HP**.*

*You will need to enter the **=TVG4HPT** command whenever you replace the main printed circuit board (PCB) or calibrate the antenna gyro, at the steps noted below.*

## **4.4 Replacing the Main PCB and Fuses**

### **Replacing the Main PCB**

13. Type **=TVG4HPT<cr>** (<cr> = Press the Enter key).

## **4.6 Replacing the Antenna Gyro Assembly**

### **Calibrating the Antenna Gyro**

8. Type **=TVG4HPT<cr>**.

# TracVision 4

## Technical Manual

This manual provides detailed instructions on the proper installation, configuration, troubleshooting, and maintenance of the KVH TracVision 4 system. Complete instructions on how to use the TracVision 4 system is provided in the *TracVision 4 User's Guide*.

Throughout this manual, important information is marked for your attention by these icons:



A helpful tip that either directs you to a related area within the manual or offers suggestions on getting the best performance from your system.



An alert to important information regarding procedures, product specifications, or product use.



Information about installation, maintenance, troubleshooting, or other mechanical issues.



An electrical safety warning to help identify electrical issues that can be a hazard to either this KVH product or a user.



### TracVision 4 Serial Number



*This serial number will be required for all troubleshooting or service calls made regarding this product.*

Direct questions, comments, or suggestions to:

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Internet: [www.kvh.com](http://www.kvh.com)

[Click here to go to our state-of-the-art Customer Support web page...the fastest and easiest way to get all of your questions answered!](#)

**If you have any comments regarding this manual, please e-mail them to [manuals@kvh.com](mailto:manuals@kvh.com). Your input is greatly appreciated!**



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# 1 — Introduction

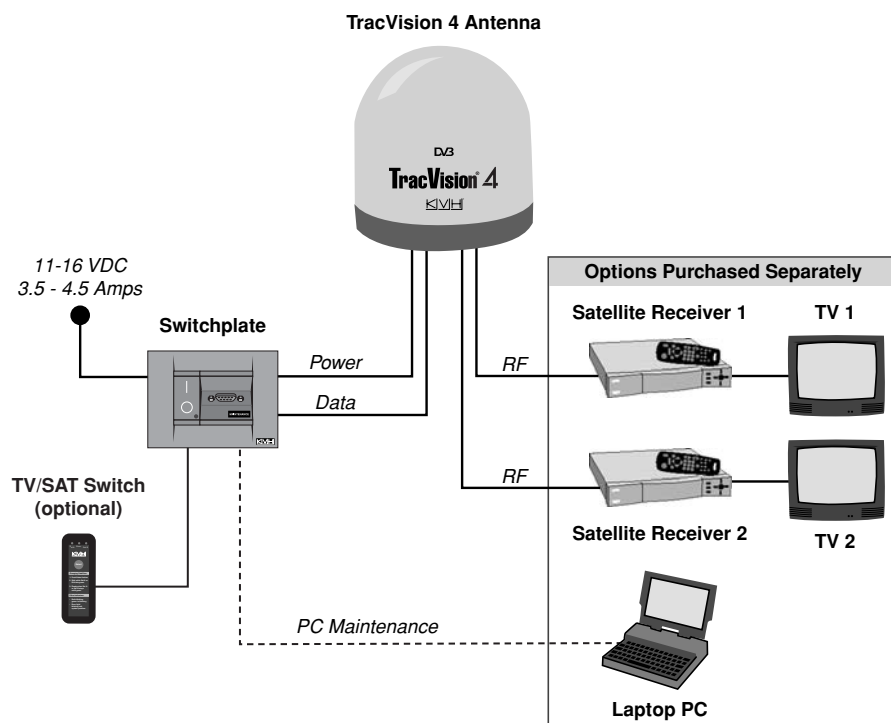
This section provides a basic overview of the TracVision 4 system. It explains how the system works and describes the function of each component.

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## 1.1 TracVision 4 System Overview

A complete satellite TV system includes the TracVision 4 antenna connected to the switchplate, an IRD (satellite TV receiver), and a television set. The optional TV/SAT Switch allows you to select a satellite at the press of a button. A desktop or laptop computer is used to configure the system and conduct diagnostics. The complete system is illustrated in Figure 1-1. *System specifications are provided in Appendix A on page 71.*



**Figure 1-1**

*TracVision 4 System Diagram*

### System Compatibility

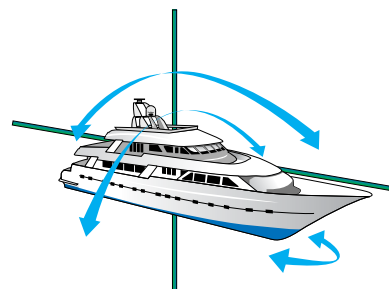
The TracVision 4 satellite antenna is fully compatible with Digital Video Broadcasting (DVB®) satellites, as well as DIRECTV®'s Digital Satellite Service (DSS) satellites. The system is also fully compatible with KVVH's TracNet™ 2.0 Mobile High-speed Internet System (for more information about TracNet 2.0, please visit our web site at [www.kvh.com](http://www.kvh.com)).

### In-motion Tracking

The TracVision 4 uses a state-of-the-art actively stabilized antenna system. Once the satellite is acquired, the antenna gyro continuously measures the heading, pitch, and roll of your vessel and sends commands to the antenna motors to keep the antenna pointed at the satellite at all times.

**Figure 1-2**

*TracVision Identifies and Compensates for Vessel Motion*







TracVision 4's default satellite pairs are:

N. America (US DIRECTV):  
DSS\_101 & DSS\_119

Europe: Astra 1 & Hotbird

## Satellite Library

Your TracVision 4 includes a pre-programmed satellite library of North American and European satellite services. When configuring the TracVision 4, you may choose a pair of satellites from the library to be active in the system and with your IRD.

For the antenna to track and receive signals from two satellites, they must be within 10° longitude of each other in orbit. As a result, certain satellites can be paired only with certain other satellites. Tables 1-1 and 1-2 list the possible satellite pairs that may be selected in North America and Europe. *If the satellite service you wish to receive is not listed in the satellite library, you may add two additional satellites of your choice to the library.*

**Table 1-1**

Available Satellite Pairs  
- North America  
(North American LNB required)

	DSS_101	DSS_119	Echo_61	Echo_110	Echo_119	Echo_148	Expressvu	ExpressTV
DSS_101		✓					✓	✓
DSS_119	✓						✓	✓
Echo_61				✓	✓		✓	✓
Echo_110			✓		✓	✓	✓	✓
Echo_119			✓	✓		✓	✓	✓
Echo_148				✓	✓		✓	✓
Expressvu	✓	✓	✓	✓	✓	✓		✓
ExpressTV	✓	✓	✓	✓	✓	✓	✓	

**Table 1-2**

Available Satellite Pairs - Europe  
(European LNB required)

	Astra 1	Astra 2N	Astra 2S	Hispasat	Hotbird	Sirius	Thor
Astra 1		✓	✓		✓	✓	
Astra 2N	✓				✓		
Astra 2S	✓				✓		
Hispasat							
Hotbird	✓	✓	✓			✓	
Sirius	✓				✓		✓
Thor						✓	

## 1.2 TracVision 4 Components

Your TracVision 4 system includes the following components:

### Antenna Unit

The antenna unit houses the antenna positioning mechanism, low noise block (LNB), power supply, and control elements within a molded ABS radome. Weathertight connectors on the bottom of the baseplate join the power, signal, and control cabling from belowdecks units.



### Switchplate

The switchplate controls power to the antenna via the On/Off switch. It also provides a DB9 maintenance port for connecting a computer or TV/SAT Switch for changing satellites and configuring the system.



### Integrated Receiver Decoder (IRD) (Satellite TV Receiver)

The IRD (purchased separately) receives satellite signals from the antenna unit for signal processing and channel selection, and sends the signals to the TV set for viewing. Please refer to the user's manual provided with your selected IRD for complete operating instructions.



*Before you can start watching satellite TV using your TracVision antenna, you will need to activate your IRD. Refer to Section 2.6, "Activating/Programming the IRD" on page 26 for details.*

## 1.3 Materials Provided With the TracVision 4

Table 1-3 lists the components and materials in the TracVision 4 shipping carton.

**Table 1-3**

*TracVision 4 Packing List*



For a list of items supplied in the kitpack, see Table 2-3 on page 10.

Component	KVH Part No.
Antenna Unit	02-0989-01HP <sup>†</sup> 02-0989-02HP <sup>††</sup>
Switchplate	02-1023
Installation Kitpack	72-0099
Data Cable	32-0619-50 <sup>†</sup> 32-0619-100 <sup>††</sup>
PC Cable	32-0628-06
RF Cable*	32-0417-50
Power Cable	32-0510-50
Ground Cable	32-0583-50
<i>TracVision 4 Technical Manual</i>	54-0150
<i>TracVision 4 User's Guide</i>	54-0150-01

<sup>†</sup> North American system

<sup>††</sup> European system

\* Not included with European systems

# 2 — Installation

This section explains how to install, configure, and test the TracVision 4 system. Follow the simple procedures in this section sequentially to ensure a safe and effective installation.

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## 2.1 Planning the Installation

### Who Should Install the TracVision 4

KVH recommends that a KVH-authorized technician install the TracVision 4 system. Installers should have experience installing electronic equipment on a vessel.

### Materials and Equipment Required for Installation

Before you begin installing the TracVision 4 system, you need to verify that you have all of the following tools and materials:

- Electric drill
- $\frac{3}{8}$ " (10 mm) drill bit and 3" (80 mm) hole saw
- Socket wrenches
- $\frac{7}{16}$ " open end wrench
- Flat head and Phillips screwdrivers
- Crimp tool (Augat T1000 or equivalent)
- Light hammer; center punch; tape; scribe/pencil
- Terminal lug crimping tool; wire strippers
- A PC with terminal emulation software such as Windows Hyperterminal or PROCOMM.
- RG-6 or RG-11 cable with F-type connectors for extra RF signal cables as needed. *Refer to Table 2-1 to determine the number of RF cables that you will need.*

Connecting to:	# RF Cables
<b>North American Systems</b>	
One IRD	1
Two or more IRDs	2*
<b>European Systems</b>	
One IRD	1
Two IRDs	2

\* Multiswitch needed for three or more IRDs. Follow multiswitch manufacturer's guidelines.



*Plan the entire installation before proceeding! Take into account antenna unit placement, cable running distances between units, and accessibility to the equipment after installation.*



*RG-11 or RG-6 cable with F-type connectors is required for all RF wiring. Use of any other cable will result in degraded performance. Use RG-6 cable for distances up to 75 ft (23 m); use RG-11 cable for distances greater than 75 ft (23 m). The KVH warranty does not cover degraded performance due to improper wiring.*

**Table 2-1**

*Number of RF Cables to Connect to the Antenna*



*You may want to connect two RF cables to the antenna in all cases. That way, if an IRD is added in the future, no additional RF cables will need to be run.*

- Power cable to connect the switchplate to ship's power (Table 2-2 provides proper gauge and length specifications).

**Table 2-2**

*Recommended Switchplate-to-Ship's Power Cable Specifications*

Cable Length	Cable Gauge
to 50 ft (15 m)	14 AWG (1.5 mm <sup>2</sup> )
+50 ft (+15 m)	12 AWG (2.5 mm <sup>2</sup> )

## Kitpack Contents

The kitpack packaged with your antenna unit contains various hardware and other materials that will be needed to complete the TracVision system installation. Ensure that the kitpack contains all of the items listed in Table 2-3.

**Table 2-3**

*Kitpack Contents*

Part	Qty.	KVH Part No.
¼"-20 x 3" hex head screws	4	14-0250-48
¼" flat washers	8	14-0251
¼"-20 self-locking nuts	4	14-0065-25
Plastic screw covers	6	19-0088
Foam seal	1	24-0116
Tie-wraps	2	22-0013
Core clamp (ferrite)	1	29-0037-02

## Choosing Component Locations

The major considerations in locating the TracVision components are described below.

### ***Cable Lengths***

When determining component locations, keep in mind accessibility and cable lengths between units. Lengths of these cables are as follows:

<b>Cable (Function)</b>	<b>Length</b>
Data Cable (Switchplate to Antenna Unit)	50 ft (15 m) <sup>†</sup> 100 ft (30 m) <sup>††</sup>
PC Cable (Switchplate to PC)	6 ft (2 m)
RF Cable (Antenna to IRD)*	50 ft (15 m) <sup>†</sup>
Power Cable (Switchplate to Antenna Unit)	50 ft (15 m)
IRD Ground Cable (IRD to Switchplate)	50 ft (15 m)

<sup>†</sup> North American system

<sup>††</sup> European system

\* Not included with European systems

**Table 2-4**

*Lengths of Provided  
Belowdecks Cables*

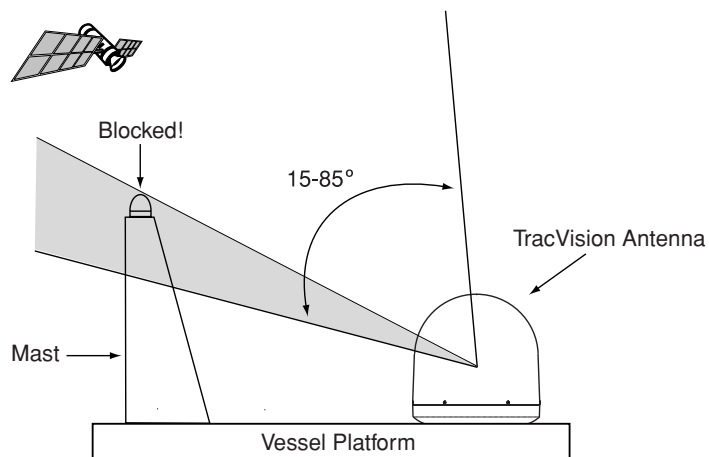


### Choosing the Best Location for the TracVision Antenna

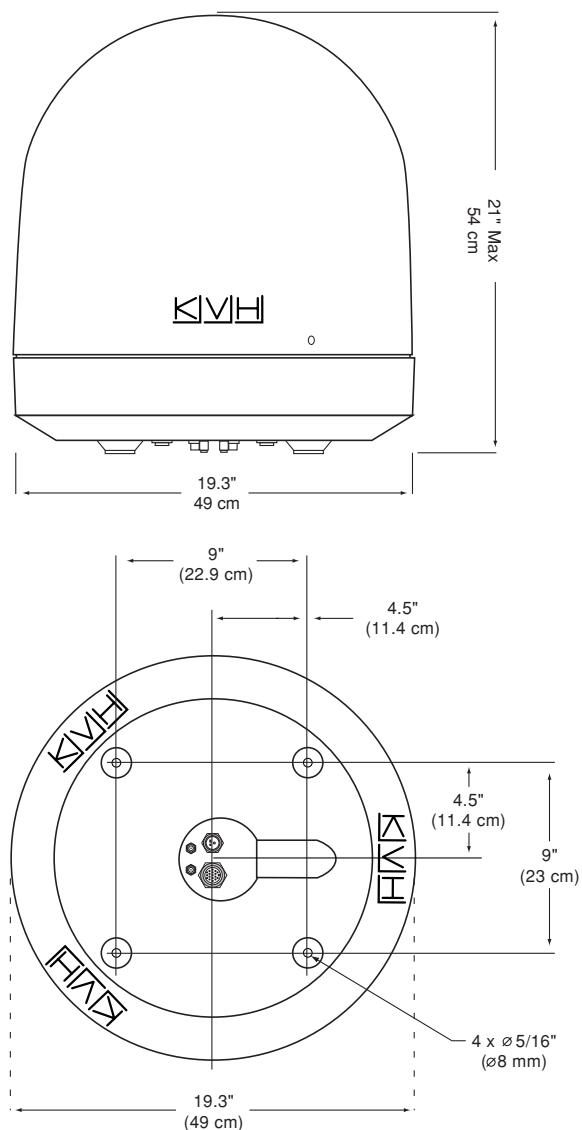
There are several factors to consider when choosing the location for the TracVision antenna.

- Since the TracVision antenna requires a clear view of the southern sky to receive satellite signals, the ideal antenna site has an unobstructed view of the horizon/satellite all around. The less blockage, the better the system performs.
- Keep the antenna clear of any obstructions above decks. The antenna requires a 15° to 85° look angle to receive satellite signals.

**Figure 2-1**  
*Antenna Blockage*



- To minimize tracking errors, place the antenna unit as close as possible to the intersection of the vessel's fore-and-aft centerline and midships.
- The mounting surface should be flat and strong enough to carry the complete assembly (30 lbs/ 13.6 kg). To prevent warpage to the antenna baseplate, make sure that the mounting surface is rigid so that it cannot flex when the vessel vibrates. If necessary, add a strength member to the mounting site to stiffen it.
- Be sure to account for the height and base dimensions (see Figure 2-2 on the following page).

**Figure 2-2***Antenna Unit Dimensions*

*The radome exterior is treated with a special finish selected for compatibility with the dome material and transparency to the satellite signals. Application of additional paints or finishes WILL degrade performance, potentially beyond acceptable limits.*



*A full-size template of the baseplate mounting holes has been provided in Appendix B on page 73.*

### **Radar Concerns**

The TracVision antenna must be kept out of line with nearby radars, as their energy levels may overload the antenna's front-end circuits. In an ideal installation, the antenna is mounted four feet (1.2 m) above and four feet (1.2 m) away from the radar (measured from the center of the antenna dome to the center of the radar).

The best placement for the TracVision antenna is above the radar. However, if there will be a significant horizontal separation between the radar and TV dome (i.e., at least 8 to 10 feet (2.5 to 3 m)), the TracVision antenna can be placed below the radar as there will be little chance of signal blockage.

## Locating the Switchplate

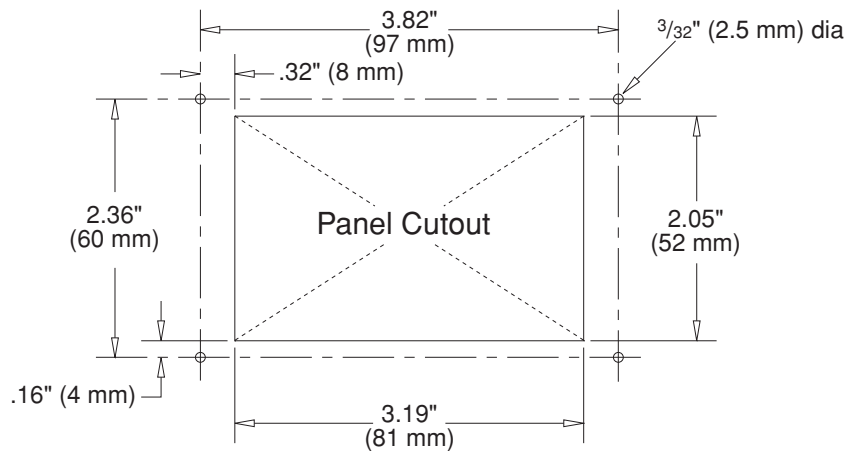
A switchplate has been provided to serve as the hub of the TracVision 4 wiring (with the exception of the RF cable, which will be connected to the IRD). The switchplate includes an On/Off switch and a DB9 maintenance port for easy access to the antenna unit's software and diagnostics. Follow the steps below to select and prepare the switchplate mounting location.

1. Select a location to mount the TracVision 4 switchplate. It should be installed in a dry, flat location within reach of the cables that will connect to the antenna unit and allowing easy access to the front panel.
2. Once you've decided on a suitable location, create a panel cutout in the mounting surface. Figure 2-3 illustrates the mounting dimensions and a template has been provided in *Appendix C*. The connecting cables will be routed through this cutout.

**Figure 2-3**  
Switchplate Panel  
Cutout Dimensions

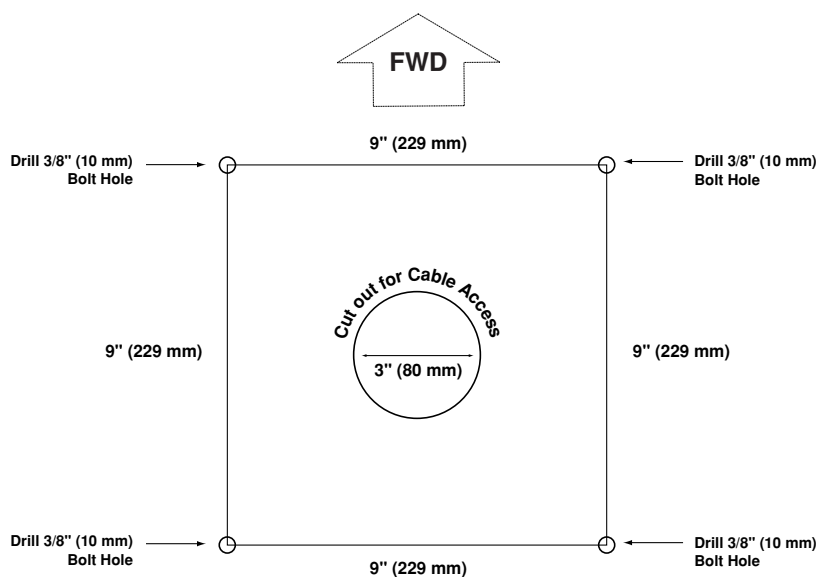


A full-scale panel cutout template has been provided in *Appendix C* on page 75.



## 2.2 Mounting the TracVision Antenna

1. Make sure that you have chosen a suitable mounting location based upon the guidelines in *“Choosing the Best Location for the TracVision Antenna”* on page 12.
2. Using the template provided in *Appendix B* on page 73 or the dimensions shown in Figure 2-4, lay out the four mounting bolt holes and cable access hole at the mounting site. Make certain that the “FWD” arrow is parallel with the vessel’s centerline and pointed toward the bow.



**Figure 2-4**

*Antenna Mounting Holes Layout*

3. Drill the four  $\frac{3}{8}$ " (10 mm) bolt holes and cut out the 3" (80 mm) diameter cable access hole (following the layout in Step 2). Smooth the edges of the cable access hole to protect the cables.
4. Bring the data cable, power cable, and RF cable(s) from belowdecks up through the cable access hole in the mounting surface (see Table 2-1 on page 9 to determine the number of RF cables required). Belowdecks, route the opposite end(s) of the RF cable(s) to the IRD(s) or multiswitch; route the opposite ends of the data cable and power cable through the switchplate panel cutout.
5. Remove the antenna unit from its shipping carton.



*Always lift the antenna unit by the gray baseplate and never by the radome or any portion of the antenna assembly. Also be careful not to strike the exposed connectors extending from the bottom of the baseplate or allow them to carry the weight of the antenna unit.*

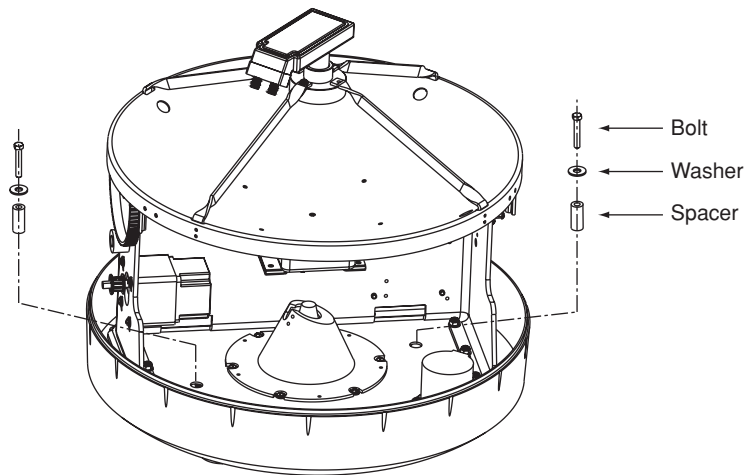
6. Remove and save the three screws securing the radome to the baseplate. Carefully lift the radome straight up until clear of the antenna assembly and set it aside in a safe place. If you bring the radome topside, be sure to secure it with a lanyard so that it does not fall overboard.
7. Remove the foam shipping restraint from the antenna unit.
8. Using a 10 mm wrench, remove the two azimuth shipping restraint bolts, washers, and spacers from the antenna unit, as shown in Figure 2-5.

**Figure 2-5**

*Azimuth Shipping  
Restraint Removal*



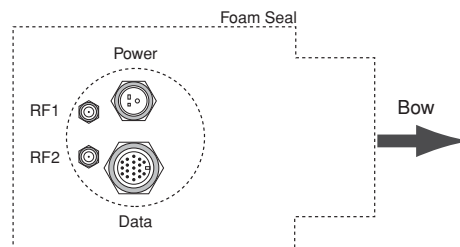
*The shipping restraints must be removed before power is applied. Save the restraints for reuse and be sure to install them whenever the antenna unit is moved from place to place. See Section 4.9, "Preparing for Shipment" on page 66 for instructions on preparing for shipment.*



9. Place the foam seal in position on the mounting surface with the hole centered over the cable access cutout. Do not remove the paper backing at this time. Align the seal with the vessel's centerline and the narrow end pointing toward the bow (see Figure 2-6). Scribe a line all around the seal.

**Figure 2-6**

*Baseplate/Foam Seal Orientation  
(Bottom View)*

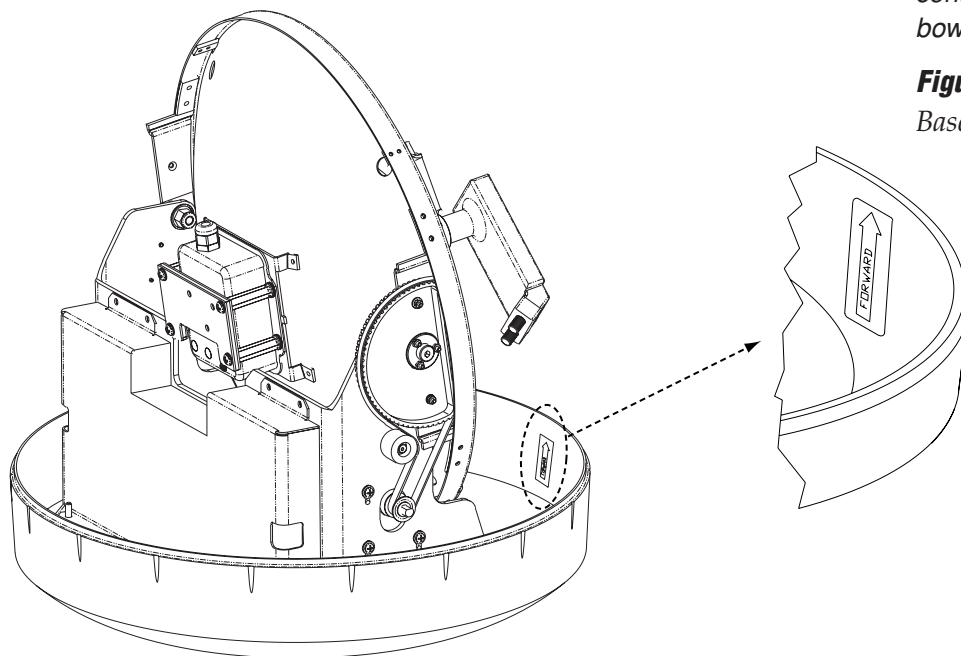


10. Position the baseplate assembly in place over the mounting holes and cable access, with the baseplate's "Forward" arrow (shown in Figure 2-7) pointing toward the bow. Ensure that all holes line up and that the connectors are centered over the cable access. Make any necessary adjustments before seating the foam seal in place permanently.



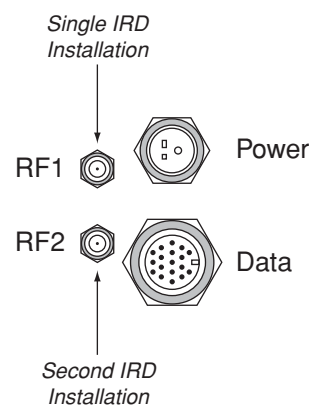
*For the antenna to work properly, the baseplate's "Forward" arrow **MUST** be parallel with the vessel's centerline and pointed toward the bow.*

**Figure 2-7**  
Baseplate "Forward" Arrow



11. Clean the mounting surface where the foam seal will be placed. Remove the paper backing from the foam seal to expose the contact cement, then lay the foam seal in place, adhesive side down, and press down firmly to bring the adhesive into full contact along the mounting surface. **Ensure the narrow end points toward the bow.**
12. Connect the data, power, and RF cables from belowdecks to the baseplate as shown in Figure 2-8. Turn the power and data cable connectors down until locked in place; don't use excessive force. Connect the RF cable(s) using a  $\frac{7}{16}$ " wrench, applying 30 in-lbs of torque. If you connect more than one RF cable, label both ends of each RF cable to match its antenna baseplate connector (RF1 or RF2). **Do NOT use teflon gel on the cable fittings as it reduces signal strength at higher frequencies.**

**Figure 2-8**  
Baseplate Connector Assignments  
(Bottom View)

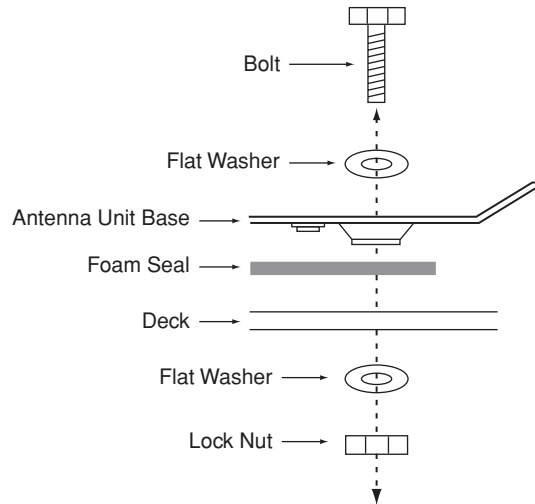




*When rotating the azimuth mechanism by hand, go slowly. Hitting the mechanical stops with excessive force will damage the azimuth limit switch.*

**Figure 2-9**

*Bolting the Antenna Unit to the Deck (Side View)*



13. Place the antenna baseplate over the holes drilled in the foundation, ensuring the "Forward" label (shown in Figure 2-7) points toward the bow.
14. At each of the four baseplate mounting holes, place a  $\frac{1}{4}$ " flat washer on a  $\frac{1}{4}$ "-20 bolt and insert the bolt into the hole from above, as shown in Figure 2-9. Carefully rotate the azimuth mechanism plate to expose all four mounting holes.

15. Apply a  $\frac{1}{4}$ " flat washer and  $\frac{1}{4}$ "-20 lock nut from below, as shown in Figure 2-9.
16. Tighten securely (but do not overtighten) until the foam seal is compressed as far as it will go and all four feet are bottomed against the mounting surface.
17. *If you are installing a European system:*  
Leave the radome off for now; you will install it later.

*If you are installing a North American system:*  
Place the radome over the baseplate. Align the three radome screw holes with the baseplate nut holders, insert the #10-24 screws and tighten. Install a protective plastic screw cap from the kitpack over each screw.



## 2.3 Connecting the IRD(s)

For the TracVision system to work, you must connect the following cables to your satellite TV receiver(s) (IRDs):

- RF Cable
- Ground Wire

### Connecting the RF Cable(s)

Each RF cable must be an RG-11 (75 ohms) or RG-6 (75 ohms) cable fitted with F-type connectors. The RF cable(s) should already be connected to the antenna baseplate (see Step 12 of Section 2.2., "Mounting the TracVision Antenna" on page 17). The following sections explain how to connect the RF cable(s) to your IRD(s).

To connect the TracVision antenna to your IRD(s), choose one of the following configurations (based on the number of IRDs you will connect to the antenna):

- Option 1 - Connecting One IRD
- Option 2 - Connecting Two IRDs
- Option 3 - Connecting Three or More IRDs  
(North American systems only)

#### Option 1 - Connecting One IRD

One end of the RF cable should already be connected to the connector labeled "RF1" on the base of the TracVision antenna. Connect the other end of the RF1 cable to the IRD connector labeled "LNB," "ANT/SAT," or "SATELLITE IN."

#### Option 2 - Connecting Two IRDs

Two RF cables should already be connected to the connectors labeled "RF1" and "RF2" on the base of the TracVision antenna. Connect the other ends of these RF cables to the connector labeled "LNB," "ANT/SAT," or "SATELLITE IN" on the two IRDs.

The IRD that is connected to the RF1 cable controls which satellite the antenna is tracking. The IRD connected to RF2 can select different channels on that satellite but not change the satellite selection itself.



*For instructions on RF wiring for TracNet, please refer to the TracNet Owner's Manual or Technical Manual.*



*Before you connect an RF cable to an IRD, turn on the IRD and TV and verify that there is no AC voltage present on the IRD's input connector, measured between center conductor and shield. If AC voltage is present on the connector, **DO NOT** connect the RF cable until you have corrected the problem. This is a potentially dangerous condition that will damage the antenna's electronics.*



Due to the signal polarization in European satellites, the use of a multiswitch will result in a loss of signal and less than optimal operation with TracVision 4 systems used in Europe.

**Figure 2-10**

*Single Multiswitch Installation  
(North American systems only)*

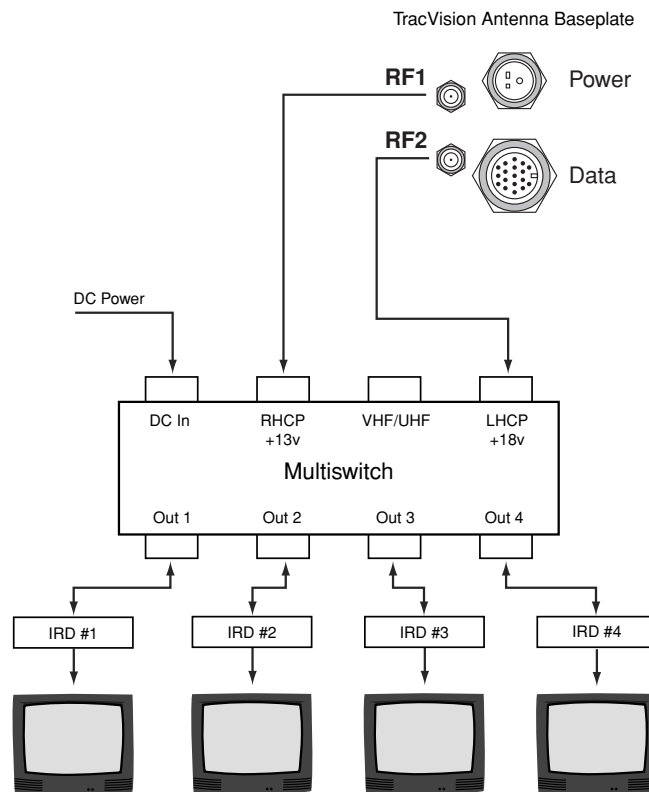


The use of an active multiswitch will interfere with the 22 KHz tone sent by DIRECTV DSS Plus™ IRDs to the antenna. As a result, the antenna will not receive the signal to change satellites when you change channels using your DIRECTV DSS Plus remote. You will need to use the optional TV/SAT Switch\* or a PC to switch between satellites.

\* To order a TV/SAT Switch (KVH Part Number 01-0245), please call +1 401 847-3327.

### Option 3 - Connecting Three or More IRDs (North American Systems only)

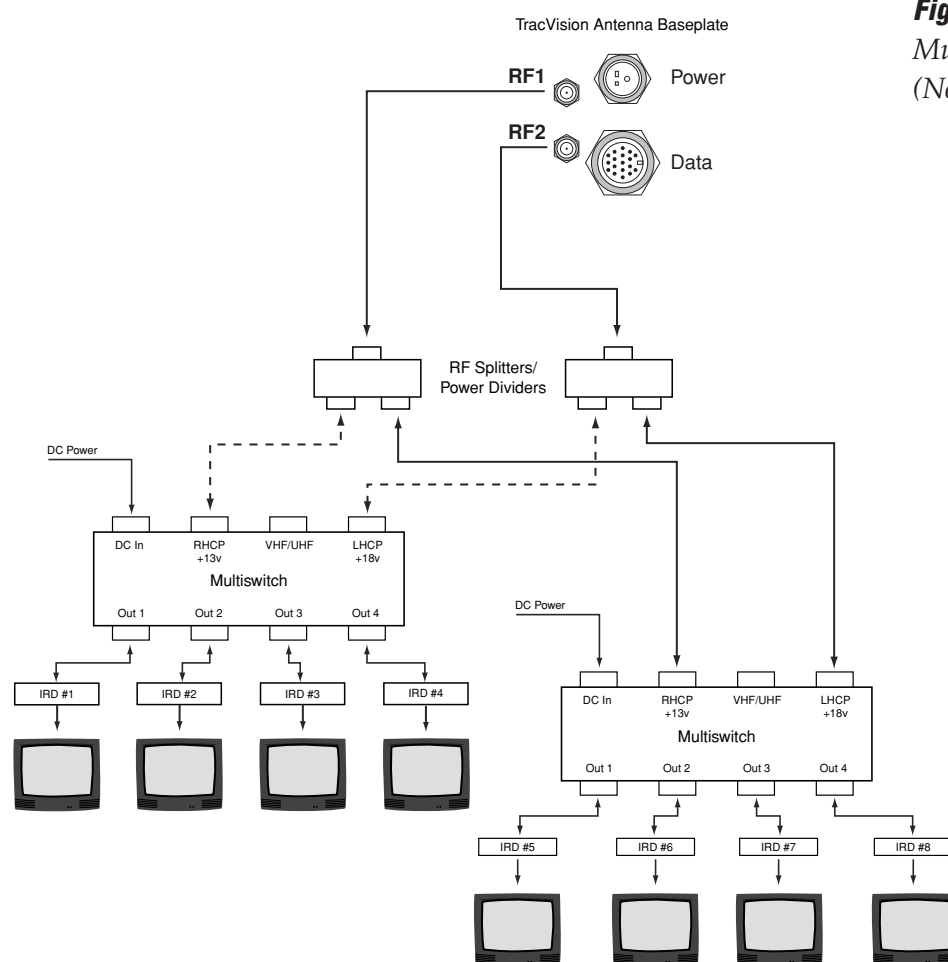
To connect three or four IRDs to the TracVision antenna, you will need to install an active multiswitch (Channel Master model 6214IFD or equivalent) between the antenna and the IRDs. Two RF cables should already be connected to the connectors labeled “RF1” and “RF2” on the base of the TracVision antenna. Figure 2-10 shows a typical wiring arrangement for three or four IRDs. Mount the multiswitch unit in accordance with the manufacturer’s instruction sheet.



1. Connect the RF cable labeled "RF1" to the multiswitch input labeled "LNB RHCP +13V."
2. Connect the RF cable labeled "RF2" to the multiswitch input labeled "LNB LHCP +18V."
3. Connect the multiswitch outputs to individual IRD inputs. Use RG-6 cable with F-type connectors for all RF connections. Terminate all unused output connectors with 75 ohm DC blocks (Channel Master #7184, Radio Shack #15-1259 or equivalent).

## Multiple Multiswitch Installation

If you need to connect more than four IRDs to the TracVision antenna, you may carry out a multiple multiswitch installation, as shown in Figure 2-11.



**Figure 2-11**

*Multiple Multiswitch Installation  
(North American systems only)*

## Connecting the IRD Ground Wire

A grounding wire has been provided to connect your IRD to a suitable ground. Attach the grounding wire to any suitable screw on the rear panel of the IRD with a good contact with the IRD chassis. The other end should be connected to a suitable DC ground, ideally to the switchplate's ground terminal (*route the ground wire through the switchplate panel cutout and leave unconnected for now*). **Each IRD that you connect to the TracVision system should have a similar ground connection.**

*If you are using a multiswitch, you can ground the multiswitch instead of the individual IRDs.*



*Be sure to connect a ground cable from each IRD to a suitable DC ground, ideally the switchplate's ground terminal.*

## 2.4 Wiring the Switchplate

All other wiring for the TracVision system connects to the switchplate. For the TracVision system to work, you must wire the following cables to the switchplate:

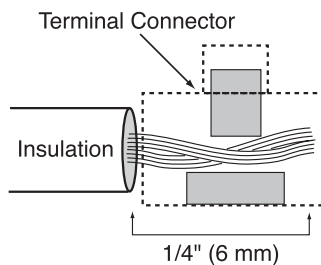
- Antenna Data Cable
- Antenna Power Cable
- Vessel Power Cable
- IRD Ground Cable(s)

### Tips for Safe and Successful Wiring

- When attaching cables to the TracVision 4 switchplate connectors, make sure the insulation is stripped back approximately  $\frac{1}{4}$ " (6 mm). Twist the wires gently to help achieve a good connection. Do not pinch insulation inside the connector.
- After attaching the power and data cables to the appropriate terminal connector strips, tug gently to ensure a firm connection.
- Do not tin (solder) the wire ends.
- All cables should be routed and dressed before terminating at the switchplate. The antenna data and power cables may be trimmed to desired length. However, be sure to cut back the data cable's drain wire (shield); do NOT connect the drain wire to anything.

**Figure 2-12**

*Correctly Securing Wires within the Switchplate Connectors*

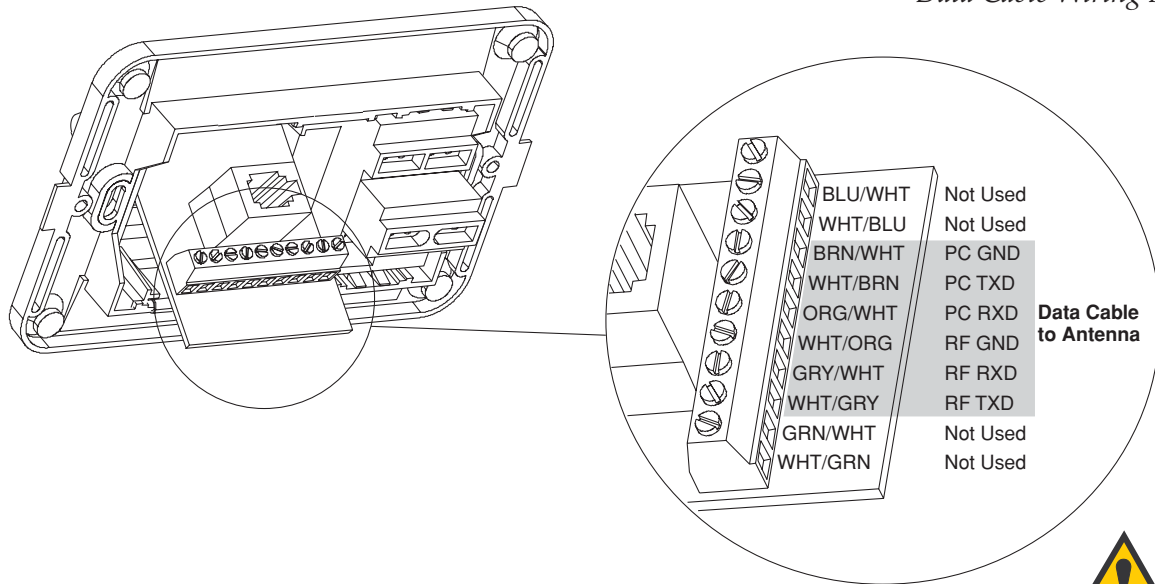


**Do NOT** connect the antenna data cable's drain wire (shield).

# Connecting the Antenna Data Cable

Find the TracVision 4 data cable where it comes through the panel cutout made earlier. Wire the data cable to the switchplate as shown in Figure 2-13. The connector board is etched with the same wire color identification to make the wiring process easier.

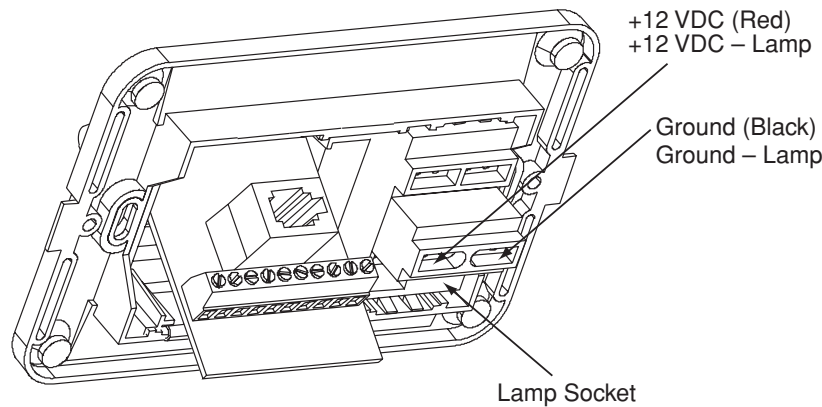
**Figure 2-13**  
Data Cable Wiring Arrangement



# Connecting the Antenna Power Cable

Find the TracVision 4 power cable where it comes through the panel cutout made earlier. Wire the antenna unit power cable to the switchplate connectors as shown in Figure 2-14. After wiring the power cable, connect the power indicator lamp, also as noted in Figure 2-14. After both the power cable and lamp are properly wired, carefully insert the lamp into its socket immediately below the switchplate connectors.

*Cut back and insulate any unused wires from the Data Cable.*



**Figure 2-14**  
Wiring the Antenna Unit Power Cable and Indicator Lamp



Before connecting the power cable, turn off vessel power and test the circuit to ensure that no power is present.

## Connecting the Switchplate to Vessel Power

Short circuits may result in severe electrical shock or burns. Turn off vessel power and test the circuit to ensure that no power is present before connecting any power cables.

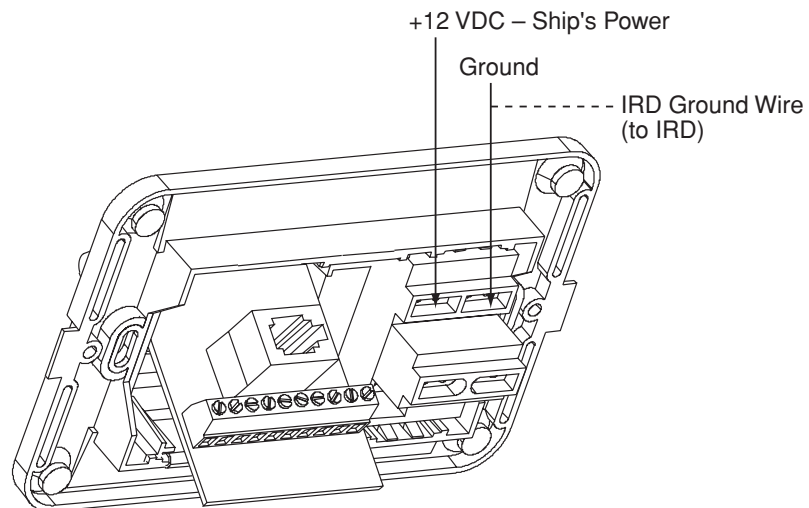
The TracVision 4 system requires an 11-16 VDC power input. A quick-tripping circuit breaker or fuse should be installed between the switchplate and vessel power. Circuit overload protection should be rated for 5 amperes. If vessel power fluctuates widely or is noisy, a 12 VDC, 5-amp AC/DC power supply or a wide-range DC/DC converter power supply should be installed. *Test the voltage and polarity before making connections to vessel power.*

Run a power cable from vessel power through the panel cutout and connect it to the switchplate as shown in Figure 2-15. For recommended power cable specifications, refer to Table 2-2 on page 10.

**Figure 2-15**  
Wiring the Switchplate  
to Ship's Power



Power supplied to the TracVision 4 **MUST NOT** exceed 16 VDC or the TracVision power supply will suffer serious damage!

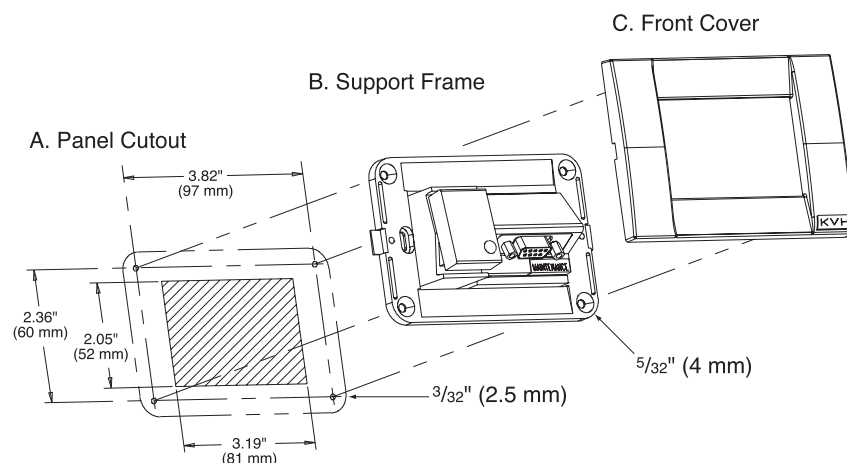


## Connecting the IRD Ground Wire(s)

Find each IRD ground wire where it comes through the panel cutout made earlier. Connect the IRD ground wire(s) to the ground connector on the switchplate (see Figure 2-15).

## 2.5 Mounting the Switchplate

After completing the switchplate wiring process, you must install the switchplate itself. This process, detailed in the following steps, is illustrated in Figure 2-16.



**Figure 2-16**

*Mounting the Switchplate Support Frame and Front Cover*



1. Fit the switchplate assembly and support frame into the panel cutout made earlier and flush to the mounting surface.
2. Drill out four  $\frac{5}{32}$ " (4 mm) holes in the countersunk settings in the switchplate support frame.
3. Drill four  $\frac{3}{32}$ " (2.5 mm) holes in the mounting surface using the countersunk holes in the support frame as the template. Secure the support frame and switchplate assembly to the mounting surface using the four #6 self-cutting screws.
4. Snap the front cover into place to cover the screws and support frame.
5. Reconnect vessel power.

*Before securing the switchplate to the mounting surface, be sure to strain relieve the wires connecting to the switchplate connectors. Several tie-wraps have been provided to aid in strain relieving the wires.*



## 2.6 Activating/Programming the IRD

Before it can be used, your IRD must be activated and/or programmed, as described below.

### DIRECTV Activation

KVH makes it easy to activate your DIRECTV IRD. Just call KVH at 1-888-584-4163 and select the **TracVision Product Activation Department** (Monday - Friday, 8:30 a.m. - 5:00 p.m. EST).

### DISH Network Activation

To activate your DISH Network IRD, please call DISH Network directly at 1-800-333-DISH (3474).

### Other IRD Activations

Please refer to the user manual that accompanied your IRD for activation instructions.

### Programming European IRDs

Before the TracVision 4 system can be used in Europe, the IRD must be programmed to receive signals from the selected DVB satellite services. Programming is conducted using menu selections displayed on the TV screen. Please refer to your IRD owner's manual for specific instructions.

Table 2-5 provides some key data for use when programming the IRD.

**Table 2-5**  
*Key IRD Settings*



*When programming the IRD with the antenna configuration data, make certain that your choices for Antenna Alternatives 1 and 2 match those installed as Satellites A and B during the Install Satellite procedure detailed in Section 2.7, "Installing Satellites to Track" on page 28.*

Configuration Item	Setting
Antenna Alternative 1	DiSEqC 1
Antenna Alternative 2	DiSEqC 2
LNB Frequency	Universal

It is also important that the IRD's settings for Antenna Alternatives 1 and 2 match the switchplate's installed satellite settings as follows:

- Antenna Alternative 1 = Satellite A
- Antenna Alternative 2 = Satellite B

Section 2.7, "Installing Satellites to Track" on page 28 provides details on the satellite installation process.

## Programming DSS Plus IRDs

If you are using multiple DSS Plus IRDs and intend to shift from one satellite to another, **only one** of the IRDs can be configured as a two-satellite receiver. All other IRDs must be configured as one-satellite receivers. The two-satellite IRD will determine which satellite the antenna is tracking while the other receivers can watch any channels available via that satellite. Refer to your IRD owner's manual for complete details on this process.



*If you use an active multiswitch to connect three or more IRDs, the multiswitch will interfere with the 22 KHz tone sent by DIRECTV DSS Plus™ IRDs to the antenna. As a result, the antenna will not receive the signal to change satellites when you change channels using your DIRECTV DSS Plus remote.*

## 2.7 Installing Satellites to Track

TracVision 4 can track a variety of DVB-compatible and DSS (DIRECTV) satellites. The system contains a preprogrammed library of North American and European satellites. It also has two open slots that you may use to program two additional satellites of your choice. Tables 2-6 and 2-7 provide a grid of possible satellite pairs. Two of these satellites may be selected to reside in the system's active memory as Satellites A and B.

**Table 2-6**

*Available Satellite Pairs  
– North America  
(North American LNB required)*

	DSS_101	DSS_119	Echo_61	Echo_110	Echo_119	Echo_148	Expressvu	ExpressTV
DSS_101		✓					✓	✓
DSS_119	✓						✓	✓
Echo_61				✓	✓		✓	✓
Echo_110			✓		✓	✓	✓	✓
Echo_119			✓	✓		✓	✓	✓
Echo_148				✓	✓		✓	✓
Expressvu	✓	✓	✓	✓	✓	✓		✓
ExpressTV	✓	✓	✓	✓	✓	✓	✓	

**Table 2-7**

*Available Satellite Pairs – Europe  
(European LNB required)*

	Astra 1	Astra 2N	Astra 2S	Hispasat	Hotbird	Sirius	Thor
Astra 1		✓	✓		✓	✓	
Astra 2N	✓				✓		
Astra 2S	✓				✓		
Hispasat							
Hotbird	✓	✓	✓			✓	
Sirius	✓				✓		✓
Thor						✓	

At the factory, the system is programmed to track the following default satellites:

- Europe: Astra 1 (Sat. A) and Hotbird (Sat. B)
- N. America (US DIRECTV): DSS\_101 (Sat. A) and DSS\_119 (Sat. B)

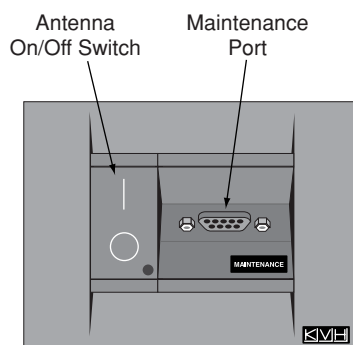
If you wish to track the default satellites, skip to *Section 2.8 on page 36 (European systems only)* or *Section 2.9 on page 37*.

If you wish to track a different satellite (either from the satellite library or a user-defined satellite), connect to the switchplate's maintenance port and enter the appropriate antenna commands, as described on the following pages.

## Connecting a PC to the Switchplate's Maintenance Port

To install satellites, you first need to connect a PC to the switchplate's maintenance port. This procedure requires Windows Hyperterminal (or other terminal emulation software, such as PROCOMM). Use the settings appropriate to your application and follow the steps below.

1. Connect one end of the PC data cable to the DB9 connector on the switchplate. Connect the other end to the serial port on your PC (a 9-pin/25-pin connector adapter may be needed for some PCs).



**Figure 2-17**

*Switchplate Front Panel*

2. Open the terminal emulation software and establish the following settings:
  - Bits per second: 9600
  - Data bits: 8
  - Parity: None
  - Stop bits: 1
  - Flow control: None
3. Apply power to the TracVision 4 system and allow the system to complete full initialization. Data should be scrolling on the PC display to identify any system problems detected. If no data is seen, recheck your connections and the terminal software setup for the correct COM port.

## Are the Satellites You Want to Track Listed in the Library?

If the satellites you want to track are listed in the library, skip to *"Installing Your Satellites"* on page 35.

If you want to track a satellite that is not listed in the library, follow the steps in the next section, *"Programming User-defined Satellites."*



*How to tell the difference between High and Low bands:*

*High: 11.700 - 12.750 GHz*

*Low: 10.700 - 11.700 GHz*



*For your reference, the satellite configuration information for the predefined satellites is available on our web site at [www.kvh.com/footprint](http://www.kvh.com/footprint).*

## Programming User-defined Satellites

The TracVision 4 satellite library has the capacity for two user-defined satellites in case you want to track a satellite that is not currently preprogrammed in the library. To configure a user-defined satellite, information about the satellite must be provided, including:

- Satellite name
- Satellite position (longitude)
- Transponder information for each of the following polarizations/frequencies:
  - vertical high & vertical low
  - horizontal high & horizontal low

*or*

  - right
  - left
- Transponder information includes:
  - frequency
  - symbol rate
  - FEC code, and
  - network ID (in hexadecimal format)
- Decoder type

This information can be obtained from your satellite service provider or from sites on the Internet, such as [www.satcodx.com](http://www.satcodx.com).

## Entering User-defined Satellite Data

To configure your user-defined satellites, follow the steps below.

1. Using your PC's terminal emulation program, type **HALT<cr>** (<cr> indicates a carriage return/ENTER key). This command puts the antenna in Idle mode.
2. Enter the **SATCONFIG** parser command:

Command:	<b>SATCONFIG,USERX,YYY,Z,D,L&lt;cr&gt;</b>
Where:	X = 1 (USER1 satellite) or 2 (USER2 satellite) YYY = longitude (0-180) Z = E (East) or W (West) D = decoding type (0 = test, 1 = DSS-A, 2 = DSS-B, 3 = DVB) L = LNB polarization (C = circular, L = linear)
Function:	configures one of the user-configurable satellites with the longitude provided
Response:	if valid entry, echoes the input data if invalid entry, returns error message

**Table 2-8**

*SATCONFIG Parser Command*

3. Type **@DEBUGON<cr>** to enter DEBUG mode.
4. Enter the satellite's transponder information:

Command:	<b>@SATCONFIG,X,N,F,S,C,ID,P,B,D&lt;cr&gt;</b>
Where:	@SATCONFIG = directs data to the RF Board X = satellite location (A = USER1, B = USER2) N = satellite table # (98 = USER1, 99 = USER2) F = frequency in MHz (either 00000 or a range from 10700 - 12700) S = the satellite transponder symbol rate in Mbit/second (01000 - 29999) C = the FEC code (e.g., 12, 23, 34, 56, 67, 78) ID = the satellite network ID in hexadecimal format (0x####) P = the LNB polarization (V = vertical, H = horizontal, R = right, L = left) B = the LNB down conversion frequency (L = low, H = high, U = USA) D = decoding type (0 = test, 1 = DSS-A, 2 = DSS-B, 3 = DVB)

**Table 2-9**

*Satellite Transponder Data Sequence*

5. Repeat Step 4 for each of the following transponder categories:

- vertical high
- horizontal high
- vertical low
- horizontal low

OR

- right
- left

TracVision 4 requires that the data fields for all transponder categories be provided. If the selected satellite does not have information for one or more of the transponder categories, default information should be entered in the fields as follows:

**Table 2-10**  
*Satellite Transponder  
Default Data*

Transponder Data	Default Value
Frequency	00000
Symbol Rate	27500
FEC Code	the same value as provided for those transponders with data
Network ID	0x0000
Polarity and Band	whichever combinations are not already provided

6. Type **ZAP<cr>** to restart the antenna.
7. If you need to configure a second user-defined satellite, repeat this procedure starting with Step 1 to enter data for the USER2 satellite.

You have now added your user-defined satellite(s) to the system's satellite library.

If you want the antenna to track one or both of these user-defined satellites, you will now need to install it. To install a satellite, use the **SATINSTALL** command, as described in "Installing Your Satellites" on page 35.

The next two pages provide examples of the user-defined satellite configuration process.

### ***An Example of Configuring a User-defined Satellite (N. America)***

The following is an example of configuring the fictional YOURSAT 123 as the USER1 configured satellite. Prior to configuring this satellite or any others, be certain to get the most up-to-date information from one of the sources previously discussed.

#### **YOURSAT 123 at 122 West, DVB decoder, Circular Polarization LNB**

<i>Right</i>	
Frequency	12.225 GHz
Symbol Rate	20000
FEC Code	5/6
Network ID	4100(dec) = 0x1004
<i>Left</i>	
Frequency	12.456 GHz
Symbol Rate	20000
FEC Code	5/6
Network ID	4100(dec) = 0x1004

Based on this information, the data entered via the PC would look like this:

```

HALT
SATCONFIG,USER1,122,W,3,C
@DEBUGON
@SATCONFIG,A,98,12225,20000,56,0x1004,R,U,3
@SATCONFIG,A,98,12456,20000,56,0x1004,L,U,3
@SAVE,A
ZAP

```



### An Example of Configuring a User-defined Satellite (Europe)

The following is an example of configuring the fictional YOURSAT 123 as the USER1 configured satellite. Prior to configuring this satellite or any others, be certain to get the most up-to-date information from one of the sources previously discussed.

#### Yoursat 123 at 7 West, DVB decoder, Linear Polarization LNB

<i>Horizontal High</i>	
Frequency	11.966 GHz
Symbol Rate	27500
FEC Code	3/4
Network ID	2048(dec) = 0x0800
<i>Vertical High</i>	
Frequency	11.823 GHz
Symbol Rate	27500
FEC Code	3/4
Network ID	2048(dec) = 0x0800
<i>Vertical Low</i>	
No Data Listed	
<i>Horizontal Low</i>	
No Data Listed	

Based on this information, the data entered via the PC would look like this:

```

HALT
SATCONFIG,USER1,7,W,3,L
@DEBUGON
@SATCONFIG,A,98,11966,27500,34,0x0800,H,H,3
@SATCONFIG,A,98,11823,27500,34,0x0800,V,H,3
@SATCONFIG,A,98,00000,27500,34,0x0000,V,L,3
@SATCONFIG,A,98,00000,27500,34,0x0000,H,L,3
@SAVE,A
ZAP

```

## Installing Your Satellites

To install the satellites you want to track, follow the steps below.

- Using your PC's terminal emulation program, type **HALT<cr>** (<cr> indicates a carriage return/ENTER key). This command puts the antenna in Idle mode.
- Enter the **SATINSTALL** parser command:

Command: **SATINSTALL,<sat\_a\_name>,<sat\_b\_name><cr>**

Where:	<sat_a_name> = the name of your choice for Satellite A <sat_b_name> = the name of your choice for Satellite B
--------	--

Table 2-11 lists the assigned names for satellites that are in the preprogrammed North American and European satellite library. If you only want to install and track one satellite, enter **NONE** as the name of Satellite B.

- Once you've assigned satellites as Satellite A and Satellite B, you need to tell the antenna which of the two satellites it should initially acquire and track. This step should be performed the first time a satellite is selected, allowing the system to download the channel guide. To do so, enter the following parser command:

Command: **@L,A or B<cr>**

Where:	A = track Satellite A B = track Satellite B
--------	--

- Type **ZAP<cr>** to restart the antenna.

### Examples:

To select Astra 2S and Hotbird for your satellite pair, and to track Hotbird, you would enter the following commands:

```
SATINSTALL,ASTRA2S,HOTBIRD<cr>
@L,B<cr>
ZAP<cr>
```

To select and track the USER1 satellite, which you programmed earlier into the library, you would enter the following commands:

```
SATINSTALL,USER1,NONE<cr>
@L,A<cr>
ZAP<cr>
```

**Table 2-11**

*Satellite Installation Names*

Satellite	Install Name
<b>North American Satellites</b>	
DSS 101°W	DSS_101
DSS 119°W	DSS_119
EchoStar 61°W	Echo_61
EchoStar 110°W	Echo_110
EchoStar 119°W	Echo_119
EchoStar 148°W	Echo_148
ExpressVu	Expressvu
ExpressVu TV	ExpressTV
<b>European Satellites</b>	
ASTRA1 19.2°E	ASTRA1
ASTRA2N 28.2°E	ASTRA2N
ASTRA2S 28.2°E	ASTRA2S
Hispasat 30.0°W	HISPASAT
Hotbird 13.0°E	HOTBIRD
Sirius 5.0°E	SIRIUS
Thor 0.8°W	THOR
<b>Other Installation Designations</b>	
User-defined 1	USER1*
User-defined 2	USER2*
None	None

\* USER1 and USER2 will only be available if one or two user-defined satellites have been added to the library as detailed in "Programming User-defined Satellites."

## 2.8 Setting the Skew Angle (European Systems Only)

To optimize channel reception, the antenna's LNB skew angle must be adjusted. Refer to your satellite service provider for the proper skew angle for your selected satellite service and geographical location.

### Adjusting the LNB Skew Angle

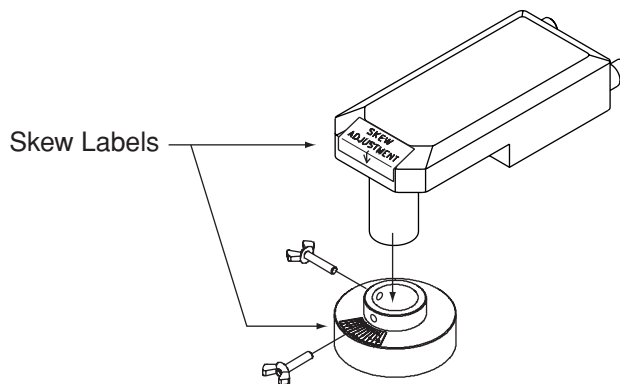
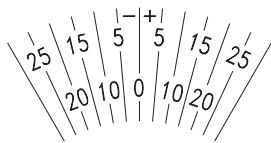
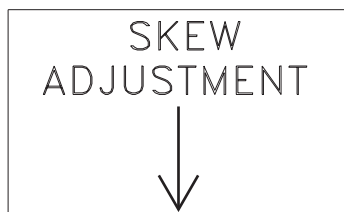
1. Turn off the power to the antenna unit.
2. If the radome is not already removed, remove the radome and set it aside in a safe place.
3. Loosen the two wing screws securing the LNB within the choke feed as illustrated in Figure 2-18.

**Figure 2-18**

*Adjusting the European  
LNB Skew Angle*

**Figure 2-19**

*Skew Angle Labels*



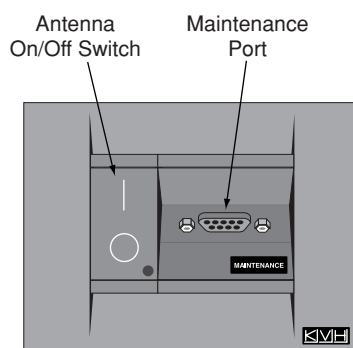
4. Refer to the LNB skew angle labels on the end of the LNB and on the LNB choke feed (shown in Figure 2-19) and adjust the LNB as necessary to match as closely as possible the skew angle provided by your service provider.
5. Retighten the wing screws.
6. Reinstall the radome. Align the three radome screw holes with the baseplate nut holders, insert the #10-24 screws and tighten. Install a protective plastic screw cap over each screw.

## 2.9 Checking Out the System

Now that you've installed the TracVision 4, you need to verify that the system functions properly. Check the system startup sequence to ensure that the system is operating within normal parameters.

To view the startup sequence, connect a PC to the switchplate's maintenance port. The diagnostics procedure requires Windows Hyperterminal (or other terminal emulation software, such as PROCOMM). Use the settings appropriate to your application and follow the steps below.

1. Connect one end of the PC data cable to the DB9 connector on the switchplate. Connect the other end to the serial port on your PC (a 9-pin/25-pin connector adapter may be needed for some PCs).



**Figure 2-20**  
*Switchplate Front Panel*

2. Open the terminal emulation software and establish the following settings:
  - Bits per second: 9600
  - Data bits: 8
  - Parity: None
  - Stop bits: 1
  - Flow control: None
3. Apply power to the TracVision 4 system and allow the system to complete full initialization. Data should be scrolling on the PC display to identify any system problems detected. If no data is seen, recheck your connections and the terminal software setup for the correct COM port.



*A sample startup sequence has been provided in Appendix E on page 81 with the typical ranges and responses for the TracVision 4 during startup and operation.*



*Be certain to fill out and submit the warranty card to KVH to ensure that your TracVision 4 is fully covered under the 2-year parts and 1-year labor warranty.*

4. After completing the review of the startup and operational routines, turn on the IRD and television and check the channels on the selected satellites. For European systems, check both horizontally and vertically polarized channels, if possible.
5. When all checks are completed, shut down the system.

## 2.10 Changing Geographic Location

If you move to a different geographic area, you will need to modify your TracVision 4 system to receive satellite TV signals in the new location. To begin receiving satellite signals in the new area, perform the following steps.

### Swap LNBs

To receive the proper satellite signals in the new geographic location, your TracVision antenna must be equipped with the appropriate LNB for that location. If moving to the U.S., you will need to install a North American-style LNB; if moving to Europe, you will need to install a European-style LNB. Table 2-12 lists the part numbers for ordering these LNB options.

Part Name	Part Number
European-style LNB Replacement Kit	02-1033-02
North American-style LNB Replacement Kit	02-1033-01

**Table 2-12**

*LNB Part Numbers*

With the new part, you will receive a simple instruction sheet for swapping the LNBs.

### Install New Satellites

When you move to a new area, the list of available satellites changes. If you're moving to the U.S., you will need to choose a new satellite pair from the list of available North American satellites (see Table 2-6). If you're moving to Europe, you will need to choose a new satellite pair from the list of available European satellites (see Table 2-7). For details on installing these new satellites, refer to *Section 2.7, "Installing Satellites to Track"* on page 28.

### Replace the IRD

In order to receive satellite TV service in your new geographic location, you will need to purchase an IRD designed for that location. Refer to your satellite TV service provider for more information.



*You may also need to replace your television when changing geographic location. In North America, your TV must support the NTSC video standard. In Europe, your TV must support the PAL video standard.*

# 3 — Troubleshooting

This section identifies basic trouble symptoms and lists their possible causes and solutions.

## Contents

3.1	Troubleshooting Matrix .....	43
3.2	Causes and Remedies for Common Operational Issues .....	44
3.3	IRD Troubleshooting .....	46
3.4	Antenna Gyro and LNB Faults .....	46
3.5	Computer Diagnostics .....	47
3.6	Maintenance Port Parser Commands .....	47

## 3.1 Troubleshooting Matrix

The troubleshooting matrix shown in Table 3-1 identifies some trouble symptoms, their possible causes, and references to troubleshooting solutions.

**Table 3-1**  
Troubleshooting Matrix

SYMPTOM	Section 3.2											
	POSSIBLE CAUSE (AND SOLUTION)											
	Blown fuse, low power, or improper wiring	Vessel turning during startup	Incorrect satellite configuration	Satellite signal blocked	Satellite coverage issue	Radar interference	Satellite frequency data changed	Incorrect or loose RF connectors	Type of multiswitch used	IRD faulty or improperly configured (Section 3.3)	Antenna gyro faulty (Section 3.4)	LNB assembly faulty (Section 3.4)
Antenna non-functional	1											
Antenna not switching satellites	1		1	1	1			2	2	2		2
No picture on TV set				1	1	2		2	2	2		2
Certain channels do not work	1			1	1		3	2		2		2
Intermittent picture for short intervals		1		1	1	2		2	2		3	2
System works at dock but not on the move				1							3	
System will not find satellite	1	1	1	1	1	2	3	2	2	2	3	2
Snowy television picture	1							2		2		
Pixelating television picture	1			1		2		2		2	3	2

**Key**

1 = Anyone can do

2 = Electronics know-how recommended

3 = Dealer service recommended



## 3.2 Causes and Remedies for Common Operational Issues

There are a number of common issues that can affect the performance of the TracVision 4. The following sections address these issues and potential solutions.

### Blown Fuse, Low Power, or Improper Wiring

#### Blown Fuse

The antenna unit is equipped with two fuses mounted on its main printed circuit board (PCB). If either of these fuses has blown or been broken, the system will not work. For details on replacing an antenna unit fuse, refer to *Section 4.4, "Replacing the Main PCB and Fuses"* on page 54.

#### Low Power

If the power cable to the antenna unit is more than 50 ft (15 m) long, the power level can decrease over the course of the cable, resulting in a voltage level at the antenna unit that is too low to power the system. Refer to *"Connecting the Switchplate to Vessel Power"* on page 24 for details on supplying adequate power to the antenna unit.

#### Wiring

If the system has been improperly wired, the antenna unit will not operate correctly. Refer to *Section 2.4, "Wiring the Switchplate"* on page 22 for complete system wiring information.

### Vessel Turning During Startup

If the vessel turns during the 60-second startup sequence that occurs immediately after turning on the power to the TracVision 4, the antenna gyro will record that variable motion as "standing still." This may cause the antenna to track improperly. To solve this problem, turn the TracVision 4 off for at least 10 seconds. Turn the system back on, ensuring that the vessel is either motionless or traveling in a straight line for the 60 seconds immediately following power-up.

## Incorrect Satellite Configuration (European Systems Only)

The satellite configuration on European IRDs must match the satellite settings on the TracVision 4 system.

- Satellite A on the TracVision 4 must be the same satellite as IRD Alternative 1 (or A, based on your IRD) and must be assigned the IRD DiSEqC 1 setting.
- Satellite B on the TracVision 4 must be the same satellite as IRD Alternative 2 (or B, based on your IRD) and must be assigned the IRD DiSEqC 2 setting.

Refer to your IRD user manual for complete instructions on configuring your IRD.

## Satellite Signal Blocked

Satellite signals can be blocked or degraded by buildings, other vessels, or equipment on the vessel itself. Refer to *“Choosing the Best Location for the TracVision Antenna”* on page 12 to make certain that the TracVision 4 antenna unit is in the optimal location. Simply moving the vessel to clear an external obstruction will also restore signal quality.

## Satellite Coverage Issue

TracVision 4 will provide outstanding reception within the 18" (45 cm) antenna coverage area for your satellite television service of choice. However, signal quality can be degraded as you approach the fringe coverage areas. Refer to your satellite television service manual to check the viable coverage area for a 18" (45 cm) antenna.



For your convenience, KVH provides links to several web sites that offer satellite coverage information. Simply go to our web site at [www.kvh.com/footprint](http://www.kvh.com/footprint).

## Radar Interference

The energy levels radiated by radar units can overload the antenna's front-end circuits. Refer to *“Choosing the Best Location for the TracVision Antenna”* on page 12 to make certain that the TracVision 4 antenna unit is in the optimal location with regard to your radar unit.

## Satellite Frequency Data Changed

If some channels work, while one or more other channels do not, or the antenna cannot find the satellite, the selected satellite's frequency data may have changed. This frequency data can be updated via the maintenance port. Please call KVH Technical Support for details.

## Incorrect or Loose RF Connectors

As part of preventive maintenance (described in *Section 4.2, "Preventive Maintenance" on page 51*) KVH recommends checking the antenna unit's cable connections. A loose RF connector can reduce the signal quality. In addition, if you are unable to switch satellites using your IRD remote, make sure that your IRD's RF cable is connected to the antenna baseplate connector labeled "RF1" (see *Section 2.3, "Connecting the IRD(s) on page 19*).

## Type of Multiswitch Used (North American Systems Only)

An active (not passive) multiswitch must always be used to connect the TracVision 4 system to multiple IRDs. Refer to *Section 2.3, "Connecting the IRD(s)" on page 19* for directions on proper multiswitch/multiple IRD cabling.

## 3.3 IRD Troubleshooting

The IRD that was provided with your satellite television service may also be the cause of less-than-ideal operation. First check the IRD's configuration to ensure it is set up for the desired programming. In the case of a faulty IRD, refer to your IRD user manual for service and warranty information. If the IRD is both configured properly and fully functional, contact your local KVH dealer or service center for assistance.

## 3.4 Antenna Gyro and LNB Faults

*Section 4, "Maintenance" on page 49* provides detailed instructions for authorized service personnel who may be required to replace the TracVision 4 antenna gyro or the LNB.

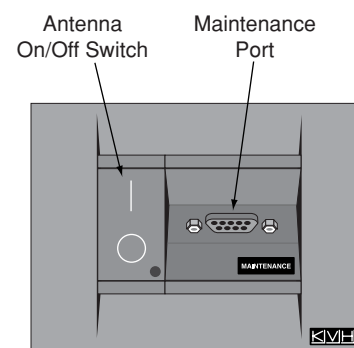
## 3.5 Computer Diagnostics

TracVision 4 has been designed to provide diagnostic readouts viewed on a PC having an RS-232 serial communication port. If you are unable to isolate a system problem, set up for computer diagnostics as described below. System problems will most likely be found somewhere through the diagnostic readouts.

The diagnostics procedure requires Windows Hyperterminal (or other terminal emulation software, such as PROCOMM). Use the settings appropriate to your application and follow the steps below.

1. Connect one end of the PC data cable to the DB9 connector on the switchplate. Connect the other end to the serial port on your PC (a 9-pin/25-pin connector adapter may be needed for some PCs).
2. Open the terminal emulation software and establish the following settings:
  - Bits per second: 9600
  - Data bits: 8
  - Parity: None
  - Stop bits: 1
  - Flow control: None
3. Apply power to the TracVision 4 system and allow the system to complete full initialization. Data should be scrolling on the PC display to identify any system problems detected. If no data is seen, recheck your connections and the terminal software setup for the correct COM port.

**Figure 3-1**  
*Switchplate Front Panel*



Appendix E on page 81 shows the diagnostic information available in the startup data sequence.

## 3.6 Maintenance Port Parser Commands

TracVision 4 system parser commands are detailed in *Appendix F on page 83*.

# 4 — Maintenance

This section identifies system components that may be replaced in the field, details how to replace those components, and lists preventive maintenance routines.

## Contents

- 4.1      Warranty/Service Information .....51
- 4.2      Preventive Maintenance .....51
- 4.3      TracVision 4 Field Replaceable Units .....52
- 4.4      Replacing the Main PCB or Fuses .....54
- 4.5      Replacing the RF PCB .....57
- 4.6      Replacing the Antenna Gyro Assembly .....59
- 4.7      Replacing the Elevation Motor or Belt .....62
- 4.8      Replacing the LNB .....64
- 4.9      Preparation for Shipment .....66

## 4.1 Warranty/Service Information

For information on KVH warranty, repair, and liability policies, please refer to the complete warranty statement provided at the conclusion of this manual. If you have any questions, please call your local authorized dealer/installer or distributor, or contact KVH or KVH Europe directly.

**IMPORTANT!** Before returning the product, be sure to obtain an RMA number from KVH's Technical Support Department and write the number on the outside of the box. Shipments received without an RMA number will be returned to you at your expense.



*Detailed information on KVH's global support program and how to contact KVH or a dealer near you is available at [www.kvh.com/global\\_support](http://www.kvh.com/global_support).*

## 4.2 Preventive Maintenance

TracVision 4 requires minimal preventive maintenance. The following tasks are sufficient to maintain peak performance.

### Monthly

- Wash the exterior of the radome and baseplate assembly with fresh water; a mild detergent may be added to remove grime. Use caution when spraying the radome directly with high-pressure water.
- Do not apply abrasive cleaners or volatile solvents such as acetone to the ABS radome.
- Check all connectors at the antenna baseplate and IRD. Remove connectors and examine for signs of corrosion; clean as needed.



*When cleaning the radome, avoid any compounds that react with plastic.*

### Semi-Annually

- Remove the radome and examine the interior of the antenna unit for signs of corrosion, loose connections, or frayed or broken wires.



*The serial number for your TracVision 4 will be required during any troubleshooting or service calls. You will find the serial number on the first page of this manual.*

## 4.3 TracVision 4 Field Replaceable Units

If you experience an operating problem or otherwise require technical assistance, please contact your local authorized TracVision 4 dealer/installer or distributor. If an authorized dealer/installer or distributor is not located nearby, contact KVH or KVH Europe directly at the telephone, fax, or e-mail listings on the first page of this manual.

Replacement part numbers for field replaceable units (FRUs) that can be serviced in the field are listed in Table 4-1. These parts may be obtained from any KVH authorized dealer/installer or may be ordered directly from KVH.

**Table 4-1**

*TracVision 4 Field Replaceable Units*



*To help us continually improve the quality and reliability of our systems, please return any failed component to KVH or KVH Europe (care of the mailing address listed on the first page of this manual) after you receive your replacement part.*

FRU	Part Number
Radome	02-0925-04
Main PCB	02-0992
RF PCB	02-1342
Antenna Gyro Sensor	02-1090
Antenna Gyro Gasket	24-0139
Elevation Drive Belt	24-0105-104
Elevation Motor	02-1356
LNB (North American System)	02-0870
LNB (European System)	02-1278
Data Cable	32-0619-50 <sup>†</sup> 32-0619-100 <sup>††</sup>
RF Cable	32-0417-50 <sup>†</sup>
PC Cable	32-0628-06
Power Cable	32-0510-50
Ground Cable	32-0583-50
CPU Fuses	16-0017-3150

<sup>†</sup> North American system

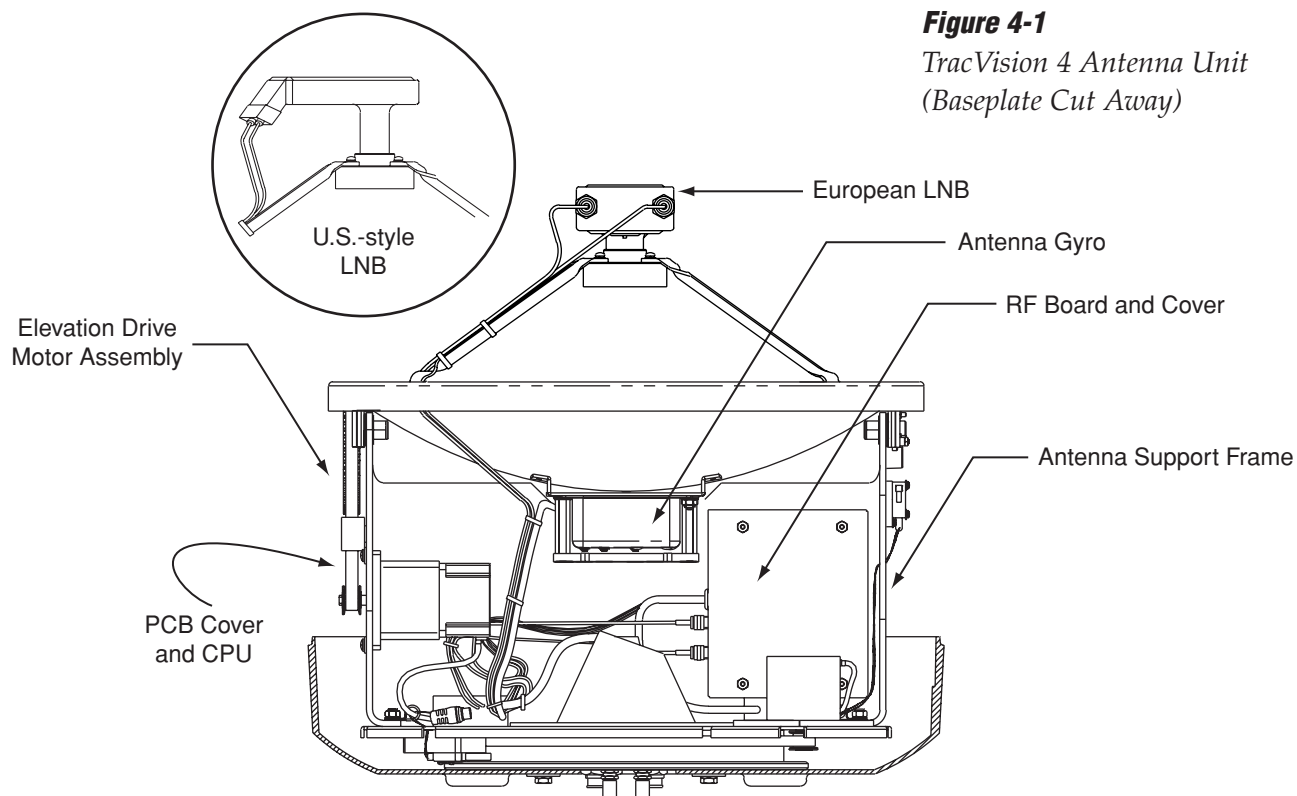
<sup>††</sup> European system

The antenna unit's printed circuit boards (PCBs), gyro, LNB, elevation motor, and elevation drive belt may be removed and replaced on site using common hand tools. Other TracVision 4 service must be done by your authorized dealer/installer, distributor or by KVH. Evidence of tampering or unauthorized repairs will void the warranty. The following sections provide step-by-step procedures for removing and replacing field replaceable units.

Figure 4-1 depicts the location of a number of components within the TracVision 4 antenna unit.



**TracVision 4 components receive power from multiple sources. Do not open any electrical assemblies or attempt servicing until IRD power and vessel input power are disconnected.**



**Figure 4-1**

*TracVision 4 Antenna Unit  
(Baseplate Cut Away)*



## 4.4 Replacing the Main PCB and Fuses

The main PCB is protected by a cover fastened to the antenna support frame. This cover must be removed to gain access to the main PCB and fuses discussed in the following sections.

### Removing the Main PCB Cover

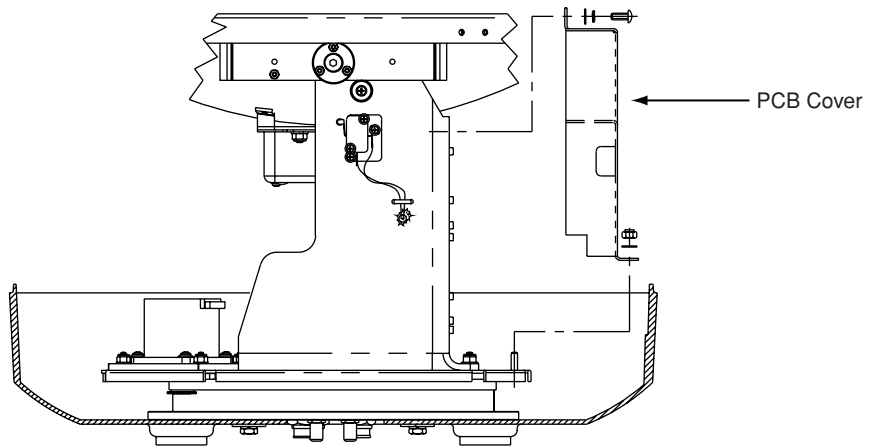
1. Using a  $\frac{3}{8}$ " nut driver/socket, remove the three nuts and washers from the PCB cover's bottom flange.

**Figure 4-2**

*PCB Cover Removal*



*The PCB cover fits snugly over the PCB. When removing or replacing the cover, take care to ensure that the cover does not dislodge any of the Molex connectors, as this will cause system errors and improper operation.*



2. Remove the three Phillips screws and washers from the PCB cover's upper flange.
3. Remove the PCB cover and set aside.

## Replacing the Main PCB

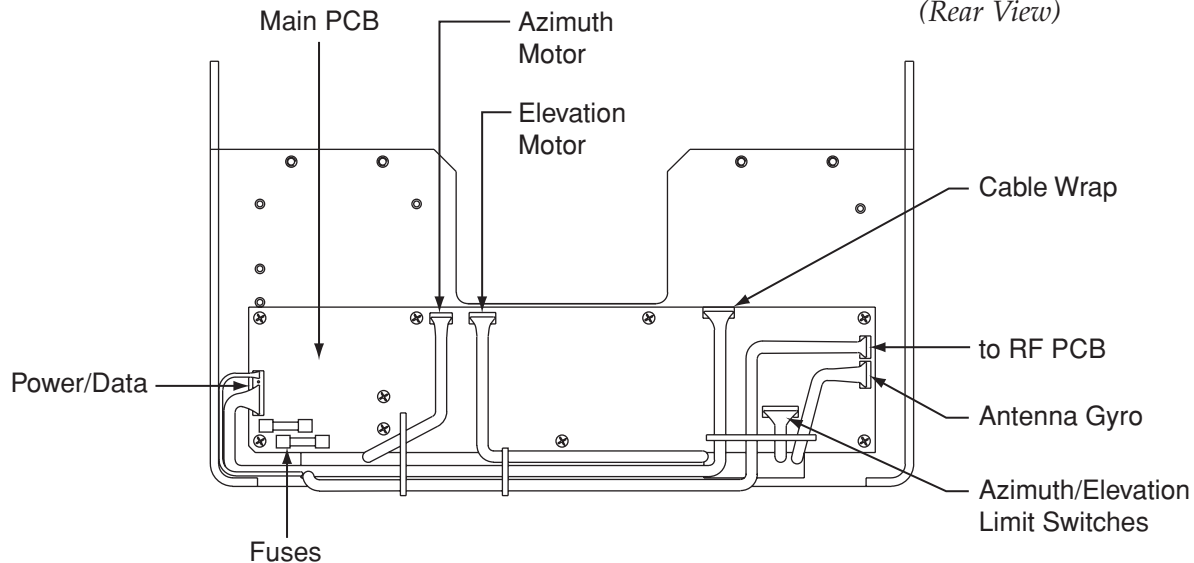
1. With a PC connected to the switchplate's maintenance port, apply power to the antenna unit.
2. Record the system serial number for later re-entry (the serial number is listed at the beginning of the startup sequence, as shown in *Appendix E on page 81*).
3. Disconnect power from the antenna unit and the IRD.
4. Remove the PCB cover, as explained in *"Removing the Main PCB Cover"* on page 54.
5. Disconnect all Molex connectors from the main PCB (see Figure 4-3).



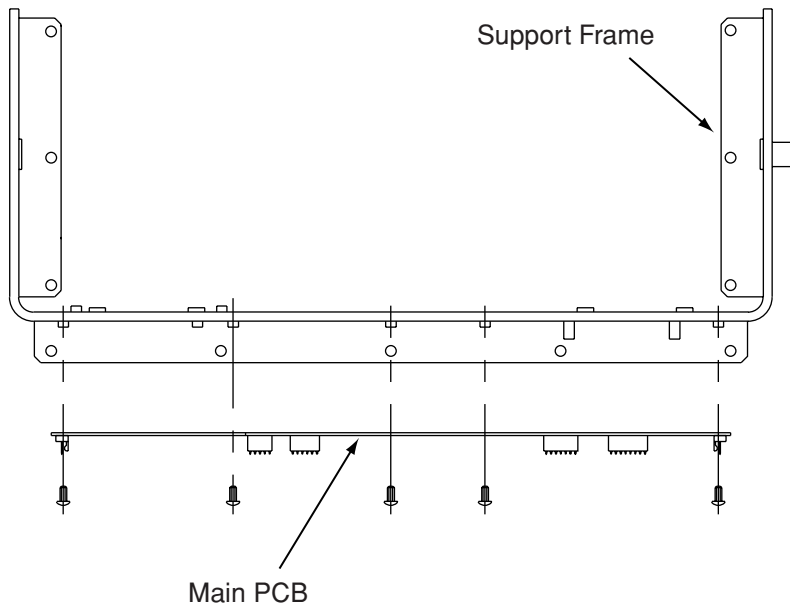
Refer to Section 3.5, "Computer Diagnostics" on page 47 for complete details on connecting a PC to the system via the maintenance port.

**Figure 4-3**

*Main PCB Connector Locations (Rear View)*



**Figure 4-4**  
Main PCB Mounting (Top View)



6. Remove the nine #6-32 screws that secure the PCB to the antenna frame (see Figure 4-4).

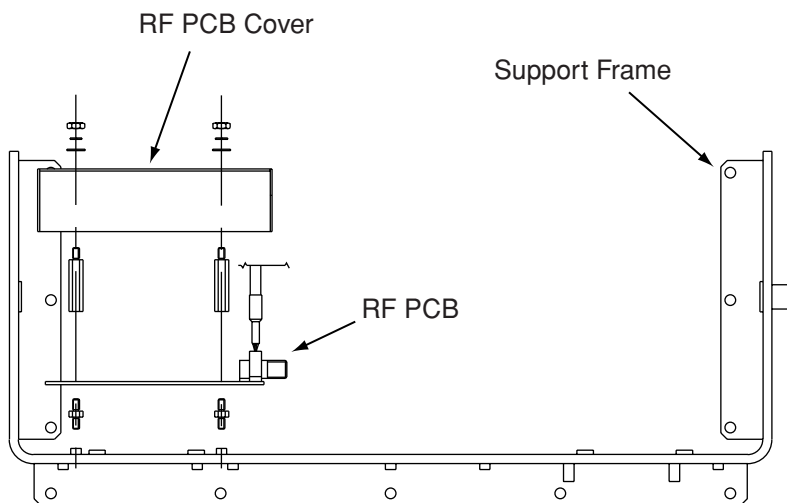
7. Remove the PCB from the antenna frame.
8. Reverse this process to install the replacement PCB. Reconnect all connectors removed in Step 5.
9. Reinstall the PCB cover.
10. Apply power to the antenna unit.
11. Type **HALT<cr>** (<cr> indicates a carriage return/ENTER key).
12. Type **DEBUGON<cr>**.
13. Type **=TVG4HP<cr>**.
14. Type **=SERNUM,<serial number><cr>**, where <serial number> = the system serial number you recorded in Step 2.
15. Type **ZAP<cr>** to restart/reinitialize the system.
16. Calibrate the antenna gyro as explained in "Calibrating the Antenna Gyro" on page 60.
17. Reinstall your selected satellites as directed in Section 2.7, "Installing Satellites to Track" on page 28.

## Replacing a Fuse

Two 5x20 mm, 3.15-amp, 250-volt fast-blow fuses are mounted to the main PCB (see Figure 4-3 on page 55). If one of these fuses has blown or been broken, simply remove the bad fuse and replace with a good fuse of the same rating.

## 4.5 Replacing the RF PCB

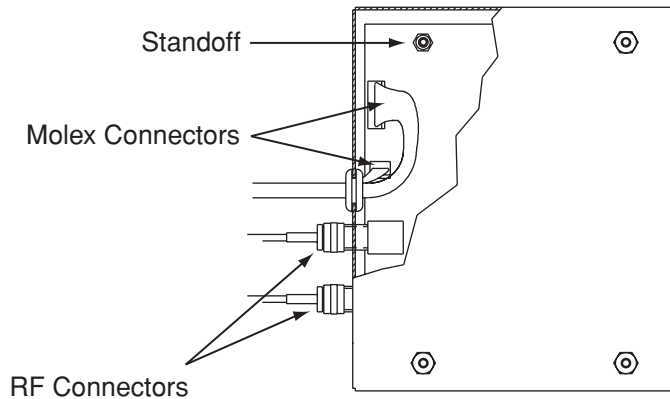
1. The RF PCB receives operating voltages from both the main PCB and the IRD (via the RF cable). Ensure that *all* power (including the IRD) is turned off before proceeding.
2. Using a  $\frac{5}{16}$ " socket wrench, remove the four nuts and washers securing the RF PCB cover (see Figure 4-5). Set the hardware and cover aside.



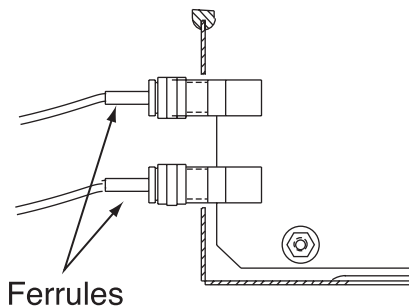
**Figure 4-5**

*RF PCB Mounting (Top View)*

**Figure 4-6**  
RF PCB Connector Locations  
(Rear View)



**Figure 4-7**  
RF Cable Ferrules

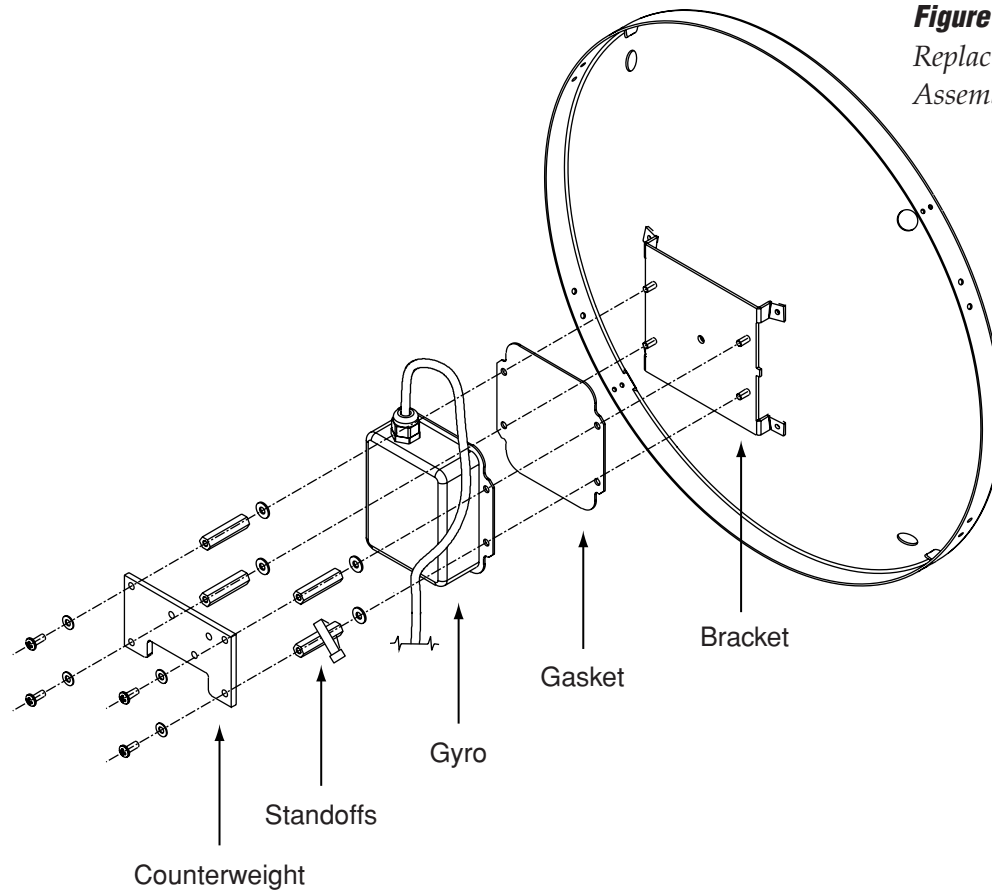


*Failure to hold the ferrules tightly while loosening the RF connectors can result in damage to the cables and reduce the signal quality.*

3. Unplug the Molex connectors from the RF PCB (see Figure 4-6).
4. If the top RF cable is not already marked, **label it** so that the RF cables can later be plugged into the proper positions on the new PCB.
5. Using a  $\frac{7}{16}$ " wrench, carefully remove the two RF cables from the RF PCB. Hold the RF connector ferrules while loosening the connectors to avoid excess stress on or twisting of the cables (see Figure 4-7).
6. Using a  $\frac{1}{4}$ " nut driver/socket, remove the four  $1\frac{1}{16}$ " standoffs and set aside.
7. Remove the old RF PCB.
8. Install the new RF PCB, making certain to align the PCB so that the RF connectors are facing inward (see Figure 4-1 on page 53).
9. Apply a drop of Loctite to the female ends of the four  $1\frac{1}{16}$ " standoffs. Install the four standoffs, Loctite-applied ends facing the RF PCB. Secure in place using the nut driver.
10. Reattach the RF cables, making certain to connect them in their original positions (marked cable on top). **Do not exceed 5 in-lbs of torque.**
11. Reattach the Molex connectors to the RF PCB.
12. Insert the split rubber grommet surrounding the Molex connector cables into the small slot on the new RF PCB cover.
13. Secure the RF PCB cover using the nuts and washers removed in Step 2.

## 4.6 Replacing the Antenna Gyro Assembly

1. Remove the main PCB cover, as described in "Removing the Main PCB Cover" on page 54.
2. Remove the four Phillips screws, four washers, and the counterweight from the end of the antenna gyro (see Figure 4-8).



**Figure 4-8**

*Replacing the Antenna Gyro Assembly*

3. Using a  $\frac{3}{8}$ " nut driver/socket, remove the four standoffs and washers securing the antenna gyro to the reflector bracket (see Figure 4-8). Slide the tie-wrap, which secures the antenna gyro cable, off the bottom right standoff.
4. Remove the tie-wraps securing the gyro cable to the RF cables.
5. Disconnect the Antenna Gyro Molex connector from the main PCB (see Figure 4-3 on page 55). Remove the old antenna gyro assembly.



*Make sure the cable passes through the PCB access slot to protect the wires from the edge of the PCB frame.*



*When rotating the antenna by hand, go slowly! Hitting the mechanical stops with excessive force will damage the azimuth limit switch.*



*Refer to Section 3.5, “Computer Diagnostics” on page 47 for complete details on connecting a PC to the system via the maintenance port.*

6. Connect the new antenna gyro's Molex connector to the main PCB.
7. Replace the antenna gyro gasket (see Figure 4-8).
8. Using the standoffs and washers removed in Step 3, secure the new antenna gyro to the reflector bracket. The antenna gyro should be oriented so that the cable extends from the top of the gyro, as shown in Figure 4-8.
9. Using a tie-wrap, secure the antenna gyro cable to the bottom right standoff.
10. Reattach the counterweight, screws, and washers removed in Step 2.
11. Redress the gyro and RF cables using tie-wraps.
12. Carefully move the reflector through its range of motion to ensure that the cable moves freely between the elevation mechanism and the lower assembly. Adjust the antenna gyro cable as necessary to ensure proper motion.
13. Reinstall the PCB cover.
14. Calibrate the gyro as described in the next section.

## Calibrating the Antenna Gyro

1. With a PC connected to the switchplate's maintenance port, apply power to the antenna unit.
2. Type **HALT<cr>** (<cr> indicates a carriage return/ENTER key) while the system is performing the limit switch initialization routine. The system will complete the initialization function by finding the azimuth and elevation switch limits and then go to the home position.

**IMPORTANT!** Record the 8-digit serial number displayed in the startup message.

3. Type **DEBUGON<cr>** to enter Debug Mode.
4. Type **CLEAREE<cr>**.
5. Type **ZAP<cr>** to restart/reinitialize the system.
6. Type **HALT<cr>**.
7. Type **DEBUGON<cr>**.

8. Type **=TVG4HP<cr>**.
9. Type **HALT<cr>**.
10. Type **DEBUGON<cr>**.
11. Type **=LSTEST<cr>**.
12. Type **EL,300<cr>**.
13. Type **=CALGYRO<cr>**. Verify that the Antenna Gyro Azimuth scale factor is between -0.00090 and -0.00110 and the Antenna Gyro Elevation scale factor is between 0.00090 and 0.00110.
14. Type **=SERNUM,<serial number><cr>**, where <serial number> = the system serial number that you recorded in Step 2.
15. Type **ZAP<cr>** to restart/reinitialize the system.

KVH recommends that you complete the following additional steps to speed satellite acquisition and improve system performance:

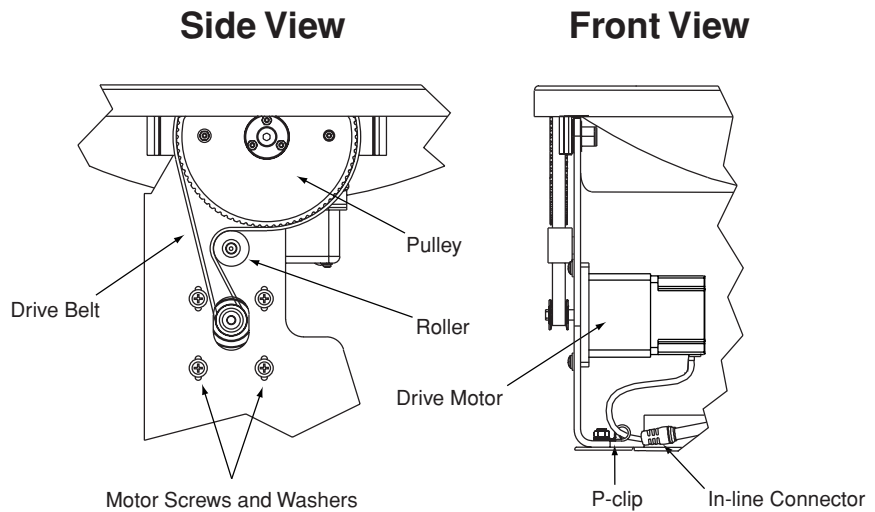
16. Type **HALT<cr>** while the system is performing the limit switch initialization routine.
17. Determine your vessel's current latitude and longitude to the nearest degree.
18. Type **GPS,AA,B,CCC,D<cr>** where:
  - AA = Latitude in degrees
  - B = N (North) or S (South)
  - CCC = Longitude in degrees
  - D = E (East) or W (West)
19. Verify that the response shows the correct parameters.
20. Type **ZAP<cr>** to restart/reinitialize the system.



## 4.7 Replacing the Elevation Motor and Belt

The elevation motor is mounted to the inside of the support frame. Machine screws and washers hold the drive motor in position to maintain proper tension on the toothed drive belt. Figure 4-9 shows the arrangement of motor, drive belt, and antenna pulley.

**Figure 4-9**  
*Elevation Drive Mechanism*



### Replacing the Drive Belt

1. Loosen the four #8-32 Phillips screws until the motor is free to move upward. Raise the motor to the top of the slots and retighten the screws to hold it there.
2. Roll the belt over the motor hub while slowly moving the antenna reflector through its vertical travel. Work the belt out from between the antenna pulley and reflector.
3. Carefully work the new belt in between the antenna pulley and the reflector. Ensure that the teeth are on the inside of the belt. Feed the belt behind the roller and over the motor hub. Once the belt is in place, work it back and forth to ensure that the belt is aligned and the teeth are engaged with the motor pulley.

4. Loosen the screws and gently press downward on the motor hub until the drive belt is at proper tension. Adjust the belt tension for a maximum of  $\frac{1}{8}$ " (3 mm) deflection with moderate finger pressure between the motor and antenna pulley. Some readjustment may be necessary if the belt tension results in excessive antenna reflector vibration.
5. Tighten the screws.



*Excessive belt tension may result in antenna reflector vibration.*

## Replacing the Elevation Drive Motor

1. Remove the P-clip that secures the elevation motor cable to the support frame (see Figure 4-9 on page 62).
2. Disconnect the elevation motor cable from the in-line connector (see Figure 4-9).
3. Remove the four Phillips screws and washers that secure the motor to the support frame (see Figure 4-9). Remove the motor assembly.
4. Install the new motor assembly with the elevation motor cable facing down, as shown in Figure 4-9. Reinstall the screws and washers but do not tighten.
5. Raise the motor and work the toothed drive belt over the outer lip of the motor hub. Press down gently on the motor body while rotating the antenna reflector up and down to ensure free movement.
6. Adjust the belt tension for a maximum of  $\frac{1}{8}$ " (3 mm) deflection with moderate finger pressure between the motor and antenna pulley. Some readjustment may be necessary if the belt tension results in excessive antenna reflector vibration.
7. Tighten the screws.
8. Connect the new elevation motor cable to the in-line connector.
9. Secure the elevation motor cable to the support frame using the P-clip that you removed previously.



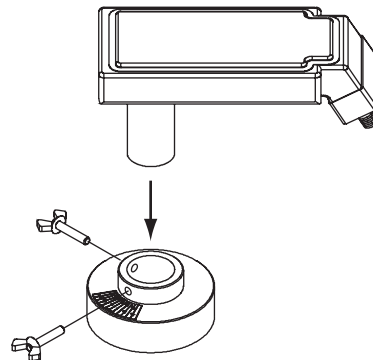
Ensure that the IRD is turned off or disconnected from its power source before removing or reconnecting the LNB.

## 4.8 Replacing the LNB

The LNB assembly receives power from the IRD via the RF PCB. Be certain that the IRD is turned off or disconnected from its power source before removing or reconnecting the LNB.

### Replacing a North American LNB

1. Using a  $\frac{7}{16}$ " wrench, carefully disconnect both RF connectors from the LNB.
2. Loosen the two wing screws on the throat of the choke feed until the LNB is free to slide out. Withdraw the LNB as shown in Figure 4-10.



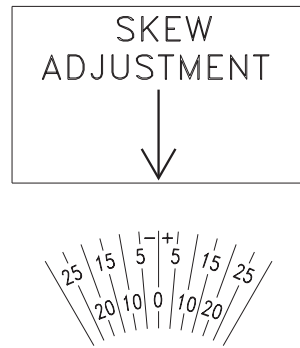
**Figure 4-10**

*North American LNB Removal*

3. Insert the replacement LNB as far as it will go, ensuring it reaches the bottom of the feedhorn. Be careful not to puncture or dislodge the plastic seal covering the LNB throat. Orient the LNB to align with the strut holding the pair of RF cables.
4. Apply a small amount of thread-locking compound (Loctite 425 or equivalent) to the wing screw threads and tighten the screws to secure the LNB in position.
5. Reattach the RF connectors to the LNB.

## Replacing a European LNB

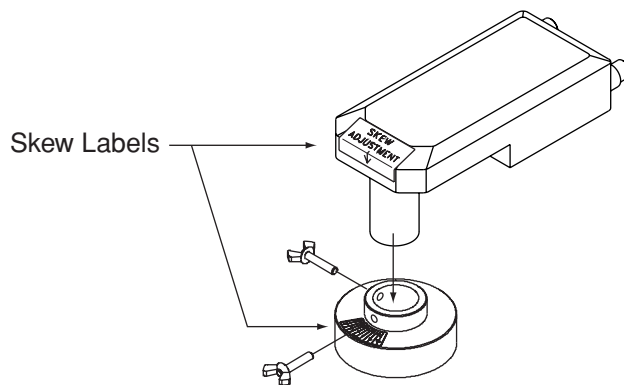
1. Using a  $\frac{7}{16}$ " wrench, carefully disconnect the RF connectors from the LNB.
2. Note the currently set skew value, as indicated by the stickers on the LNB and choke assembly (see Figure 4-11).



**Figure 4-11**

*Skew Angle Labels*

3. Loosen the wing screws and remove the LNB from the choke assembly as shown in Figure 4-12.



**Figure 4-12**

*European LNB Removal*

4. Insert the replacement LNB as far as it will go, ensuring it reaches the bottom of the feedhorn. Be careful not to puncture or dislodge the plastic seal covering the LNB throat. Adjust the LNB's position so that it has the same skew value noted in Step 2.
5. Apply a small amount of thread-locking compound (e.g., Loctite 425 or equivalent) to the wing screw threads and tighten the screws to secure the LNB in position.
6. Reattach the RF connectors to the LNB.

## 4.9 Preparing for Shipment

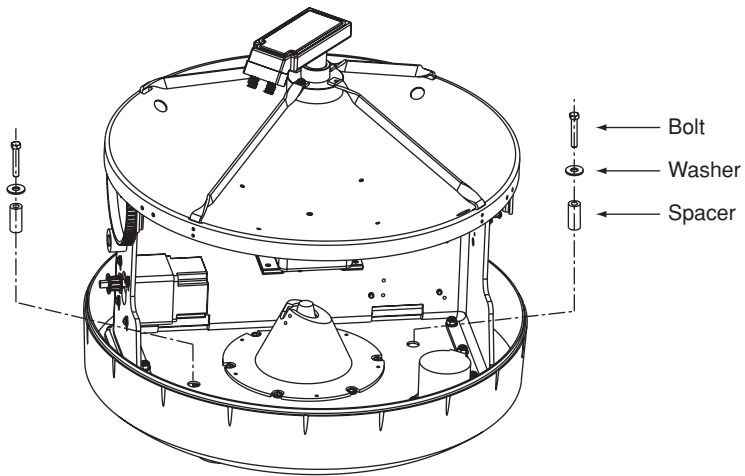
If you need to repack the antenna unit for shipment, the shipping restraints removed during installation must be replaced. Follow these steps to reinstall the restraints.



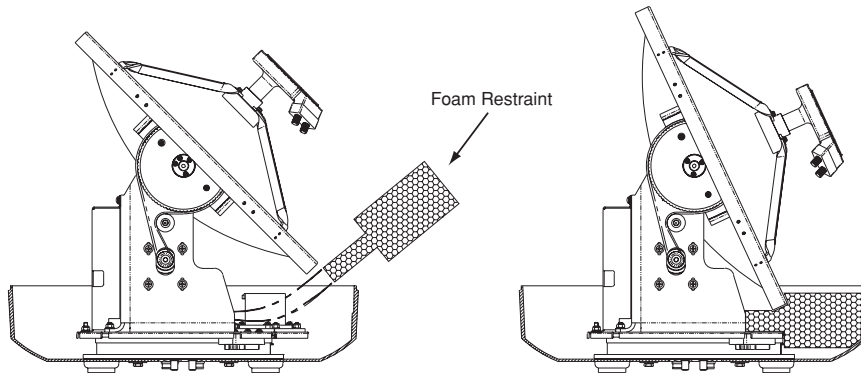
*When rotating the azimuth mechanism by hand, go slowly! Hitting the mechanical stops with excessive force will damage the azimuth limit switch.*

1. Rotate the azimuth mechanism slowly to find the limit switch stop. The front of the antenna should be facing the forward arrow.
2. Rotate the azimuth mechanism 180° in the opposite direction to ensure that the mechanism is not resting on the limit switch stop.
3. Insert the two azimuth shipping restraint bolts, washers, and spacers (removed during installation) into the rotating plate, as shown in Figure 4-13. Using a 10 mm wrench, secure the rotating plate to the metal base.

**Figure 4-13**  
*Azimuth Shipping  
Restraint Placement*



4. With the antenna reflector slightly elevated, slip the narrow end of the elevation shipping restraint beneath the lip of the reflector. Gently wedge the restraint inside the baseplate as shown in Figure 4-14.



**Figure 4-14**

*Elevation Shipping Restraint Placement*

5. Pack the TracVision 4 antenna unit in its original package.
6. As detailed in the warranty accompanying this product and printed on the last page of this manual, a Return Material Authorization (RMA) number is required prior to the return of the TracVision 4 system to KVH. Contact the KVH Technical Support Department at +1 401 847-3327 or via e-mail at [techs@kvh.com](mailto:techs@kvh.com) to obtain the RMA number. Please review your warranty to familiarize yourself with all requirements, liabilities, and policies.



*KVH is not liable for damage caused by improper shipping.*



***Before returning the product, be sure to obtain an RMA number from KVH's Technical Support Department and write the number on the outside of the box. Shipments received without an RMA number will be returned to you at your expense.***

# Appendices

This section contains several appendices of supplemental information, including mounting templates, wiring diagram, and parser commands.

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# Appendix A

## System Specifications

### Physical Characteristics

Antenna Unit	21" (53 cm) h x 19.2" (49 cm) d; 30 lbs (13.6 kg)
Operating temperature	−25° to +55° C (−13° to +130° F)
Storage temperature	−40° to +85° C (−40° to +185° F)
Humidity	to 100% non-condensing

### Input Power

Input	11–16 VDC @ 3.5 amps nominal (4.5 amps peak)
-------	---

### Antenna System Performance

Minimum EIRP	50-51 dBW
Elevation range	15° - 85°
Azimuth range	720°
Pitch/roll range	±15°
Pitch/roll rate	45°/second
Turn rate	45°/second
Yaw	±90° in 10 seconds
Tracking rate	30° per second
Position repeatability	0.1°
Surge/sway/heave	±0.2 G
Shock	20 G, 11 msec
Vibration	0.9 G rms over 5-33 Hz

**Table A-1**

*TracVision 4 Antenna  
Physical Specifications*

**Table A-2**

*TracVision 4 Power Specifications*

**Table A-3**

*TracVision 4 Performance  
Specifications*

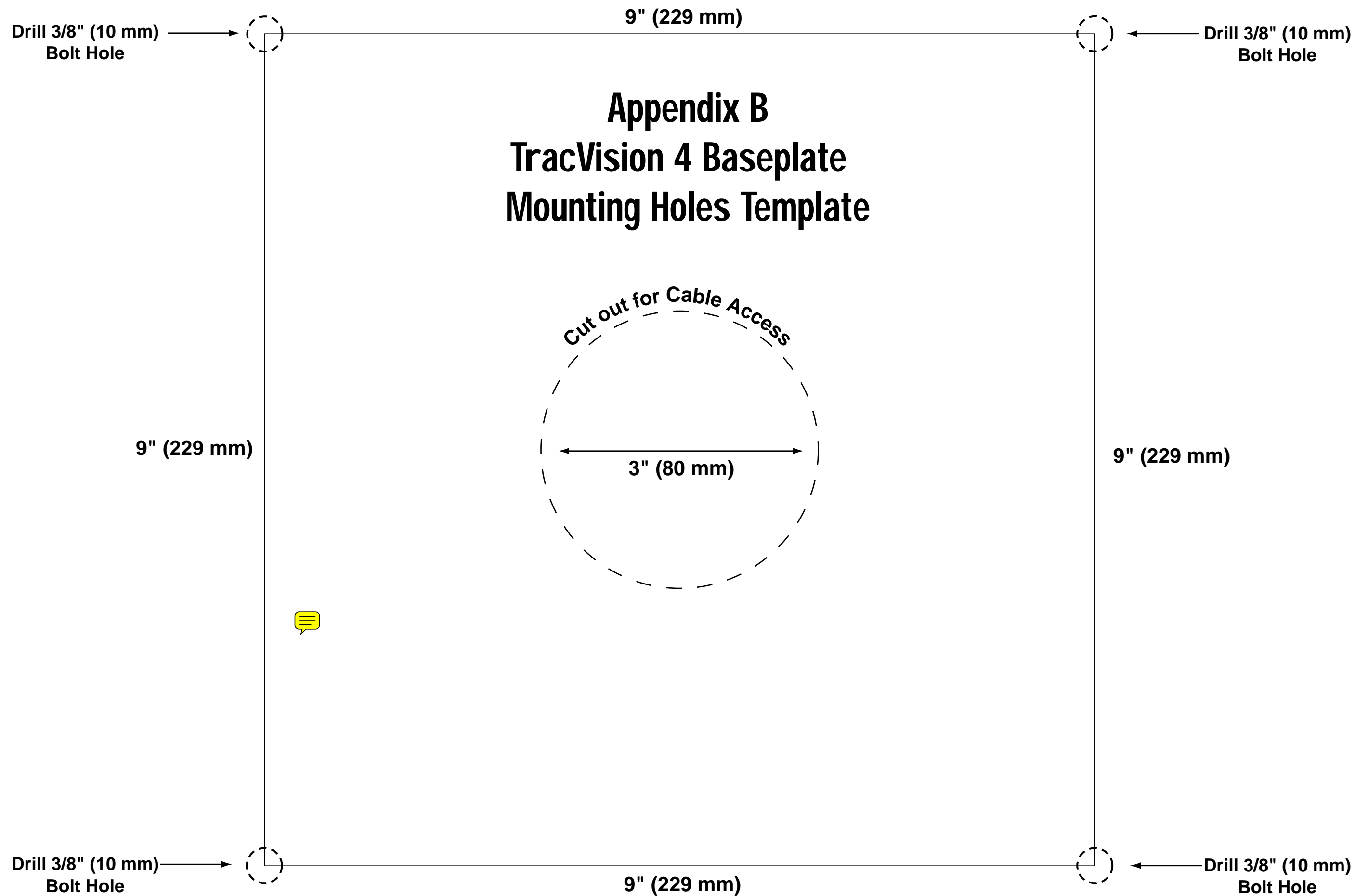




# **Appendix B**

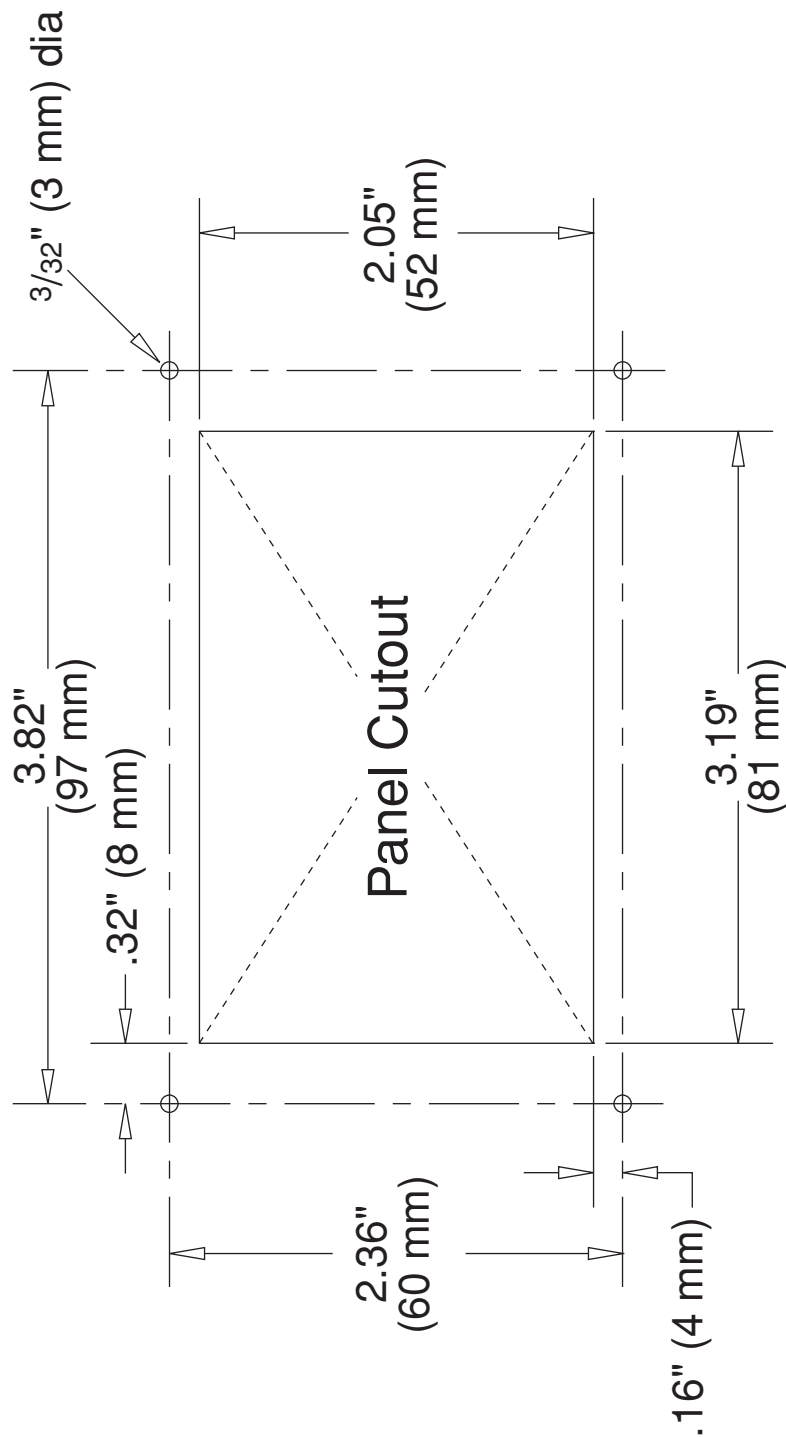
## **TracVision 4 Baseplate Mounting Holes Template**

A template for the four mounting holes is presented on the following page.



# Appendix C

## Switchplate Template



# **Appendix D**

## **Comprehensive TracVision 4**

### **Wiring Diagram**

The comprehensive TracVision 4 wiring diagram is unavailable in PDF format. If you require a copy of this wiring diagram, please contact KVH Technical Support at +1 401 847-3327 or via email at [techs@kvh.com](mailto:techs@kvh.com). A copy of the diagram can be mailed or faxed to you upon request.

# Appendix E

## Startup Data Sequences

The data on the following pages presents a sample startup data sequence registered by the TracVision 4 when receiving signals from DIRECTV, the DISH Network, or ExpressVu. This sequence may vary based on the software version loaded onto the TracVision 4 system. This data can be recorded using the maintenance port and a PC.

?PGM

TracVision G4 Controller Rev X - Version X.XX - Serial number XXXXXXXX

NMB Motors

RF: ZAP

\*\*\* Initializing RF Controller \*\*\*

RF: S,A,H,U,V

RF: SATINSTALL,55,C,57,C

RF: S,A,H,U,V

RF: L,A-----Identifies Satellite A or B as currently  
loaded for acquisition

RF: F,A,12368,20000,67,0X0000,V,U,2-----Satellite configuration data, Satellite A

RF: F,A,12368,20000,67,0X0000,V,U,2

RF: F,A,12238,20000,67,0X0000,H,U,2

RF: F,A,12238,20000,67,0X0000,H,U,2

RF: F,B,12374,20000,34,0X1004,V,U,3-----Satellite configuration data, Satellite B

RF: F,B,12374,20000,34,0X1004,V,U,3

RF: F,B,12381,20000,34,0X1004,H,U,3

RF: F,B,12381,20000,34,0X1004,H,U,3

RF: RF PCB Version 8.1 -----Current RF software revision

RF: I,0,51496,00000,00516,0

RF COMM: PASS-----PASS is expected

Limit Switch Test

Limit Switch Status: PASS-----PASS is expected

\*\*\* Initializing Ext Sensor \*\*\*

RF: S,A,V,U,V

RF: ?

,=h,0,S,=h,1RF: S,A,H,U,V

RF: S,A,V,U,V

ES Status Timeout

,=h,0,S,=h,1ES Status Timeout

,=h,0,S,=h,1RF: S,A,V,U,V

ES Status Timeout

Running Sensorless. No Ext Sensor Detected---Configuring for sensorless operation

\*\*\* Initializing Antenna \*\*\*

\*\*\* NO GPS-Default Used \*\*\* -----Accessing default location based on sat install

GPS: UTC: 083000.00, Lat: 4131.00N, Long: 7115.00W

GPS: DSS\_119 AZ = 238.9, EL = 22.1-----Default satellite position based on sat install

```

GPS: DSS_101 AZ = 220.9, EL = 33.4
*** Initializing Rate Bias ***
RF: S,A,H,U,V
RF: S,A,H,U,V
A/D: 2480 1973 453
RF: S,A,H,U,V
RF: S,A,V,U,V
RF: S,A,V,U,V
A/D: 2042 2011 423
RF: S,A,V,U,V
A/D: 2036 1994 452
Gyro Bias: Az = 2040.87, El = 2002.51-----Expected range is 1700-2300
Gyro Uncertainty: Az = 3.00, El = 3.00
*** Entering Search Mode 1A ***
RATE BIAS: PASS-----PASS is expected
Searching for DSS_101, Threshold = 1000
RF: S,A,H,U,V
+POS: 199.9 33.5 118
RF: S,A,V,U,V
RF: S,A,V,U,V
+POS: 209.2 33.4 317
RF: S,A,V,U,V
RF: S,A,H,U,V
RF: S,A,H,U,V
+POS: 34.8 33.5 417
RF: S,A,H,U,V
Satellite Found: AZ = 119.1, EL = 33.4, RF = 1767
*** Entering Tracking ***
+POS: 149.8 33.4 812
RF: S,A,H,U,V
RF: S,A,V,U,V
RF: Freeze DAC = -00561
+POS: 130.4 32.5 2673
+POS: 129.7 31.9 2232
+POS: 129.1 31.4 2298
RF: S,A,V,U,V
RF: Freeze DAC = +00848
+POS: 128.8 31.2 2272
RF: S,A,H,U,V
*** Network ID Check ***-----Comparing the tracked satellite's network ID to
RF: S,A,H,U,V the selected satellite's network ID
+POS: 127.4 32.3 2549
+POS: 129.0 31.6 2936
RF: Y,0X0000-----Indicates positive satellite identification
*** Tracking DSS_101 ***-----Identifies satellite currently tracked
+POS: 128.5 32.0 2822 (TV broadcast image should be available)
+POS: 129.3 31.2 2864
RF: S,A,H,U,V
+POS: 128.9 32.1 2800

```

# Appendix F

## Maintenance Port Parser Commands

The TracVision 4 system parser commands are parsed when the system receives an ASCII carriage return (Hex 0D). An ASCII line feed (Hex 0A) is permitted but is ignored in any transmitted command. All system responses are terminated with an ASCII carriage return followed by a line feed and ending with either an acknowledge character (ASCII > (Hex 3E)) or a not-acknowledge character (ASCII ? (Hex 3F)). The parser commands are shown below in boldface capital letters but they are not case-sensitive. In most cases, the command is responded to with an echo; that is, if you type **ZAP**, for example, and press “ENTER” the response will be the command you have entered. For other commands, the response is specific for each command, such as **VERSION**, **STATUS** or **HELP**.

### F.1 System Commands

#### Software Version

Function:	reports software version and system type
Command:	<b>VERSION</b>
Response:	KVH TracVision 4 Rev X - Version X.XX - XXX Motors

**Table F-1**  
*System Commands*

#### System Status Report

Function:	reports general system status
Command:	<b>STATUS</b>
Response:	system status string

#### Initialize/Restart the System

Function:	initializes the system (performs a soft reset)
Command:	<b>ZAP</b>
Response:	echoes the command, then reinitializes the system

**Help on Parser Commands**

Function:	lists parser commands
Command:	<b>HELP</b>
Response:	lists all parser commands

**Turn On Sleep Mode**

Function:	turns on Sleep Mode
Command:	<b>SLEEPON</b>
Response:	echoes the command

**Turn Off Sleep Mode**

Function:	turns off Sleep Mode
Command:	<b>SLEEPOFF</b>
Response:	echoes the command

**Turn On Instant On**

Function:	turns on Instant On feature
Command:	<b>INSTANTON</b>
Response:	echoes the command

**Turn Off Instant On**

Function:	turns off Instant On feature
Command:	<b>INSTANTOFF</b>
Response:	echoes the command

**Report Skew Angle**

Function:	reports skew angle of the current satellite
Command:	<b>SKEWANGLE</b>
Response:	SKEW ANGLE = XXXX.X

**Report Serial Number**

Function:	reports system serial number
Command:	<b>=SERNUM</b>
Response:	SN = XXXXXXXX



**Enter Serial Number**

Function:	enters system serial number
Command:	<b>=SERNUM,XXXXXXXX</b>
Where:	XXXXXXXX = the system's serial number
Response:	SN = XXXXXXXX

**Configure System**

Function:	configures software for a particular system model
Command:	<b>=TVXXXX</b>
Where:	XXXX = system model (i.e., G4HP)
Response:	system configures software and antenna restarts

## F.2 Manual Positioning Commands

To execute the following commands, first put the antenna unit in idle mode by typing **HALT** and pressing "ENTER." Positioning commands may be entered after the antenna comes to rest.

**Azimuth Angle**

Function:	commands a manual azimuth angle that the mechanism moves to
Command:	<b>AZ,XXXX</b> (range is 0000-3599)
Argument:	desired azimuth angle of the mechanism relative to external magnetic reference, or baseplate fwd, 000°-359.9°
Response:	echoes the command; mechanism moves at a fixed velocity

**Elevation Angle**

Function:	commands a manual elevation angle that the mechanism moves to
Command:	<b>EL,XXX</b> (range is 100-850)
Argument:	desired elevation angle of the mechanism relative to up, or external sensor attitude reference, 10.0°-85.0°
Response:	echoes the command; mechanism moves at a fixed velocity

**Table F-2***Manual Positioning Commands*

**Azimuth CW Step**

Function:	commands a manual 0.1° clockwise step in azimuth angle
Command:	<b>6</b>
Response:	echoes the command

**Azimuth CCW Step**

Function:	commands a manual 0.1° counter-clockwise step in azimuth angle
Command:	<b>4</b>
Response:	echoes the command

**Elevation UP Step**

Function:	commands a manual 0.1° UP step in elevation angle
Command:	<b>8</b>
Response:	echoes the command

**Elevation DOWN Step**

Function:	commands a manual 0.1° DOWN step in elevation angle
Command:	<b>2</b>
Response:	echoes the command

## F.3 Operational Commands

**Table F-3**  
*Operational Commands*

**Tracking Mode**

Function:	starts active tracking of the satellite
Command:	<b>TRACK</b>
Response:	echoes the command

**Idle Mode**

Function:	halts active tracking and conical scan, then enters Idle mode
Command:	<b>HALT</b>
Response:	echoes the command

## F.4 Tracking and Conical Scan Commands

### Target Location

Function:	reports the target location in antenna frame; data format is E### for elevation in degrees 000-900 and A#### for azimuth in degrees 0000-3599 with implied decimals
Command:	<b>TGTLOCATION</b>
Response:	Target Location = A = E###, A#### B = E###, A####

**Table F-4**

*Tracking and Conical Scan Commands*

### Analog Signal Strength Report

Function:	reports signal strength from RF detector circuit in A/D counts (000-FFF Hex)
Command:	<b>SIGLEVEL</b>
Response:	Signal Strength = XXXX

## F.5 RF Board Commands

### Serial Communications, Status/Polarization Report, Tone Changes

Function:	starts serial communications, reports status and polarization/tone changes
Command:	<b>@S</b>
Response:	S,s,p,b,m <cr> every 5 seconds until ><cr> is returned from system software
Where:	s = satellite (A = primary, B = secondary)  p = polarization (V = vertical, H = horizontal, R = right, L = left, X = no LNB power)  b = band (H = high band, L = low band, U = USA)  m = mode (V = valid, I = invalid)*

**Table F-5**

*RF Board Commands*

\* The Mode bit is used to evaluate the Satellite, Polarization and Band combination vs. the Frequency/Symbol Rate/FEC currently in RAM. This bit will be set to invalid if the Frequency for the selected combination is set to 0x0000; otherwise it will be set to valid. For example the Mode bit will be set to invalid when the frequency is set to 00000 to indicate that there is not a frequency to track for the LNB tone and voltage setting.

**Report RF Tracking Parameters**

Function:	reports all RF tracking parameters for primary & secondary satellites*
Command:	<b>@SATCONFIG</b>
Response:	F,x,ffff,S,C,ID,P,B,D <cr>
Where:	<p>x = satellite (A = primary, B = secondary)</p> <p>ffff = frequency in MHz (00000 and 10700 to 12700)</p> <p>S = symbol rate in Mbit/Sec (1000 to 29999)</p> <p>C = FEC code rate (valid rates = 12, 23, 34, 56, 67, 78)</p> <p>ID = satellite network ID in hexadecimal format (valid range = 0x0000 to 0xffff hex)</p> <p>P = LNB polarization (V = vertical, H = horizontal, R = right, L = left)</p> <p>B = LNB down conversion frequency (L = low, H = high, U = USA)</p> <p>D = decoding type (0 = test, 1 = DSS-A, 2 = DSS-B, 3 = DVB)</p>

\* This command returns all eight combinations of the Satellite/Freq/Sym/FEC/ID/POL/Band/Decode currently stored in RAM.

**Set RF Tracking Parameters**

Function:	sets RF tracking parameter
Command:	<b>@SATCONFIG,X,N,F,S,C,ID,P,B,D&lt;cr&gt;</b>
Response:	Echoes the input data
Where:	<p>@SATCONFIG = directs data to the RF Board</p> <p>X = satellite location A or B</p> <p>N = satellite table # (98 &amp; 99 are slots for user-configured satellites)</p> <p>F = frequency in MHz (either 00000 or a range from 10700 - 12700)</p> <p>S = satellite transponder symbol rate in Mbit/second (01000 - 29999)</p> <p>C = FEC code (e.g., 12, 23, 34, 56, 67, 78)</p> <p>ID = satellite network ID in hexadecimal format (0x####)</p> <p>P = LNB polarization (V = vertical, H = horizontal, R = right, L = left)</p> <p>B = LNB down conversion frequency (L = low, H = high, U = USA)</p> <p>D = decoding type (0 = test, 1 = DSS-A, 2 = DSS-B, 3 = DVB)</p>

**Switch Satellites**

Function:	shifts tracking to the second satellite
Command:	<b>@L,A or B</b>
Response:	echoes the command
Where:	<p>A = switches to Satellite A</p> <p><b>or</b></p> <p>B = switches to Satellite B</p>

**ID Match/Decoded Network ID**

Function:	reports ID match and decoded network ID
Command:	<b>@CHECKID</b>
Response:	<p>Y,0X####</p> <p>N,0X####</p> <p>Y,NoID</p> <p>N,NoID</p>
Where:	<p>Y = yes</p> <p>N = no</p> <p>0X#### = network ID</p> <p>NoID = satellite unidentified</p>



Do **NOT** use the Frequency Scan function unless directed by KVH Technical Support or a KVH-authorized technician. Improper data selection may affect the system's operation.

### Frequency Scan

Function:	updates satellite frequency data
Command:	<b>@SC,XXXXX,YY</b>
Where:	XXXXX = symbol rate (010000 - 399999) YY = FEC code (e.g., 12, 23, 34, 56, 67, 78)
Response:	system automatically searches for the frequency with the strongest signal, then updates the satellite's programmed data with the new frequency (and associated network ID) and stores it in the satellite library

### RF PCB Software Version

Function:	reports RF PCB software version
Command:	<b>@VER</b>
Response:	RF PCB Version X.X

### Report Tracking Information

Function:	reports hardware/software locks, AGC value, bit error rate, and ADC value
Command:	<b>@I</b>
Response:	I,X,G,B,D,Y
Where:	X = hardware lock (0 = not locked, 1 = locked on satellite) G = AGC value (signal level) B = bit error rate D = ADC value Y = software lock (0 = not locked, 1 = locked on satellite)

## F.6 Installation Commands

### Set/Report GPS Position

Function:	reports or sets default GPS position
Command:	<b>GPS&lt;cr&gt;</b> <b>GPS,XX,D,YYY,E</b>
Response:	GPS = XXD YYYY GPS: XXD YYYY
Where:	XX = latitude (0-90) D = S (South) or N (North) YYY = longitude (0-180) E = E (East) or W (West)

**Table F-6**

*Installation Commands*

### Report Satellite Names

Function:	reports names for satellites A and B
Command:	<b>SATINSTALL</b>
Response:	SATINSTALL,<sat_a_name>,<sat_b_name>

### Report Tracked Satellite

Function:	reports name of satellite currently being tracked
Command:	<b>SAT</b>
Response:	SAT = <sat_name>

### Report Configured Satellite Names

Function:	reports names for all configured satellites
Command:	<b>SATLISTA</b>
Response:	SATLISTA,<sat_name1>,...,<sat_nameX>

### Report Valid Satellite B Selections

Function:	reports names for all valid Satellite B selections for a given Satellite A selection
Command:	<b>SATLISTB,&lt;sat_a_name&gt;</b>
Response:	SATLISTB,<sat_a_name>,<sat_b_name1> ...,<sat_b_nameX>

### Install Satellite Pair

Function:	installs satellites A and B as the satellite pair
Command:	<b>SATINSTALL,&lt;sat_a_name&gt;,&lt;sat_b_name&gt;</b>
Response:	If valid pair, echoes the input data If invalid pair, returns error message

**Configure Longitude of a User-configurable Satellite**

Function:	configures one of the user-configurable satellites with the longitude provided
Command:	<b>SATCONFIG,USERX,YYY,Z,D,L</b>
Response:	If valid, echoes the input data If invalid, returns error message
Where:	X = 1 or 2  YYY = longitude (0-180)  Z = E (East) or W (West)  D = decoding type (0 = test, 1 = DSS-A, 2 = DSS-B, 3 = DVB)  L = LNB polarization (C = circular, L = linear)

**Set Saved Satellite Position**

Function:	sets saved satellite position
Command:	<b>GOTO,AZXXXX,ELYYY</b>
Response:	SAVED SAT POS: AZ = XXXX, EL = YYY
Where:	XXXX = azimuth (0000 - 3599)  YYY = elevation (100 - 850)

## F.7 Debug Commands

**Table F-7**  
*Debug Commands*

**Enter Debug Mode**

Function:	enters Debug mode
Command:	<b>DEBUGON</b>
Response:	echoes the command, system enters Debug mode

**Limit Switch Test**

Function:	performs a limit switch test
Command:	<b>=LSTEST</b>
Response:	Limit Switch Status: PASS

**Set/Report Offset Angles**

Function:	reports or sets system offset angles
Command:	<b>OFFSETS OFFSETS,XXXXX,YYYY</b>
Response:	Offsets = XXXXX.X YYYYYY.Y
Where:	X = azimuth offset (-1800 - 1800)  Y = elevation offset (-450 - 450)



**Apply Default Values to Default Satellites**

Function:	updates the default satellites to the default values
Command:	<b>SATPAIR,X</b>
Response:	displays numerous frequency commands and reports "Satellite Installation Complete"
Where:	X = 0 (satellites default to Astra1 & Hotbird) <b>or</b> X = 1 (satellites default to Expressvu and EchoStar 119) <b>or</b> X = 2 (satellites default to DSS_101 and DSS_119)

**Report Last Satellite Tracked/Update Value**

Function:	reports the last satellite tracked or updates the last tracked satellite to the value input if it is different from the current value
Command:	<b>LASTSAT</b> <b>LASTSAT,X</b>
Response:	Last = <sat_name>
Where:	X = A (updates to Satellite A) <b>or</b> X = B (updates to Satellite B)

# **KVH Industries Limited Warranty**

## **TracVision 4**

### **Limited Warranty on Hardware**

KVH Industries, Inc. warrants the KVH product purchased against defects in materials for a period of TWO (2) years and against factory labor costs for a period of ONE (1) year from the date of original retail purchase by the original purchaser. It is the customer's responsibility to verify the date of purchase by returning the warranty card included with the product to KVH within 30 days of purchase, or by providing a copy of a dated sales receipt for the KVH product under warranty with the warranty claim. If this date cannot be verified, the warranty period will begin 30 days after the date of manufacture of the original product purchased.

If you discover a defect, KVH will, at its option, repair, replace or refund the purchase price of the product at no charge to you, provided you return it during the warranty period, transportation charges prepaid, to the factory direct. Please attach your name, address, telephone number, a description of the problem and a copy of the bill of sale or sales receipt as proof of date of original retail purchase, to each product returned to warranty service. Alternatively, you may bring the product to an Authorized KVH dealer/distributor for repair. During the first year, and if the product was installed by an Authorized KVH dealer/distributor (identified with the KVH Authorized dealer/distributor list), KVH will cover the dealer's/distributor's labor charges for warranty repairs, provided the dealer/distributor contacts KVH for pre-approval of the charges. Approval of charges is at KVH's sole discretion.

This Limited Warranty does not apply if the product has been damaged by accident, abuse, misuse or misapplication or has been modified without the written permission of KVH; if any KVH serial number has been removed or defaced; or if any factory-sealed part of the system has been opened without authorization.

### **Return Authorization**

A Return Material Authorization is required prior to returning the product to KVH Industries. Please call our Technical Support Department at +1 401 847-3327 or send an e-mail to [techs@kvh.com](mailto:techs@kvh.com) to obtain the RMA number. Write the number in large, clear characters on the outside of the box. To avoid confusion and misunderstandings, shipments without an RMA number clearly visible on the outside box will be refused and returned to you at your expense. If possible, use the original box and packing material to protect the equipment from damage in shipment. KVH assumes no responsibility for warranty shipments from the customer to the factory if not shipped in the manner prescribed above.

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