



HUGHES
An EchoStar Company



inmarsat

Hughes 9450 Mobile Satellite Terminal Series

Installation Guide

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Understanding safety alert messages

Safety alert messages call attention to potential safety hazards and tell you how to avoid them. These messages are identified by the signal words **WARNING** or **CAUTION**, as illustrated below. To avoid possible property damage, personal injury, or in some cases possible death, read and comply with all safety alert messages.

Messages concerning personal injury

The signal words **WARNING** and **CAUTION** indicate hazards that could result in personal injury or in some cases death, as explained below. Each of these signal words indicates the severity of the potential hazard.




WARNING indicates a potentially hazardous situation, which if not avoided, could result in death or serious injury.



CAUTION indicates a potentially hazardous situation, which if not avoided, could result in minor or moderate injury.

Safety symbols

The generic safety alert symbol  calls attention to a potential personal injury hazard. It appears next to the **WARNING** and **CAUTION** signal words as part of the signal word label. Other symbols may appear next to **WARNING** or **CAUTION** to indicate a specific type of hazard (for example, fire or electric shock).

Chapter 1

Introduction

The purpose of this guide is to provide assistance to personnel installing the Hughes 9450 mobile satellite terminal into a vehicle.

WARNING

This product must be installed by Authorized Service Personnel.



Note: Damages resulting in the failure to conform to the instructions found herein, as well as standard installation practices, will be the responsibility of the installer.

Hughes 9450 mobile satellite terminals

The mobile satellite terminals are composed of four parts: the transceiver or Indoor Unit (IDU), the antenna or Outdoor Unit (ODU), the power connector/cable, and an RF cable.



Figure 1-1 9450 IDU (left) and Class 10 antenna (middle) Class 11 antenna (right)

The Hughes IDU has multiple interfaces that various Terminal Equipment (TE) devices such as laptops, phones, etc., can connect to: four PoE/Ethernet (RJ-45), ISDN, two POTS (RJ-11) and Wireless Local Area Network (WLAN).

There are multiple versions of the 9450. The IDU housing is common but the different versions have different user interfaces.

Table 1. 9450 Variants

9450 Version	Interfaces
9450	Ethernet (with PoE), POTS, ISDN, WLAN
9450E	Ethernet (with PoE), POTS, ISDN
9450L	Ethernet
9450LW	Ethernet, WLAN
9450TW	Ethernet (with PoE), POTS, WLAN

Indoor Unit (IDU)

The IDU provides all of the TE interfaces, plus the interface for the antenna (ODU) and manages the communications over the Inmarsat BGAN network. Communication to the ODU is provided by the RF cable from the IDU.

Physical dimensions

IDU: Size: 46 mm x 281 mm x 233 mm
Weight: 2.2 kg

RF cable: Coaxial LMR-195 or equivalent (<10 dB loss@ 1.6GHz and 50 Ohm impedance), TNC connectors



Figure 1-2 9450 Indoor Unit (IDU)

Power port

The power port is the connection from the power supply (vehicle battery or some other 12 or 24 Vdc power source) to the IDU. The power cable has a +V power line, an ignition sense line and a -V power line.

Table 2. Power port pin out

Line type	Pin number
+V power line	1
Ignition Sense	2
-V power line	3

4X RJ-45 Ethernet with Power over Ethernet (PoE) ports

There are four RJ-45 ports with Power over Ethernet (PoE) on the IDU. Note, the 9450L and LW do not have PoE. The ports supply standard PoE according to the IEEE 802.3af standard (48 Vdc up to 15.4 W) and 10/100BaseT Ethernet. The pinout of the ports supports a direct straight-through connection to a PC with a standard Ethernet cable. Table 3, shows the pinout of the Ethernet connector.

Table 3. RJ-45 Ethernet port pinout

Pin	
1	RX+
2	RX-
3	TX+
4	NC
5	NC
6	TX-
7	NC
8	NC



Note: The 48 Vdc for PoE devices is supplied over the TX, RX pairs. They are only active when an 802.3af compliant device is plugged in. The other pairs (4, 5, 7, and 8) are unused.

The total power supplied by the PoE is limited to 30.8 W maximum for 12 V installations and 61.6 W maximum for 24 V installations. The IDU automatically detects the class of the device plugged in and will apply power such that the total cannot exceed these limits. If the user attempts to connect a combination of devices that require more than this, the IDU will not power any devices that would cause the limit to be exceeded.



Note: Class 4 (802.3at) PD devices are not supported.

ISDN port

There is one ISDN port on the IDU of the 9450 and 9450E. It provides 4 kbps voice, 3.1 kHz audio, and 64 kbps data communication. The following table lists the pinout of the ISDN connector.

Table 4. ISDN port pin out

Pin	
1	NC
2	NC
3	ISDN RX+(+40 V)
4	ISDN TX+(-40 V)
5	ISDN TX-(-40 V)
6	ISDN RX-(+40 V)
7	NC
8	NC

RJ-11 ports

There are two RJ-11 ports on the IDU of the 9450, 9450E and 9450TW: FAX is for 3.1 kbps fax calls and TEL for 4 kbps speech calls. The following table lists the pinout of the RJ-11 connectors.

Table 5. RJ-11 port pinout

Pin	
1	NC
2	NC
3	Ring (-V)
4	Tip (+V)
5	NC
6	NC

Antenna port

The antenna connects to the 50 Ohm female TNC connector antenna port. This line carries the L-band RF, ASK signaling, and DC power (42 Vdc) for the antenna.



The antenna cable carries DC power; do not connect or disconnect the antenna cable while the unit is powered on.

WLAN port

The WLAN port on the 9450, 9450LW and 9450TW IDU is a reverse polarity SMA jack. The supplied antenna is a 2.4 GHz 3 dBi “Rubber Duck” antenna with RP-SMA plug connector, part number HG2403RD-RSF.

To prevent blocking or attenuation of the WLAN signal, the IDU should be installed such that there is no metal blocking the radio path to the user’s device.

SIM card

The IDU requires an Inmarsat SIM to be installed. Insert the SIM (supplied by the dealer) into the SIM card holder with the metal contacts facing down. Insert the SIM card as shown in Figure 1-3.

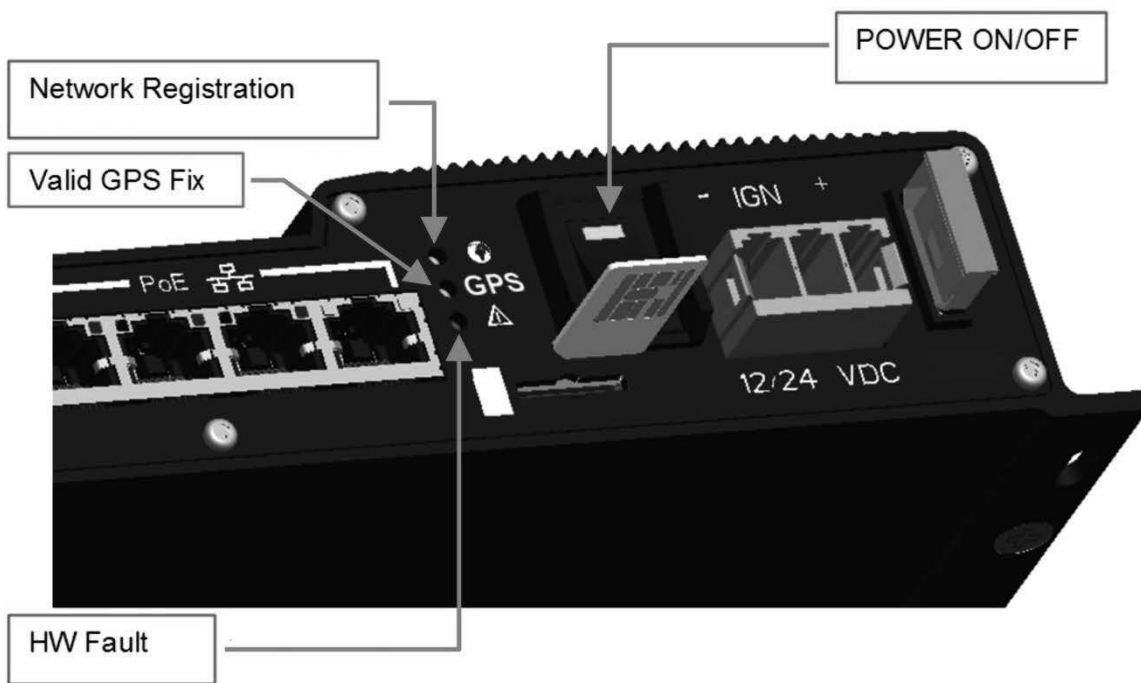


Figure 1-3 Inserting SIM card in the SIM card holder

Chapter 2

System power requirements

There is one power connection on the IDU. This must be connected to a 12 or 24 Vdc power supply.

Power requirements and consumption are as follows:

Table 6. System power requirements

Voltage Input Minimum	10 V
Voltage Input Maximum	32 V
Total Current for ODU, and IDU (Max. @12V)	12 A
Required Fuse	15 A

Fuse

The fuse is a 15 Amp, fast blow, ATO blade fuse. The installed part is from Littelfuse, part number 0287015. To replace the fuse, pull fuse out of fuse holder (pliers may be needed to grip fuse) and press new fuse into fuse holder.

Power cable

The power cable uses a Phoenix contact #1718384 PC5/3 STCL-7, 62 connector and the pinout is shown in Table 6.

Table 7. Power cable pinout

Color	Function
red	DC +
white	Ignition Sense
black	DC -

The optional accessory car adapter power cable, Hughes' part number 3500472-0002, includes a car adapter plug with a 20 Amp, 250 V fuse, and the ignition sense wire is connected to the positive power wire in the plug.

Chapter 3

Standard cable connections

In addition to the DC power connection, an ignition sense connection must be made. This is done using the three-wire power cable. In the case of a vehicle installation, the power source is typically the vehicle battery. Cables should be routed appropriately and cable ties and clamps should be used as required to ensure that vibration and/or rubbing of the cables does not occur.

Ignition sense (white wire)

Route and connect the white wire (ignition sense) to a switched 12 or 24 Vdc source, such as accessory line or fuse block. Extended use of ignition sense in the accessory position (ACC) by the end user may lead to a discharged car battery.



Note: Ensure that the connection is a switched source: OFF when ignition is off or in start and ON only when ignition switch is in the ACCESSORIES or RUN position.

If using the car adapter plug, the ignition sense wire is already connected to the positive power wire in the plug.

Chassis grounding

The unit includes an isolating power supply. The IDU must be grounded by connecting a grounding wire from the chassis ground point to the vehicle chassis. See Figure 3-1. The ground wire should be clamped between the two nuts ensuring both are securely tightened.

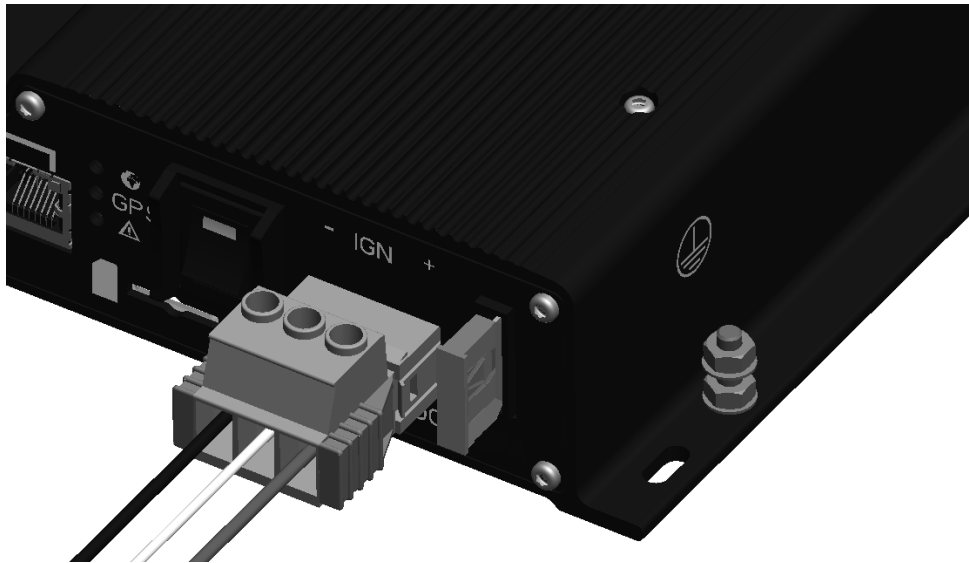


Figure 3-1 Chassis ground

Chapter 4 Package materials

The 9450 kit is an over-pack box with the following contents based on model:

Table 8. Package materials

Model	Hughes part number	Description
9450 Kit	3500497-00xx	Mobile Satellite Terminal – C11 or C10
	3500462-00xx	9450x Radio
	<ul style="list-style-type: none"> • 9506197-0001 (9450, 9450LW and 9450TW only) • 3500472-0001 • 3004129-0001 	<ul style="list-style-type: none"> • WLAN antenna (2.4 GHz, 3 dB) (9450, 9450LW and 9450TW only) • Power cable with 3-pin connector • Common Install Manual
	1504876-0001 or	C10 antenna or
	1504875-000x	C11 Antenna
3501053-0001	LMR-195 coax cable TNC-TNC	

Chapter 5 Vehicular installation

Basic installation procedure

The basic installation procedure is as follows:

1. Decide where you are going to install the antenna and IDU.
2. Ensure that the IDU is located inside the vehicle and attached to something structurally solid. Loose mounts that vibrate will degrade performance.
3. Determine the cable length required for the power installation.
4. Perform the installation of the antenna and IDU.
5. Connect the antenna via the three magnetic mounts (optional) to the vehicle's roof or permanently mount using screws/bolts.
6. Connect the RF cable to both the IDU and antenna TNC connectors
7. Connect the power to the IDU.
8. Properly ground the IDU
9. Power up the IDU/antenna

Installation notes

WARNING

1. Use a minimum of 14 gauge wire for both Positive and Negative wires to ensure low impedance. See Figure 5-4.
2. Whenever routing cable through holes drilled in metal or through bulkheads, use grommets and RTV sealant to weatherproof all holes drilled on the outside of the vehicle.
3. Use cable ties every 300 – 450 mm (12"-18").
4. The IDU can be mounted in either the horizontal or vertical position.
5. The main power line must be connected to a fused 12 or 24 Vdc power source. The unit is fused, but a 15A or greater fuse is required in the source to protect against shorts in the cabling. If connecting to a circuit in the fuse box that is already in use, ensure that the circuit can supply the unit with up to 15A for a 12 V installation or 7.5 A for a 24 V installation. If using the car adapter cable, it already includes the fuse in the adapter.
6. Route and connect the white ignition sense wire to a switched 12 or 24 Vdc source.
7. Ground the IDU to the vehicle via a wire connected to the IDU chassis ground. See Figure 3-1.

8. Install the IDU in a protected but ventilated area. Allow at least a 1-inch space around all surfaces, except for the bottom surface attached to the vehicle, to provide adequate cooling. Ensure that the location is accessible for servicing.
9. The IDU is not waterproof.
10. Always provision the wiring into the IDU with a drip loop.
11. With the exception of the IDU-to-antenna RF cable, do not route the power cable outside the vehicle.

Common IDU mounting information



Note: Use care when drilling through the body of the vehicle to avoid puncturing critical items.

Instructions for the installer:

1. Mount the terminal onto a flat surface using at least four screws (not supplied). Use screws with a diameter between 3.5 to 4 mm. Vibration-resistant screws or lock washers should be used.
2. There are two mounting holes/slots on either side of the terminal base.

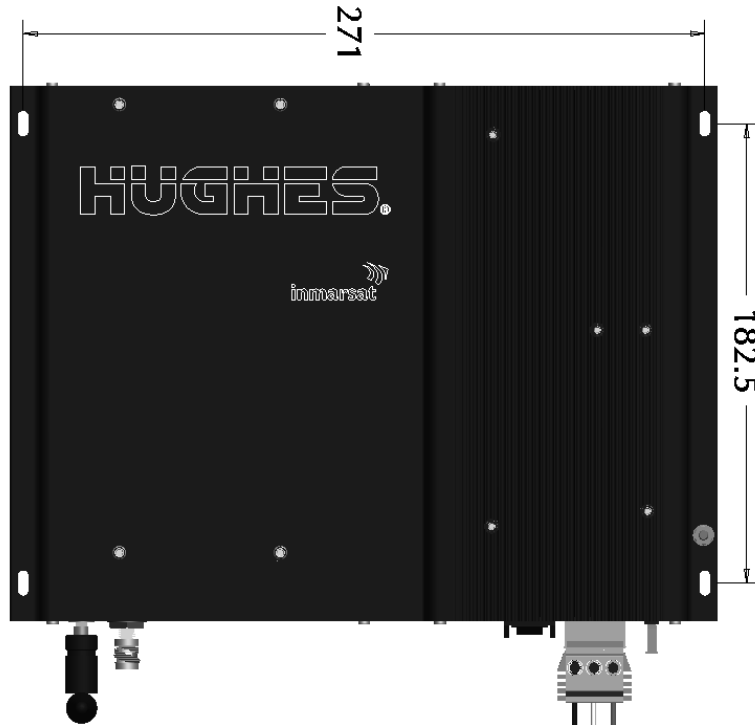


Figure 5-1 Common Indoor Unit mounting dimensions

Final dimensions after mounting: 46 mm x 233 mm x 281 mm without accessories

Power Management

Hughes recommends that a power management device (e.g., Charge Guard) be installed in the vehicle to prevent battery drain and extend battery life.

Charge Guard features:

- automatically turns mobile equipment On when you start the engine
- When you turn the engine Off, the equipment stays On from 5 seconds to infinity depending upon the time delay setting and the battery capacity
- Turns equipment Off before preset time if battery voltage drops too low
- For ordering go to:

http://www.havis.com/products/CHRGGRD_UNV_CNTRLMDL-38782-0.html

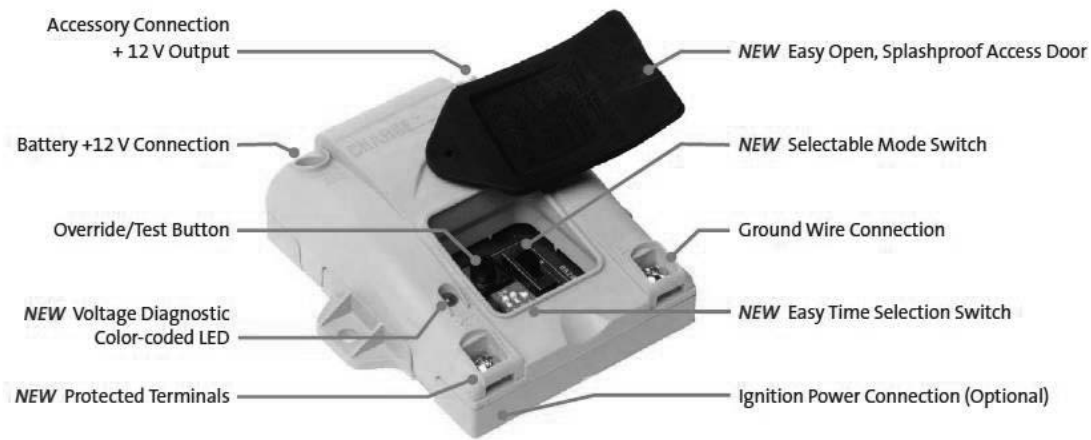


Figure 5-2 Charge Guard Features

Charge Guard Wiring Diagram

Connect the Charge Guard in the ignition path to the 9450 as shown below.



Note: IGN is low current and therefore less susceptible to voltage drop during operation. The 9450 ignition input has a hardware enforced power down mechanism to ensure that the Charge Guard is effective in this application.

⚠ WARNING

Do not connect the Charge Guard in series with the positive supply wire of the 9450 as this is a high current connection and the impedance must be kept to a minimum.

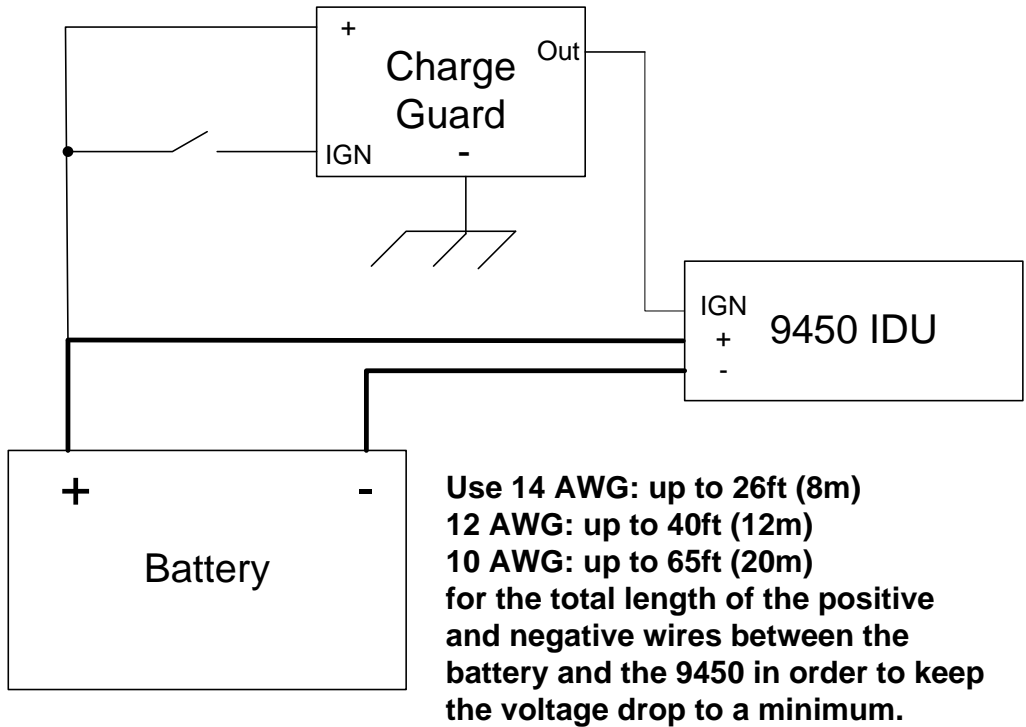


Figure 5-3 Charge Guard Wiring Diagram

TERMINAL GUIDE (CG-X)

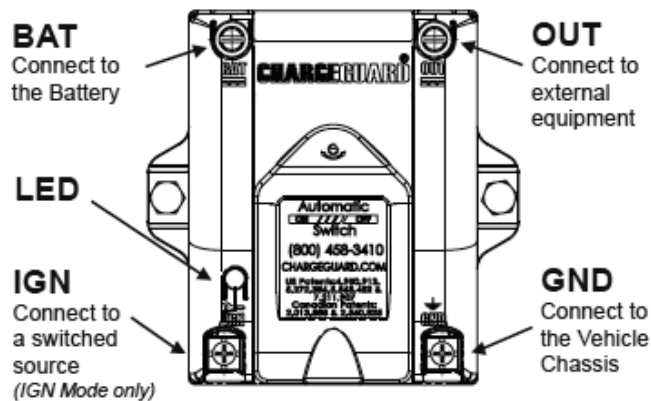


Figure 5-4 Charge Guard Guide

Chapter 6

The antenna Outdoor Unit (ODU)

The antenna unit is composed of the antenna element, high-power and low-noise amplifier systems, and a mechanical tracking system housed in the radome.

The Class 10 and Class 11 ODU's are a 2-axis antenna intended for land-mobile use.

Connection to the ODU is made by a TNC connector. The single coaxial cable carries L-band RX and TX, power, and tracking information.

Physical dimensions

- C10 ODU: **Size:** 477 mm x 152 mm
Weight: 5.5 kg



Figure 6-1 C10 antenna unit

- C11 ODU: **Size:** 252 mm x 119 mm
Weight: 2 kg



Figure 6-2 C11 antenna unit

Antenna cable lengths and types

The Hughes IDU has an automatic cable calibration feature that determines the dB loss of the cable. If a longer RF cable is required for the installation, the end-to-end RF loss needs to be <10 dB at 1.6 GHz and the cable must be 50 Ohm impedance.



Note: The installer is responsible for choosing the proper type of cable for the length required in order to meet the <10 dB requirement.

Installing the antenna

WARNING

Avoid exposure to microwave radiation. Keep a minimum safe distance of 1 meter (39 inches) to the side and above the antenna.

WARNING

The antenna cable carries DC power. Always power the IDU down prior to connecting or disconnecting the antenna cable from either the antenna or the IDU.

The antenna port is a 50 Ohm female TNC. This line carries RF, signaling, and DC power for the antenna.

Keep a clear line-of-sight to the satellite. Preferably, avoid all obstructions within 3 meters of the antenna. Obstructions less than 150 mm (6 inches) in diameter can be ignored beyond this distance.

Do not locate the antenna close to interfering signal sources or receivers. It is recommended that no other antennas be located within 3 meters of the 9450 antennas. If there is other equipment installed near the Hughes 9450 mobile satellite terminal, it is recommended to operate all equipment simultaneously and verify there is no co-interference.

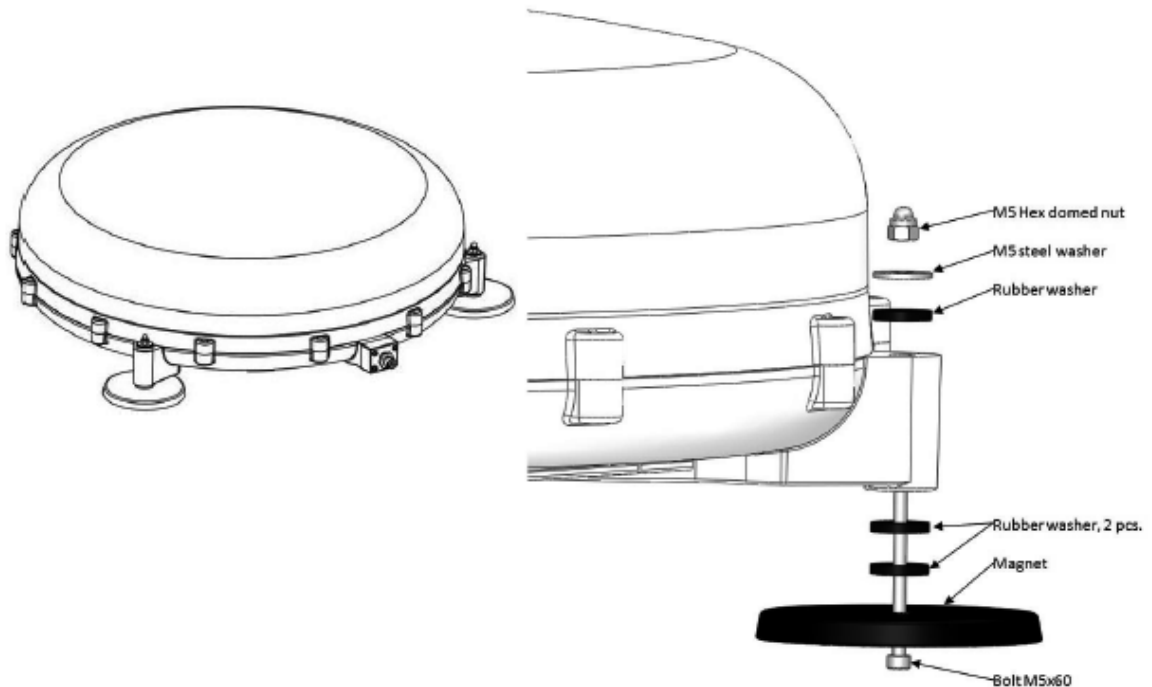
Magnetic mounting (optional)

Three magnetic mounts (part number 3501152-0001 for C10 or 3501152-0002 for C11) are optional for the antenna installation. These mounts will withstand 100 mph wind force. If the antenna cannot be mounted using the magnetic feet, the mounting holes can be used to bolt the antenna onto a roof bracket system.

C10 Magnetic Mount Installation

MAGNETIC MOUNT INSTALLATION

(Part number: SAC-1023H)



The Magnetic Mount consists of 3 individual high intensity magnets with rubber coating. Each magnet having a stainless steel M5 center bolt.

There are 3 "legs" on the antenna where the magnets are bolted in place. Note the position of the three nylon rubber washers just below and above each "leg", the stainless steel washer above the upper washer and the M5 protective nut on top. Use torque of 2,5 Nm.

Now place the antenna with magnets on the roof of the car.

When installing the antenna cable, it's important to protect against moisture – using self amalgating tape wrapped around the coaxial connector or similar. Also be careful with the cable run from the antenna and secure it at short intervals. An unsupported length of cable will vibrate when driving and could over time develop bad connection.

Dismounting:

Grab the antenna near one of the magnets and lift up. When one magnet is loose, the other two are easy to "break off".

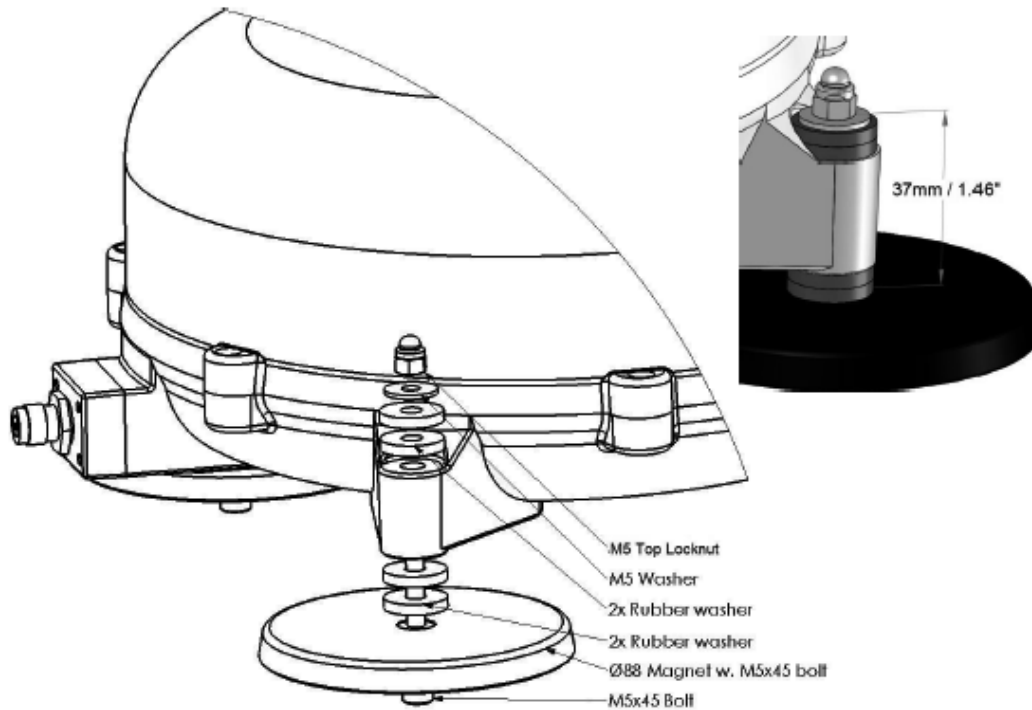
In some situation the magnetic force is so large that it is necessary to unscrew the antenna first and remove the magnets separately.

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C11 Magnetic Mount Installation

Magnetic Mount Installation

(Part number: SAC 1030H)



The Magnetic Mount consists of 3 individual high intensity magnets with rubber coating.

First put the bolt thru the magnet. Then place two rubber washers on each bolt. There are 3 "legs" on the antenna where the magnets are placed. Then place two rubber washers on each bolt above each "leg", the stainless steel washer above the upper washer and the M5 protective nut on top. Torque until height is 37mm / 1.46", as shown on picture above.

Now place the antenna with magnets on the roof of the car.

When installing the antenna cable, it's important to protect it against moisture – using self amalgamating tape wrapped around the coaxial connector. Also be careful with the cable run from the antenna and secure it at short intervals. An unsupported length of cable will vibrate when driving and could over time develop bad connection.

Dismounting:

Grab the antenna near one of the magnets and lift up. When one magnet is loose, the other two are easy to "break off".

In some situation the magnetic force is so large that it is necessary to unscrew the antenna first and remove the magnets separately.

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Permanent mount installation

When permanently installing the antenna on vehicles, some important guidelines must be followed in order to ensure long and trouble free operation.

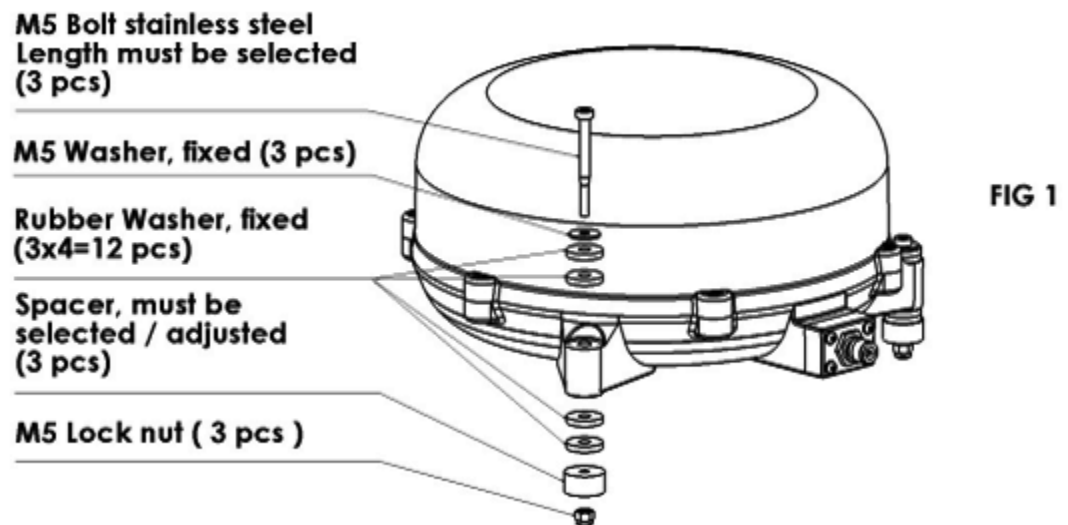
Not following these guidelines will void the warranty of the antenna. If in doubt, please consult SpaceCom at spacecom@spacecom.dk or call (+45) 98511576, Service Department.

1. Always install the antenna so that it is in a horizontal position, even if the surface on which it is installed e.g. roof of a vehicle, is not horizontal.

The antenna has three drainage holes at the bottom.

2. Always install the antenna so that clearance between bottom of antenna with drainage holes and mounting surface is no less than 5 mm and preferably 10 mm, refer to Fig.2.

In order to fulfill the above criteria 1 and 2, a set of bolts and washers has to be defined for each individual installation; refer to Fig.1.



The M5 stainless steel washers are **always** used and **positioned** as shown in Fig.1. The rubber washers are **always** used and **positioned** as shown in Fig.1. The spacers are **always** used and **positioned** as shown in Fig.1.

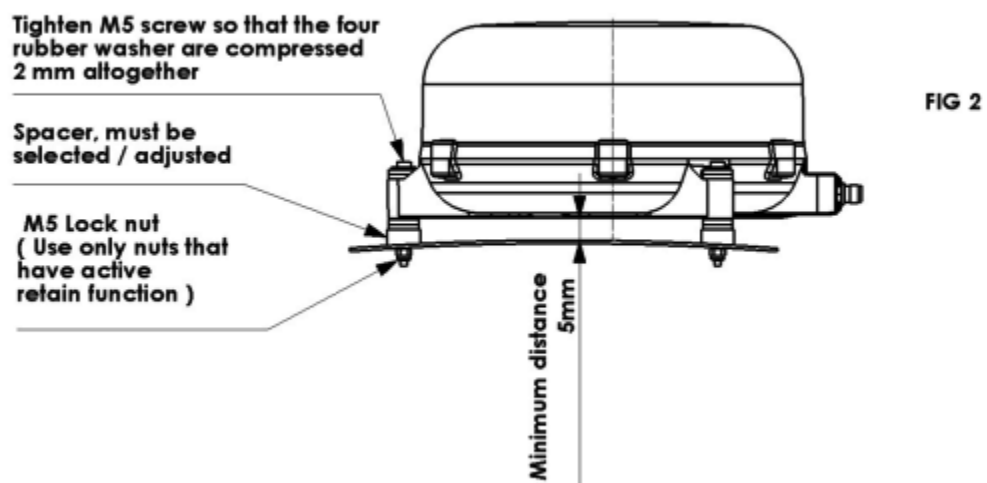
The 3 spacers will have identical length if the antenna is installed on a non-tilting surface, but may require individual length adjustment if the surface is tilting. The M5 stainless steel bolts will have identical length if the three spacers are identical and may require individual length adjustment if spacer length are different.

An Installation Kit is included with every antenna. It contains the washers that are always used, three standard 10 mm spacers used for a typical installation on a non-tilting surface and standard length M5 stainless steel bolts with nuts – **Note** length may have to be adjusted to accommodate a tilting surface.

Additional Installation Kits are available from SpaceCom Part No.: SPAC-AC-1036 Installation Kit.

Drainage of the antenna

In order to keep the height of the antenna as small as possible and in order to avoid the complex and often unreliable complete sealing of the antenna a simple mechanism in the form of three holes in the dome (plastic enclosure) bottom is used. The holes are made so that water e.g. solid drops is not likely to enter the dome and simultaneously water that incidentally has entered the dome or moisture condensed in the dome is drained out simply by gravity. Correct function of the drainage system will only be ensured by following criteria 1 and 1 above.



Mounting Hole Patterns

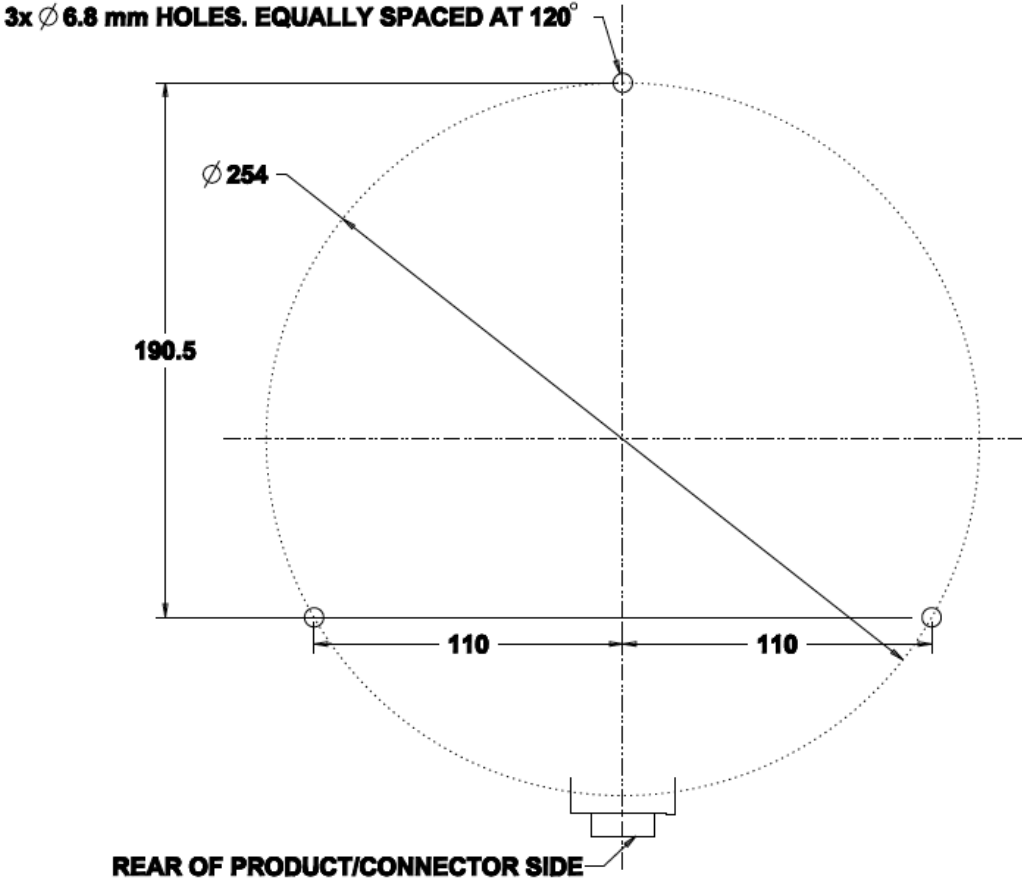


Figure 6-3 C11 Mounting Hole Pattern

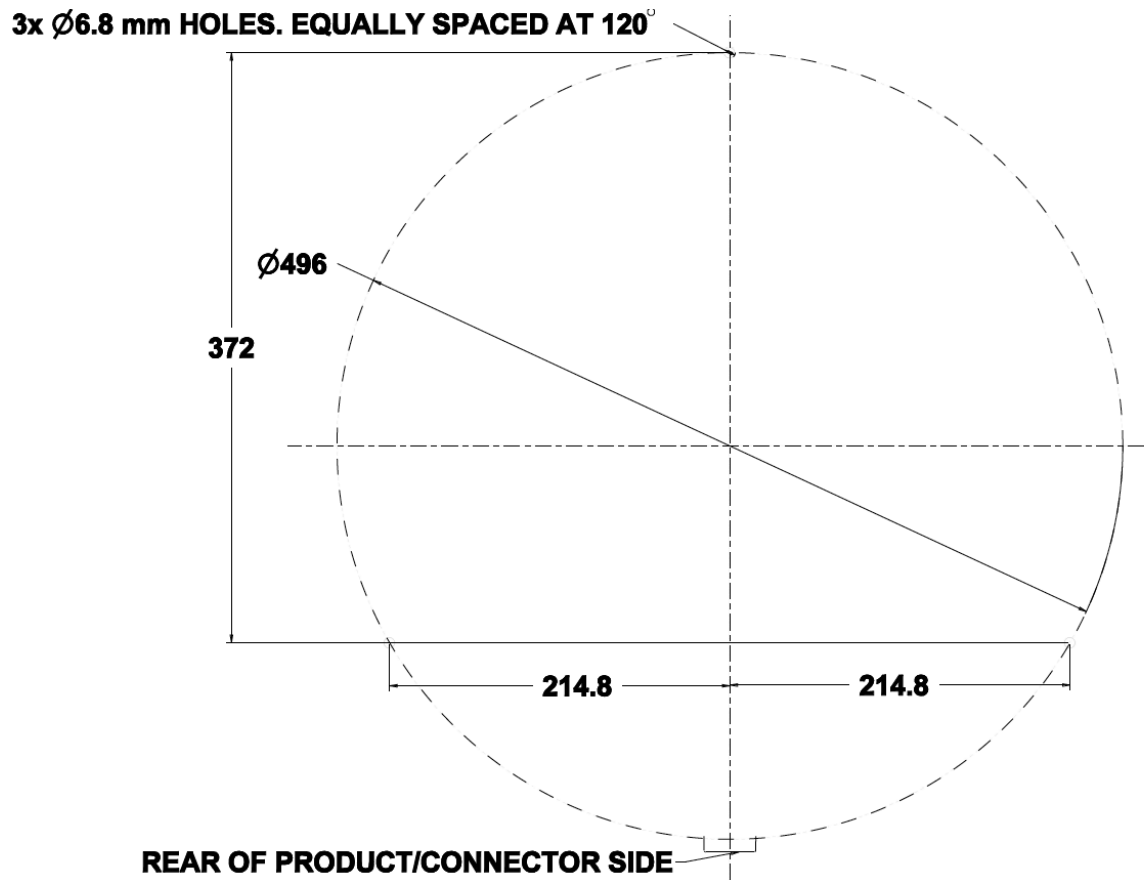


Figure 6-4 C10 Mounting Hole Pattern

Extreme Conditions

A supplementary kit, that enhances the robustness against splashing water from any direction and improves robustness against dirt and dust in very harsh environments, is available from SpaceCom. This kit will however increase the total height of the antenna by 15 mm. Criteria 1 and 2 still have to be fulfilled. Part No.: SPAC-AC-1025 - Water lock for radome.